

# Determination of Riparian buffers within the St. Clair River AOC Subwatersheds

St. Clair Region Conservation Authority  
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Alison Seidler  
Maria Strybos  
Chris Durand





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## 1. Introduction

St. Clair Region Conservation Authority (SCRCA) undertook this project as a partnership with Environment Canada. The project began in late 2011 and was finished in March, 2012. The purpose of the project is to report the most updated values on the status of the Riparian zone in the Area of Concern (AOC) for the St. Clair River Remedial Action Plan (RAP).

Monitoring and measuring changes in watercourse health is a necessary part of the St. Clair River AOC delisting criteria. Calculating the area of riparian vegetation has long been recognized as a determinant of stream health, or conversely stream degradation in the loss or absence of riparian vegetation (Steedman, 1987). In *How Much Habitat is Enough: A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concerns*, the recommended riparian area is 75% of stream length having a naturally vegetated 30m wide zone (Environment Canada, 2005).

Past studies were conducted in 1998 (Natural Heritage Study, Geomatics International Inc.) and 2006 (St. Clair River AOC Natural Heritage Study). Advances in technology and most significantly, the newest orthophotography (20cm resolution, 2010) provide an accurate geo-referenced image with which to monitor and evaluate natural heritage features such as wetlands, woodlands and riparian zones. Building on the 2006 Natural Heritage Study, this report will provide the framework for comparison to the past indices, as well as the ability to analyze riparian coverage and to target priority areas.

## 2. Study Area boundary

The study area boundary (AOC) coincides with the study area used in the *Natural Heritage Study Update – 2006 Study* and represents an area of 897km<sup>2</sup>. The AOC has been divided into 13 subwatershed units. These subwatershed units were created from a topologically-derived first order subwatershed model (SCRCA staff, 2006). The 13 subwatershed/sub-units are depicted on **Map 1 – AOC Subwatershed Units**. All reporting within this study was determined on a subwatershed basis.

## 3. Methodology

### 3.1. Creating a buffer of the watercourse – Riparian area

#### 3.1.1. Watercourse Delineation

Generating the most accurate riparian area required the use of a number of data sources and a number of succinct steps. The first stage was to produce an accurate vector representation of the watercourses. Watercourses were either represented as a single line, when the watercourse width is less than 5 meters, or as a double line (representing the water's edge) when the watercourse is greater than 5 meters in width. The SCRCA watercourses layer was used to represent the centerline of a watercourse when the width of the stream was less than 5m. These watercourses were reviewed for currency, accuracy and precision over the entire study area. Working at a scale of 1:2000 and using the 2010 air photo, single line watercourses were either copied or digitized into a new layer in preparation for buffering. When the SCRCA watercourses accurately represented the watercourse on the 2010 air photo, then it was copied. If the SCRCA watercourse differed from the 2010 air photo, a new line representing the watercourse was digitized at a maximum scale of 1:1000. Watercourses present in the SCRCA layer were not included if they were clearly not present on the 2010 air photo at 1:1000. If the presence of a watercourse from the SCRCA layer was questionable and was unable to be verified through air photo interpretation, the watercourse was retained. If a watercourse was absent from the SCRCA watercourse layer but appeared to have water at a 1:2000 scale on the 2010 photo, it was added. These watercourses were checked on the IRS imagery where the blue-green water stands out visibly against red-purple vegetation. All closed tile drains were removed.



# St. Clair River AOC Subwatersheds

## Legend

- Municipal Boundaries
- Michigan
- Watercourses
- Provincial Highway
- Former Highway
- Other Roads

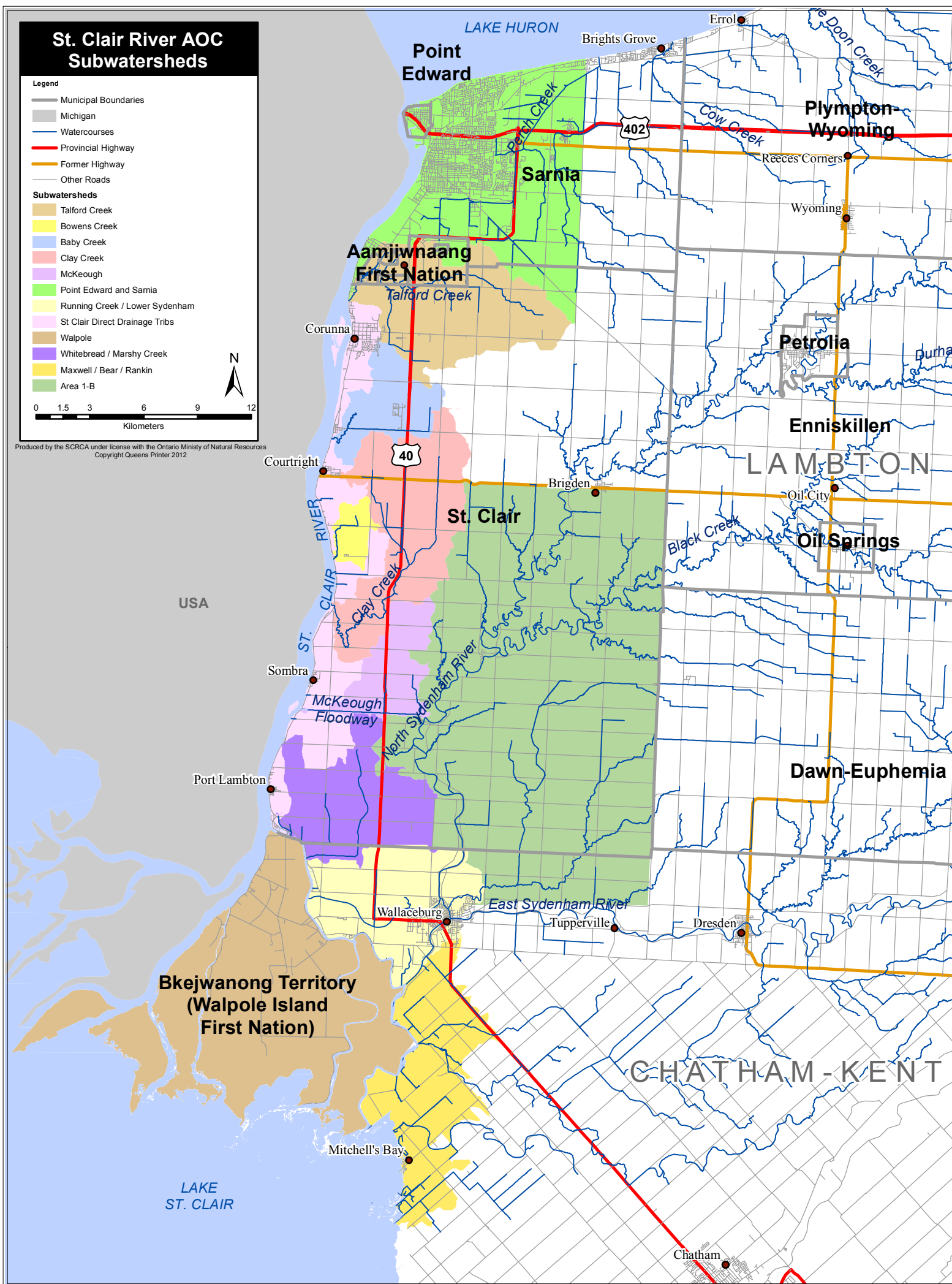
## Subwatersheds

- Talford Creek
- Bowens Creek
- Baby Creek
- Clay Creek
- McKeough
- Point Edward and Sarnia
- Running Creek / Lower Sydenham
- St Clair Direct Drainage Tribs
- Walpole
- Whitebread / Marshy Creek
- Maxwell / Bear / Rankin
- Area 1-B

0 1.5 3 6 9 12  
Kilometers



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An existing dataset containing two-sided edges of watercourses was created during the *St. Clair River Area of Concern Natural Heritage Study Update – 2006*. This layer was used and amended where the stream width was greater than 5m to create a two-sided profile of all watercourses with a width greater than 5m. Edges of watercourses were digitized at a scale of 1:000. Any in-line ponds were included in the double-sided profile; however, offline ponds that do not have surface connection to the watercourse were omitted.

The final product, the layer used to buffer, contained single line and double-line representations of all watercourses within the St. Clair River AOC.

### **3.1.2. Buffering**

Two buffers were created using the final watercourse layer, a 5 meter and a 30 meter buffer using the Geoprocessing buffer tool. The buffer layers were dissolved for all fields to create continuous buffers along all lengths of watercourse.

## **3.2. Creating the Riparian Vegetation**

A previously existing layer, NRVIS woodlands, provided the basis for delineating riparian vegetation. All the woodlands within the AOC were pulled from this dataset and copied to a new shapefile called Riparian Vegetation. The Riparian Vegetation layer was coded with an attribute domain of 3 vegetation groups: Woodland, Scrubland thicket and, Grassland /Pasture. A description of each vegetation group is provided in Table 1.

Using this data set (NRVIS woodlands) as a starting point, further air photography interpretation was used to classify the 30m riparian zone into the other vegetation classes from Table 1. The Riparian Vegetation shapefile was overlaid on the 2010 digital orthophotography and visually examined to determine and delineate the Vegetation Groups (from Table 1) that occur within the 30 m riparian zone. The 5 m buffer represents the minimum distance to be considered as a naturally vegetated buffer (ie any vegetation feature less than 5m was not included). Each vegetation class was attributed to its corresponding classification in the Riparian Vegetation Attribute table.

### **3.3. Attributing for the presence/absence of a buffer**

For the purpose of this study, the required reporting index is the linear length of watercourse with either a one-sided, two-sided or no natural vegetated buffer within each subwatershed. For this reason, one last watercourse layer, representing the centerline of all watercourses was created. This layer was created by using the previously created final watercourse layer (as described in section 3.1.1) and adding the centerline for all double sided watercourses. This layer was duplicated so that two centerline flow layers exist for representing a 5 m buffer or a 30m buffer.

The centerline flow layers were used to record the presence/absence of a riparian buffer zone for both the 5m and 30m riparian zone. A field was added to the attribute tables of the centerline flow layers to record whether a line segment of a watercourse was buffered. One centerline flow layer represents the presence/absence of 5m or more of natural vegetation. The buffer codes used were as follows: 1 = at least one side buffered, 2 = both sides buffered or 0 = no buffer on either side. This process was repeated for the other centerline flow layer to represent a minimum threshold of 30m buffer. Buffer end points were spatially tracked by splitting the centerline flow layers in line with buffer extends at their upstream and downstream limits.



#### 4. Riparian Vegetation Classification

Vegetation within the 30m riparian buffer was classified into three vegetation groups. The vegetation groups used were established using the methodology from the Huron County Natural Heritage Study. This study was conducted by the Upper Thames Valley Conservation Authority and forms the framework for Natural Heritage Studies in the region. Using previously established vegetation groups easily enables further work to continue on a larger-scale Natural Heritage feature study in the St. Clair River AOC.

Vegetation Groups organize vegetation communities into groups based on similar ecological patterns and processes. Table 1 provides a summary of the vegetation groups identified and the method of identification and attribution.

##### 4.1. Digitizing/Editing rules were established for the delineation of Vegetation Groups and are as follows:

- All editing and digitizing of vegetation groups is at a maximum scale of 1:1000 and minimum scale of 1:500.
- Minimum mapping unit (MMU) for the study was limited to 0.20 ha. Any single polygon below this size criterion was not digitized. This would hopefully eliminate the issue of transition zones which occur where a meadow is succeeded by scrubland which is succeeded by forest edge. The most dominant transition zone in each situation would be digitized and attributed an appropriate classification.
- A riparian buffer was minimally considered to be naturalized vegetation extending beyond 5m of each side of a surface watercourse. Using this definition, grassy or shrubby embankments (typical bank vegetation when most woody vegetation has been removed) of small watercourses were not to be included within the Riparian Vegetation layer.
- Vegetation polygons will be separated by the channel width for all double-sided channels whereas vegetation polygons can extend across the river for watercourses represented with single lines.
- When the double-sided channel widths and the Riparian Vegetation layer are overlaid there may be instances when the existing woodlands delineation exceeds the newly derived channel width.
- Align all vegetation groups so that they snap with the channel widths.
- Snapping should be set between coincident polygons vegetation groups.
- Any residential and commercial land-use including lawns were not included in any vegetation group or digitizing.
- When digitizing woodlands that extend past the 30m buffer, the complete vegetation shape was captured. (This could prove useful, if further Natural Heritage studies continue in the region).

**Table 1: Vegetation groups used to attribute riparian vegetation types.**

<i>Vegetation Group</i>	<i>Vegetation community</i>	<i>Description</i>
<b>Woodland</b> Attribute domain: Wooded (Trees)	Coniferous Woodland, Deciduous Woodland, Mixed Woodland, Plantation	Woodlands are defined as areas with > 50 % canopy cover of tree species. Plantations, orchards and hedgerows were included in this vegetation class. -bright red (deciduous) and green (coniferous) tones in IRS imagery, casts large shore shadows on IRS imagery



<p><b>Scrubland/thicket</b> Attribute domain: Low woody shrubs and grass</p>	<p>Riparian thicket</p>	<p>Thickets are dominated by shrubs and woody species smaller than tree size. Classified as &gt;10 % scattered woody vegetation (trees or shrubs) or continuous areas area of shrubs or immature trees, this class generally represents the intermediate successional phase between grassland and forest -least uniform pattern of 4 vegetation groups, casts shore shadows on IRS imagery, with purple-red colour</p>
<p><b>Meadow/grassland/pasture</b> Attribute domain: Grassland and Pasture</p>	<p>Riparian meadow</p>	<p>Dominant plants in this class are grasses and broad-leaved herbaceous species. Meadows were defined as primarily open with very low cover of woody vegetation (&lt; 10% trees or shrubs) and also refer to uncultivated grassland and pasture. -appears granular with some texture and of uniform height on IRS imagery, with red to purple colour</p>



**Table 2:****Summary Statistics for Riparian Lengths by Subwatershed for 5m Riparian Buffers**

<b>Total Study Area</b>	<b>Total length watercourse within AOC – 1308 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	253.9	19.4 %
	Two sides	513	39.2 %
	Riparian Buffer (Either one side or two sides)	752.8	57.6 %
<b>Talford Creek</b>	<b>Total length within watercourse Talford Creek -68.6 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	9.7	14.1 %
	Two sides	37.7	55 %
	Riparian Buffer (Either one side or two sides)	47.4	69.1 %
<b>Baby Creek</b>	<b>Total Length watercourse within Baby Creek -29.4 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	3.1	10.5 %
	Two sides	13.4	45.6 %
	Riparian Buffer (Either one side or two sides)	16.5	56.1 %
<b>Bowens Creek</b>	<b>Total length watercourse within Bowens Creek - 9.6 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	.3	3.1 %
	Two sides	3.9	40.6 %
	Riparian Buffer (Either one side or two sides)	4.2	43.7 %
<b>Whitebread/Marshy Creek</b>	<b>Total length watercourse within Whitebread/Marshy Creek =49.8 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	15.9	32 %
	Two sides	8.9	17.9 %
	Riparian Buffer (Either one side or two sides)	24.8	49.9 %



<b>Running Creek</b>	<b>Total length watercourse within Running Creek - 58.2 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	25.4	43.6 %
	Two sides	10.4	17.9 %
	Riparian Buffer (Either one side or two sides)	35.8	61.5 %
<b>Maxwell/Bear</b>	<b>Total length watercourse within Maxwell Bear - 128.6 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	44	34.2 %
	Two sides	24	18.7 %
	Riparian Buffer (Either one side or two sides)	68	52.9 %
<b>St. Clair River Tribs</b>	<b>Total length watercourse within Maxwell Bear -32 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	8.3	25.9%
	Two sides	4.2	13.1%
	Riparian Buffer (Either one side or two sides)	12.5	39 %
<b>Walpole</b>	<b>Total length watercourse within Maxwell Bear - 250.9 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	44.1	17.6%
	Two sides	74.2	29.6%
	Riparian Buffer (Either one side or two sides)	118.3	47.2 %
<b>Area 1-B</b>	<b>Total length watercourse within Maxwell Bear -369.6 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	52	14.1%
	Two sides	236	63.9 %
	Riparian Buffer (Either one side or two sides)	288	78 %
<b>Pt. Edward /Sarnia</b>	<b>Total length watercourse within Maxwell Bear -129.9 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	22.6	17.4 %
	Two sides	44.5	34.2 %
	Riparian Buffer (Either one side or two sides)	67.1	51.6 %



<b>Mckeough</b>	<b>Total length watercourse within Maxwell Bear - 24.1 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	2.8	11.6 %
	Two sides	14.7	61 %
	Riparian Buffer (Either one side or two sides)	17.5	72.6 %
<b>Clay Creek</b>	<b>Total length watercourse within Maxwell Bear -87.5 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	11.6	13.2 %
	Two sides	41.1	47 %
	Riparian Buffer (Either one side or two sides)	52.7	60.2 %



**Table 3:****Summary Statistics for Riparian Lengths by Subwatershed for 30m Riparian Buffers**

<b>Total Study Area</b>	<b>Total length watercourse within AOC – 1308 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	283.1	21.6 %
	Two sides	185.7	14.2 %
	Riparian Buffer (Either one side or two sides)	458.8	35.0 %
<b>Talford Creek</b>	<b>Total length within watercourse Talford Creek -68.6 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	14.3	20.8 %
	Two sides	21.1	30.8 %
	Riparian Buffer (Either one side or two sides)	35.4	51.6 %
<b>Baby Creek</b>	<b>Total Length watercourse within Baby Creek -29.4 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	7	23.8 %
	Two sides	3.8	12.9 %
	Riparian Buffer (Either one side or two sides)	10.8	36.7 %
<b>Bowens Creek</b>	<b>Total length watercourse within Bowens Creek - 9.6 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	1	10.4 %
	Two sides	3.1	32.3 %
	Riparian Buffer (Either one side or two sides)	4.1	42.7 %
<b>Whitebread/Marshy Creek</b>	<b>Total length watercourse within Whitebread/Marshy Creek =49.8 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	9.4	18.9 %
	Two sides	1.6	3.2 %
	Riparian Buffer (Either one side or two sides)	11	22.1 %



<b>Running Creek</b>	<b>Total length watercourse within Running Creek - 58.2 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	6	10.3 %
	Two sides	.9	1.5 %
	Riparian Buffer (Either one side or two sides)	6.9	11.8 %
<b>Maxwell/Bear</b>	<b>Total length watercourse within Maxwell Bear - 128.6 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	13.6	10.6 %
	Two sides	.9	0.7 %
	Riparian Buffer (Either one side or two sides)	14.5	11.3 %
<b>St. Clair River Tribs</b>	<b>Total length watercourse within Maxwell Bear -32 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	4.4	13.8%
	Two sides	.6	1.8 %
	Riparian Buffer (Either one side or two sides)	5	15.6 %
<b>Walpole</b>	<b>Total length watercourse within Maxwell Bear - 250.9 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	83.1	33.1%
	Two sides	34.7	13.8%
	Riparian Buffer (Either one side or two sides)	117.8	46.9 %
<b>Area 1-B</b>	<b>Total length watercourse within Maxwell Bear - 369.6 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	81.8	22.1%
	Two sides	82.3	22.3 %
	Riparian Buffer (Either one side or two sides)	164.1	44.4%
<b>Pt. Edward /Sarnia</b>	<b>Total length watercourse within Maxwell Bear - 129.9 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	26.5	20.4%
	Two sides	14.3	11 %
	Riparian Buffer (Either one side or two sides)	40.8	31.4 %



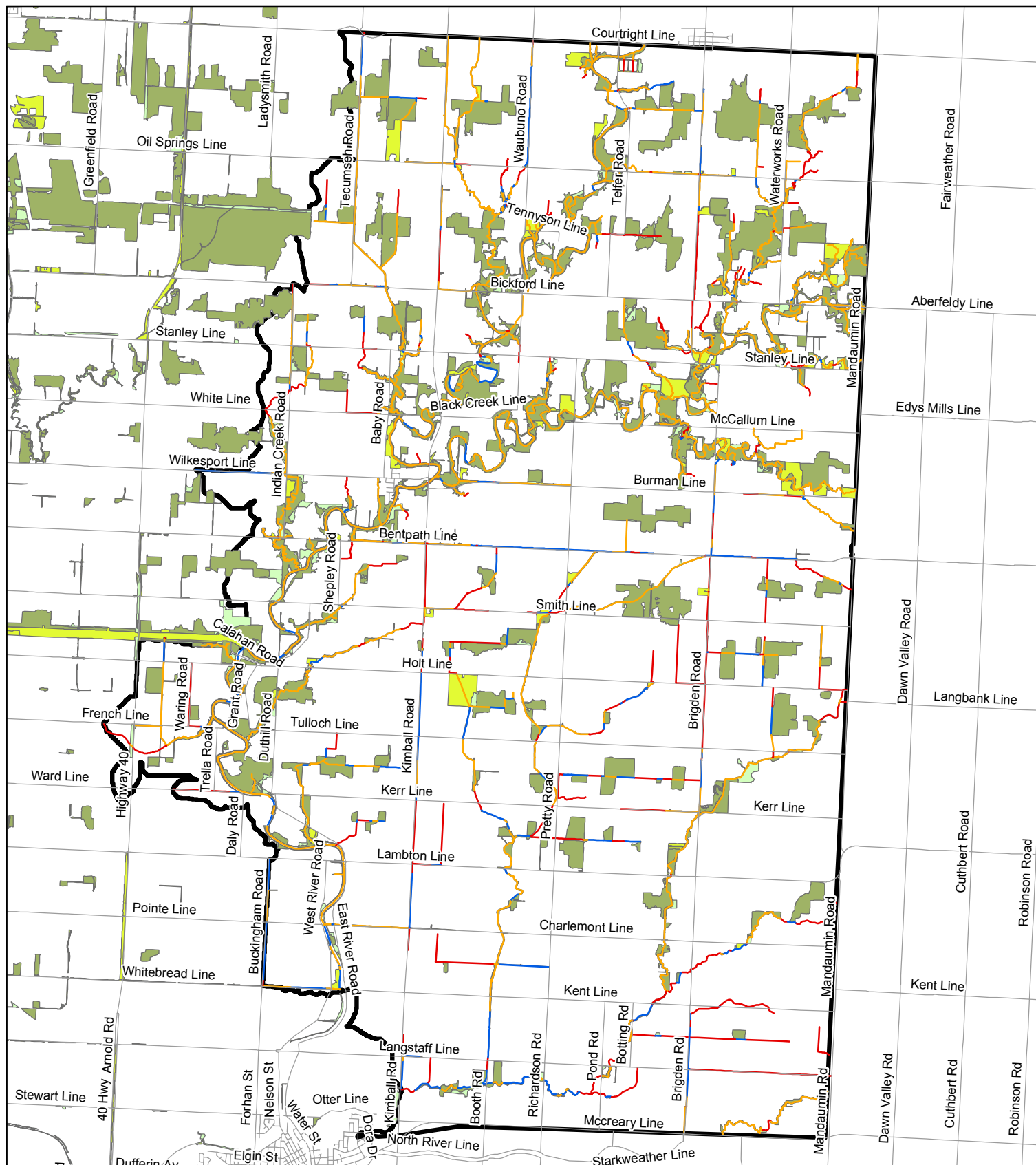
<b>Mckeough</b>	<b>Total length watercourse within Maxwell Bear - 24.1 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	6.5	27 %
	Two sides	8.9	36.9 %
	Riparian Buffer (Either one side or two sides)	15.4	63.9 %
<b>Clay Creek</b>	<b>Total length watercourse within Maxwell Bear 87.5 km</b>		
	<b>Buffer Category</b>	<b>Total length(km)</b>	<b>% of total length with buffer</b>
	One side only	19.3	22.1 %
	Two sides	13.3	15.2 %
	Riparian Buffer (Either one side or two sides)	32.6	37.3 %



## **Appendix 1**

### **Subwatershed Maps showing Areas with 5 meter Riparian Zones**





## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### Area 1-B Subwatershed

0 0.5 1 2 3 4  
Kilometers



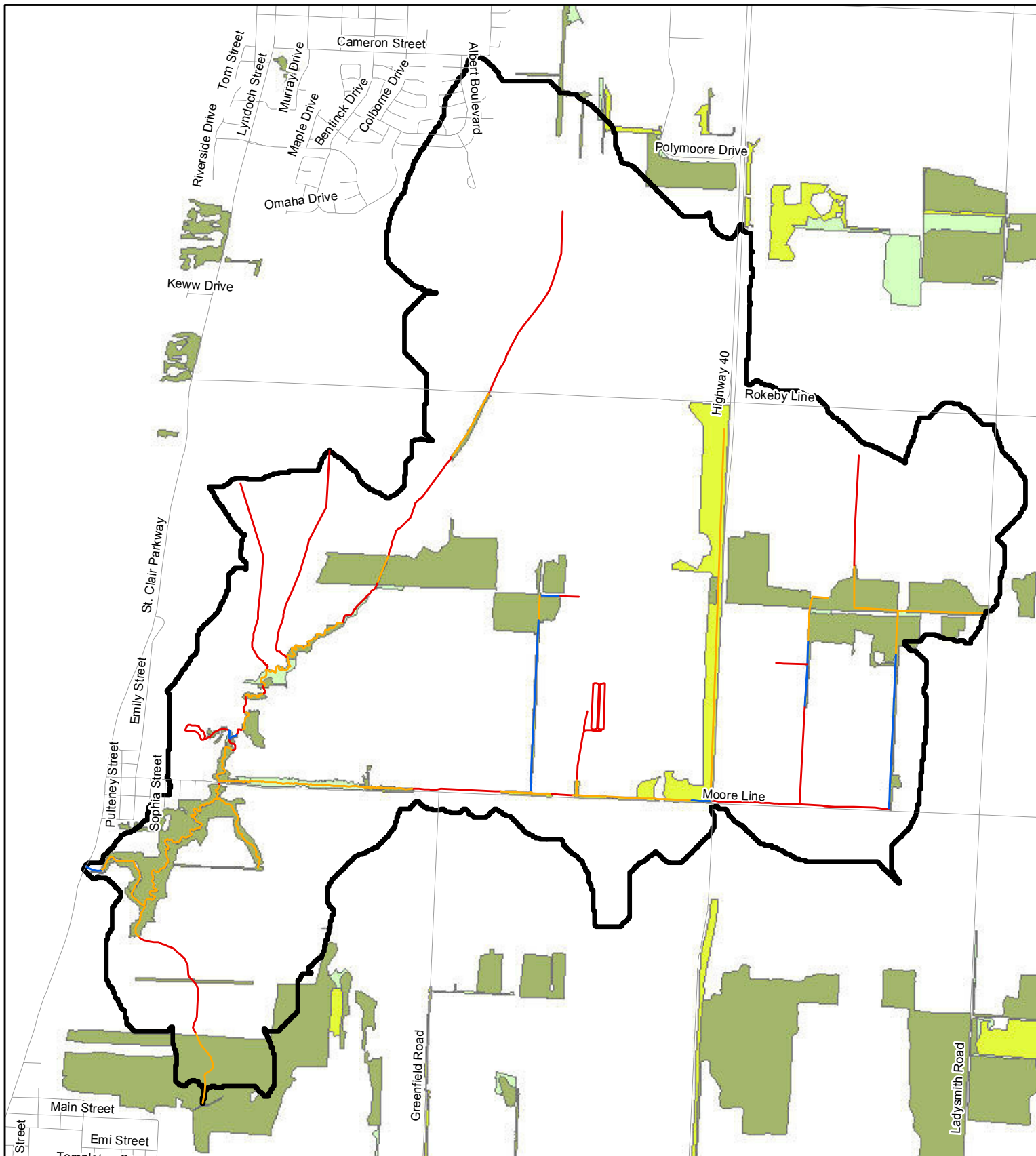
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



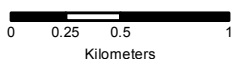


## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### Baby Creek Subwatershed



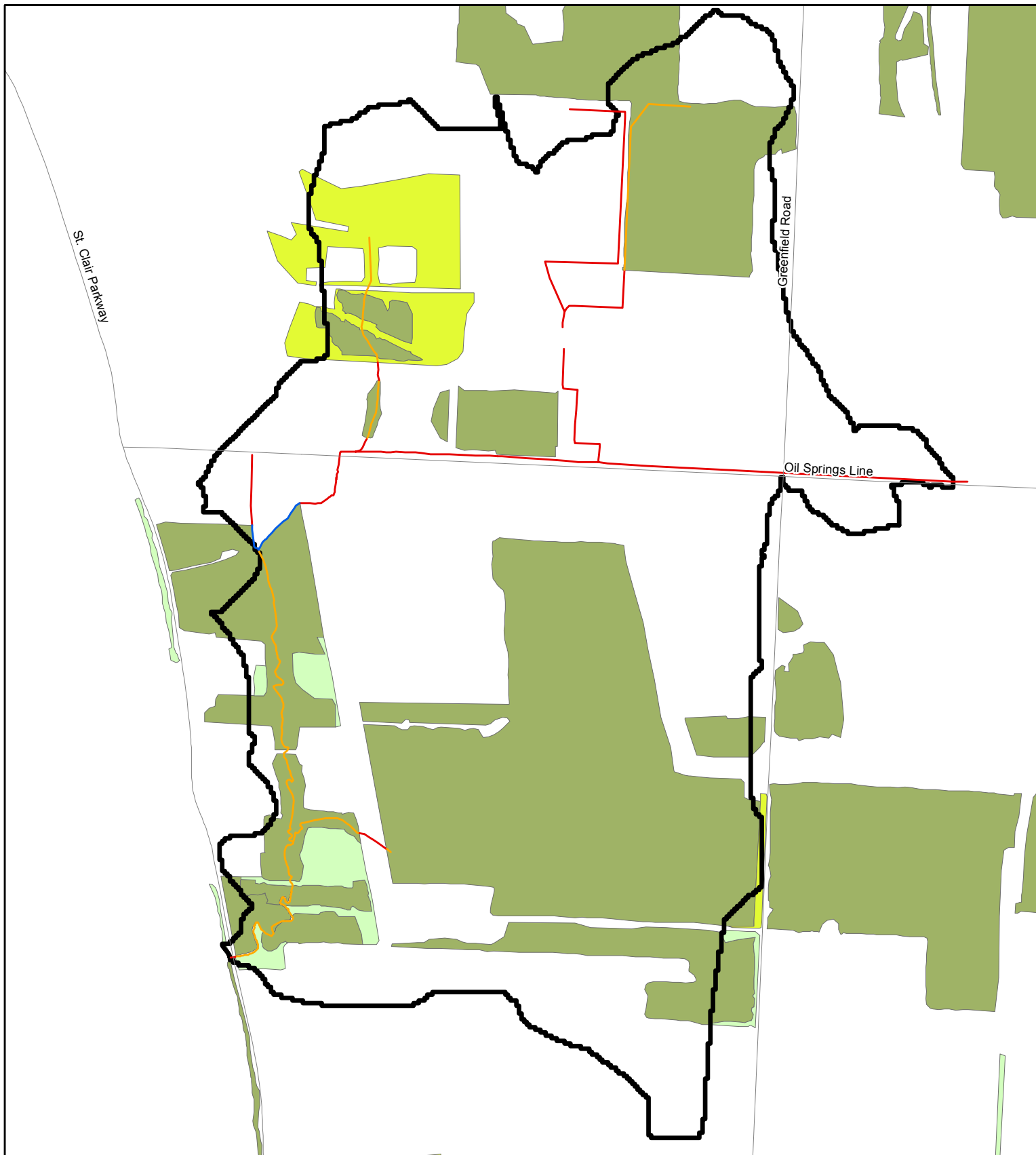
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary





## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### Bowens Creek Subwatershed

0 0.125 0.25 0.5  
Kilometers



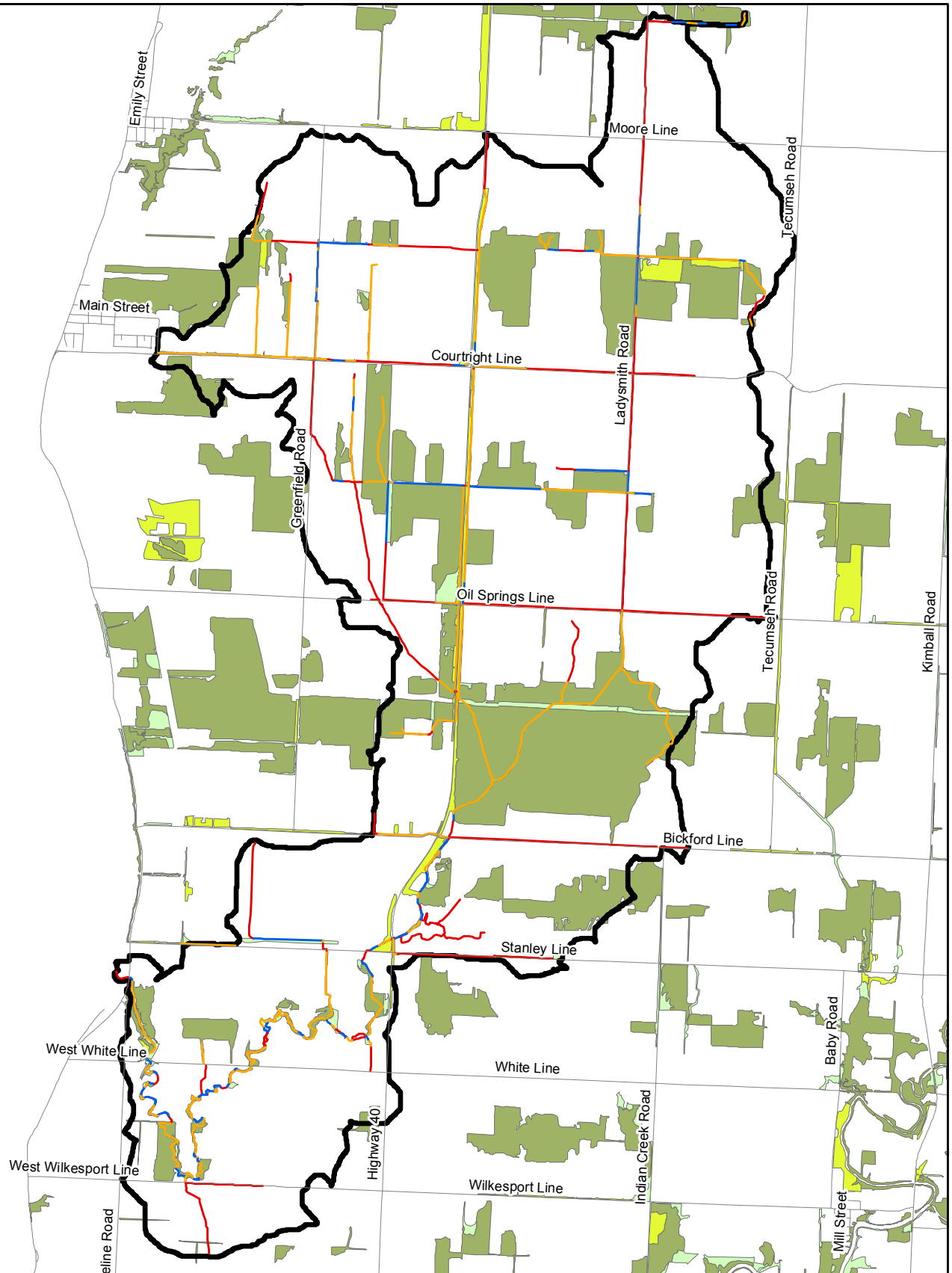
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



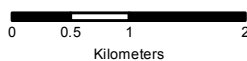


## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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Clay Creek Subwatershed



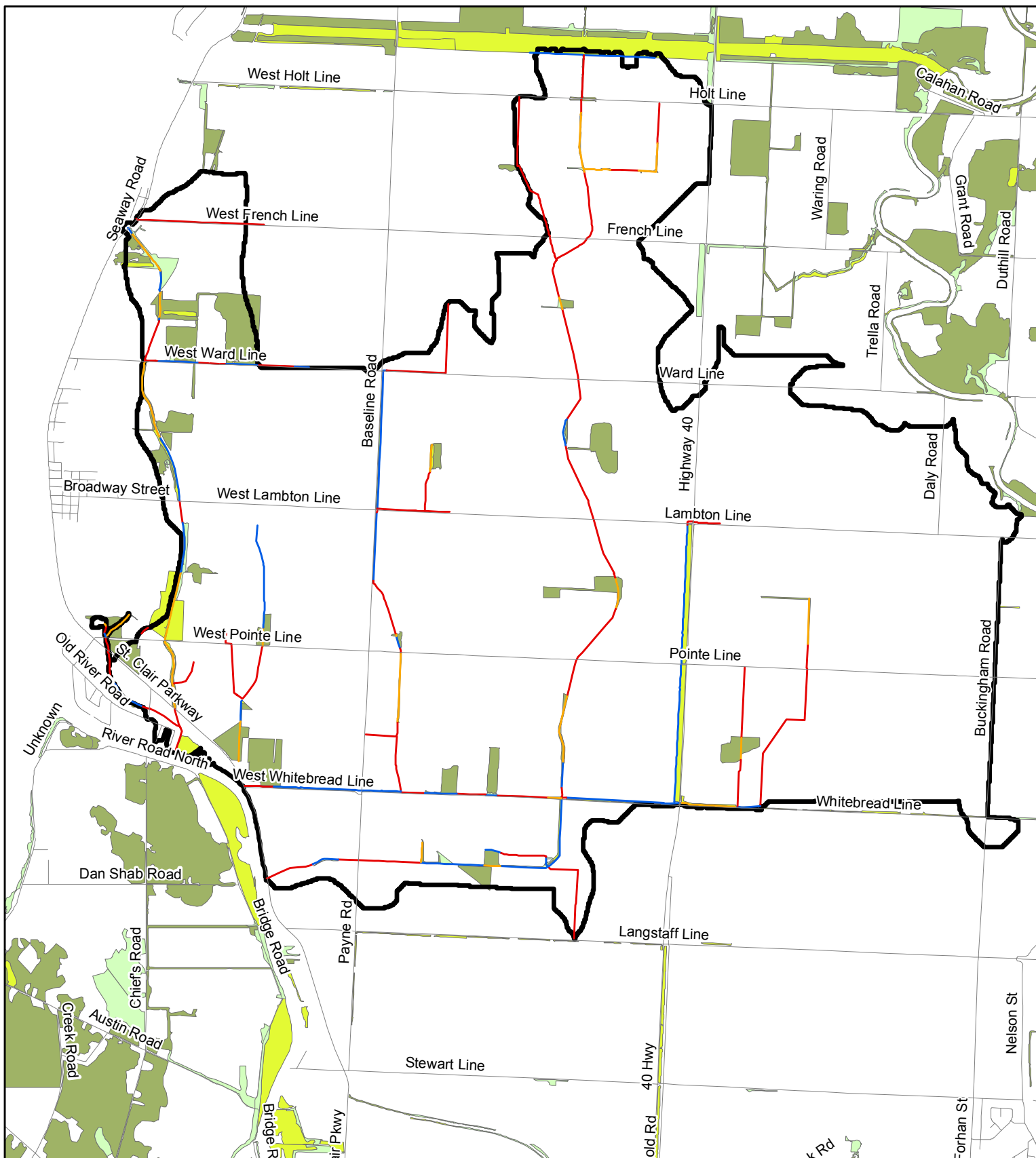
### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary





## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### Marshy Creek Subwatershed

0 0.375 0.75 1.5  
Kilometers



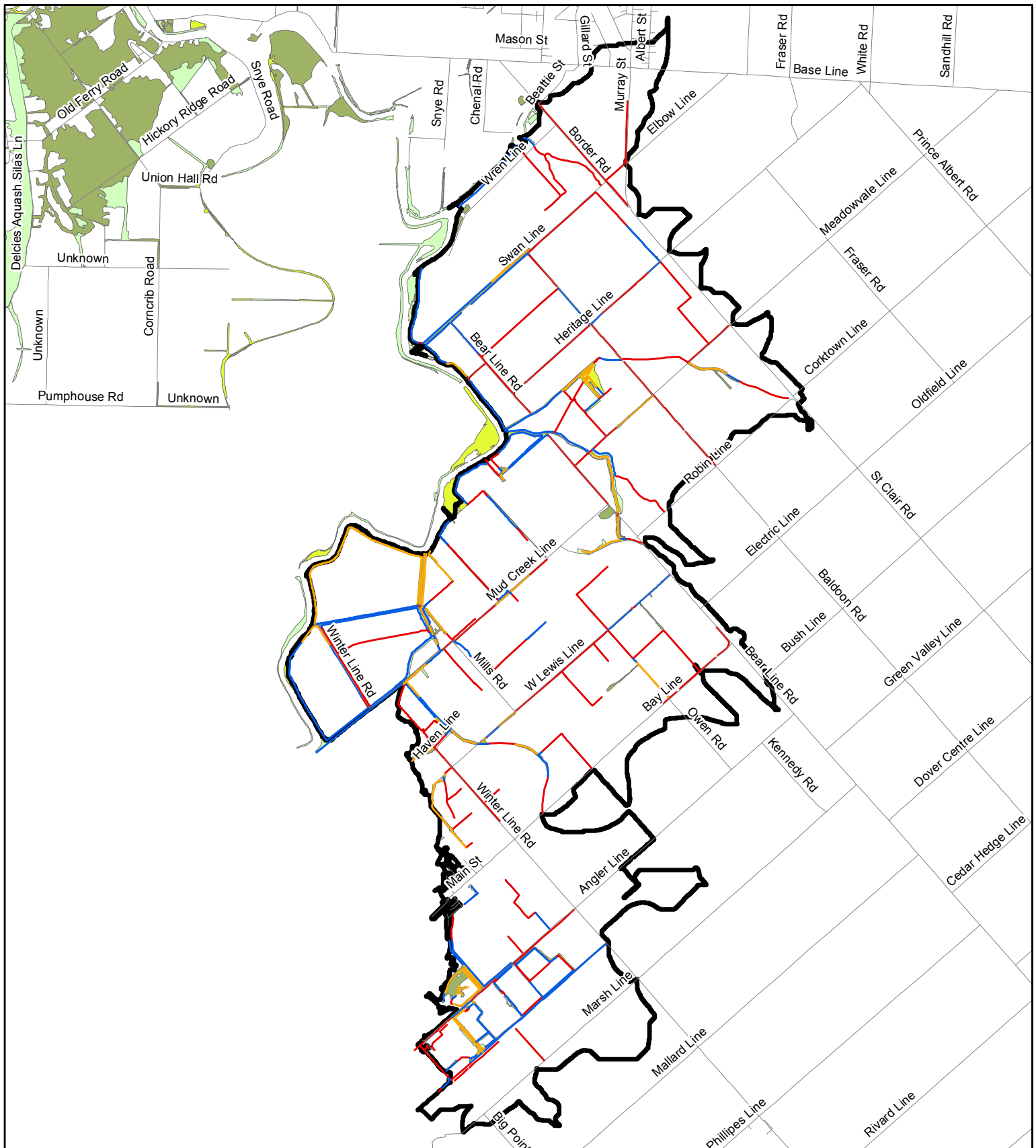
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary





## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### Maxwell/Bear Creek Subwatershed

0 0.5 1 2  
Kilometers



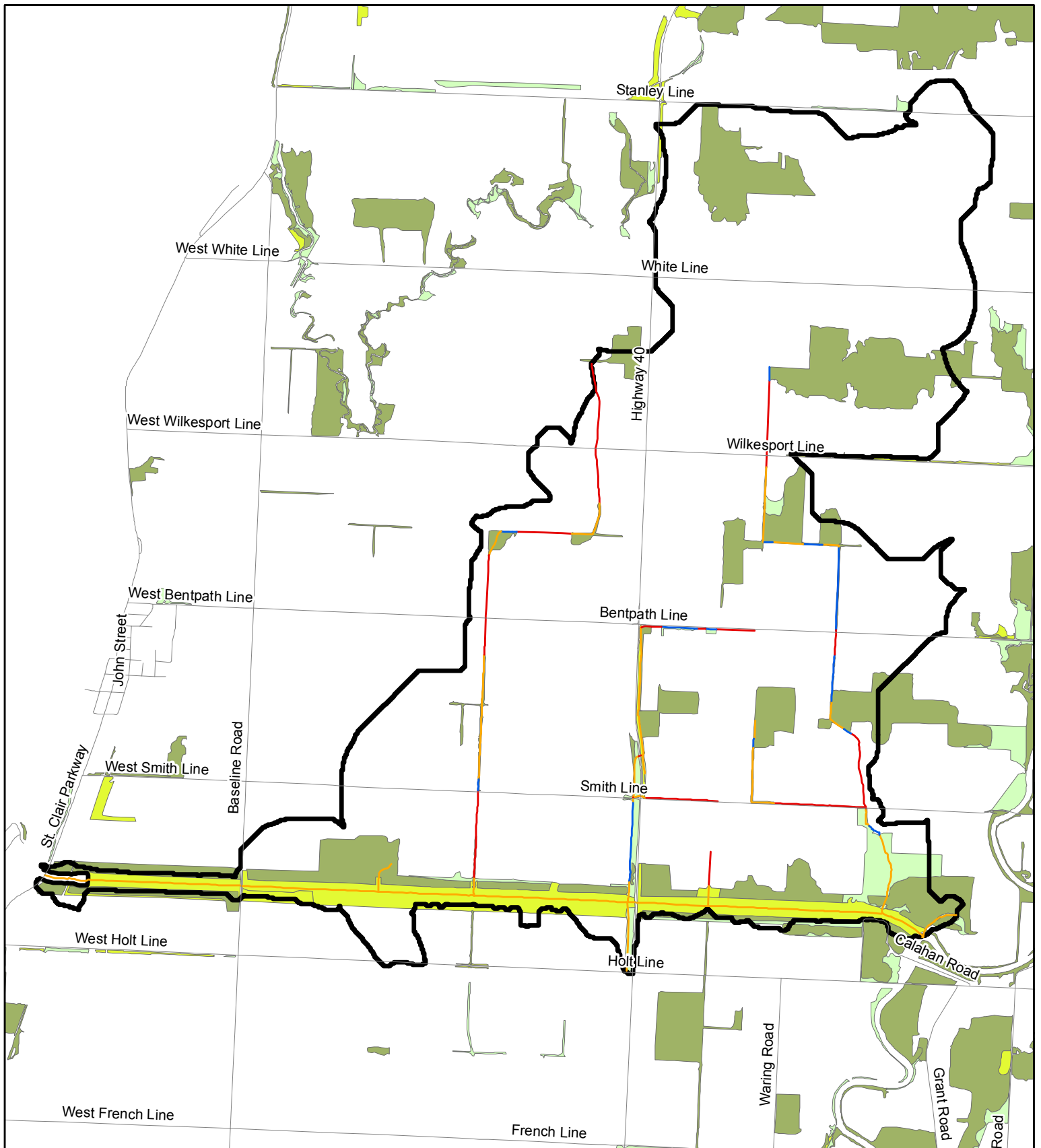
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



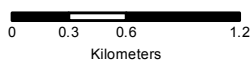


## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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**Mckeough Subwatershed**



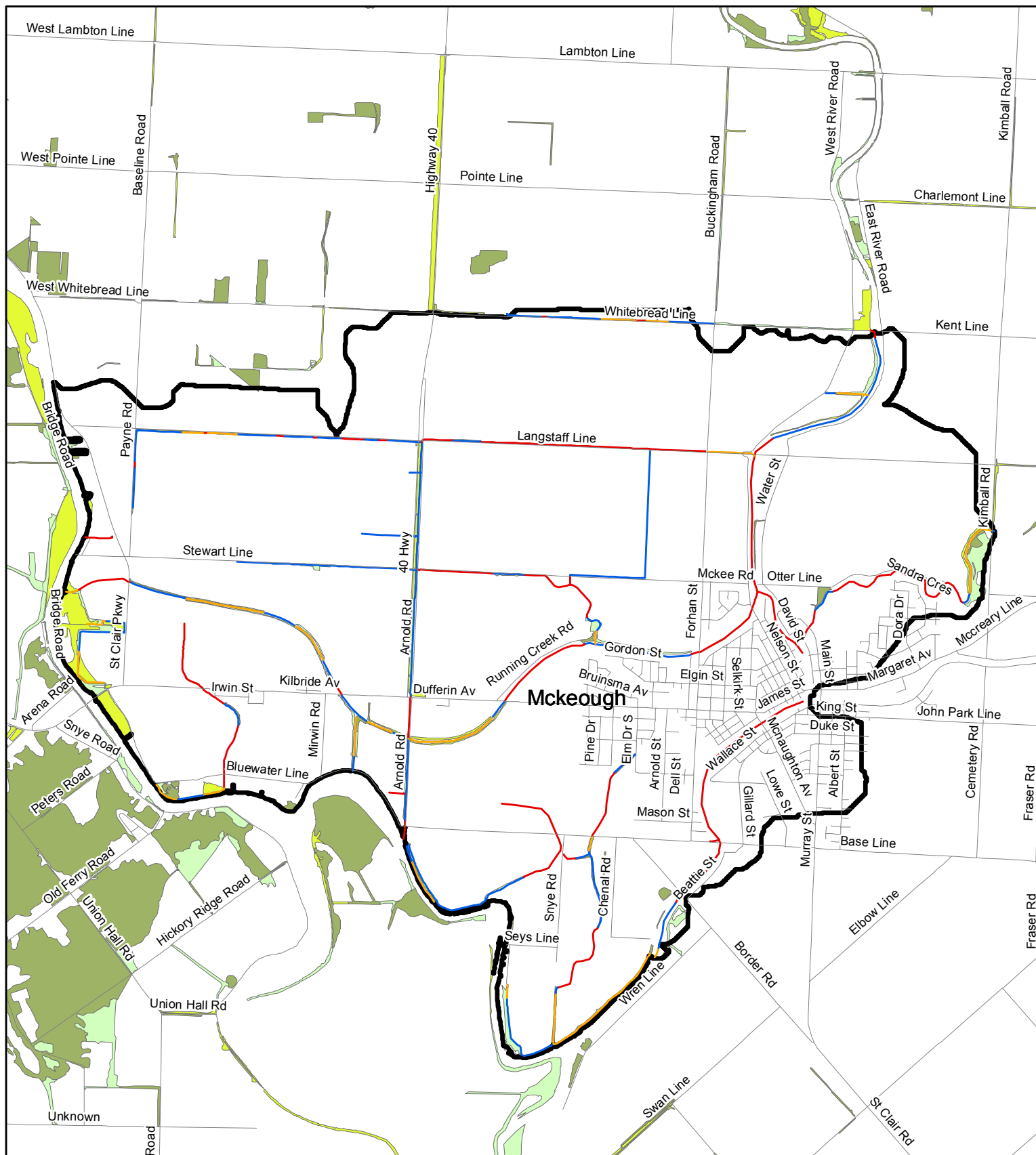
### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



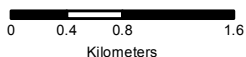


## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### Running Creek Subwatershed



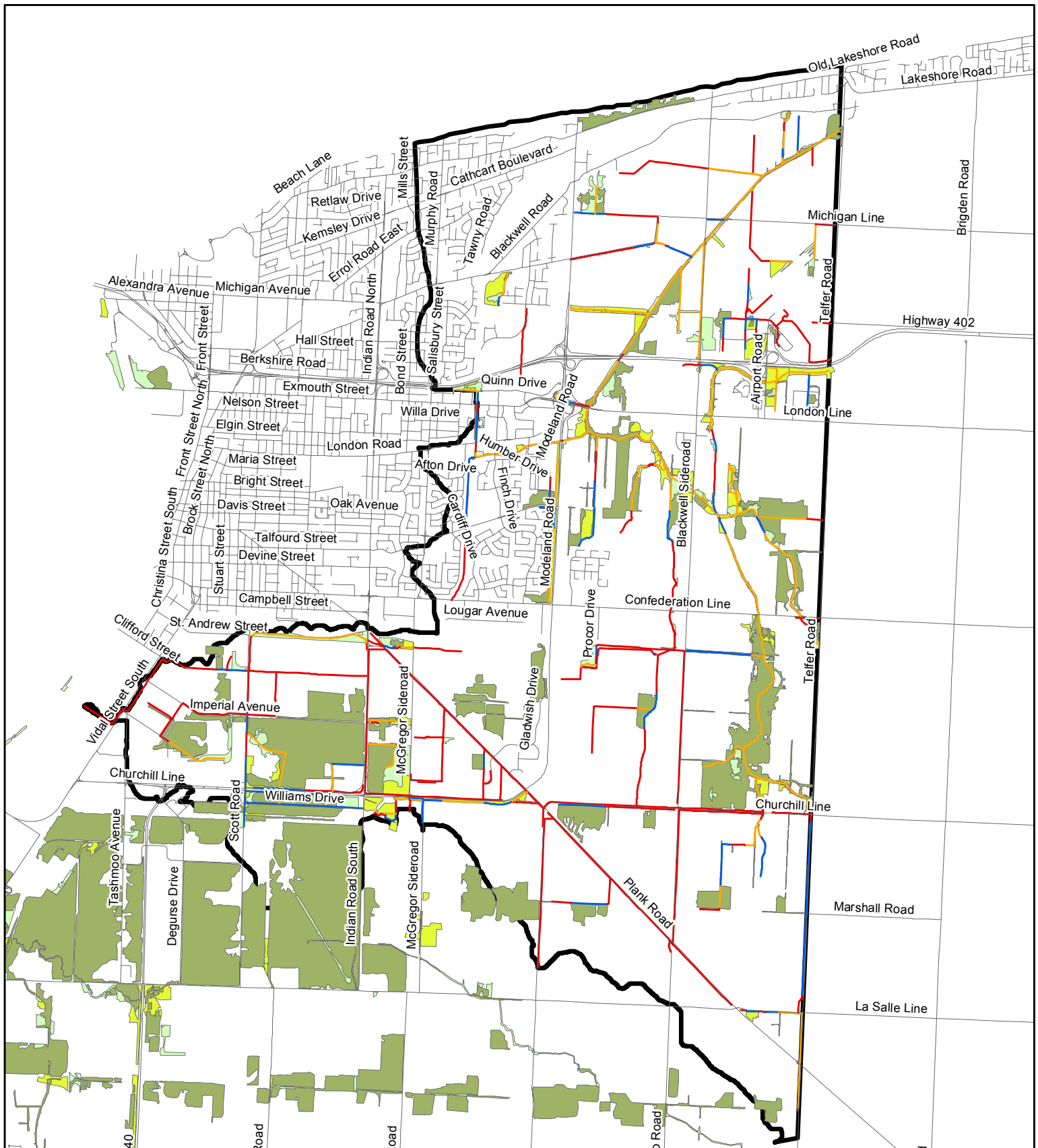
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary





## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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**Sarnia Subwatershed**

0 0.5 1 2  
Kilometers



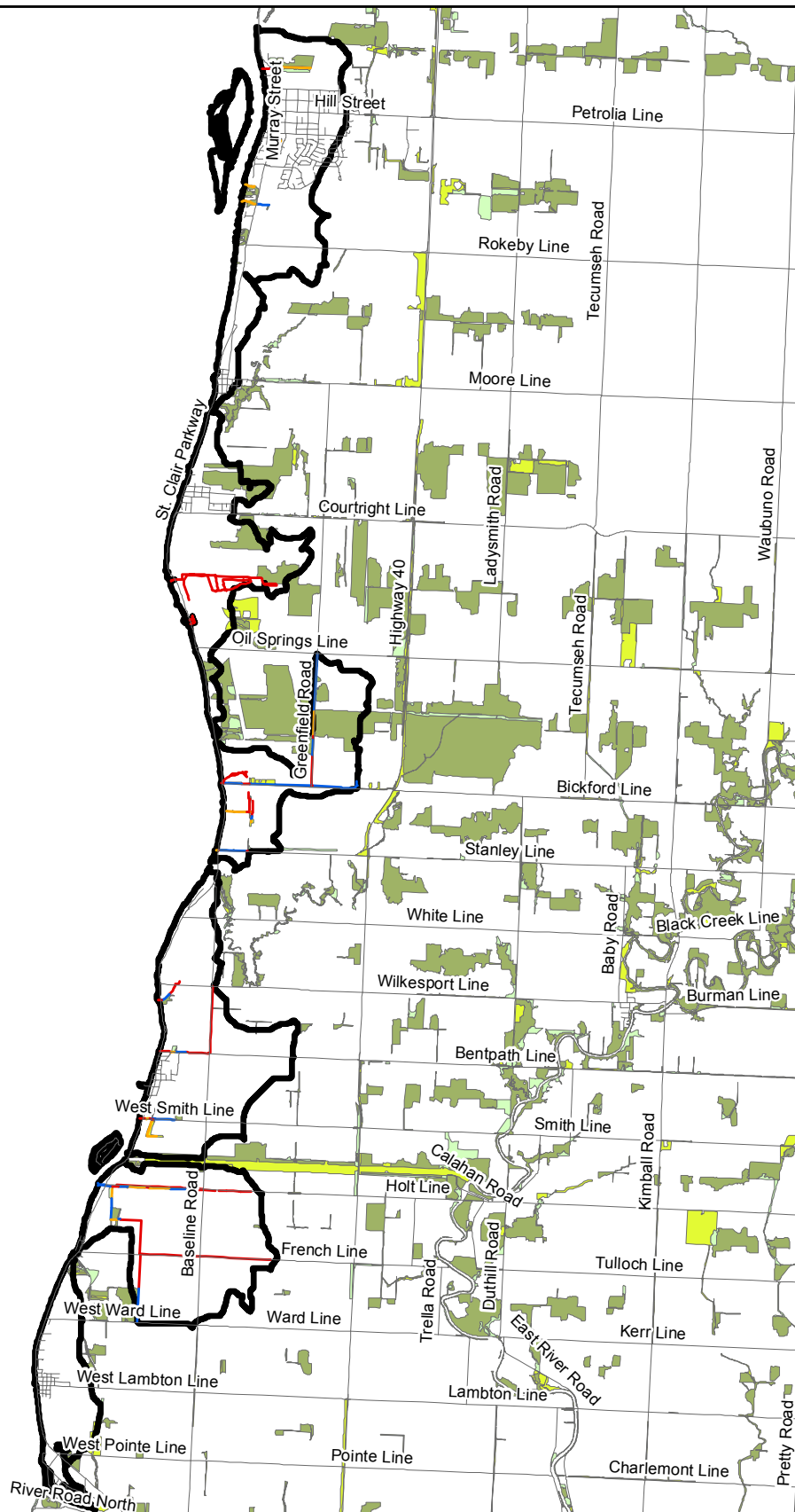
### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



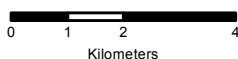


## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### St. Clair River Tribs Subwatershed



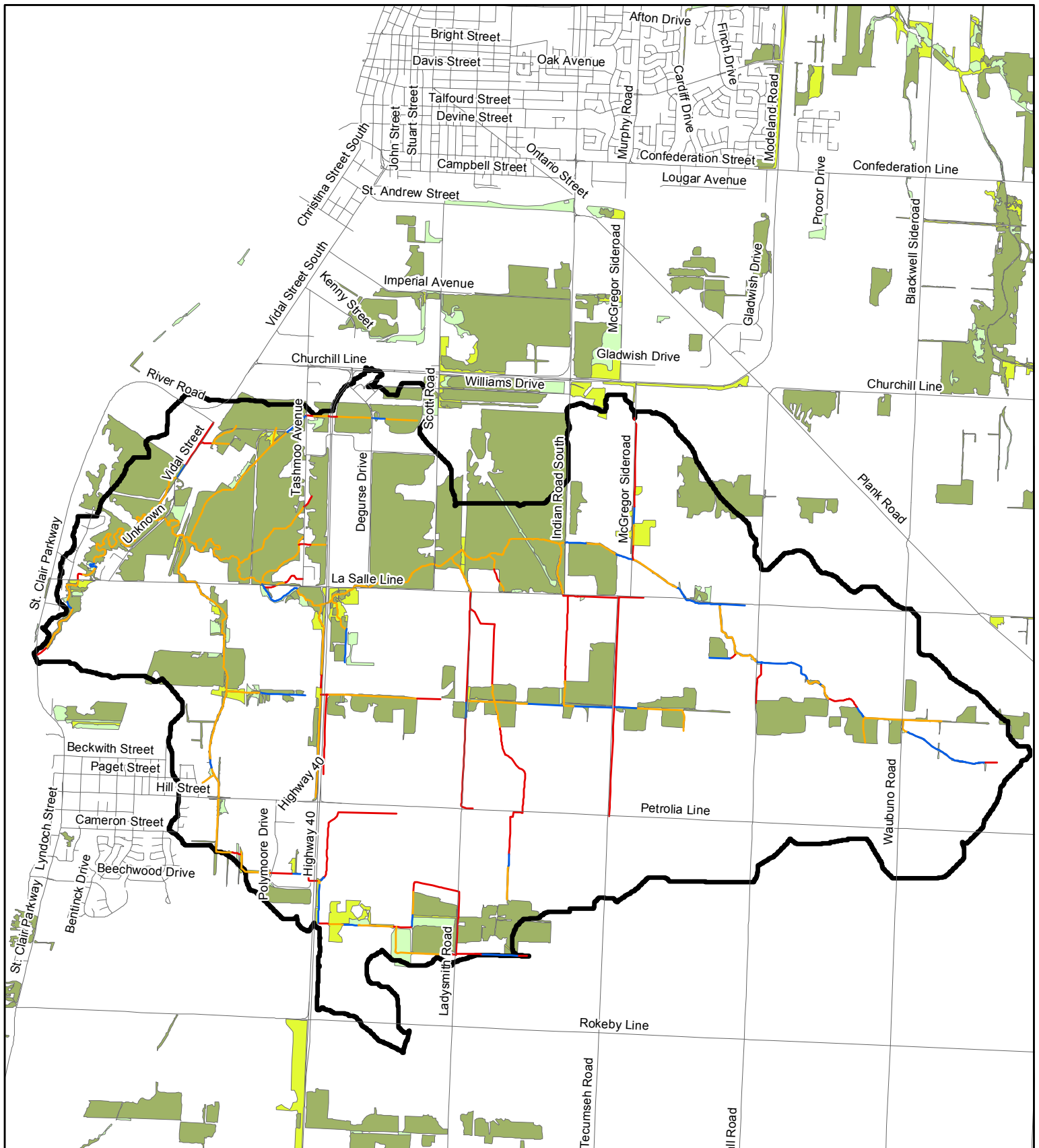
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



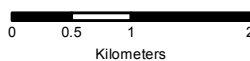


## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### Talford Creek Subwatershed



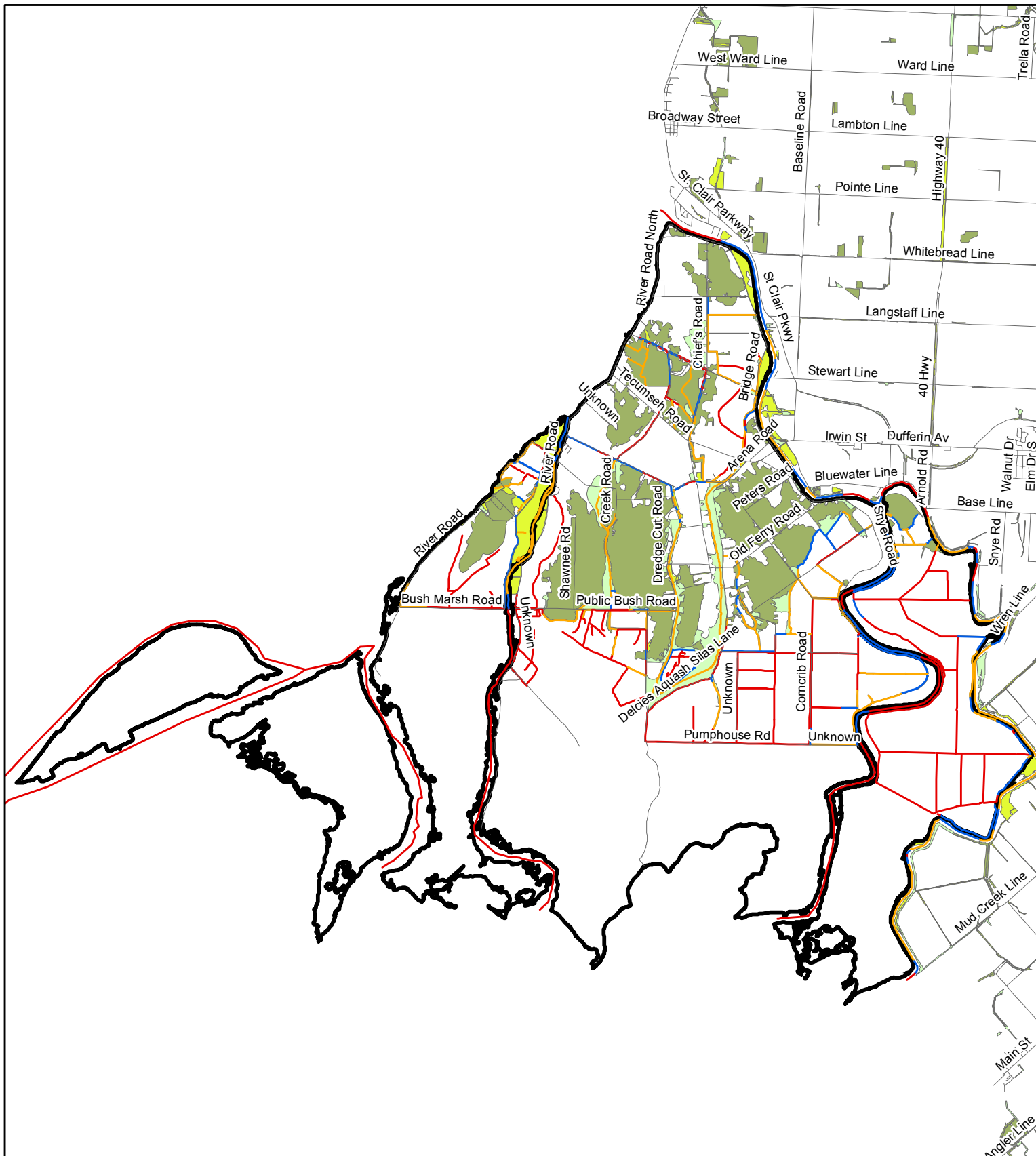
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



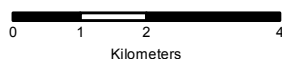


## St. Clair River Area of Concern - Riparian Zones - Greater than 5 Meters



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### Walpole Island Subwatershed



### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

### Riparian Buffer Type

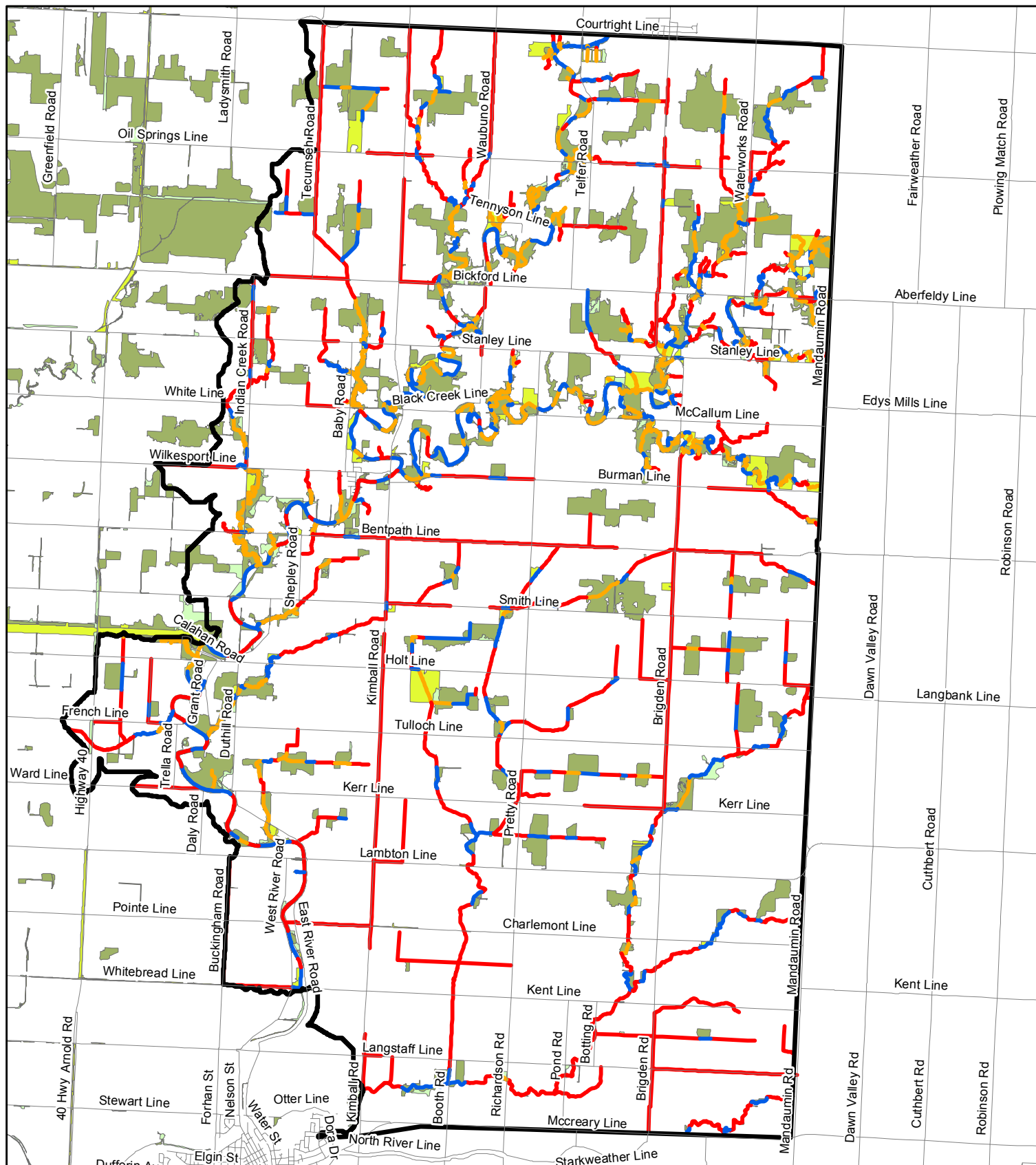
- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



## **Appendix 2**

### **Subwatershed Maps showing Areas with 30 meter Riparian Zones**





## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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### Area 1-B Subwatershed

0 0.5 1 2 3 4  
Kilometers



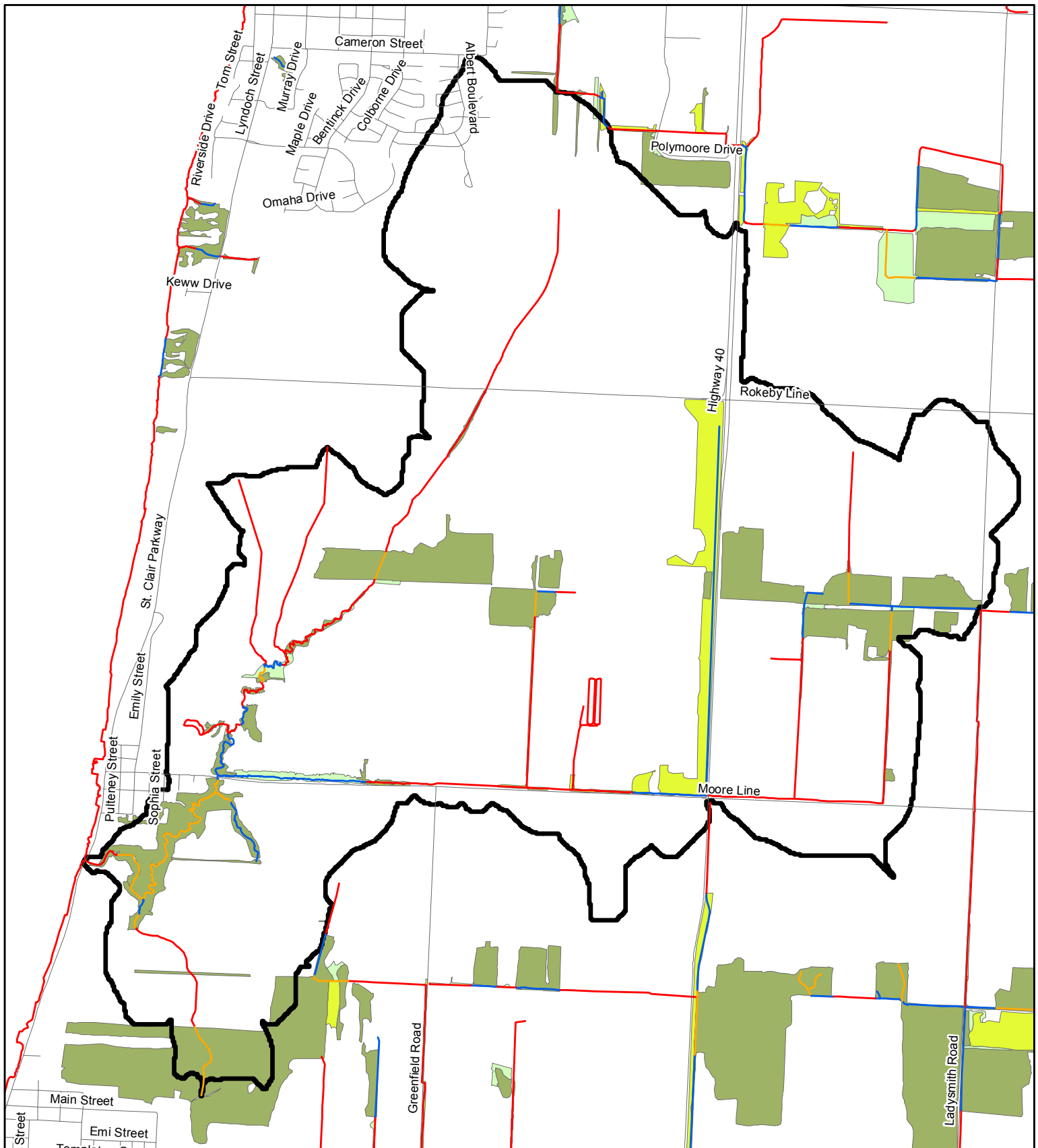
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



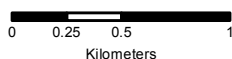


## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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### Baby Creek Subwatershed



#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary





## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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### Bowens Creek Subwatershed

0 0.125 0.25 0.5  
Kilometers



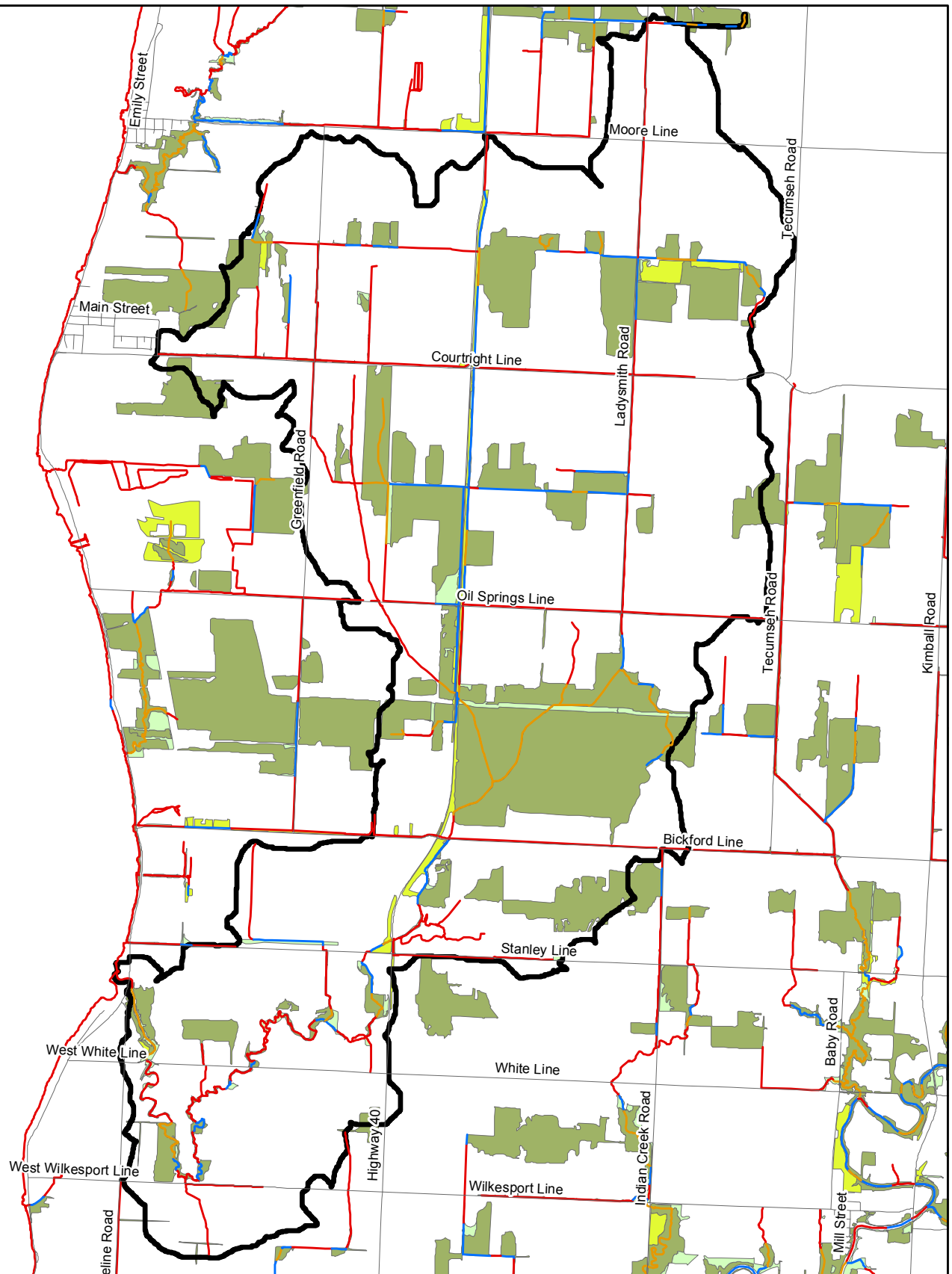
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



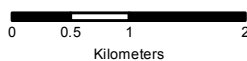


## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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### Clay Creek Subwatershed



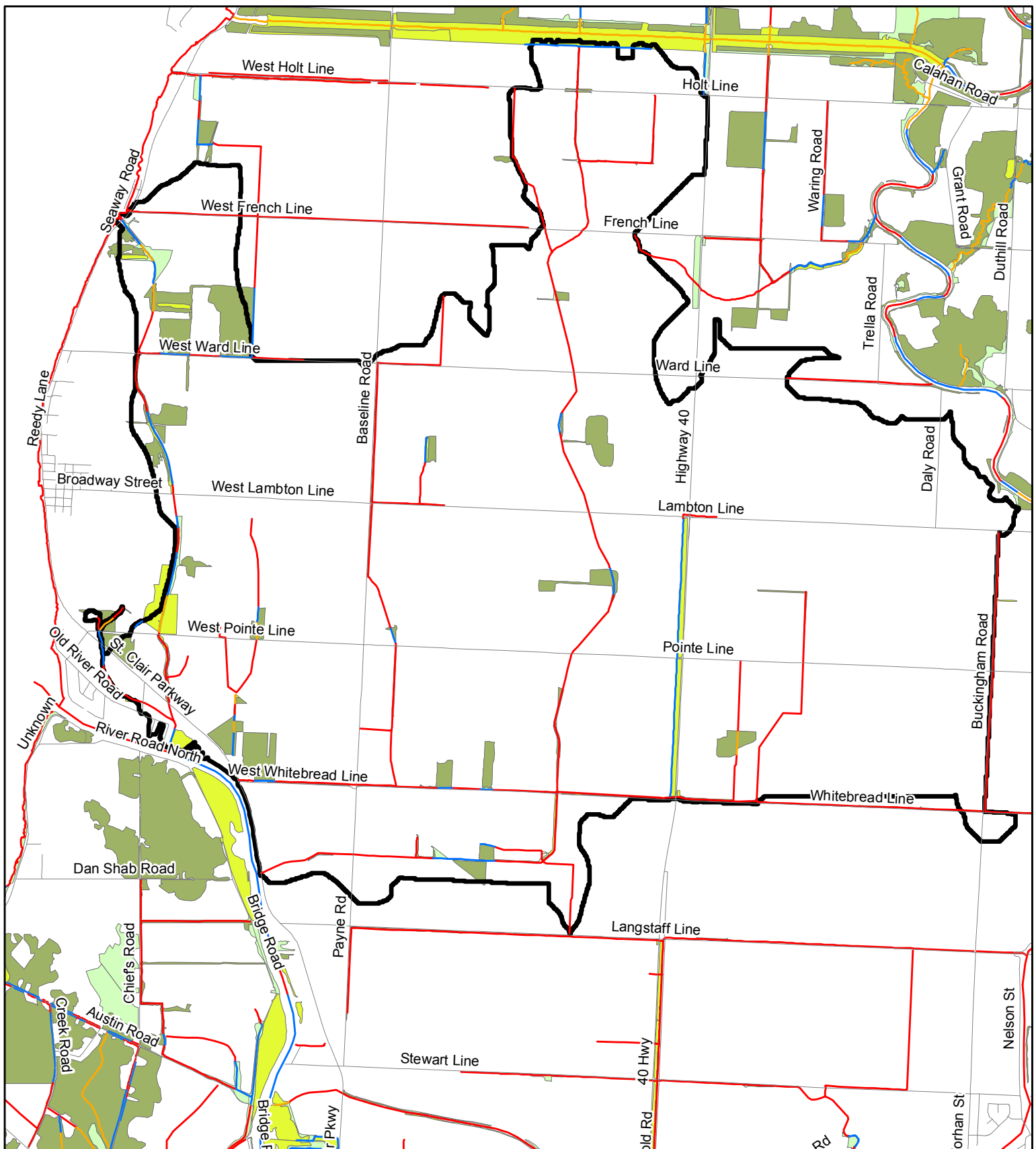
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary





## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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**Marshy Creek Subwatershed**

0 0.375 0.75 1.5  
Kilometers



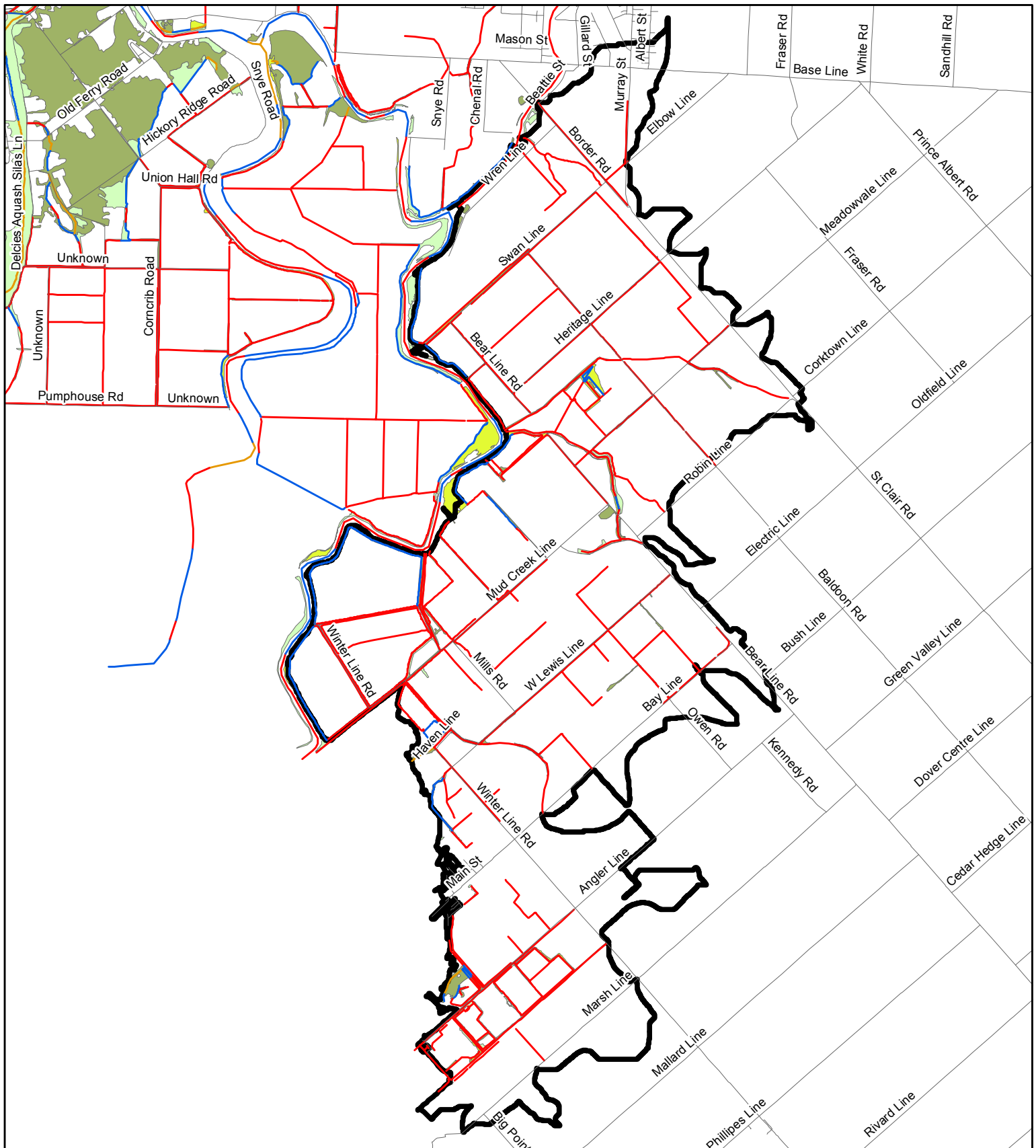
### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

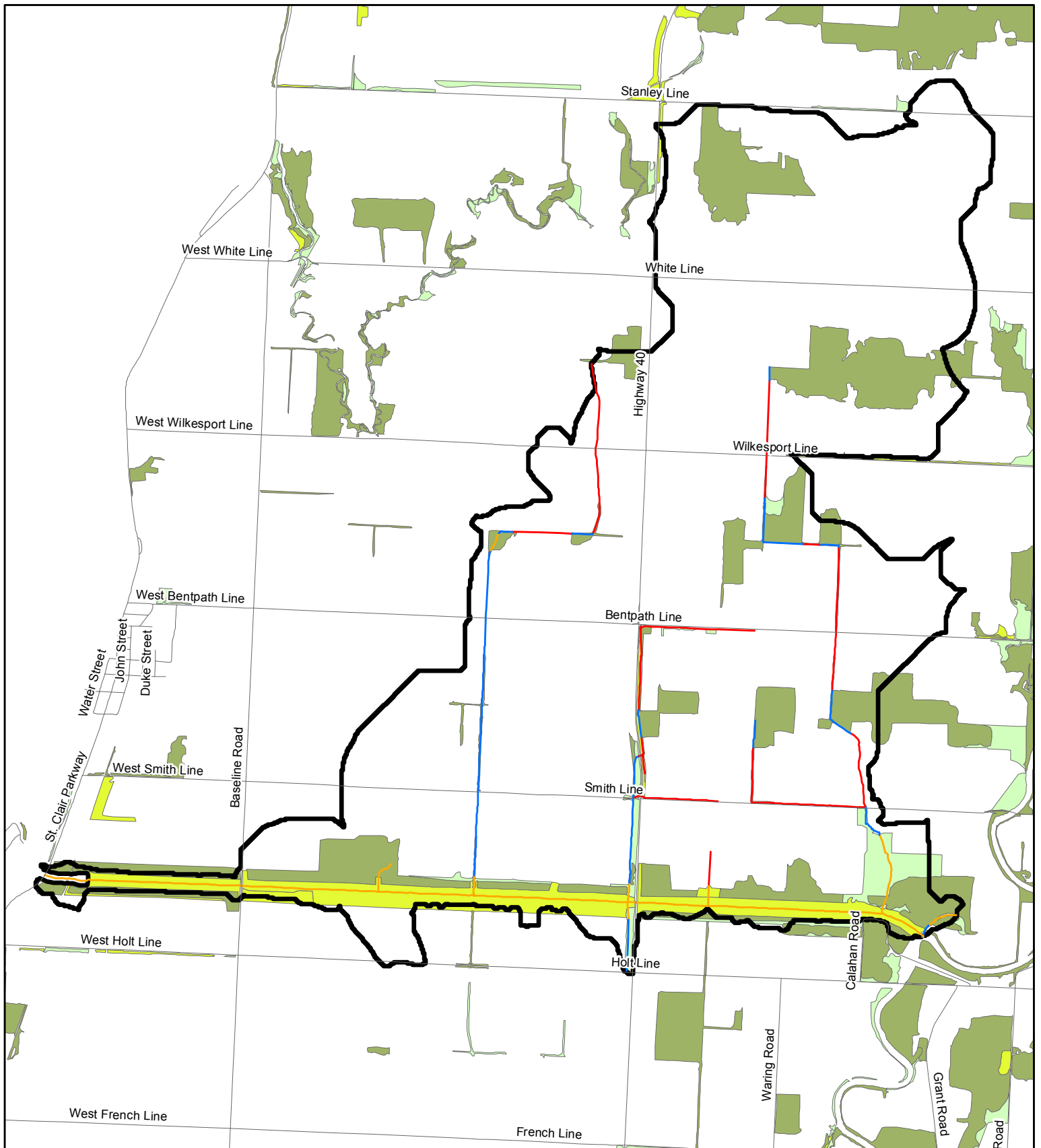
### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary







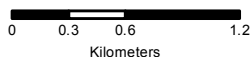


## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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**Mckeough Subwatershed**



### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary

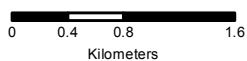


### St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters







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


## Running Creek Subwatershed



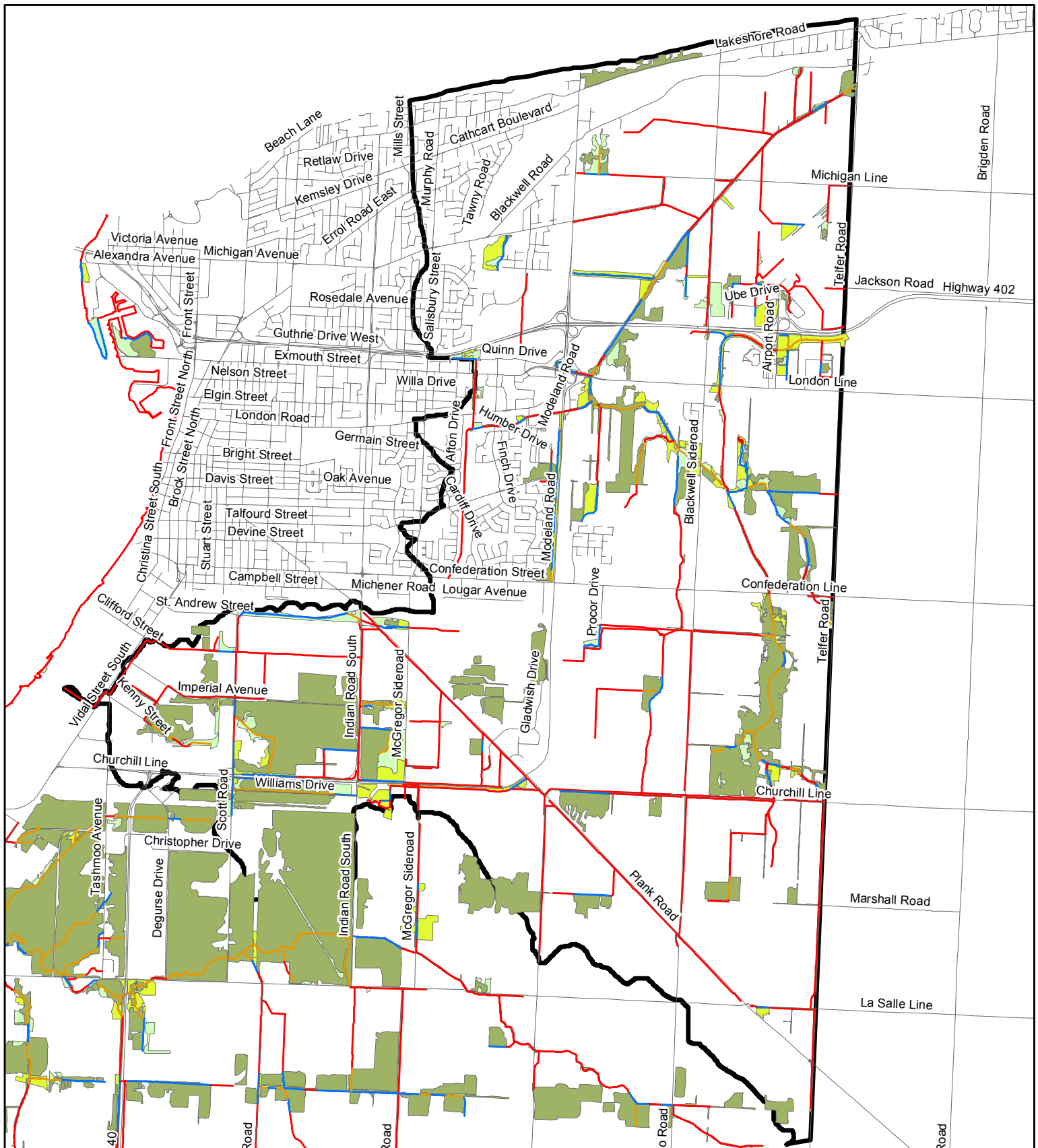
### Vegetation Type

-  Built-up Areas
-  Grassland and Pasture
-  Low Woody Shrubs and Grass
-  Wooded (Trees)

### Riparian Buffer Type

-  No Buffer  
 One Side Buffer  
 Two Sided Buffer  
 Subwatershed Boundary



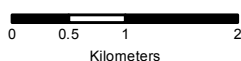


## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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**Sarnia  
Subwatershed**



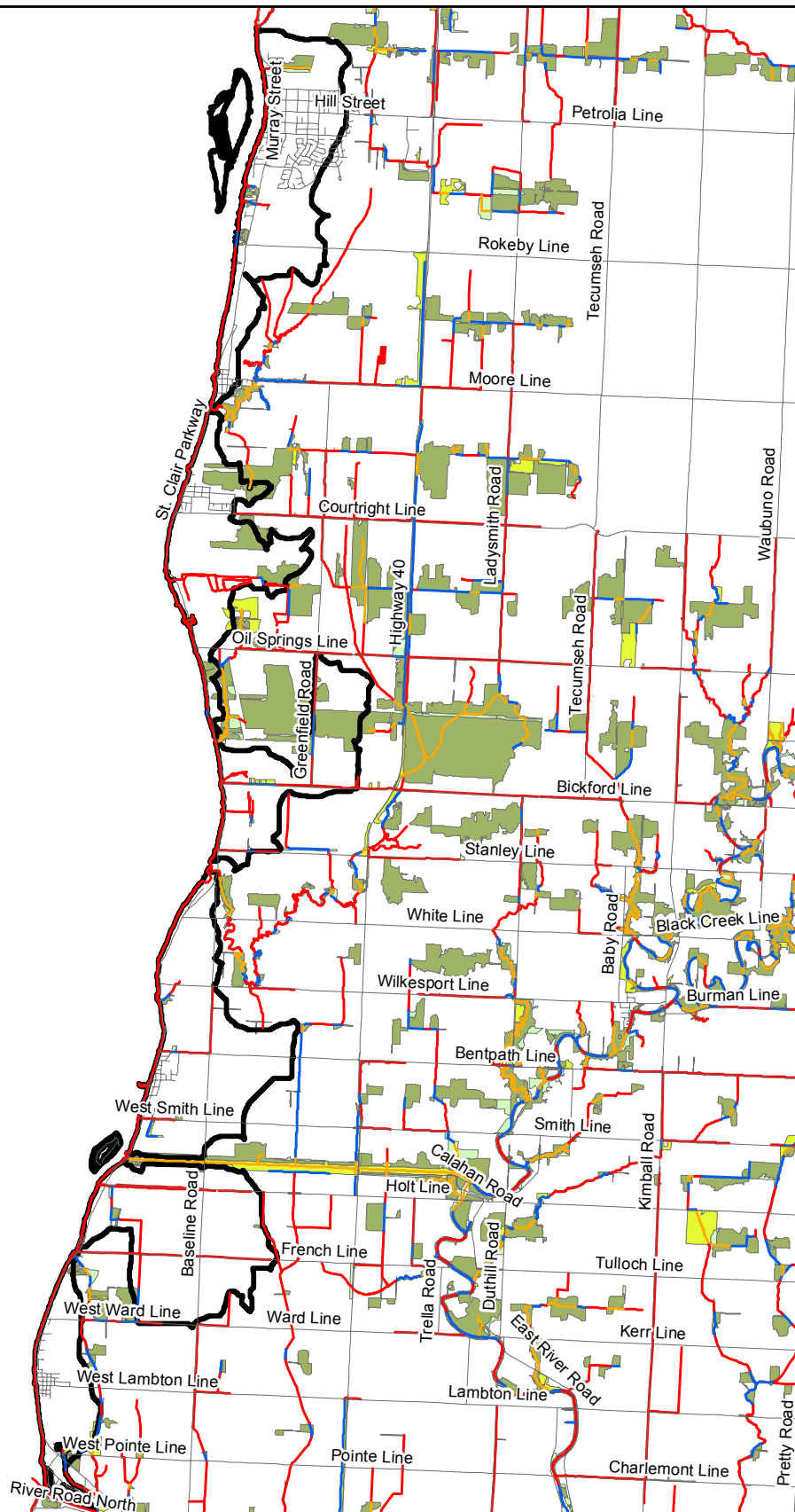
### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



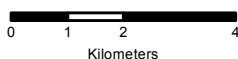


## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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### St. Clair River Tribs Subwatershed



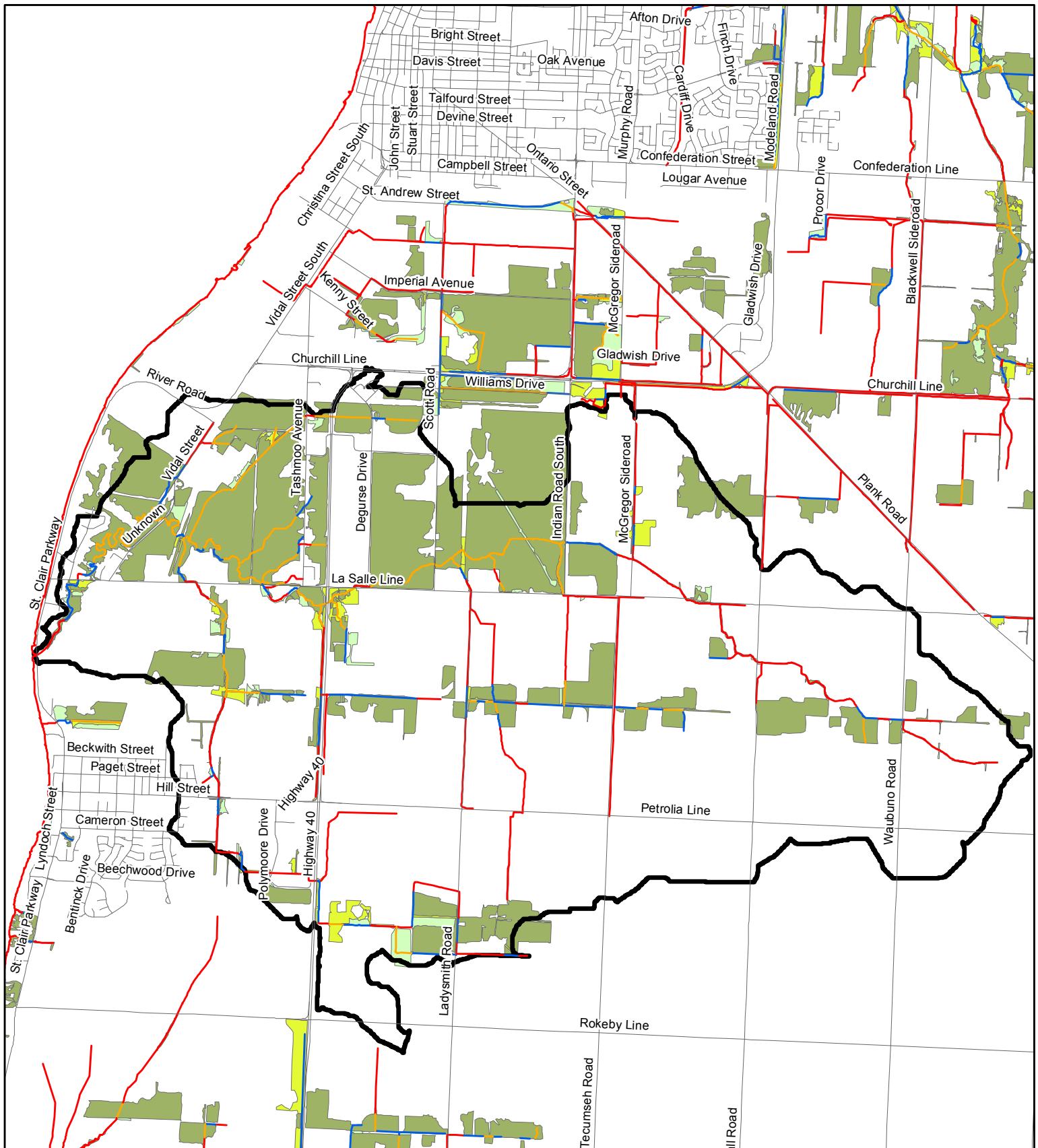
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary





## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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### Talford Creek Subwatershed

0 0.5 1 2  
Kilometers



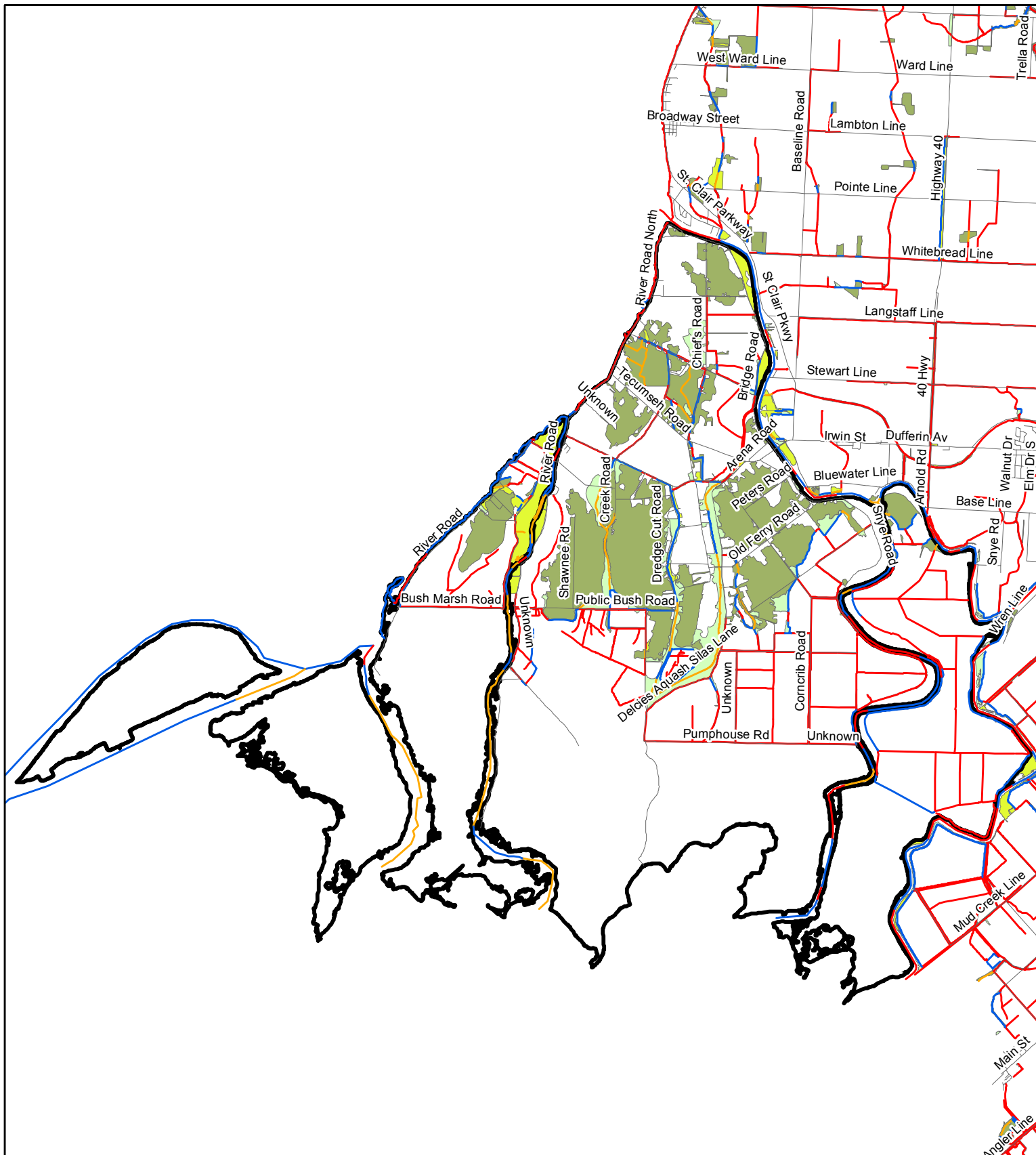
#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary



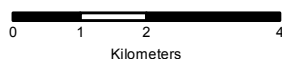


## St. Clair River Area of Concern - Riparian Zones - Greater than 30 Meters



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### Walpole Island Subwatershed



#### Vegetation Type

- Built-up Areas
- Grassland and Pasture
- Low Woody Shrubs and Grass
- Wooded (Trees)

#### Riparian Buffer Type

- No Buffer
- One Side Buffer
- Two Sided Buffer
- Subwatershed Boundary