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1 Phase Description

1.1 Name and location of structures

This submission encompasses the culvert structure described below.

Designation/Name	Culvert Centreline	Description
CV-4	STA 9 + 954.862	Geraedts Drive Culvert

1.2 Permitted traffic speed

Posted speeds for traffic on the roadways passing over the culvert are:

- 50km/h on Geraedts Drive

2 Proposed Structures

2.1 Description of structures

Culvert CV-4 is a cast-in-place single barrel reinforced concrete box culvert. Key details for this culvert are given in the following table.

Culvert Zone	Description	Length @ CL (m)	Inside Span (m)	Inside Height (m)
CV-4	Geraedts Drive Culvert	28.5	6.0	2.6

Culvert CV-4 under Geraedts has sufficient cover to effectively distribute vehicle loading as vehicles move onto the culvert. As such, approach slabs are not required.

The inlet and outlet to CV-4 have a short header beam extending above the top surface of the culvert to retain fill slopes extending down from the edges of the sidewalks on Geraedts Drive.

Cast-in-place reinforced concrete footing retaining walls are provided for both the inlet and outlet to retain channel side slopes.

A pedestrian barricade railing is to be located along the top of the header wall and extended along the full length of the retaining walls at the inlet and outlet to prevent falls into the channel by pedestrians.

2.2 Structural types

A single barrel, cast-in-place box culvert was chosen for CV-4 as these types of culverts are inherently resistant to sliding, and are robust and well suited to the demands placed upon them by both the water courses they convey and the loads they resist laterally and vertically. The large span of 6.0m is handled adequately by the box culvert design.

2.3 Foundation type

The foundation type for CV-4 is slab-on-grade. Box culverts have large load transfer surfaces due to their integral bottom slab, and this large surface area reduces the effective bearing pressure on the soils, which makes it possible to place a large box culvert on soils that have a modest bearing capacity. A subgrade protection slab has been indicated under the culvert as there is the potential for spoiling of the subgrade by the action of water in the channel.

2.4 Proposed Means for Inspection and Maintenance

Some interior surfaces of CV-4 will be accessible for inspection at low-water through the use of ladders. The exterior of the culverts will not be accessible with the exception of the inlet and outlet structures, header walls, and retaining walls. Due to the nature of the loading on the culverts, the tension faces of the top and bottom concrete slabs (which govern the design) face the interior of the culvert. The interior of the top slab will be completely accessible for inspection at low water, as will the side walls. To inspect the top surfaces of the bottom slabs, the river stone infill in the culvert would need to be moved aside.

2.5 Materials and Finishes

2.3.1 Concrete

Minimum compressive strength at 28 days: 30 MPa

2.3.2 Reinforcing Steel

Plain and coated reinforcing steel bars: CAN/CSA G30.18-M92; Grade 400W

2.3.3 Finishes

Concrete finishes shall comply with the applicable requirements of Project Agreement, Schedule 15-2.

3 Design/Assessment Criteria

3.1 Live Loading and Clearances

3.1.1 Design Live Loading on Culvert Roof Slab

Ontario Culvert Manual tables consulted as this is a standard dimension culvert. The Ontario Culvert Manual considers truck wheel loads plus dynamic load allowance to CAN/CSA-S6-06.

3.1.2 Design Vehicle

CL-625-ONT Truck

3.1.3 Other Live Loading

Lateral pressure resulting from approaching wheel loads.

3.1.4 Provision for Exceptional Abnormal Loads

None

3.1.5 Any Special Loading Not Covered

None

3.1.6 Minimum Clearance Provided

Internal clear height for passage of water:
2.0m

3.1.7 Authorities Consulted and Any Special Conditions Required

Department of Fisheries and Oceans – require low flow channel for fish passage through culvert.

3.2 List of Relevant Design Documents

Design criteria in accordance with Part 2 of Project Agreement - Schedule 15-2:

Article 1 - Highway Geometrics Design Criteria

Article 3 - Structural Design Criteria

Technical Report 285380-04-119-0022 (Geotechnical Report)

In the event of discrepancy, the hierarchy of referenced documents shall be as instructed.

4 Structural Analysis

4.1 Method of Analysis

Ontario Culvert Design Manual based on CHBDC S6 for standard rigid frame box culvert tables were used in the design of CV-4 culvert. The 6000 x 3000mm internal opening table was used with a fill height of 2m.

Retaining walls were designed with hand calculations using earth pressure coefficients provided in Technical Report 285380-04-119-0022 (Geotechnical Report).

4.2 Calculation of Structural Stiffness

Structural stiffness was calculated according to CAN/CSA-S6-06.

4.3 Earth Pressure Coefficients

Earth pressure coefficients were obtained from Technical Report 285380-04-119-0022 (Geotechnical Report).

5 Ground Design Considerations

5.1 Ground Conditions

Refer to Technical Report 285380-04-119-0022 (Geotechnical Report).

5.2 Geotechnical Design Parameters

Refer to Technical Report 285380-04-119-0022 (Geotechnical Report).

5.3 Differential Settlement

Refer to Technical Report 285380-04-119-0022 (Geotechnical Report).

5.4 Anticipated Ground Movements or Settlement

Refer to Technical Report 285380-04-119-0022 (Geotechnical Report).

5.5 Groundwater Conditions and Mitigative Measures

Refer to Technical Report 285380-04-119-0022 (Geotechnical Report).

5.6 Variance from Geotechnical Report Recommendations

None

6 Construction Considerations

Refer to Technical Report 285380-04-119-0022 (Geotechnical Report) for additional information on excavation, temporary cut slopes, backfilling, and frost protection.

7 Drawings and Documents

7.1 List of Drawings (included in this submission)

Drawing No.	Sheet No.	Revision	Drawing Title
285380-03-060-SEG1-5400	S5400	0	COVER SHEET and KEY PLAN
285380-03-060-SEG1-5401	S5401	0	GENERAL ARRANGEMENT
285380-04-090-SEG1-5402	S5402	0	BOREHOLE LOCATION AND SOIL STRATA
285380-03-061-SEG1-5404	S5403	0	REINFORCEMENT 6000 x 2600
285380-03-061-SEG1-5405	S5404	0	RETAINING WALLS
285380-03-065-SEG1-5406	S5405	0	BACKFILL DRAINS
285380-04-094-SEG1-5408	S5406	0	CONSTRUCTION NOTES – BACKFILL AT STRUCTURES

7.2 List of Documents (included in this submission)

Document No.	Revision	Description
285380-04-119-0022	0	Geotechnical Investigation and Design Report Culvert CV-4, February 2012

7.3 List of Reference Drawings and Documents (not included in this submission)

Not Used.

8 Checking and Review

8.1 Independent Check

Independent check is not required as per Project Agreement - Schedule 15-2, Part 2, Article 3 3.2 (c) (i).

8.2 Responsible Design Personnel

Originator: Chris Dyck, P.Eng.

Checker: Jan Fojt, Ph.D.

Reviewer: Biljana Rajlic, P.Eng.

The above TAF is submitted for review

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