

**STRUCTURAL INSPECTION REPORT  
FOR  
THE BOVAIRD DRIVE STRUCTURES  
ENVIRONMENTAL ASSESSMENT**

Submitted to:

**Regional Municipality of Peel**

Submitted by:

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## EXECUTIVE SUMMARY

AMEC Earth & Environmental has been retained by the Region of Peel to complete a Class Environmental Assessment for improvements to Bovaird Drive, from Lake Louise Drive to the Halton Peel boundary. The attached report addresses the condition of the structures in this section of road based on the inspections completed by members of our staff. A summary of the findings is outlined in the table below.

In general, fifteen structures were reviewed, with structure 2A and 2B being a twin structure for the west bound and east bound lanes of Bovaird Drive.

The structures range from small (0.5m diameter CSP culverts) to larger bridges 30m span (Structure No. 2). Conditions range from poor to fair. It is our recommendation that three of the small CSP culverts be replaced with the consideration of a replacement of a fourth. Rehabilitation is required on the main bridge on Bovaird Drive (Structure No. 2).

The other structures appear to be in fair condition but rehabilitation should be considered for work such as repair of erosion, some minor end deterioration and possible extensions to suit the new road work. Final decision on any repairs, rehabilitation and / or replacements should be made jointly with the hydraulic requirements and associated road improvement for any structure affected by this proposed work.

No.	Structure Location	Span/ Type	Observation	Recommendation
1	Bovaird Drive, 20m west of Lake Louise Drive	2.25m Ellipse	Good condition	Existing structure adequate.
2A	Bovaird Drive, CN Overhead (west bound lane structure)	30m Bridge	Fair condition	Rehabilitation required.
2B	Bovaird Drive, CN Overhead (east bound lane structure)	30m Bridge	Good condition	Existing structure adequate.
3	Bovaird Drive, 115m east of Ashby Field Road	0.9m Box 1.05m CSP	Good condition with damage to CSP	Concrete section adequate. Consider CSP removal/replacement.
4	Bovaird Drive, 280m west of Ashby Field Road	0.9m Box	Good with minor defects	Existing section adequate with minor repair.
5	Bovaird Drive, 20m east of Mississauga Road (Bridge 1071879)	5.53m Box Open Footing	Good condition	Existing structure adequate.
6	Mississauga Road, 20m north of Bovaird Drive	0.63m CSP	Good condition	Existing structure adequate.
7	Mississauga Road, 400m south of Bovaird Drive	0.50m CSP	Ends in poor condition	Replace CSP.

No.	Structure Location	Span/ Type	Observation	Recommendation
8	Mississauga Road, 80m south of Bovaird Drive	0.65m CSP	Ends in poor condition	Replace CSP.
9	Bovaird Drive, 320m west of Mississauga Road	0.9m Open Footing	Good condition with minor defects	Existing structure adequate with minor repair.
10	Bovaird Drive, 440m east of Heritage Road	1.2m Open Footing	Good condition Banks eroding.	Existing structure adequate with repair of erosion.
11	Bovaird Drive, 20m west of Heritage Road	1.2m Open Footing	Good condition Banks eroding.	Existing concrete structure adequate. Remove CSP section and repair erosion.
12	Heritage Road, 50m south of Bovaird Drive	0.9m CSP	Corrosion throughout. Damage to ends.	Replace CSP
13	Bovaird Drive, 450m west of Heritage Road	0.91m Open Footing	Sagging and cracking	More detailed structural investigation recommended.
14	Bovaird Drive, 1.1km west of Heritage Road	1.2m Box	Outlet end is fair. Inlet is unknown.	More detailed structural recommended required. Reconstruction of inlet end.

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## 1.0 INTRODUCTION

### Introduction

AMEC Earth & Environmental has been retained by the Region of Peel to complete a Class Environmental Assessment for improvements to Bovaird Drive, from Lake Louise Drive to the Halton Peel boundary.

This report addresses the structural condition of the structures in this section of road, based on inspections completed in December 2009 by Derk Meyer, P. Eng. and Derek Jansen, E.I.T. from AMEC Earth & Environmental.

### 1. Bovaird Drive, 20m West of Lake Louise Drive

Structure type:	Precast concrete ellipse
Skew angle:	Varies
Roadway width:	7 lanes (4 thru, 2 turning, 1 merging)
Barriers:	Yes
Approximate cover:	2m
Clear span / width:	2.25m
Approximate height:	1.46m
Approximate length:	60m
Clearance above water:	1.36m
Water depth:	0.1m

#### **Significant Findings:**

The structure was found to be in generally good condition throughout. The concrete inlet structure and adjoining armour stone retaining walls appear to be in good condition as well.

#### **Recommendations:**

This structure is in good condition, thus if the hydraulic capacity is acceptable, the existing structure should be lengthened.

### 2A. Bovaird Drive (West Bound Lane Structure) CN Overhead

Structure type:	Bridge
Skew angle:	45 <sup>0</sup>
Approximate Roadway width:	2 lanes
Barriers:	PL-2 (cast in place concrete)
No. of spans:	3
Approximate width:	13.3m
Approximate length:	30.0m

***Significant Findings:***

The existing structure was constructed in 1964 and provides for two traffic lanes and no pedestrian capacity except on the shoulders. The structure is in fair condition (Photo 4 and 5).

The superstructure consists of 7 precast concrete girders believed to be ASHTO Type 1 that supports a concrete deck with an asphaltic wearing surface and waterproofing system. The barriers are parapet walls with a performance rating of two (PL-2) (Photo 5).

The bridge has expansion joints at each end of the deck. Approach slabs are provided beyond the expansion joints (Photo 5).

The foundation for the abutments is not known; however, the east abutment footing is exposed on the east abutment substructure which suggests that the structure is founded on deep foundations (Photo 11). As there is sufficient bearing capacity just below track level we suspect that the piers are founded on spread footings, although this cannot be confirmed from our inspection. The structure has a typical conventional abutment and piers with four pier shafts and a concrete cap. A protection wall was not provided at track level on the east pier, limiting protection of the structure and ultimately the road traffic in case of a derailment (Photo 4).

The west abutment has been modified as part of the GO Transit program. The addition of the retaining wall in front of the abutments was to allow for the construction of the third track under the west span of the structure, constructed for the Mount Pleasant GO Station, just west of the structure. The west pier as part of this program was upgraded by the protection wall (Photo 4 and 7).

The east abutment is protected by slope pavement. There are a number of areas where the pavement has failed, namely along the south third to half of the slope (Photos 11, 12 and 13).

Some of the abutment bearings are not seated properly (Photo 9).

Some deterioration is occurring on a concrete diaphragm (Photo 10).

The guide rails on the southwest corner of the structure are not in compliance with the MTO standards as several posts are missing at the left approach to the structure. This should be corrected as soon as possible (Photo 14 and 15).

The shoulder at the northwest corner of the structure has eroded and a void exists that unless filled will eventually affect the wearing surface condition (Photo 15).

The temporary protection system used to construct the east bound lane structure is exposed in the gap between the structures. This should be corrected by the construction of a protection wall when the westbound structure is replaced. (Photo 16). This structure shows no indication that it does not have the capacity to carry current traffic loading in accordance with the CHBDC.



## **2B. Bovaird Drive (East Bound Lane Structure)**

### **CN Overhead**

Structure type:	Bridge
Skew angle:	45°
Approximate roadway width:	3 lanes
Barriers:	PL-2 (cast in place concrete)
No. of spans:	3
Approximate width:	13.3m
Approximate length:	30.0m

### **Significant Findings:**

The existing structure was constructed in 2007. The structure was designed to enable construction of the adjacent WBL structure maintaining super elevation across both structures clearance of 7.01m on the westbound lane structure. The structure is in good condition.

The superstructure consists of 8 CPCI girders supporting a concrete deck with an asphaltic wearing surface and waterproofing system. The structure provides for three lanes and a sidewalk along the south side of the structure, which is separated from the traffic by a jersey barrier. The exterior barrier consists of a concrete wall with vertical posts spaced along the length of the bridge. Between the posts, a tube rail is provided similar to the MTO standard.

The bridge has expansion joints at each end of the deck. Approach slabs are provided beyond the expansion joints.

The substructure is founded on spread footings, with a typical conventional abutment and piers with five pier shafts and a concrete cap. Protection walls are provided at the track level to protect the structure in case of a derailment.

The abutments of this structure are vertical, providing an opportunity for a fourth track to be constructed, except for the slope that spills in front of the east abutment from the westbound structure.

This structure shows no indication that it does not have the capacity to carry current traffic loading in accordance with the CHBDC.

### 3. Bovaird Drive, 115m East of Ashby Field Road

Structure type:	Concrete box (north end), CSP (south end)
Skew angle:	0°
Roadway width:	7 lanes (5 thru, 2 turning)
Barriers:	No
Approximate cover:	1m
Clear span / width:	0.90 (box), 1.05 (CSP)
Approximate height:	0.90 (box), 1.05 (CSP)
Approximate length:	46m
Clearance above water:	Varies
Water depth:	0.1 at north end, 0.5m at south end

#### **Significant Findings:**

The concrete box portion of this structure was found to be in generally good condition. The CSP portion showed minor separation approximately 3m from the south end. The CSP has started to collapse at the connection to the concrete box section. Inspection of the barrel was limited due to access restrictions.

#### **Recommendations:**

Extension of the concrete section will be structurally sufficient if hydraulic capacity is acceptable. Consideration should be given to replacement of the CSP portion with a concrete culvert

Alternatively, the CSP damage should be repaired during widening.

### 4. Bovaird Drive, 280m West of Ashby Field Road

Structure type:	Concrete box
Skew angle:	0°
Roadway width:	3 lanes
Barriers:	No
Approximate cover:	1m
Clear span / width:	0.9m
Approximate length:	33m
Clearance above water:	0.9m

#### **Significant Findings:**

Some spalls were detected at the south end inside the culvert. The remainder of the culvert appeared to be in generally good condition. Inspection of the barrel was limited due to access restrictions.

**Recommendations:**

Extension of the existing concrete box culvert will be structurally sufficient for road widening of hydraulic capacity is acceptable. Repairs to spalls at the south end should be completed during road construction.

**5. Bovaird Drive, 20m East of Mississauga Road (Bridge 1071879)**

Structure type:	Open footing cast in place rigid frame
Skew angle:	0°
Roadway width:	3 lanes (2 thru, 1 turning)
Barriers:	Yes - SBGR
Approximate cover:	1.5m
Clear span / width:	5.53m
Approximate height:	1.65
Approximate length:	60m

**Significant Findings:**

This structure was found to be generally in good condition. Inspection of the barrel was limited due to access restrictions.

**Recommendations:**

Extension of the existing cast in place culvert will be structurally sufficient for road widening, if hydraulic capacity is acceptable.

**6. Mississauga Road, 20m North of Bovaird Drive**

Structure type:	CSP
Skew angle:	0°
Roadway width:	3 lanes (2 thru, 1 turning)
Barriers:	Yes – wood post with 3 cable on east side of road
Approximate cover:	1.5m
Diameter:	0.63m
Approximate length:	22m
Clearance above water:	0.63m
Water depth:	0m

**Significant Findings:**

This CSP was found to be generally in good condition. Inspection of the barrel was limited due to access restrictions.

**Recommendations:**

Extension of the existing CSP culvert will be structurally sufficient for road widening, if hydraulic capacity is acceptable.

## 7. Mississauga Road, 400m South of Bovaird Drive

Structure type:	CSP
Skew angle:	0°
Roadway width:	2 lanes
Barriers:	No
Approximate cover:	2m
Diameter:	0.50m
Approximate length:	28m
Clearance above water:	0.25m
Water depth:	0.25m

### ***Significant Findings:***

This CSP is severely corroded at both ends. Inspection of the interior was limited due to access restrictions, although it appears to generally be in good condition.

### ***Recommendations:***

Repair to the ends will be required. Full replacement of the CSP culvert is recommended for any road widening.

## 8. Mississauga Road, 80m South of Bovaird Drive

Structure type:	CSP
Skew angle:	0°
Roadway width:	3 lanes (2 thru, 1 turning)
Barriers:	No
Approximate cover:	2m
Diameter:	0.65m
Approximate length:	25m
Clearance above water:	0.45m
Water depth:	0.2m

### ***Significant Findings:***

This CSP is severely corroded at both ends. There is medium rust along the bottom of the interior, and there appears to be a partially collapsed section midway through the culvert. Inspection of the barrel was limited due to access restrictions.

### ***Recommendations:***

Repair to the ends will be required. Full replacement of the CSP culvert is recommended for any road widening.

## 9. Bovaird Drive, 320m West of Mississauga Road

Structure type:	Open footing cast in place rigid frame
Skew angle:	0°
Roadway width:	2 lanes
Barriers:	No
Approximate cover:	1m
Clear span / width:	0.9
Approximate height:	0.96
Approximate length:	27m
Clearance above water:	0.96m (North end), 0.57m (South end)
Water depth:	Varies

### **Significant Findings:**

Medium scaling at exposed end sections of structure. The interior appears to be in generally good condition. Inspection of the barrel was limited due to access restrictions.

### **Recommendations:**

Extension of the existing cross section will be structurally sufficient for road widening, if hydraulic capacity is acceptable. Repair of scaling is recommended during widening.

## 10. Bovaird Drive, 440m East of Heritage Road

Structure type:	Open footing cast in place rigid frame
Skew angle:	0°
Roadway width:	2 lanes
Barriers:	No
Approximate cover:	0.6m
Clear span / width:	1.2m
Approximate length:	23m
Clearance above water:	0.60m at North end, 0.45m at South end
Water depth:	Varies

### **Significant Findings:**

There is erosion at the northwest and southwest corners. Erosion is more significant at north end. Structure is in generally good condition. Inspection of the barrel was limited due to access restrictions.

### **Recommendations:**

Repair of erosion is recommended during widening. Extension of existing cross section will be structurally sufficient for road widening, if hydraulic capacity is acceptable.

## 11. Bovaird Drive, 20m West of Heritage Road

Structure type:	Open footing cast in place rigid frame, CSP end section
Skew angle:	0°
Roadway width:	4 lanes (2 thru, 2 turning)
Barriers:	Yes - SBGR
Approximate cover:	1.5m
Clear span / width:	1.2m
Approximate length:	28m
Clearance above water:	1.05m upstream, 0.37m at downstream CSP
Water depth:	Varies

### ***Significant Findings:***

Erosion noted at northwest and northeast corner. South end of concrete structure is closed with concrete and joined to a 0.9m long CSP. Inspection of the barrel was limited due to access restrictions.

### ***Recommendations:***

Repair of erosion is recommended during widening. Extension of existing concrete open footing culvert will be structurally sufficient for road widening, if hydraulic capacity is acceptable. Removal of the short CSP extension is recommended.

## 12. Heritage Road, 50m South of Bovaird Drive

Structure type:	CSP
Skew angle:	0°
Roadway width:	2 lanes
Barriers:	No
Approximate cover:	1.5m
Diameter:	0.9m
Approximate length:	14m
Clearance above water:	0.8m
Water depth:	0.1m

### ***Significant Findings:***

Corrosion along bottom of culvert end to end. Damage to downstream end of culvert. Inspection of the barrel was limited due to access restrictions.

### ***Recommendations:***

Due to damage at culvert ends, and rust inside culvert, full replacement of the CSP is recommended for any road widening.

### 13. Bovaird Drive, 450m West of Heritage Road

Structure type:	Open footing cast in place rigid frame
Skew angle:	0°
Roadway width:	3 lanes
Barriers:	Yes - SBGR
Approximate cover:	4m
Clear span / width:	0.91m
Approximate height:	0.70m
Approximate length:	35m

#### **Significant Findings:**

There is slight sag along the length of the culvert. Some minor cracking with staining and efflorescence is evident. Structure generally is in good condition. Inspection was limited due to access restrictions.

#### **Recommendations:**

Prior to widening operations, a more detailed structural investigation is recommended in order to determine the significance of the sag and the cracking.

### 14. Bovaird Drive, 1.1km West of Heritage Road

Structure type:	Cast in place concrete box
Skew angle:	0°
Roadway width:	3 lanes
Barriers:	Yes – SBGR on south side of road
Approximate cover:	10m
Clear span / width:	1.2m
Approximate height:	2.43m
Approximate length:	95m
Clearance above water:	2.28m
Water depth:	0.15m

#### **Significant Findings:**

There is vertical cracking in the culvert walls with ice forming in the cracks on the day of inspection. The upstream end is covered in vegetation and earth. We were unable to locate the exact point of the inlet under the debris. The watercourse is creating its own path. There is a 760x1220 metal inlet grate atop a concrete chamber inletting midway into the culvert. Water at the culvert outlet drops approximately 0.5m, causing scour underneath the culvert. Aside from the cracks, concrete culvert appears sound. Full inspection of the culvert barrel was limited due to access restrictions.

***Recommendations:***

A more detailed investigation of the condition and location of the culvert inlet is recommended, and exposing of the inlet is strongly recommended to determine the inlet's condition. The current concrete culvert has the structural capacity for road widening, if the hydraulic capacity is acceptable; however, the inlet may need to be replaced or rehabilitated.

Respectfully submitted by;

AMEC Earth & Environmental,  
a division of AMEC Americas Limited

Per: Derk Meyer, P. Eng.  
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## **APPENDIX A**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 1  
Bovaird Drive, 20m west of Lake Louise Drive**

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**Photo 1 – Structure No. 1: Inlet Structure**



**Photo 2 – Structure No. 1: Typical Culvert Barrel**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 1  
Bovaird Drive, 20m west of Lake Louise Drive**

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**Photo 3 – Structure No. 1: Culvert Looking Upstream to Inlet Structure**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 2  
Bovaird Drive CN Overhead**

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**Photo 4 – Structure No. 2: North Elevation**



**Photo 5 – Structure No. 2: West Bound Lanes**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 2  
Bovaird Drive CN Overhead**

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**Photo 6 – Structure No. 2: Two Tracks – Centre Span  
1 Track – West Span Slope Protection Deterioration**



**Photo 7 –Structure No. 2: Lead Track to Gold’s Layover Facility Protection Wall**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 2  
Bovaird Drive CN Overhead**

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**Photo 8 – Structure No. 2: Soffit**



**Photo 9 –Structure No. 2: Light Cracking on Bearings –  
Gap between Girder and T/Bearing Pad**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 2  
Bovaird Drive CN Overhead**

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**Photo 10 – Structure No. 2: Deterioration of Diaphragm**



**Photo 11 – Structure No. 2: Slope Protection-Footing Exposed**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 2  
Bovaird Drive CN Overhead**

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**Photo 12 – Structure No. 2: Protection Deterioration**



**Photo 13 – Structure No. 2: Slope Protection Deterioration and RSS Wall**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 2  
Bovaird Drive CN Overhead**

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**Photo 14 – Structure No. 2: SBGR Posts Missing**



**Photo 15 – Structure No. 2: Erosion at End of West Wingwall – North Side**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 2  
Bovaird Drive CN Overhead**

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**Photo 16 – Structure No. 2: Protection System Left in Place**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 3  
Bovaird Drive, 115m east of Ashby Field Road**

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**Photo 17 – Structure No. 3: North End of Structure**



**Photo 18 – Structure No. 3: North Barrel Looking South**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 3  
Bovaird Drive, 115m east of Ashby Field Road**

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**Photo 19 – Structure No. 3: South End of Structure**



**Photo 20 – Structure No. 3: South Barrel Looking North**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 4  
Bovaird Drive, 280m west of Ashby Field Road**

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**Photo 21 –Structure No. 4: North End of Culvert**



**Photo 22 – Structure No. 4: South End of Culvert**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 4  
Bovaird Drive, 280m west of Ashby Field Road**

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**Photo 23 – Structure No. 4: Culvert Barrel**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 5  
Bovaird Drive, 20m east of Mississauga Road**

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**Photo 24 – Structure No. 5: North End of Culvert**



**Photo 25 – Structure No. 5: North Barrel Looking South**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 5  
Bovaird Drive, 20m east of Mississauga Road**

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**Photo 26 – Structure No. 5: South End of Culvert**



**Photo 27 – Structure No. 5: South Barrel Looking North**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 6  
Mississauga Road, 20m north of Bovaird Drive**

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**Photo 28 – Structure No. 6: East End of Culvert**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 7  
Mississauga Road, 400m south of Bovaird Drive**

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**Photo 29 – Structure No. 7: Damaged Culvert End**



**Photo 30 – Structure No. 7: Damaged Culvert End**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 8  
Mississauga Road, 80m south of Bovaird Drive**

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**Photo 31 – Structure No. 8: West End of Culvert**



**Photo 32 – Structure No. 8: West Barrel Looking East**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 8  
Mississauga Road, 80m south of Bovaird Drive**

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**Photo 33 – Structure No. 8: East End of Culvert**



**Photo 34 – Structure No. 8: East Barrel Looking West**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 9  
Bovaird Drive, 320m west of Mississauga Road**

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**Photo 35 –Structure No.9: North End of Culvert**



**Photo 36 – Structure No. 9: North Barrel Looking South**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 9  
Bovaird Drive, 320m west of Mississauga Road**

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**Photo 37 – Structure No. 9: South End of Culvert**



**Photo 38 – Structure No. 9: South Barrel Looking North**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 10  
Bovaird Drive, 440m east of Heritage Road**

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**Photo 39 –Structure No. 10: North End of Culvert**



**Photo 40 –Structure No. 10: North Barrel Looking South**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 10  
Bovaird Drive, 440m east of Heritage Road**

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**Photo 41 – Structure No. 10: South End of Culvert**



**Photo 42 – Structure No. 10: South Barrel Looking North**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 11  
Bovaird Drive, 20m west of Heritage Road**

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**Photo 43 – Structure No. 11: North End of Culvert**



**Photo 44 – Structure No. 11: North Barrel Looking South**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 11  
Bovaird Drive, 20m west of Heritage Road**

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**Photo 45 – Structure No. 11: South End of Culvert**



**Photo 46 – Structure No. 11: South End of Culvert**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 11  
Bovaird Drive, 20m west of Heritage Road**

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**Photo 47 – Structure No. 11: South Barrel Looking North**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 12  
Heritage Road, 50m south of Bovaird Drive**

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**Photo 48 – Structure No. 12: West End of Culvert**



**Photo 49 – Structure No. 12: West Barrel Looking East**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 12  
Heritage Road, 50m south of Bovaird Drive**

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**Photo 50 – Structure No. 12: East End of Culvert**



**Photo 51 – Structure No. 12: East Barrel Looking West**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 13  
Bovaird Drive, 450m west of Heritage Road**

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**Photo 52 – Structure No. 13: North End of Culvert**



**Photo 53 – Structure No. 13: North Barrel Looking South**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 13  
Bovaird Drive, 450m west of Heritage Road**

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**Photo 54 –Structure No. 13: South End of Culvert**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 14  
Bovaird Drive, 1.1km west of Heritage Road**

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**Photo 55 –Structure No. 14: Approximate Area of Inlet**



**Photo 56 – Structure No. 14: North Slope Failure**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 14  
Bovaird Drive, 1.1km west of Heritage Road**

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**Photo 57 – Structure No. 14: South Culvert Outlet**



**Photo 58 – Structure No.14: Scour Potential at Culvert Outlet**



**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 14  
Bovaird Drive, 1.1km west of Heritage Road**

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**Photo 59 – Structure No.14: Culvert Barrel Looking North**



**Photo 60 – Structure No. 14: Typical Culvert Wall Cracks**

**BOVAIRD DRIVE CULVERT INSPECTIONS  
STRUCTURE NO. 14  
Bovaird Drive, 1.1km west of Heritage Road**

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**Photo 61 – Structure No.14: Metal Grate Inlet Midway Through Culvert**