

Bridge & Culvert Prioritization Program

*West
Grey*

Public Meeting
October 3, 2024



**TRITON
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Introduction

- The Municipality of West Grey currently owns 114 structures with a span greater than 3.0 metres
- Recent 2024 OSIM reports have identified 25 structures that have a Bridge Condition Index (BCI) under 70 with a service life less than 10 years and considered critical from an asset management perspective
- Due to the large number of structures, a **Bridge Prioritization Program** is necessary to determine how to best allocate resources to align with the needs of the Municipality of West Grey and its Asset Management Planning



Purpose of the Program

01

Create an order of priority based on the **Total Risk of Asset Failure** by assessing **Probability of Failure** and the **Total Consequence of Closure/Failure**

02

Maintain an up-to-date list of structures with the highest replacement priority to best suit the needs of the transportation network within the Municipality of West Grey

03

Provide a quantitative approach to asset management to remove subjectivity as much as possible

West Grey Critical Structures

B-025



Sideroad 10 (Closed)

G-133



South Line

B-008



Baseline

N-185



171600 Sideroad 25

N-188



172307 Sideroad 25

N-184



171600 Sideroad 25

N-055



Side Road 20 (Closed)

N-061



Concession Road 14

West Grey Critical Structures

B-001



Concession Road 12

G-033



Traverston Road (Closed)

N-070



Baseline (Closed)

B-006



171600 Sideroad 25

G-041



172307 Sideroad 25

G-038



343609 North Line (Closed)

G-037



343608 North Line

N-051



Concession Road 18 (Closed)

West Grey Critical Structures

B-003



Concession Road 6

G-132



Baseline

B-020



Concession Road 2 (Closed)

N-060



182401 Concession Road 12

N-058



18246 Concession Road 12

B-009



522598 Welbeck Rd

G-040



Concession Road 4

B-196



522613 Welbeck Road

G-011



Sideroad 3

Total Risk of Asset Failure

$$\begin{aligned} & \textit{Total Risk of Asset Failure} \\ & = \textit{Probability of Failure} * \textit{Consequence of Failure} \end{aligned}$$

- A higher numeric value for the Total Risk of Asset Failure Indicates a potentially higher priority in the **Bridge Prioritization Program**

Total Probability of Failure

The sum of the following components and scored out of 5 each:

1. ADT – Average Daily Traffic from traffic counts provided by the Municipality
2. Bridge Condition Index (BCI) – Structural rating from the Ontario Structure Inspection Manual (OSIM) Report

A higher value indicates a higher probability of failure

Total Consequence of Closure/Failure

The sum of the following components and scored out of 5 each:

1. ADT – Consistent with Total Probability of Failure
2. Detour Length (km) – Distance from one side of the structure to the other without crossing
3. Emergency Response Time – Change in response time measured in minutes resulting from the closure of a structure
4. Local Access – Inconvenience of a structure closure to residents

A higher value indicates greater consequence to the public as a result of closure/failure

Total Probability of Failure – Average Daily Traffic (ADT)

- Number of vehicles per 24-hour period counted on the road segment the structure is located
- Indicative of importance of a road segment to the overall transportation network within the Municipality
- Greater vehicular traffic increases the likelihood of failure
- Traffic count data is from 2016, however is representative of traffic patterns prior to structure closures in West Grey

Average Daily Traffic (ADT) Scoring System

Score	1	2	3	4	5
ADT	0 - 100	100 - 250	250 - 500	500 - 1000	1000+

Total Probability of Failure – Bridge Condition Index

- Obtained from the 2024 Ontario Structure Inspection Manual (OSIM) Reports
- Structural condition rating and estimate of the remaining service life of the bridges and culverts in West Grey
- Scaled to be scored out of 5 total points

$$Score\ for\ BCI = \frac{100 - BCI}{100} * 5$$

Total Consequence of Closure/Failure – Detour Length

- Based on shortest route, in kilometres, from one side of the structure to the other without crossing
- Weighted from 1 – 5 relative to other detour lengths analyzed in this program

$$\text{Detour Length Score} = \frac{\text{Structure Detour Length}}{\text{Maximum Detour Length}} * 5$$

Total Consequence of Closure/Failure – Local Access

- Local access represents the inconvenience created by the closure/failure of a structure

Local Access Scoring System	
Score	Description
1	No residential access located on the road segment resulting in minor access issues
2	less than 10 residents located on structures road segment
3	greater than 10 residents located on structures road segment
4	closed structure splits an owned parcel
5	closed structure isolates a property from access to road segment

Total Consequence of Closure/Failure – Emergency Response Time



The greatest change in response time from the structure to the nearest hospital



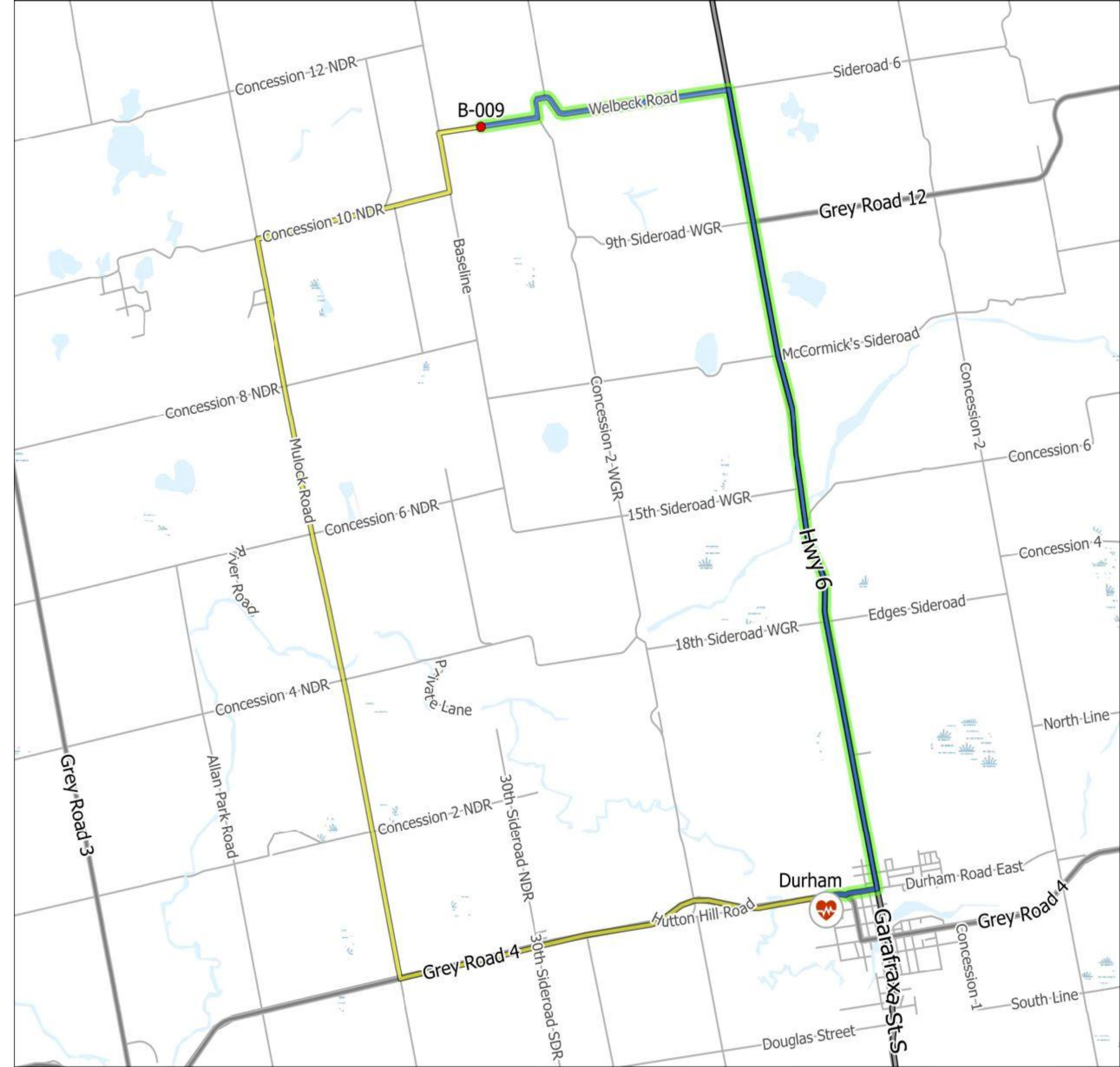
Provided by the Grey County GIS and Data division, and confirmed by Grey County Paramedic Services



Emergency response time was multiplied by 2 to account for both segments of the trip (dispatch to structure and then structure to hospital) and scored out of 5 relative to all other response times analyzed

Emergency Response Time Example

- As shown on the right for B-009, travel time to the hospital from the structure was modelled
- The travel time difference was the greatest between the N/W Barrier and S/E Barrier scenarios
- This number was multiplied by 2 to account for both segments of the trip
- EMS response time for B-009 is 6.8 minutes



Structure: B-009

Travel Time Difference: 3.4 minutes

- Prioritized Structure
- 🏥 Hospital
- 🟢 Original (Fastest)
- 🟡 N/W Barrier
- 🟠 S/E Barrier

Name - Closest Hospital	Travel Time (min)	Kilometers	Scenario
B-009 - Durham	14.6	16.1	Original
B-009 - Durham	14.6	16.1	N/W Barrier
B-009 - Durham	17.9	21.3	S/E Barrier



Created by: Grey County GIS
Date: Sept 5, 2024
NAD83 UTM Zone 17

Critical Structure Scores

Structure ID	Struture Status (open/closed)	Average Daily Traffic (ADT)	ADT Score	Bridge Condition Index (BCI)	BCI Score	Detour Length (km)	Detour Length Score	EMS Response Time (min)	EMS Response Score	Local Access Score	Total Probability of Failure	Total Consequence of Failure	Total Risk of Asset Failure	Deck Area (m2)	Replacement Cost (\$)
N-051	Closed	1018	5.0	57.8	2.11	10.7	3.30	7.4	3.43	3	7.11	14.73	104.72	128	\$ 2,944,000.00
N-060	Open	1196	5.0	69.7	1.52	11.7	3.61	6.4	2.96	4	6.52	15.57	101.47	49	\$ 1,127,000.00
N-058	Open	1196	5.0	70	1.50	11.7	3.61	5.0	2.31	4	6.50	14.93	97.02	75	\$ 1,725,000.00
B-020	Closed	953	4.0	51.4	2.43	16.2	5.00	4.8	2.22	3	6.43	14.22	91.45	139	\$ 3,197,000.00
B-003	Open	601	4.0	50.1	2.50	8	2.47	3.8	1.76	2	6.50	10.23	66.43	113	\$ 2,599,000.00
G-038	Closed	54	1.0	44.3	2.79	16	4.94	3.4	1.57	5	3.79	12.51	47.36	87	\$ 2,001,000.00
G-132	Open	44	1.0	61.8	1.91	16.2	5.00	10.8	5.00	5	2.91	16.00	46.56	58	\$ 1,334,000.00
G-037	Open	54	1.0	57.7	2.12	16	4.94	3.6	1.67	5	3.12	12.60	39.26	78	\$ 1,794,000.00
B-009	Open	196	2.0	68.7	1.57	6.7	2.07	6.8	3.15	3	3.57	10.22	36.42	95	\$ 2,185,000.00
B-196	Open	196	2.0	66.9	1.66	6.7	2.07	6.2	2.87	3	3.66	9.94	36.32	32	\$ 736,000.00
G-040	Open	119	2.0	67.5	1.63	7.9	2.44	3.4	1.57	4	3.63	10.01	36.29	107	\$ 2,461,000.00
G-041	Open	119	2.0	69.6	1.52	7.9	2.44	3.2	1.48	4	3.52	9.92	34.92	70	\$ 1,610,000.00
N-188	Open	165	2.0	54.1	2.30	8.5	2.62	2.8	1.30	2	4.30	7.92	34.02	26	\$ 598,000.00
B-006	Open	232	2.0	70	1.50	12.1	3.73	4.2	1.94	2	3.50	9.68	33.88	67	\$ 1,541,000.00
B-001	Open	197	2.0	67.4	1.63	7.8	2.41	5.8	2.69	2	3.63	9.09	33.01	69	\$ 1,587,000.00
G-033	Closed	74	1.0	48.7	2.57	9.2	2.84	5.2	2.41	3	3.57	9.25	32.97	209	\$ 4,807,000.00
N-055	Closed	130	2.0	63.2	1.84	8.3	2.56	4.0	1.85	2	3.84	8.41	32.31	136	\$ 3,128,000.00
N-061	Open	134	2.0	68.5	1.58	11.4	3.52	2.8	1.30	2	3.58	8.81	31.51	88	\$ 2,024,000.00
N-184	Open	61	1.0	46.8	2.66	7.9	2.44	5.4	2.50	2	3.66	7.94	29.05	33	\$ 759,000.00
B-011	Open	46	1.0	67.5	1.63	8.7	2.69	10.8	5.00	2	2.63	10.69	28.05	57	\$ 1,311,000.00
B-008	Open	134	2.0	63.8	1.81	6.6	2.04	2.6	1.20	2	3.81	7.24	27.59	61	\$ 1,403,000.00
N-070	Closed	25	1.0	67.4	1.63	6.8	2.10	9.6	4.44	2	2.63	9.54	25.10	190	\$ 4,370,000.00
N-185	Open	61	1.0	67.4	1.63	7.9	2.44	4.8	2.22	2	2.63	7.66	20.15	42	\$ 966,000.00
G-133	Open	78	1.0	65.5	1.73	5.5	1.70	2.2	1.02	3	2.73	6.72	18.30	27	\$ 621,000.00
B-025	Closed	44	1.0	57.8	2.11	6.5	2.01	0.4	0.19	2	3.11	5.19	16.15	153	\$ 3,519,000.00

*Replacement cost is based on an average cost per square metre for a conventional concrete span structure

** Replacement cost **was not** a factor throughout this process when determining the Total Risk of Asset Failure or the Structure Priority List

Total Risk of Asset Failure – Highest Risk

- These structures have potential to significantly impact the transportation network of West Grey if they require closure or are currently closed

Structure ID	Structure Status (open/closed)	Total Probability of Failure	Total Consequence of Failure	Total Risk of Asset Failure
N-051	Closed	7.11	14.73	104.72
N-060	Open	6.52	15.57	101.47
N-058	Open	6.50	14.93	97.02
B-020	Closed	6.43	14.22	91.45
B-003	Open	6.50	10.23	66.43
G-038	Closed	3.79	12.51	47.36
G-132	Open	2.91	16.00	46.56
G-037	Open	3.12	12.60	39.26
B-009	Open	3.57	10.22	36.42
B-196	Open	3.66	9.94	36.32
G-040	Open	3.63	10.01	36.29
G-041	Open	3.52	9.92	34.92

Total Risk of Asset Failure – Lowest Risk

- This group of structures are either still structurally capable of performing as designed and/or will have less of an impact if they require closure, or are already closed

Structure ID	Structure Status (open/closed)	Total Probability of Failure	Total Consequence of Failure	Total Risk of Asset Failure
B-025	Closed	3.11	5.19	16.15
G-133	Open	2.73	6.72	18.30
N-185	Open	2.63	7.66	20.15
N-070	Closed	2.63	9.54	25.10
B-008	Open	3.81	7.24	27.59
B-011	Open	2.63	10.69	28.05
N-184	Open	3.66	7.94	29.05
N-061	Open	3.58	8.81	31.51
N-055	Closed	3.84	8.41	32.31
G-033	Closed	3.57	9.25	32.97
B-001	Open	3.63	9.09	33.01
B-006	Open	3.50	9.68	33.88
N-188	Open	4.30	7.92	34.02

Years of Service Life Remaining

- These structures have the lowest remaining years of service life in the Municipality of West Grey
- 0 Years of service indicates the structure is currently closed

Structure ID	Total Probability of Failure	Total Consequence of Failure	Total Risk of Asset Failure	Years of Service
N-051	7.11	14.73	104.72	0
B-020	6.43	14.22	91.45	0
G-038	3.79	12.51	47.36	0
G-033	3.57	9.25	32.97	0
N-055	3.84	8.41	32.31	0
N-070	2.63	9.54	25.10	0
B-025	3.11	5.19	16.15	0
B-003	6.50	10.23	66.43	1 to 5
G-132	2.91	16.00	46.56	1 to 5
G-037	3.12	12.60	39.26	1 to 5
N-188	4.30	7.92	34.02	1 to 5
N-184	3.66	7.94	29.05	1 to 5
B-001	3.63	9.09	33.01	6 to 10
B-011	2.63	10.69	28.05	6 to 10
B-008	3.81	7.24	27.59	6 to 10

Structure Priority List

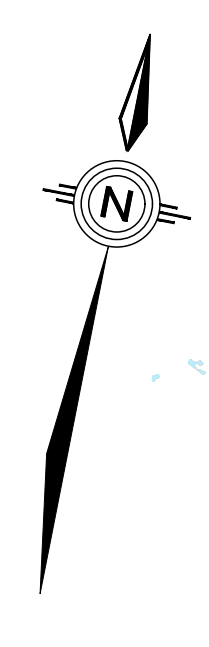
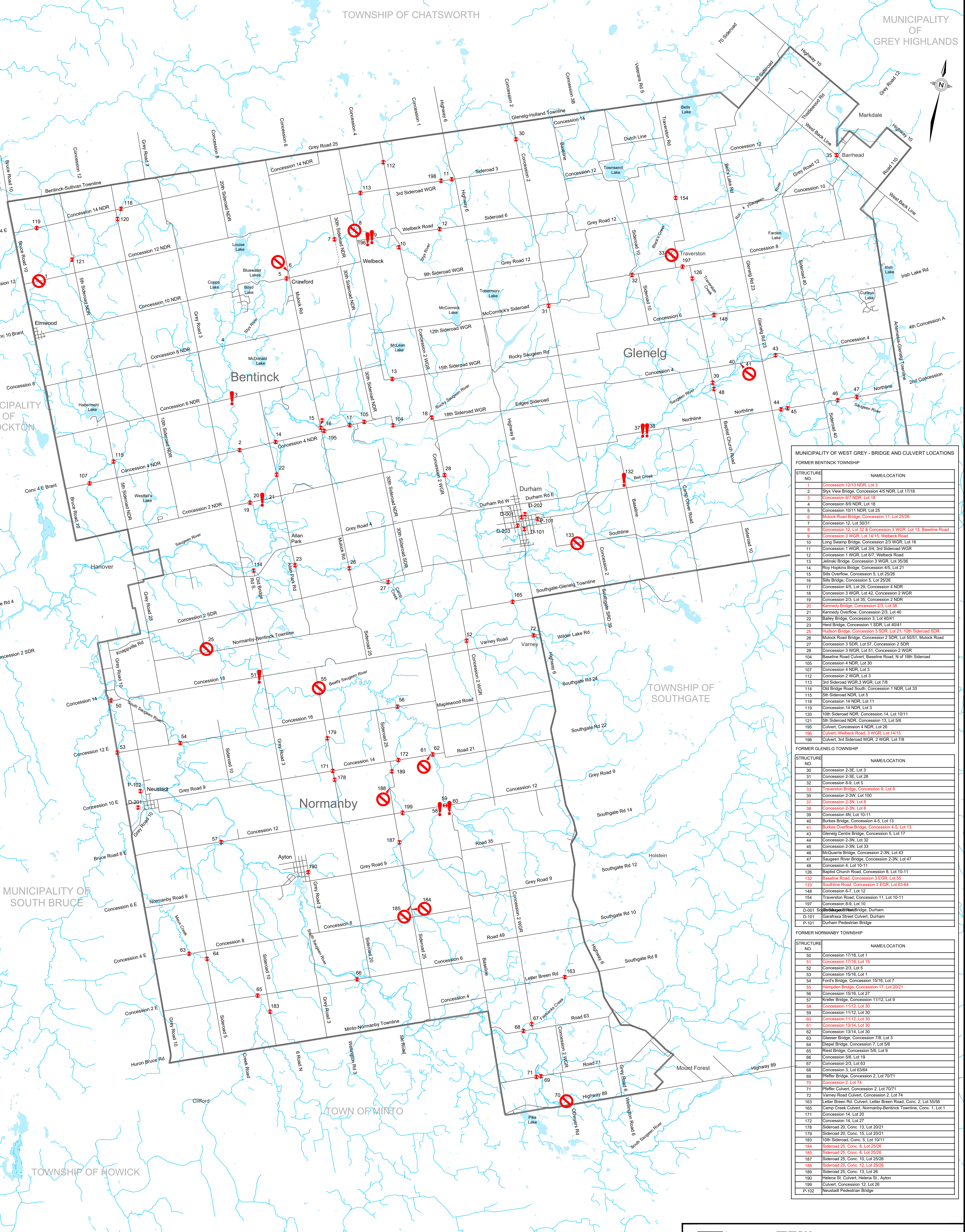
- Derived from the highest risk ranking as well as estimated remaining service life from 2024 OSIM
- This list will be kept up to date with new structures analyzed and added to this list as they approach the end of their service life
- A closed structure that isolates property from the transportation network is given highest priority

Rank	Structure ID	Discussion	Cost (2024 Dollar Value for Concrete)
1	G-038	Isolation of properties from potential flooding known to occur on this road segment. Structure is currently closed.	\$ 2,001,000
1	G-037	Isolation of properties from potential flooding known to occur on this road segment.	\$ 1,794,000
3	N-051	Closed due to significant deterioration. ADT of 1018 was the highest amongst structures with less than 5 service years remaining and a high change in EMS response time.	\$ 2,944,000
4	B-003	High ADT of 601 with limited service life remaining. It is Currently recommended for inspection every 6 months.	\$ 2,600,000
5	G-132	While the use is minimal, a property becomes isolated if closed.	\$ 1,334,000
6	B-020	Although B-020 has been closed for almost 6 years now, the 2016 ADT indicates this road segment has a high ADT of 953.	\$ 3,197,000
7	N-060	This structure has a high ADT of 1196 and reported in fair to poor condition with no signs of structural distress.	\$ 1,127,000
8	N-058	This structure has a high ADT of 1196 and reported in fair to poor condition with no signs of structural distress.	\$ 1,725,000
9	B-009	This structure is reported to be in fair condition with no signs of structural distress.	\$ 2,185,000
10	B-196	This structure is reported to be in fair condition with no signs of structural distress.	\$ 736,000

Candidate Structures for Long-Term Closure

- Highlighted structures are currently closed
- Based on their Total Consequence of Closure/Failure to the Municipality, these structures can be considered for long-term closure at the end of their service life
- Permanent closure would result in a replacement capital and life cycle cost savings up to \$30 million based on typical 2024 concrete construction values

Structure ID	Total Probability of Failure	Total Consequence of Failure	Total Risk of Asset Failure	Years of Service
B-025	3.11	5.19	16.15	0
G-133	2.73	6.72	18.30	10+
B-008	3.81	7.24	27.59	6 to 10
N-185	2.63	7.66	20.15	10+
N-188	4.30	7.92	34.02	1 to 5
N-184	3.66	7.94	29.05	1 to 5
N-055	3.84	8.41	32.31	0
N-061	3.58	8.81	31.51	10+
B-001	3.63	9.09	33.01	6 to 10
G-033	3.57	9.25	32.97	0
N-070	2.63	9.54	25.10	0
B-006	3.50	9.68	33.88	10+
G-041	3.52	9.92	34.92	10+



MUNICIPALITY OF WEST GREY - BRIDGE AND CULVERT LOCATIONS
FORMER BENTINCK TOWNSHIP

STRUCTURE NO.	NAME/LOCATION
1	Concession 12/13 NDR, Lot 3
2	Styx View Bridge, Concession 4/5 NDR, Lot 17/18
3	Concession 6/7 NDR, Lot 18
4	Concession 8/9 NDR, Lot 18
5	Concession 10/11 NDR, Lot 25
6	Mulock Road Bridge, Concession 11, Lot 25/26
7	Concession 12, Lot 30/31
8	Concession 12, Lot 32 & Concession 3 WGR, Lot 13, Baseline Road
9	Concession 3 WGR, Lot 14/15, Welbeck Road
10	Long Siding Bridge, Concession 2/3 WGR, Lot 16
11	Concession 1 WGR, Lot 34, 3rd Sideroad WGR
12	Concession 1 WGR, Lot 67, Welbeck Road
13	Jelinski Bridge, Concession 3 WGR, Lot 35/36
14	Roy Hopkins Bridge, Concession 4/5, Lot 21
15	Sils Overflow, Concession 5, Lot 25/26
16	Sils Bridge, Concession 5, Lot 25/26
17	Concession 4/5, Lot 29, Concession 4 NDR
18	Concession 3 WGR, Lot 42, Concession 2 WGR
19	Concession 2/3, Lot 35, Concession 2 NDR
20	Kennedy Bridge, Concession 2/3, Lot 38
21	Kennedy Overflow, Concession 2/3, Lot 40
22	Bailey Bridge, Concession 3, Lot 40/41
23	Herd Bridge, Concession 1 SDR, Lot 40/41
24	Hudson Bridge, Concession 3 SDR, Lot 21, 10th Sideroad SDR
25	Mulock Road Bridge, Concession 2 SDR, Lot 50/51, Mulock Road
26	Concession 3 SDR, Lot 57, Concession 2 SDR
27	Concession 3 SDR, Lot 57, Concession 2 SDR
28	Concession 3 WGR, Lot 51, Concession 2 WGR
104	Baseline Road Culvert, Baseline Road, N of 18th Sideroad
105	Concession 4 NDR, Lot 30
107	Concession 4 NDR, Lot 3
112	Concession 2 WGR, Lot 3
113	3rd Sideroad WGR, Lot 7/8
114	Old Bridge Road South, Concession 1 NDR, Lot 33
115	5th Sideroad NDR, Lot 5
118	Concession 14 NDR, Lot 11
119	Concession 14 NDR, Lot 3
120	10th Sideroad NDR, Concession 14, Lot 10/11
121	5th Sideroad NDR, Concession 13, Lot 5/6
195	Culvert, Concession 4 NDR, Lot 26
196	Culvert, Welbeck 3 WGR, Lot 14/15
198	Culvert, 3rd Sideroad WGR, 2 WGR, Lot 7/8

FORMER GLENELG TOWNSHIP

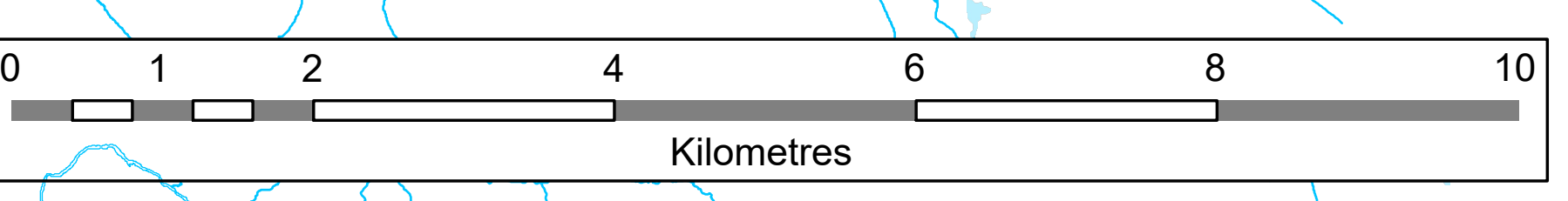
STRUCTURE NO.	NAME/LOCATION
30	Concession 2-3E, Lot 3
31	Concession 2-3E, Lot 28
32	Concession 8-9, Lot 5
33	Traverston Bridge, Concession 9, Lot 9
35	Concession 2-3W, Lot 100
37	Concession 2-3N, Lot 6
38	Concession 2-3N, Lot 6
39	Concession 4N, Lot 10-11
40	Burkes Bridge, Concession 4-5, Lot 13
41	Burkes Overflow Bridge, Concession 4-5, Lot 13
43	Glenelg Centre Bridge, Concession 5, Lot 17
44	Concession 2-3N, Lot 32
46	Concession 2-3N, Lot 53
47	McQuarrie Bridge, Concession 2-3N, Lot 43
47	Saugen River Bridge, Concession 2-3N, Lot 47
48	Concession 4, Lot 10-11
126	Baptist Church Road, Concession 8, Lot 10-11
132	Baseline Road, Concession 3 EGR, Lot 55
133	Southline Road, Concession 2 EGR, Lot 63-64
148	Concession 6-7, Lot 12
154	Traverston Road, Concession 11, Lot 10-11
197	Concession 8-9, Lot 10
D-001	Southgate Railway Bridge, Durham
D-101	Garafaxa Street Culvert, Durham
P-101	Durham Pedestrian Bridge

FORMER NORMANBY TOWNSHIP

STRUCTURE NO.	NAME/LOCATION
50	Concession 17/18, Lot 1
51	Concession 17/18, Lot 15
52	Concession 2/3, Lot 5
53	Concession 15/16, Lot 1
54	Ford's Bridge, Concession 15/16, Lot 7
55	Hampden Bridge, Concession 17, Lot 20/21
56	Concession 15/16, Lot 27
57	Krieger Bridge, Concession 11/12, Lot 9
58	Concession 11/12, Lot 30
59	Concession 11/12, Lot 30
60	Concession 11/12, Lot 30
61	Concession 13/14, Lot 30
62	Concession 13/14, Lot 30
63	Glasser Bridge, Concession 7/8, Lot 3
64	Diaper Bridge, Concession 7, Lot 5/6
65	Riess Bridge, Concession 5/6, Lot 9
66	Concession 5/6, Lot 19
67	Concession 2/3, Lot 63
68	Concession 3, Lot 63/64
69	Pfeifer Bridge, Concession 2, Lot 70/71
70	Concession 2, Lot 71
71	Pfeifer Culvert, Concession 2, Lot 70/71
72	Varney Road Culvert, Concession 2, Lot 74
163	Letter Breen Rd. Culvert, Letter Breen Road, Conc. 2, Lot 55/56
165	Camp Creek Culvert, Normanby-Bentinck Townline, Conc. 1, Lot 1
171	Concession 14, Lot 20
172	Concession 14, Lot 27
179	Sideroad 20, Conc. 13, Lot 20/21
179	Sideroad 20, Conc. 15, Lot 20/21
183	10th Sideroad, Conc. 5, Lot 10/11
184	Sideroad 25, Conc. 8, Lot 25/26
185	Sideroad 25, Conc. 8, Lot 25/26
187	Sideroad 25, Conc. 10, Lot 25/26
188	Sideroad 25, Conc. 12, Lot 25/26
189	Sideroad 25, Conc. 13, Lot 26
190	Helena St. Culvert, Helena St., Aytan
199	Culvert, Concession 12, Lot 26
P-102	Neustadt Pedestrian Bridge

MUNICIPALITY OF WEST GREY - DAM LOCATIONS

STRUCTURE NO.	NAME/LOCATION
D-201	Neustadt Dam
D-202	Durham Upper Dam
D-203	Durham Lower Dam



LEGEND

- CANDIDATE FOR CLOSURE
- HIGH PRIORITY STRUCTURE
- ALL STRUCTURES

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

TOWNSHIP OF WEST GREY BRIDGE & CULVERT PRIORITIZATION PLAN
KEY PLAN
PROJECT No. A3411