

# CAST-IN-PLACE REINFORCED CONCRETE BOX CULVERT (NO SKEW)


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## LEGEND

- Information added to the drawing
  
- Data enclosed is for information only and not to be shown on the drawing

Typical Layout sheets ( marked "SAMPLE") are intended for general sheet arrangement only. The following sheets show all information required in detail.

 <p style="text-align: center; margin-top: 10px;">Water Control &amp; Structures</p>	DETAIL DESCRIPTION		GENERAL LEGEND
	LOCATION		DETAIL No.
	SITE No.	DATE	November 2007
			1.1.1

## ABBREVIATIONS

Elev	-	Elevation
T.W.	-	Tail water
H.W.	-	Head water
mm	-	millimetre
m	-	metre
sta.	-	Station
min.	-	Minimum
c. to c.	-	centre to centre
Mk.	-	Mark
cl.	-	Clearance
R.C.	-	Reinforced concrete
F.P.	-	Final pavement

# PLANS OF PROPOSED R.C. BOX CULVERT IN

ON  No.

## SHEET LEGEND

- COVER SHEET AND ELEVATION
- TYPE AND CROSS SECTION
- BOXING LEGS
- SITE AND PROPOSED CONTROL PUMP
- CONCRETE REINFORCING DETAILS
- SLAB REINFORCING DETAILS
- WALL REINFORCING DETAILS
- MANHOLE REINFORCING DETAILS
- PERFORMANCE DETAILS

ALL APPROACH ROADWAYS SHALL BE SUPPLIED BY  
THE ROAD AGENCIES  
ALL APPROACH CURB/LINE DETAILS SHALL BE SUPPLIED BY  
THE ROAD AGENCIES

TYPE:  REINFORCED CONCRETE

LENGTH:  METRES

ROADWAY WIDTH:  METRES

LOCATION:  ROAD OF



31		38				1
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- DESIGN DATA**
- SPECIFICATIONS:**  
ASPHALT PAVEMENT DESIGN SPECIFICATIONS 6th EDITION 2007
- LOADING:**  
HORIZONTAL: NORTH (HS-C) TRUCK  
VERTICAL: HS-C (TRUCK)  
LIVE LOAD:  kN/m<sup>2</sup>  
WIND:  kN/m<sup>2</sup>  
SEMI TRAILER PRESURE:  kN/m<sup>2</sup>  
AT REST EARTH PRESSURE:  kN/m<sup>2</sup>
- STRUCTURAL CONCRETE**  
CONCRETE STRENGTH:  MPa  
COMBUSTION CLASS: C-1  
REINFORCING STEEL:  MPa  
MINIMUM CLEAR COVER: 50 mm UNLESS NOTED OTHERWISE
- FOUNDATION DATA:**  
FACTORED RESISTANCE:  kPa  
MINIMUM ELEVATION:  mm
- HYDRAULIC DESIGN DATA**  
DESIGN DISCHARGE:  m<sup>3</sup>/s  
MINIMUM FLOW:  m<sup>3</sup>/s  
MAXIMUM FLOW:  m<sup>3</sup>/s  
MINIMUM VELOCITY:  m/s  
MAXIMUM VELOCITY:  m/s  
MINIMUM HEAD:  m  
MAXIMUM HEAD:  m  
MINIMUM WATER DEPTH:  mm  
MAXIMUM WATER DEPTH:  mm

- SURVEY CONTROL**  
HORIZONTAL DATUM: MANITOBA  
VERTICAL DATUM: CGVD08  
ELLIPSOID: GRS 1980  
GEOD. REF. ZONE:
- SITE CONTROL POINT DATA**  
CONTROL POINT:   
CONTROL POINT:   
CONTROL POINT:
- VERTICAL DATUM:   
HORIZONTAL DATUM:   
ELLIPSOID:   
GEOD. REF. ZONE:   
SCALE FACTOR:   
CONTROL POINT:   
CONTROL POINT:   
CONTROL POINT:   
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CONTROL POINT:   
CONTROL POINT:

**ENVIRONMENTAL APPROVALS**

MANITOBA ENVIRONMENT ACT LICENSE  
DATE:  FILE #:   
FISHERIES AND OCEANS CANADA - AUTHORIZATION OR REVIEW  
DATE:  FILE #:   
TRANSPORT CANADA - INQUIRY ACT  
DATE:  FILE #:   
MANITOBA INFRASTRUCTURE ENVIRONMENTAL APPROVAL  
DATE:  FILE #:   
PERFORMANCE REVIEW COMPLETED  
DATE:   
COMPLETED BY:   
PRINT NUMBER:

ALL DIMENSIONS ARE IN MILLIMETRES (mm) AND ALL ELEVATIONS AND STATIONS ARE IN METRES UNLESS SHOWN OTHERWISE.

MANITOBA WATER STEWARDSHIP  
DIRECTOR OF WATERWAY OPERATIONS AND HIGHWAY DRAINAGE  
CHECKED BY:   
APPROVED BY:

RELEASED FOR CONSTRUCTION BY:

DIRECTOR OF BRIDGES AND HIGHWAY STRUCTURES  
DATE:

DRAWN BY:  DATE:   
CHECKED BY:  DATE:

SHEET No.  SITE No.

# MANITOBA TRANSPORTATION AND INFRASTRUCTURE

WATER CONTROL AND STRUCTURES



Transportation and Infrastructure  
Bridges and Highway Structures

DETAIL DESCRIPTION		COVER SHEET TYPICAL LAYOUT	
LOCATION		DETAIL No.	
SITE No.	DATE	October 2019	1.2.1

# DESIGN DATA

## SPECIFICATIONS:

AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 8th EDITION, 2017

## LOADING:

LIVE LOAD: MODIFIED AASHTO HSS-25 TRUCK or HSS-30 project specific  
AASHTO LRFD "HL-93" LOADING

EARTH LOAD: SOIL DENSITY =  kg/m<sup>3</sup>  
ACTIVE EARTH PRESSURE  $K_a$  =   
AT REST EARTH PRESSURE  $K_a$  =

## STRUCTURAL CONCRETE

COMPRESSIVE STRENGTH 35 MPa  
CEMENT CSA A23.1 CLASS C-1,  
AIR CATEGORY 1 WITH 15% FLY CI ASH

REINFORCING STEEL CAN/CSA G30.18 M92 GRADE 400W  
CLEAR COVER 50 mm UNLESS NOTED OTHERWISE

## FOUNDATION DATA:

FACTORED BEARING RESISTANCE AT  
1. STRENGTH STATE LIMIT  kPa  
2. SERVICE STATE LIMIT  kPa

## HYDRAULIC DESIGN DATA

DESIGN DISCHARGE:  $Q_{2\%}$  =  m<sup>3</sup>/sec  
 $3d Q_{10}$  =  m<sup>3</sup>/sec  
 $V_{3d Q_{10}}$  =  m/s  
HWL  m

**MANITOBA WATER STEWARDSHIP**  
APPROVAL AS TO HYDRAULIC CAPACITY  
OF WATERWAY OPENINGS AND HIGHWAY DRAINAGE

CHECKED BY \_\_\_\_\_

APPROVED BY \_\_\_\_\_

Not always required  
check with hydraulic engineer  
at Water Control Operations

ALL DIMENSIONS ARE IN MILLIMETRES (mm) AND ALL ELEVATIONS  
AND STATIONS ARE IN METRES (m) UNLESS SHOWN OTHERWISE.



Water Management and Structures

DETAIL DESCRIPTION

**COVER SHEET  
DESIGN DATA**

LOCATION

DETAIL No.

SITE No.

DATE October 2019

1.2.2

# SHEET LEGEND

1. COVER SHEET
2. GENERAL ELEVATION
3. BORING LOGS
4. SITE AND EROSION CONTROL PLAN
5. CONCRETE DETAILS
6. SLAB REINFORCING DETAILS
7. WALL REINFORCING DETAILS
8. HEADWALL REINFORCING DETAILS
9. REINFORCING DETAILS

AR1. APPROACH ROADWORKS	IF REQ'D TO BE SUPPLIED BY
AG1. APPROACH GUARDRAIL DETAILS	REGION OR OTHERS

TYPE Single  
Double or  
Triple   x  REINFORCED CONCRETE BOX CULVERT

LENGTH  OUT TO OUT OF HEADWALLS

ROADWAY WIDTH  ROADWAY WIDTH WITH SHOULDERS &  SIDE SLOPES

LOCATION   
R.M. OF

### ENVIRONMENTAL APPROVALS

MANITOBA ENVIRONMENT ACT LICENCE  
DATE : \_\_\_\_\_  
FILE \* : \_\_\_\_\_

FISHERIES AND OCEANS CANADA - AUTHORIZATION OR REVIEW  
DATE : \_\_\_\_\_  
FILE \* : \_\_\_\_\_

TRANSPORT CANADA - NAVIGATION ACT  
DATE : \_\_\_\_\_  
FILE \* : \_\_\_\_\_

MANITOBA INFRASTRUCTURE ENVIRONMENTAL APPROVAL  
DATE : \_\_\_\_\_  
FILE \* : \_\_\_\_\_

ENVIRONMENTAL REVIEW COMPLETED  
DATE : \_\_\_\_\_  
COMPLETED BY : \_\_\_\_\_  
(PRINT NAME)



DETAIL DESCRIPTION		<b>COVER SHEET LEGEND</b>	
LOCATION			DETAIL No.
SITE No.	DATE	September 2019	1.2.3


# SURVEY CONTROL

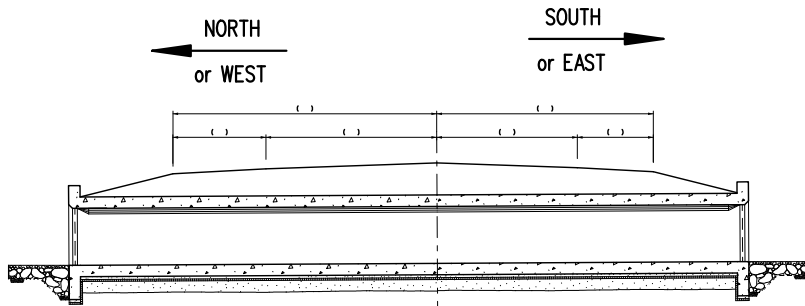
HORIZONTAL DATUM: NAD83CSRS  
 VERTICAL DATUM: CGVD28  
 ELLIPSOID: GRS 1980  
 GEOID (HT2.0): -----  
 UTM: ZONE \_\_\_\_  
 SCALE FACTOR: -----

## SITE CONTROL POINT DATA

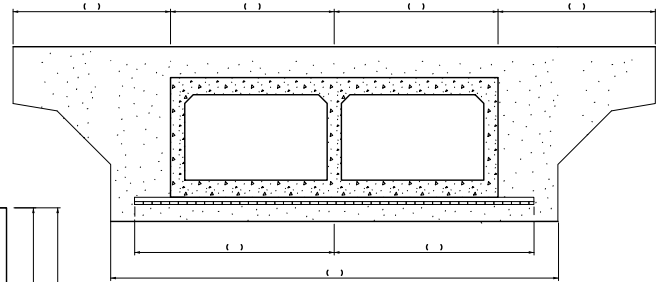
CONTROL POINT #-----	NORTHING: -----
	EASTING: -----
	ELEVATION: -----
	DATE: -----
CONTROL POINT x-----	NORTHING: -----
	EASTING: -----
	ELEVATION: -----
	DATE: -----
CONTROL POINT #-----	NORTHING: -----
	EASTING: -----
	ELEVATION: -----
	DATE: -----

Primary survey control is established and administered by Construction Support Services (CSS) in Universal Transverse Mercator (UTM) coordinates. See Policy/Standard No.CSS-100

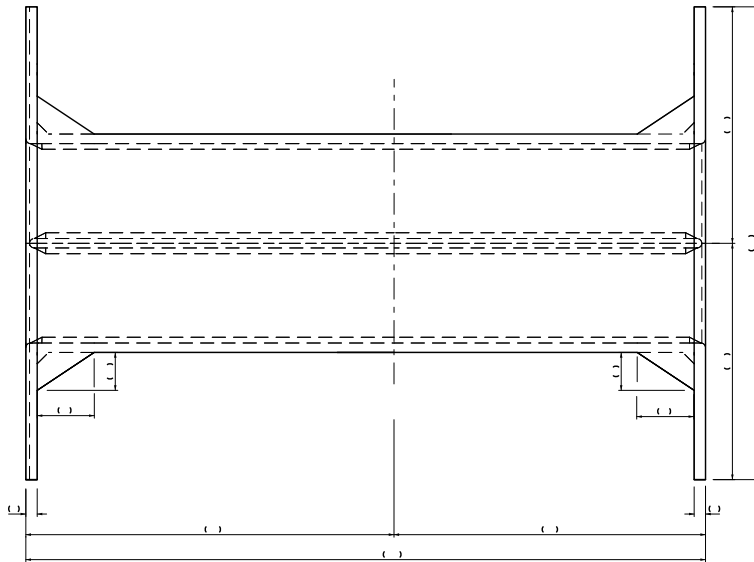
 <b>Manitoba</b> Infrastructure Water Management and Structures	DETAIL DESCRIPTION		COVER SHEET
	LOCATION		SURVEY CONTROL
	SITE No.	DATE	September 2019



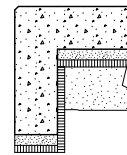
LONGITUDINAL SECTION



CROSS SECTION



PLAN



DETAIL 'A'



EDGE TREATMENT

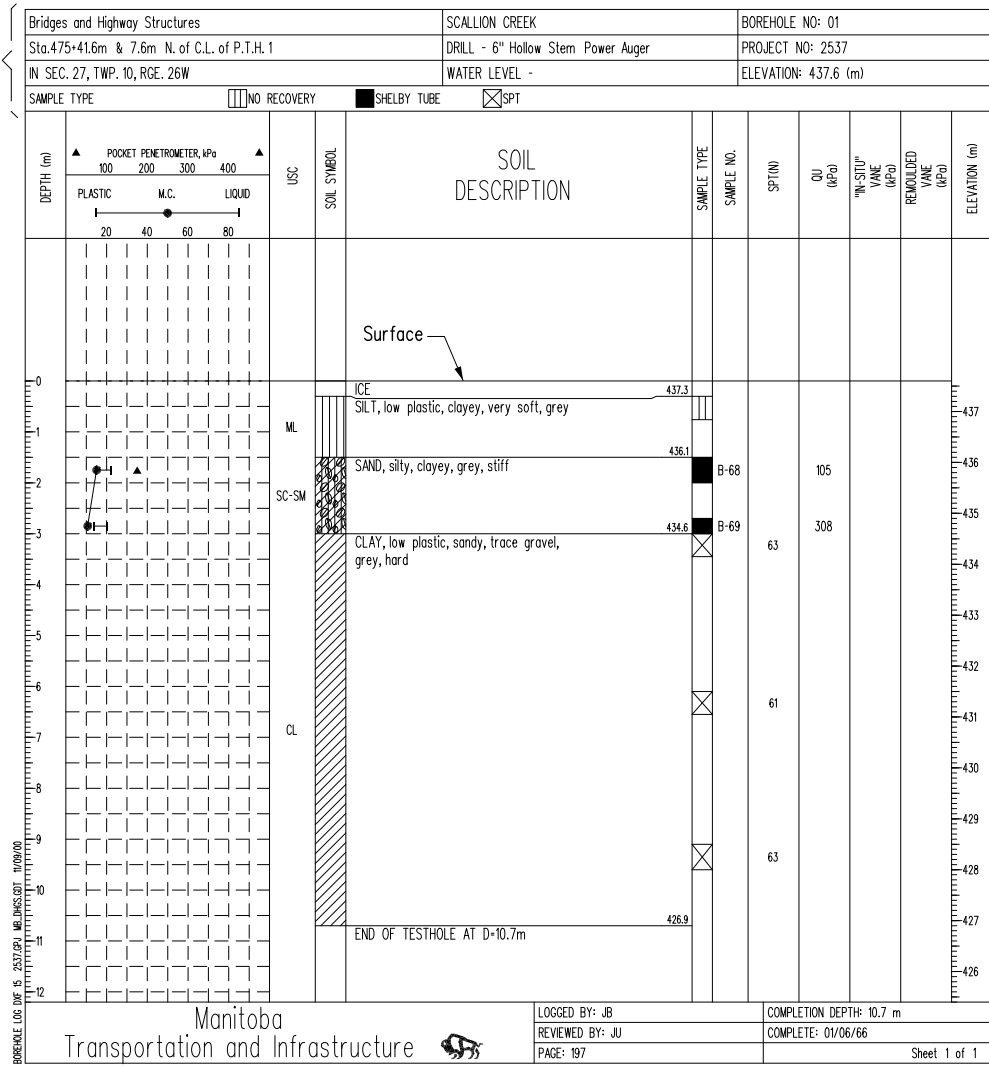


OVERLAPPING DETAILS

RIP RAP DETAILS



Reference to new structure  $\phi$  and new roadway  $\phi$



**NOTES - re Boring Logs**

- The Department provides log boring information shown on the Plans. This information may not be representative of the soil conditions throughout the site. Contractors may peruse all available soil information in the Bridges and Highway Structures Branch located on the 6th. floor, 215 Garry Street, Winnipeg.
- The following abbreviations apply to bore hole information:
  - Qu - Laboratory unconfined compressive strength in kPa
  - SPT(N) - Number of blows per 300 mm - Standard Penetration Test
  - USC - Unified Soil Classification
  - M.C. - Moisture Content
- All stations, elevations, offsets and depths as shown are in metres.
- All borehole locations shown in plan view are approximate.
- Elevations on boring logs are not to scale.

For R.C box culverts detail bore holes approx. 1.5 m below bottom of granular backfill.



DETAIL DESCRIPTION		BORING LOGS	
LOCATION		DETAIL No.	
SITE No.		DATE	
		April 2014	
		1.3.2	

SOUTH  
or  
EAST

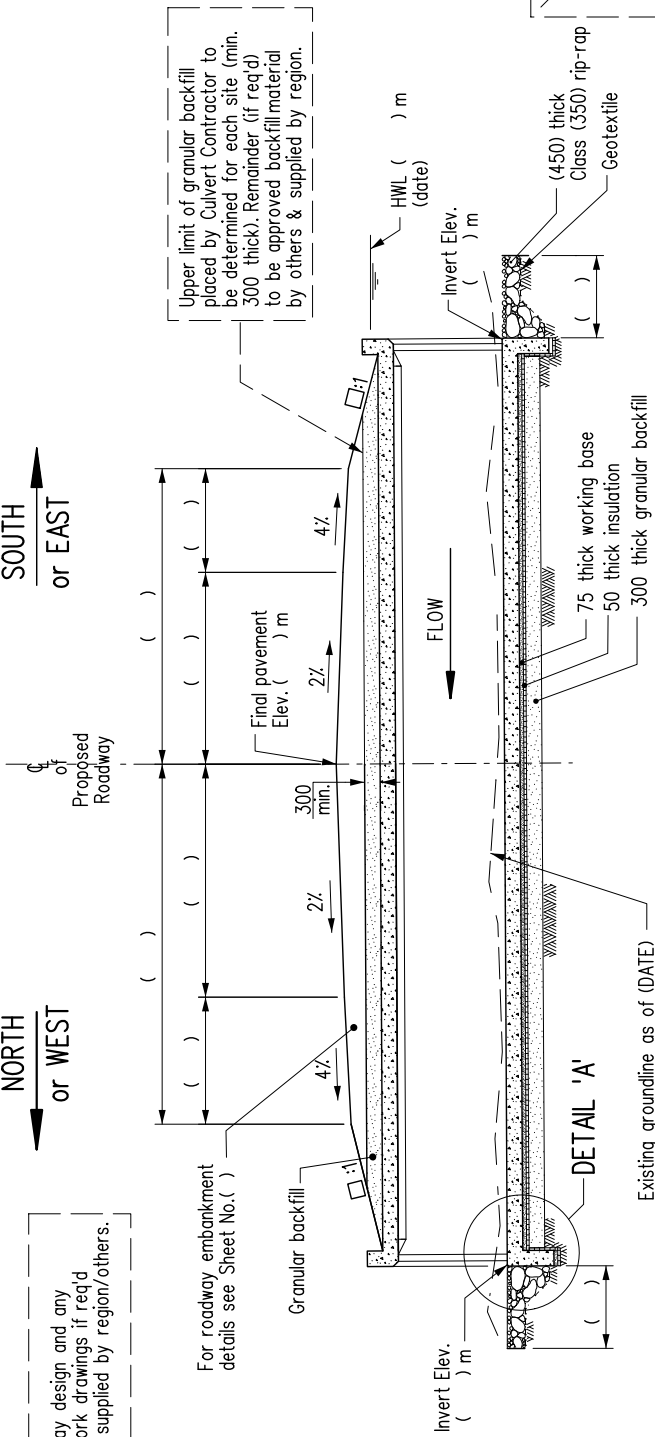
NORTH  
or  
WEST

Roadway design and any  
Roadwork drawings if req'd  
to be supplied by region/others.

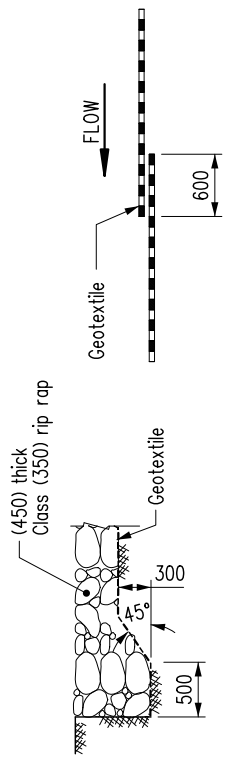
Upper limit of granular backfill  
placed by Culvert Contractor to  
be determined for each site (min.  
300 thick). Remainder (if req'd)  
to be approved backfill material  
by others & supplied by region.

Typ.  
unless noted  
otherwise

Make a note if placing  
of rip-rap will be  
performed by other than  
Culvert Contractor



**LONGITUDINAL SECTION**



**EDGE TREATMENT**

**OVERLAPPING DETAILS**

**RIP RAP DETAILS**

N.T.S.

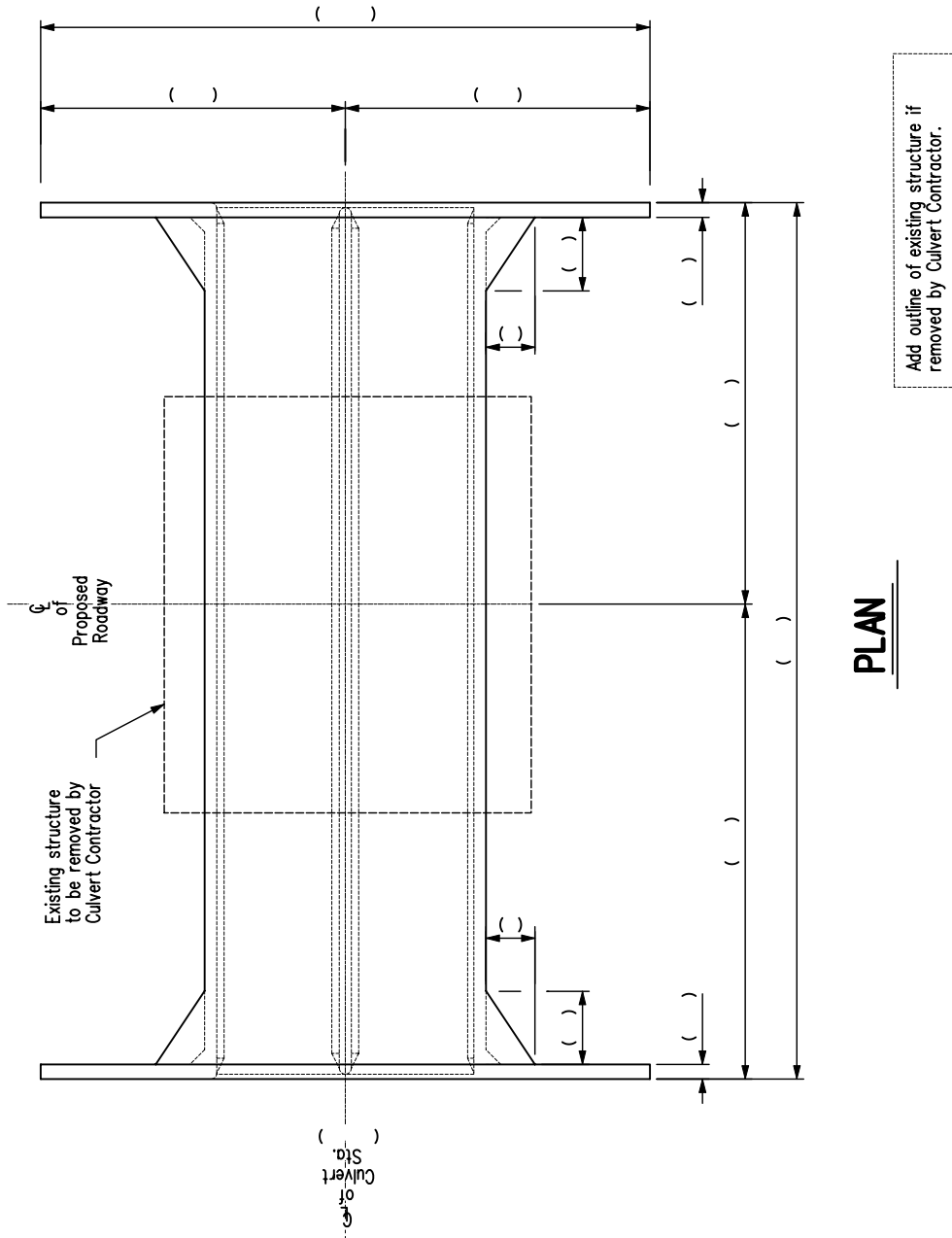
**NOTES :**

1. All geotextile shall be Non-Woven Geotextile, Class I (Heavy Duty) from the Manitoba Transportation and Infrastructure's Approved Product List.
2. Geotextile shall be placed under all rip rap, overlapping 600mm in direction of flow.

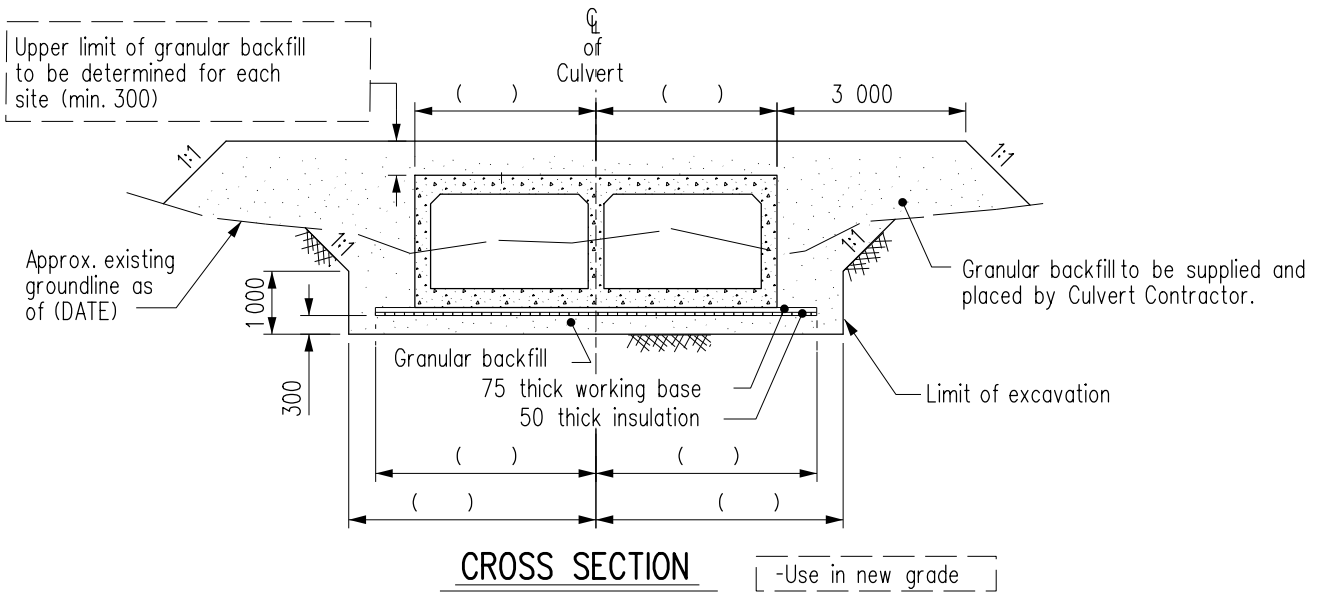


REVISIONS	
Revised Date	Description
2022-10-14	N.J. Granular backfill and Roadway design by region/others
2018-11-20	N.J. Revised Note 1 as per MI's Approved Products for geotextile

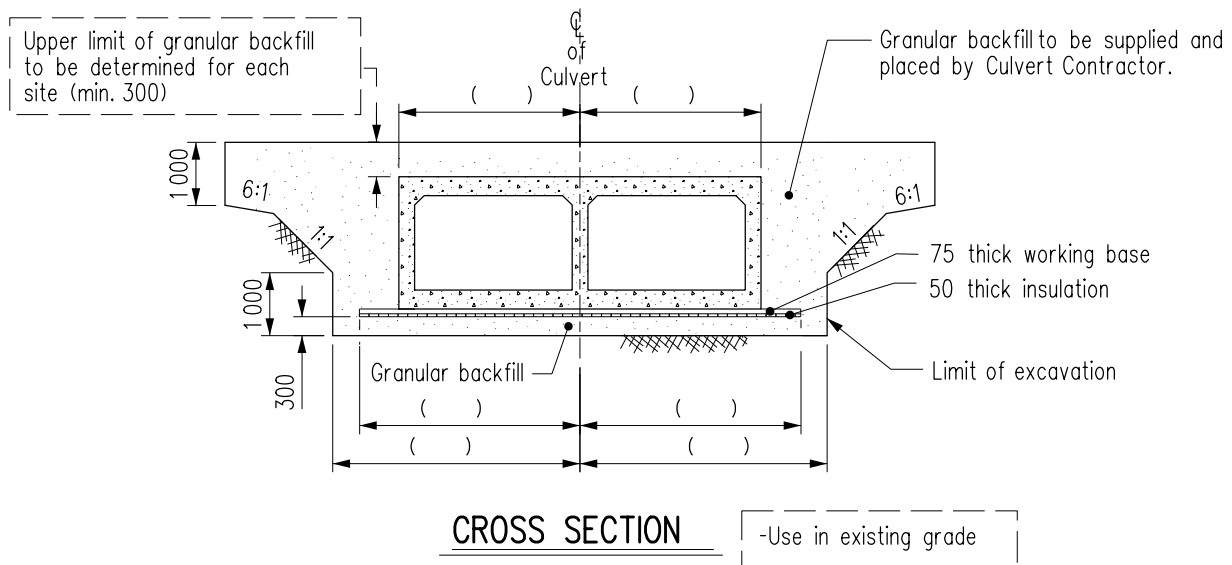
DETAIL DESCRIPTION	DATE DRAWN:	DETAIL No.
<b>GENERAL ELEVATION LONGITUDINAL SECTION</b>	April 2014	<b>1.3.3</b>



LOCATION		DETAIL No. <b>1.3.4</b>
SITE No.	DATE <b>November 2007</b>	



- Insulation Width
- Insulation shall project a min. 450 each side of culvert (for frost protection) and rounded up to nearest increment of 2ft. (610) widths.
- Excavation Width
- Excavation width at the base shall be a min. 1000 to 1500 on each side of box culvert



- Excavation
- Excavation thru any existing grade (P.R. or P.T.H.) shall conform to MB Workplace Health and Safety requirements.
  - Vertical face for bottom 1 m with 1:1 side slopes until 2 m in remaining vertical height is reached and then 6:1 for 1 m in height with last 1 m vertical face.

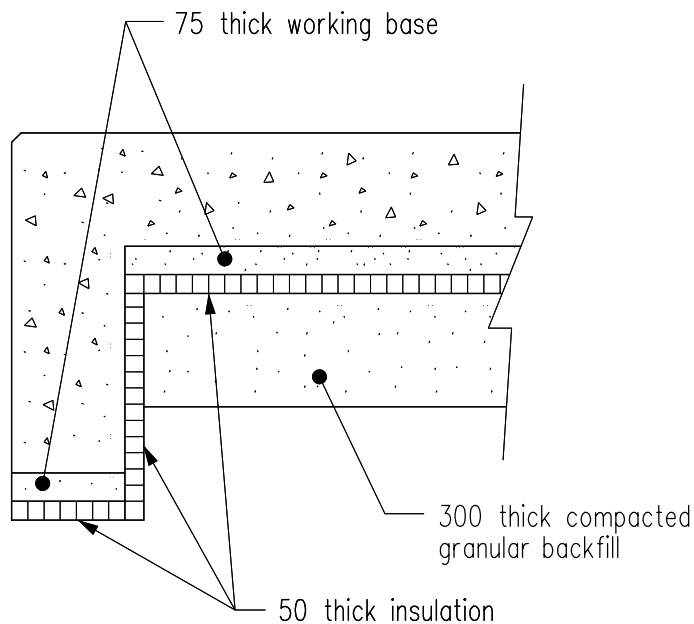
**Manitoba** 

Infrastructure and Transportation  
Water Management and Structures

DETAIL DESCRIPTION		GENERAL ELEVATION CROSS SECTION	
LOCATION			DETAIL No.
SITE No.	DATE	April 2014	1.3.5

NOTES:

1. Granular backfill shall be used within minimum limits as shown on "CROSS SECTION".
2. Insulation shall be supplied and placed by Culvert Contractor as follows:
  - a) Insulation shall be placed under all working base concrete including headwalls and shall extend vertically behind cut off wall as shown in DETAIL "A"
  - b) Insulation shall be 50 mm thick extruded polystyrene placed with staggered joints.
  - c) Insulation shall be completely enclosed in 6 mil. polyethylene with all joints poly-vinyl taped.
3. Working base shall be lean mix concrete 75 mm thick.



DETAIL "A"

Scale 1 : 20

	DETAIL DESCRIPTION		GENERAL ELEVATION	
			NOTES, DETAIL "A"	
	LOCATION		DETAIL No.	
SITE No.		DATE	1.3.6	
		April 2014		

# GENERAL ELEVATION

FOR DOUBLE 1 500 x 2 500 R.C. BOX CULVERT  
 IN BACHMAN DRAIN  
 ON P.T.H. No. 44 PROPOSED WEST BOUND LANES  
 N. OF N.W. 1/4 SEC. 2-13-7E  
 R.M. OF BROKENHEAD

**Manitoba**  
 Infrastructure and Transportation

Water Control & Structures

RELEASED FOR CONSTRUCTION  
 BY:

DESIGN

BY: M.B.C.

CHECKED: B.L.

DIRECTOR DATE  
 STRUCTURES, DESIGN AND CONSTRUCTION BRANCH

SCALE:

1:200 or

SHEET No. 2

DETAILS

BY: E.F.

CHECKED: M.B.C.

As Shown

SITE No. 2251-01

**Manitoba**  
 Infrastructure and Transportation

Water Control & Structures

DETAIL DESCRIPTION

GENERAL ELEVATION  
 TITLE BOX

LOCATION

DETAIL No.

SITE No.

DATE

November 2007

1.3.7

Place Plan of site and include the minimum of the following:

- proposed structure outline
- overlay contour plan if available
- show extent of rip rap
- show proposed silt barrier location
- show limits of construction area
- show right of way limits
- show river/stream centreline
- show roadway centreline and width

## NOTES

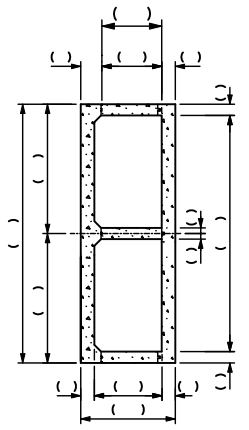
Place any relevant notes as it pertains to the placement of silt barriers and or cofferdams for the Contractor to follow.

## SITE PLAN

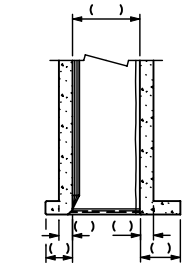
### LEGEND

- ◆ — ◆ — ◆ — Limits of laydown, staging and access areas & limits of construction and access area
- — — — — Proposed sediment barrier
- ▬▬▬▬▬▬▬▬▬▬ Proposed cofferdam (as req'd)

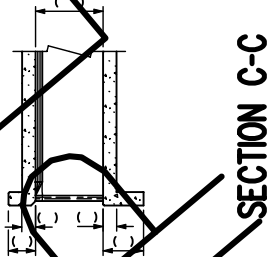
DETAIL DESCRIPTION		SITE AND EROSION CONTROL PLAN	
		SITE PLAN	
LOCATION			DETAIL No.
SITE No.			1.4.1
DATE	May 2014		



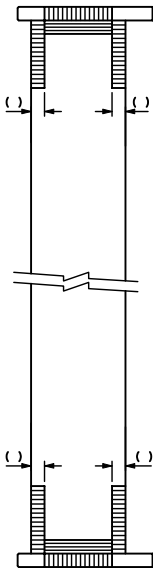
**CROSS SECTION**



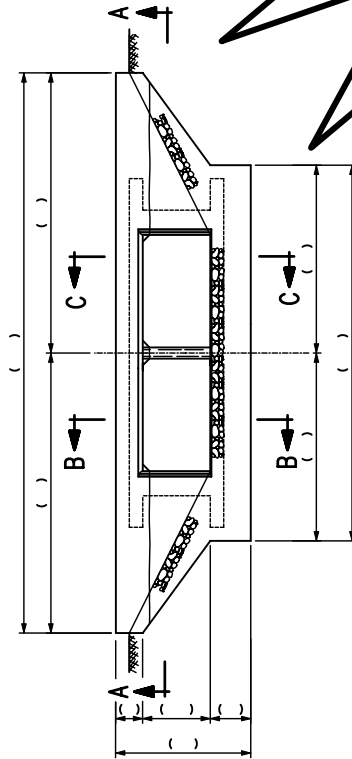
**SECTION B-B**



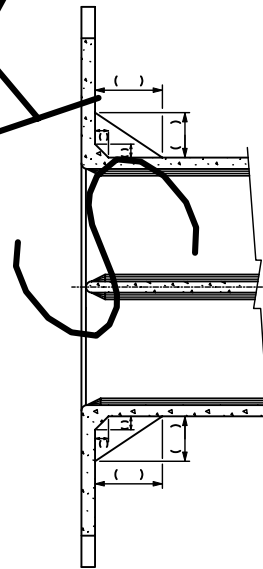
**SECTION C-C**



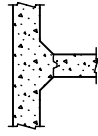
**SIDE ELEVATION**



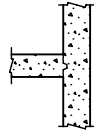
**END ELEVATION**



**SECTION A-A**



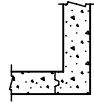
**JOINT AT TOP OF INTERIOR WALLS**



**JOINT AT BOTTOM OF INTERIOR WALLS**



**JOINT AT TOP OF EXTERIOR WALLS**



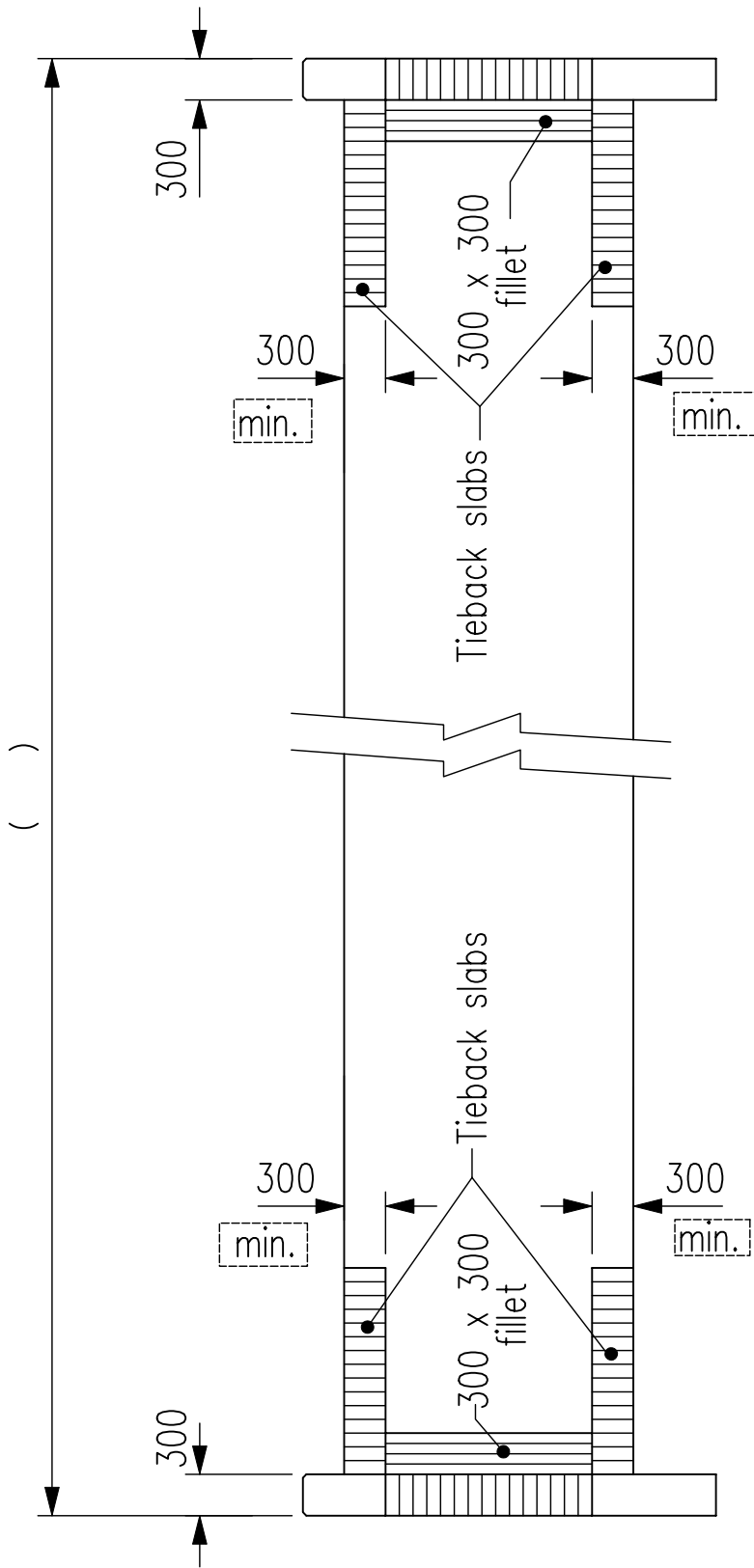
**JOINT AT BOTTOM OF EXTERIOR WALLS**

**DETAILS OF CONSTRUCTION JOINTS**

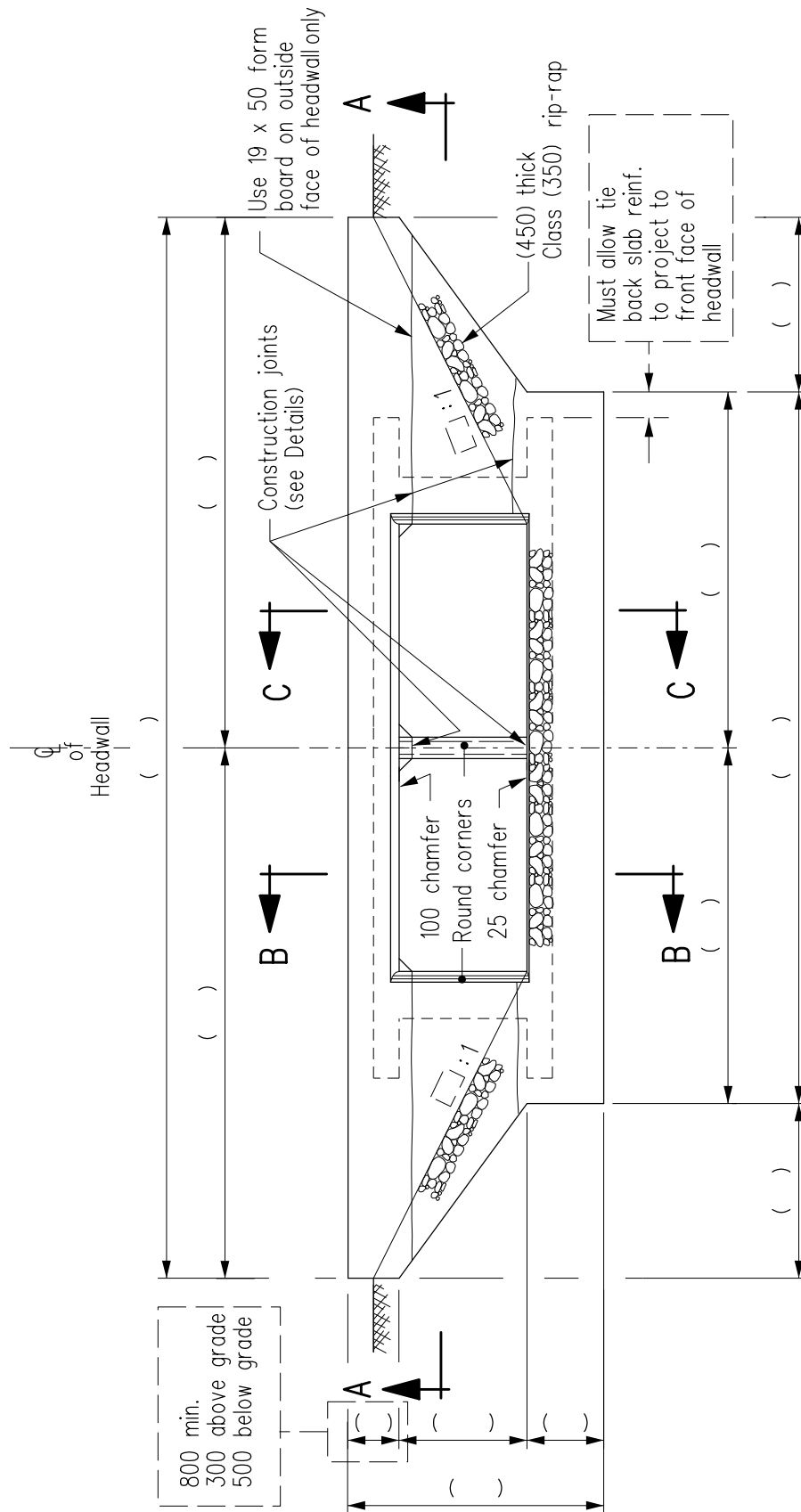
NOTES:

POURING SCHEDULE





# SIDE ELEVATION



# END ELEVATION



Infrastructure and Transportation  
Water Management and Structures

DETAIL DESCRIPTION

CONCRETE DETAILS  
END ELEVATION

LOCATION

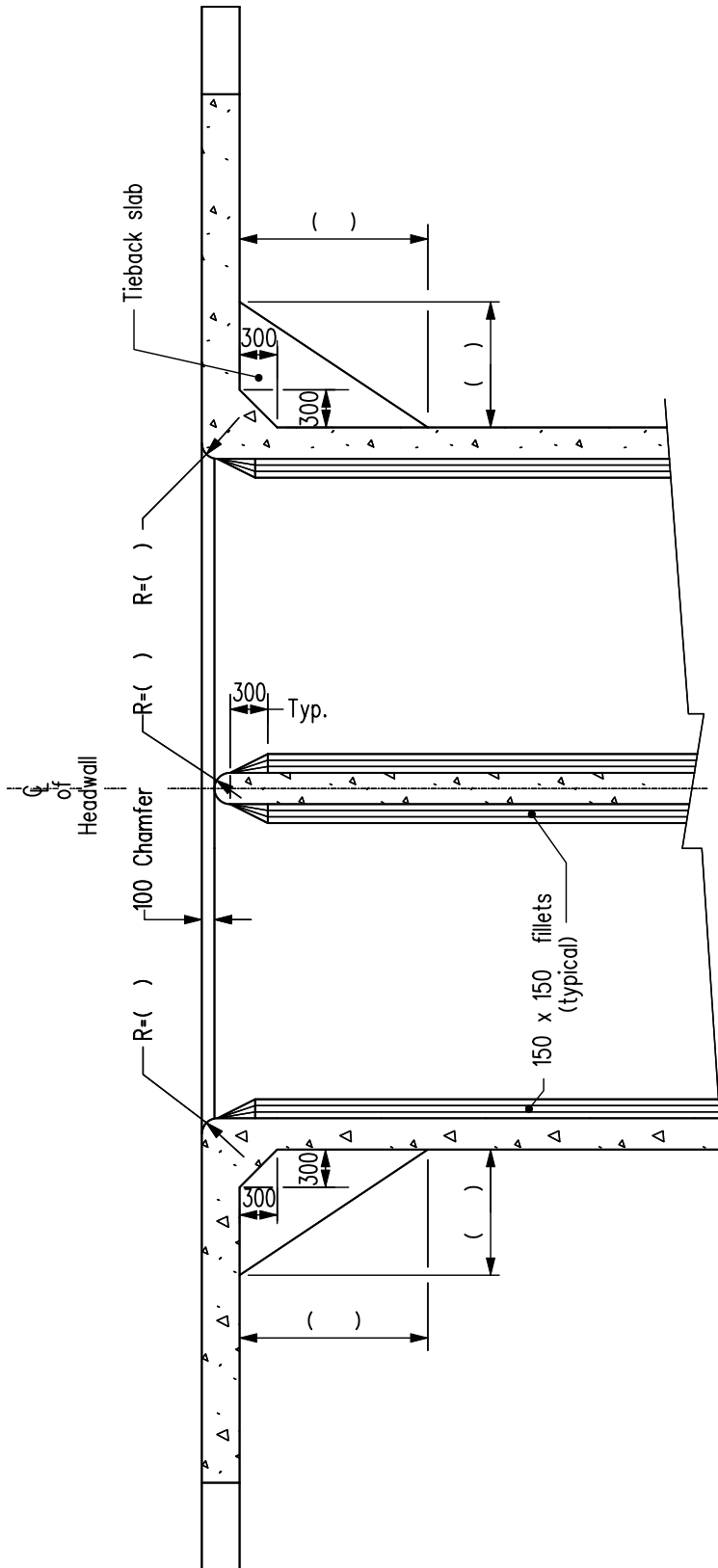
DETAIL No.

SITE No.

DATE

April 2014

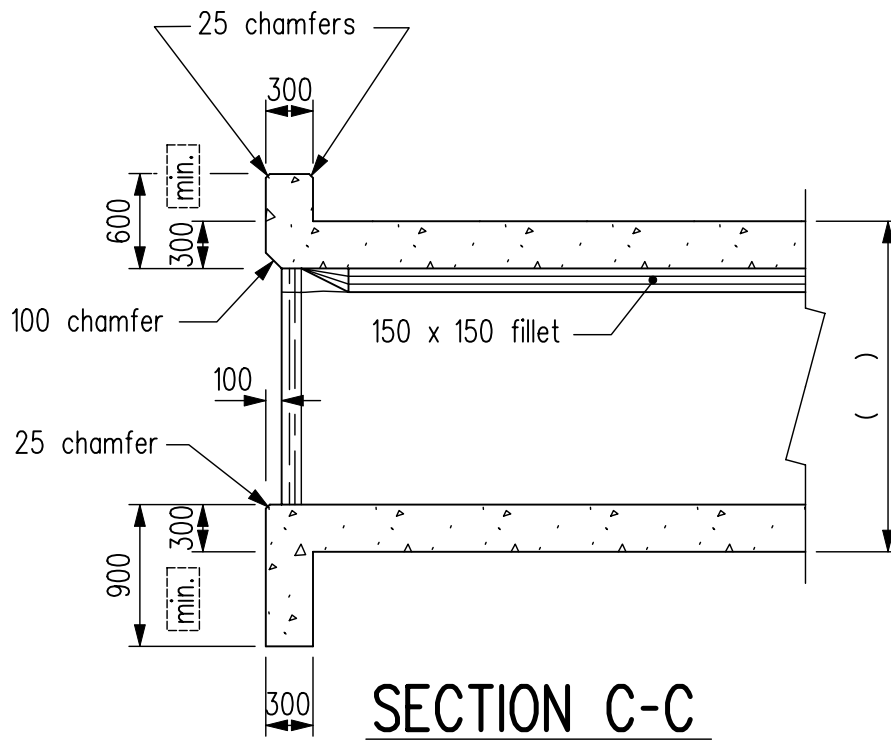
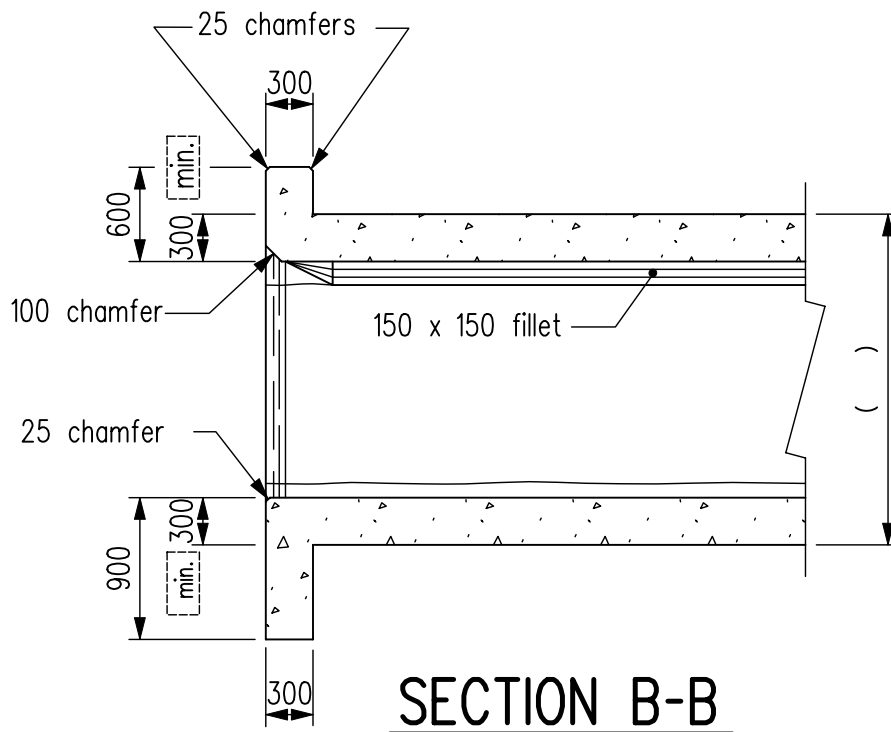
1.5.3



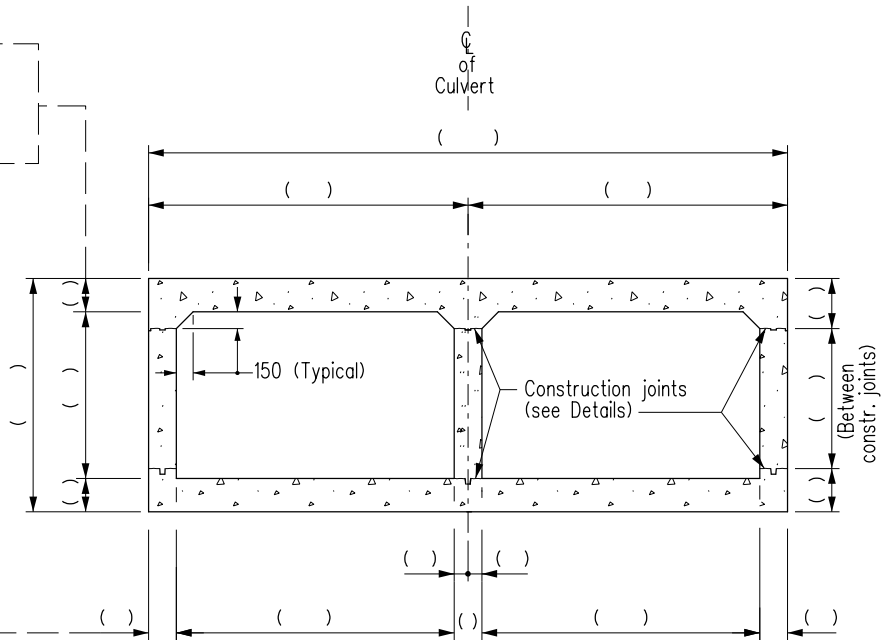
Suggested tieback slab dimensions

1. 1.000 x 1.50 for  $h \leq 2.50$  m
2. 1.5 x 2.25 for  $h > 2.50$  m
3.  $h$  = vertical opening of barrel

## SECTION A-A

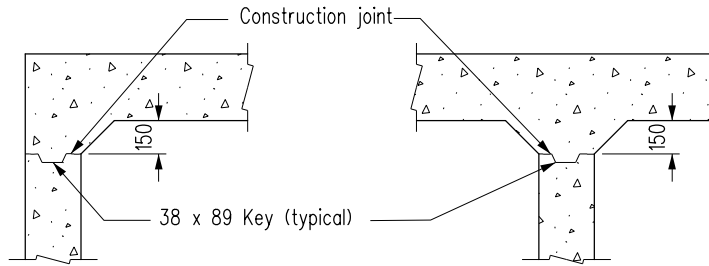


Top & bottom slabs must be 300 thick min. to accept 6 layers of reinforcing steel at tieback slabs



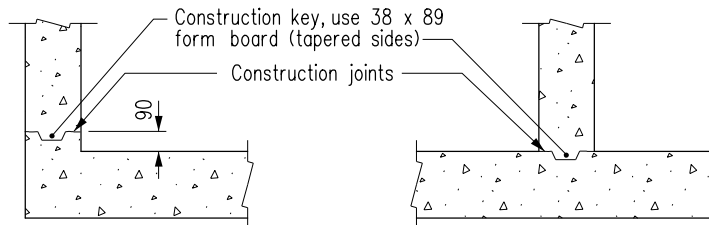
All walls to be 300 mm thick min. to accommodate concrete placement

## CROSS SECTION



JOINT AT TOP OF EXTERIOR WALLS

JOINT AT TOP OF INTERIOR WALLS



JOINT AT BOTTOM OF EXTERIOR WALLS

JOINT AT BOTTOM OF INTERIOR WALLS

## DETAILS OF CONSTRUCTION JOINTS

Scale 1:2



Infrastructure and Transportation  
Water Management and Structures

DETAIL DESCRIPTION CONCRETE DETAILS  
CROSS SECTION, DETAILS OF CONSTRUCTION JOINTS

LOCATION

DETAIL No.

SITE No.

DATE

April 2014

1.5.6

## NOTES:

1. All exposed edges of barrel and headwalls to be chamfered 25 mm except where noted otherwise.
2. Construction joints as per details. Construction joints extending into headwall must be neat and level.
3. Areas to be Permeable Formwork Liner Finish;
  - a) All exposed surfaces of headwalls
  - b) All round faces of entrance and exit to culvert
4. All surfaces in contact with backfill material to be asphalt waterproofed.

### Permeable Formwork Liner Finish:

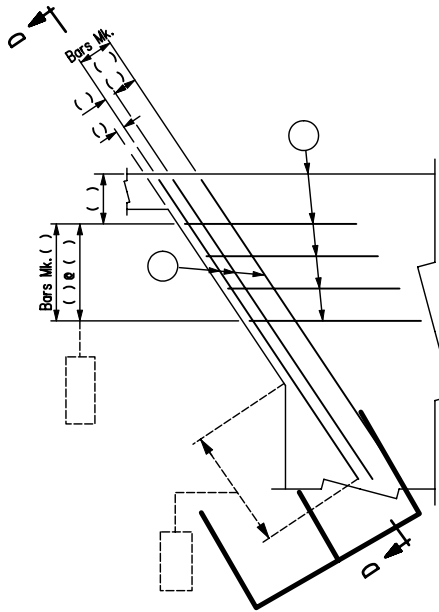
- Exposed area of front face of headwall to invert and 300 (perpendicular) below groundline on wingwalls
- Top 300 on rear face of headwalls
- Ends of headwall 300 below groundline
- Total area should be rounded to nearest  $m^2$  and shown to two decimals (for computer) eg. 74.00  $m^2$

## POURING SCHEDULE

1. POUR 1	Below lower construction joint	( ) $m^3$
2. POUR 2	Between construction joints	( ) $m^3$
3. POUR 3	Above the upper construction joint	( ) $m^3$
		<hr/>
	Total	( ) $m^3$

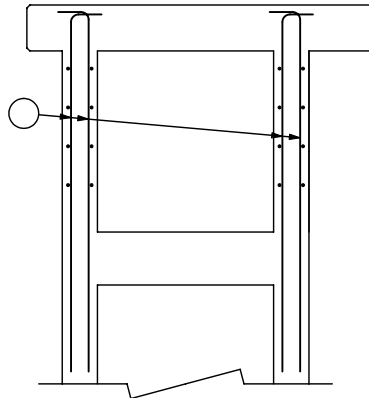
### Volume of concrete

- Volume of structural concrete to be rounded to first decimal place and shown to two decimals (for computer) eg. 39.50  $m^3$



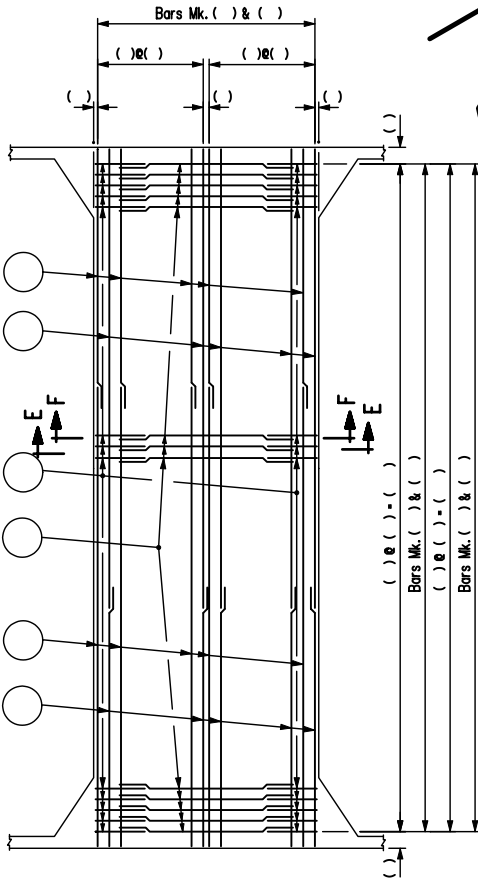
**PLAN OF TIEBACK SLAB**

Typical for top and bottom of each tieback slab.  
Scale 1:



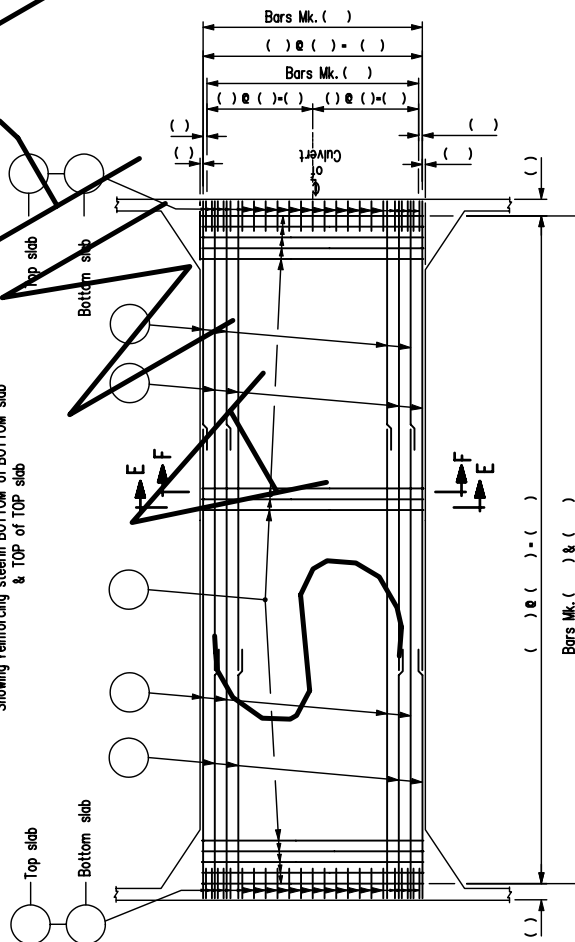
**SECTION D-D**

Headwall and barrel wall reinforcing not shown.  
Scale 1:



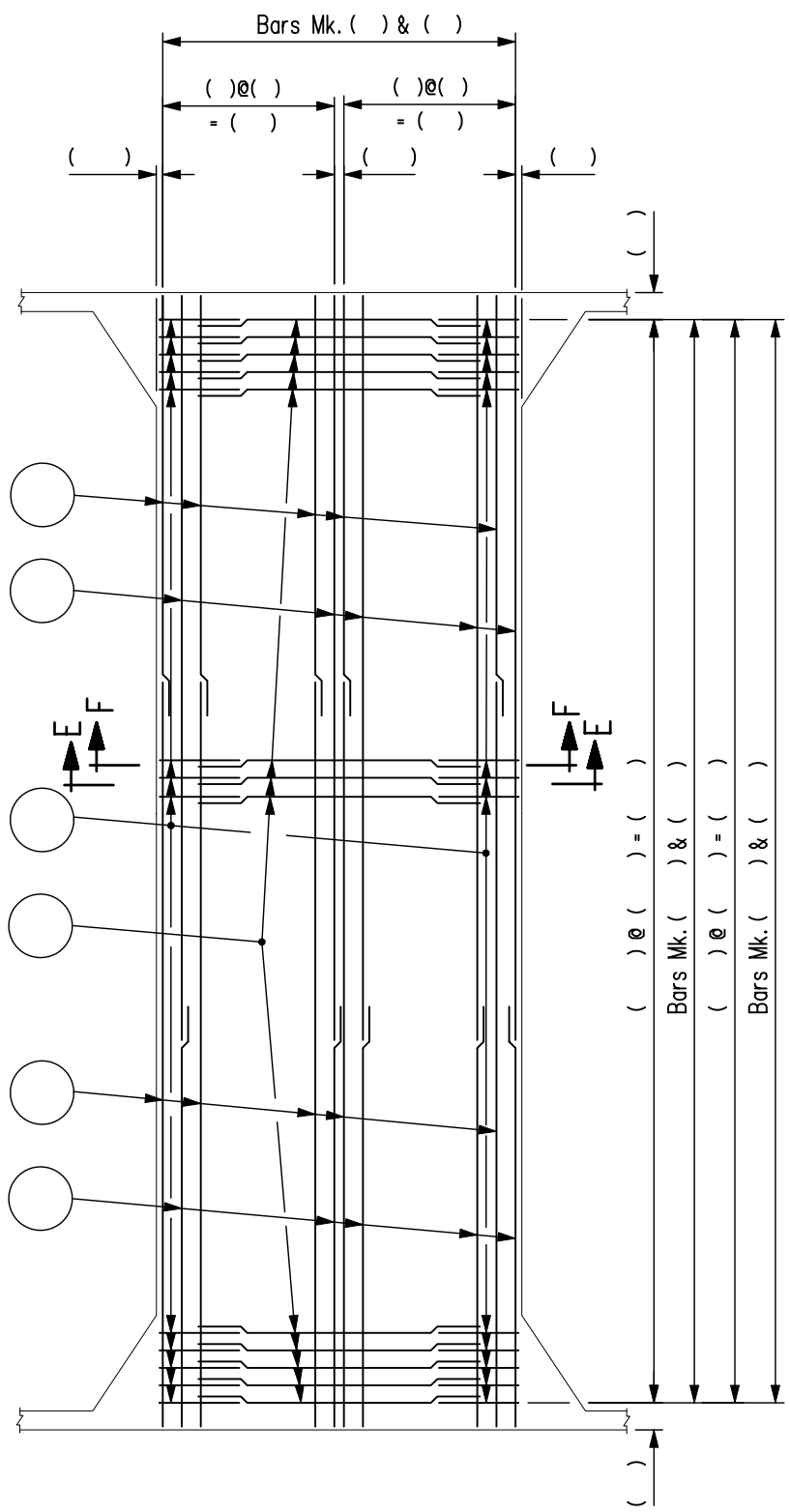
**PLAN**

Showing reinforcing steel in BOTTOM of BOTTOM slab & TOP of TOP slab



**PLAN**

Showing reinforcing steel in TOP of BOTTOM slab & BOTTOM of TOP slab



## PLAN

Showing reinforcing steel in BOTTOM of BOTTOM slab & TOP of TOP slab

**NOTE:**

1. For Sections E-E and F-F see sheet No.
2. 50 cl. all around unless noted otherwise.
3. Bars Mk.20M to be lapped 700 mm  
Bars Mk.15M to be lapped 550 mm.

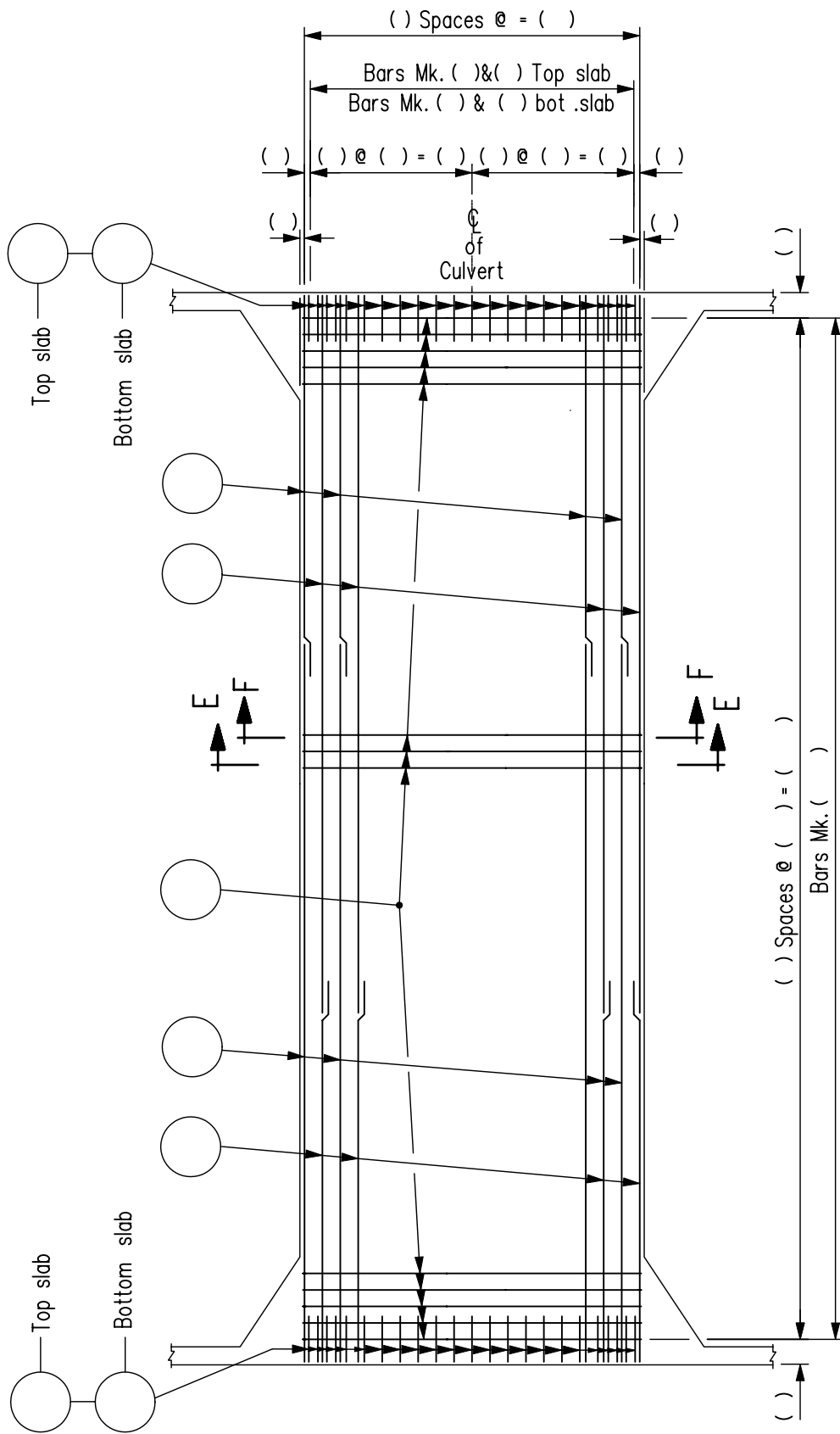
- Stock lengths of reinforcing steel = 6m & 12m & 18m.  
 - preferable max. length of reinforcing steel to be used for ease of shipping & handling = 12m.  
 - All longitudinal reinforcing bars in slabs shall be straight bars.



Water Control & Structures

DETAIL DESCRIPTION		SLAB REINFORCING DETAILS PLAN	
LOCATION			DETAIL No.
SITE No.	DATE	November 2007	1.6.2





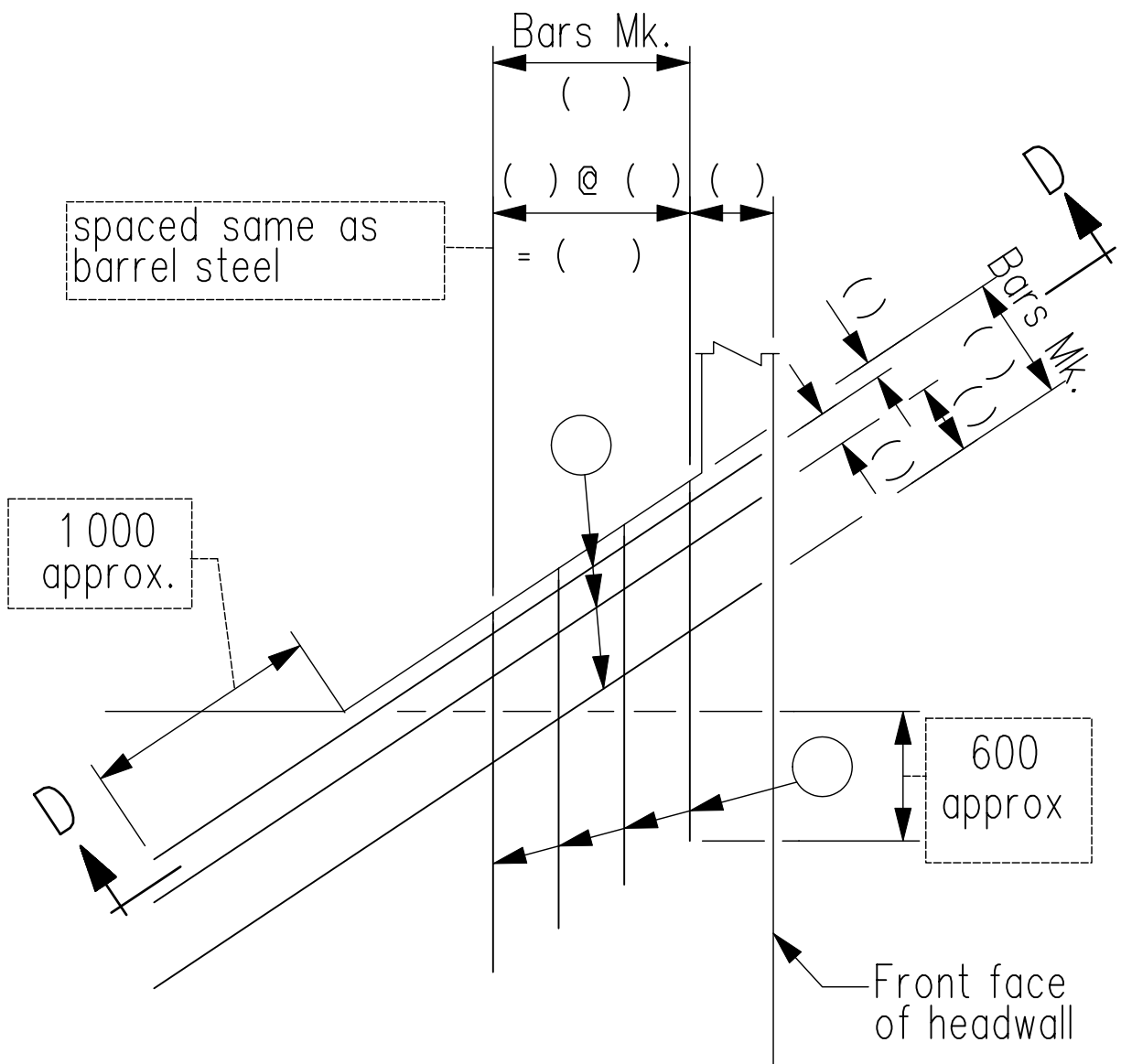
**PLAN**

Showing reinforcing steel in TOP of BOTTOM slab & BOTTOM of TOP slab

**Manitoba** Infrastructure and Transportation

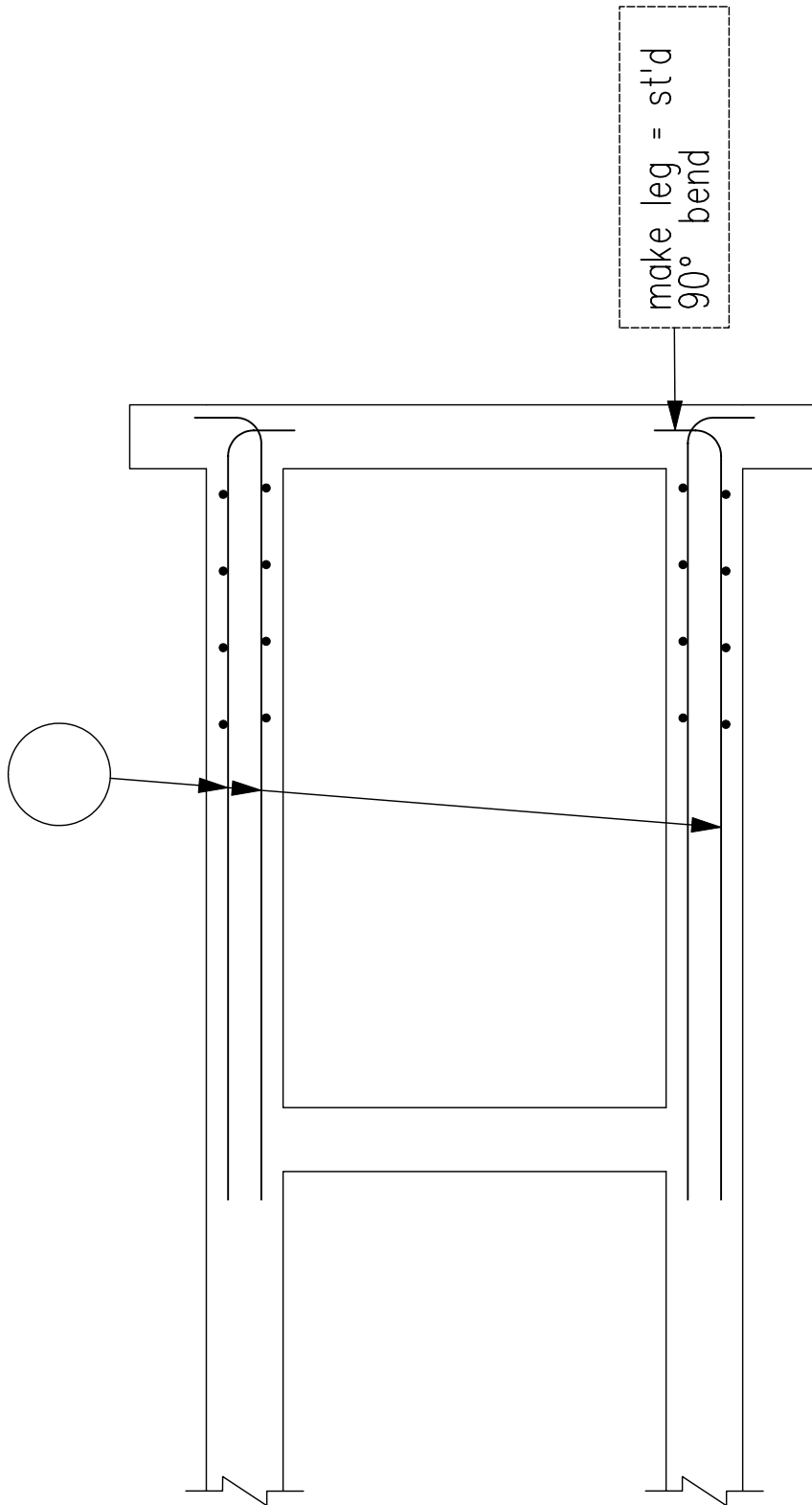
Water Control & Structures

DETAIL DESCRIPTION		SLAB REINFORCING DETAILS PLAN	
LOCATION		DETAIL No.	
SITE No.	DATE	November 2007	
		1.6.3	



## PLAN OF TIEBACK SLAB


Typical for top & bottom of each tieback slab  
 Scale 1:

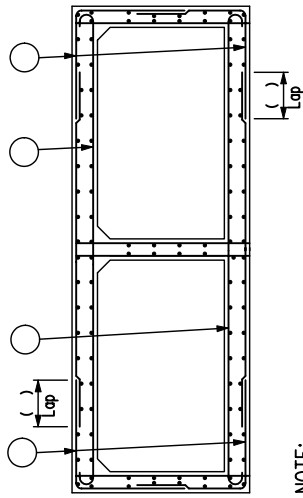


# SECTION D-D

Headwall & barrel wall reinforcing not shown

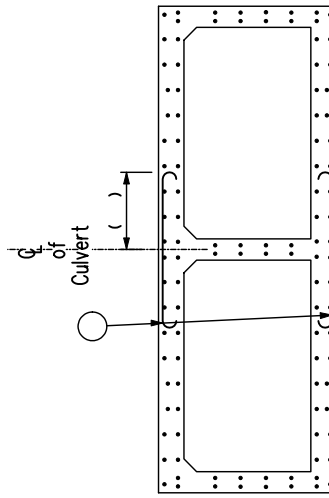
Scale 1:

 <p><b>Manitoba</b> Infrastructure and Transportation</p> <p>Water Control &amp; Structures</p>	DETAIL DESCRIPTION		SLAB REINFORCING DETAILS SECTION D-D		
	LOCATION			DETAIL No.	
	SITE No.	DATE	November 2007	1.6.5	



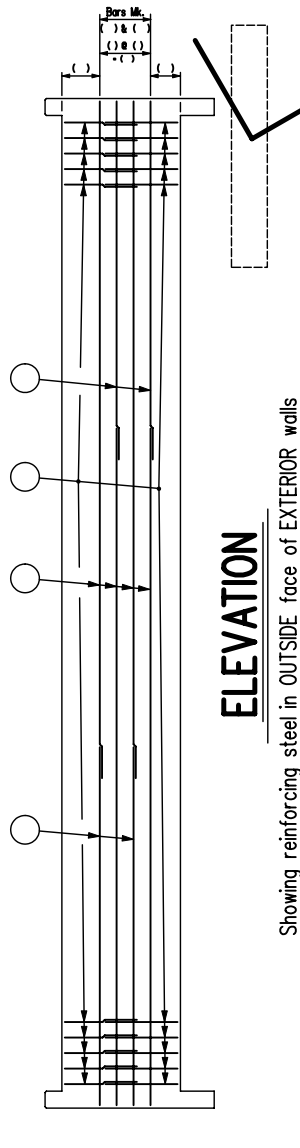
**SECTION E-E**

Scale 1: [ ]



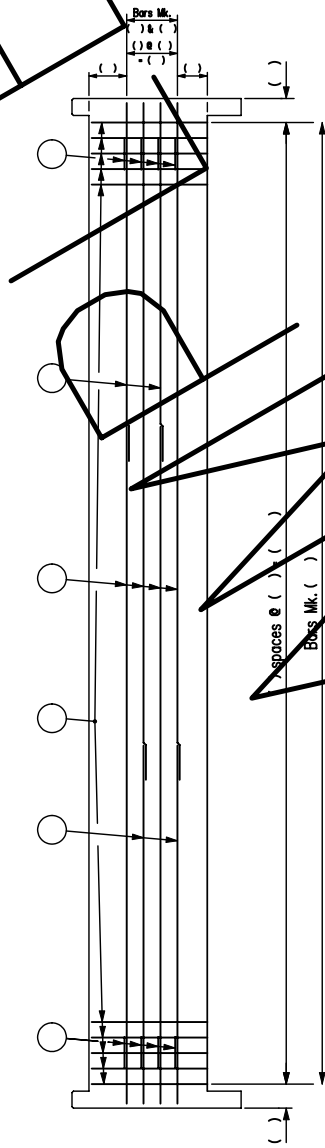
**SECTION F-F**

Scale 1: [ ]



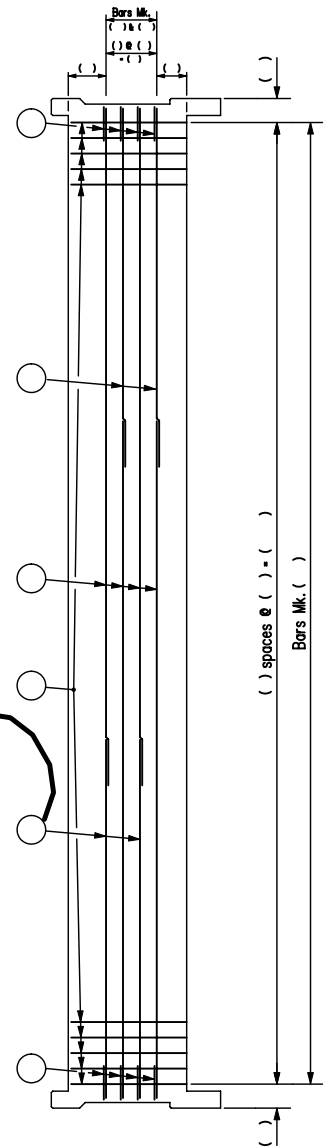
**ELEVATION**

Showing reinforcing steel in OUTSIDE face of EXTERIOR walls



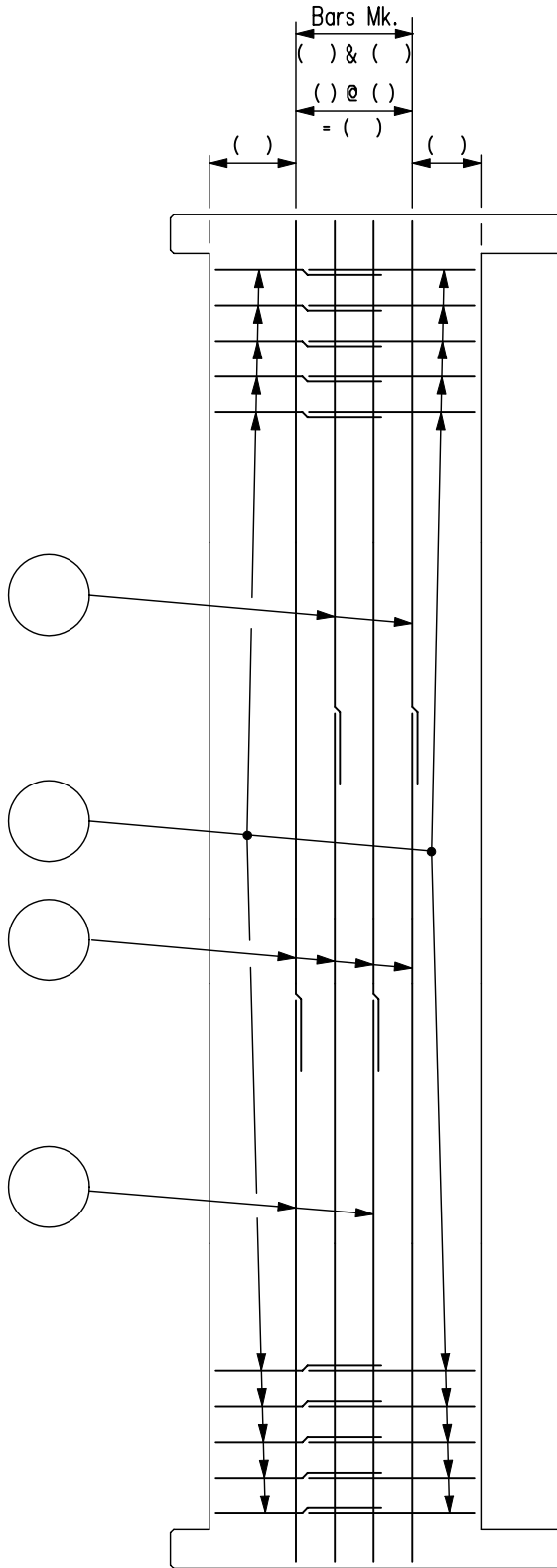
**ELEVATION**

Showing reinforcing steel in INSIDE face of EXTERIOR walls



**ELEVATION**

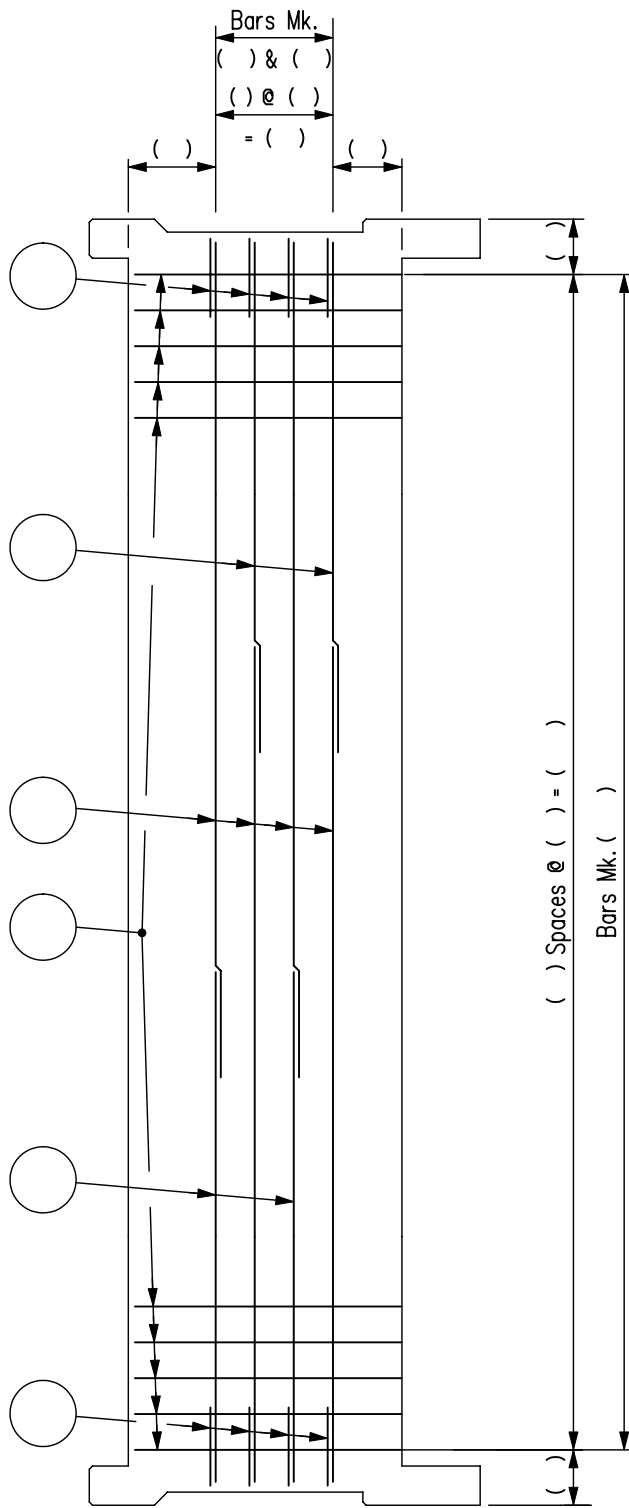
Showing reinforcing steel in BOTH faces of INTERIOR walls



# ELEVATION

Showing reinforcing steel in OUTSIDE face of EXTERIOR wall

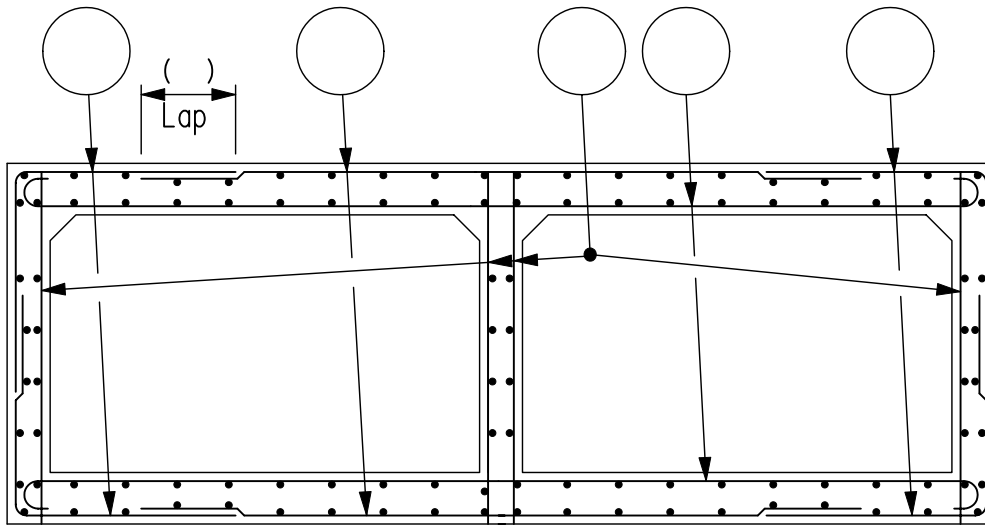
For clarity headwall reinforcing not shown.  
 All longitudinal bars in walls to be straight bars



# ELEVATION

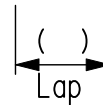
Showing reinforcing steel in BOTH faces of INTERIOR wall

For clarity headwall reinforcing is not shown.  
All longitudinal bars in walls to be straight bars



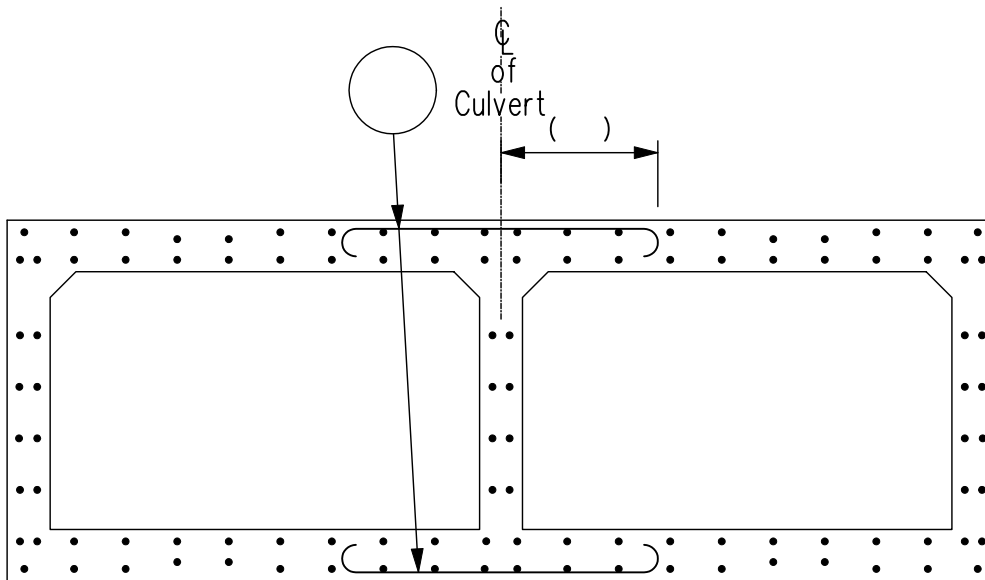
NOTE:

50 cl. all around except straight vertical bars at bottom of culvert.



## SECTION E-E

Scale 1:( )



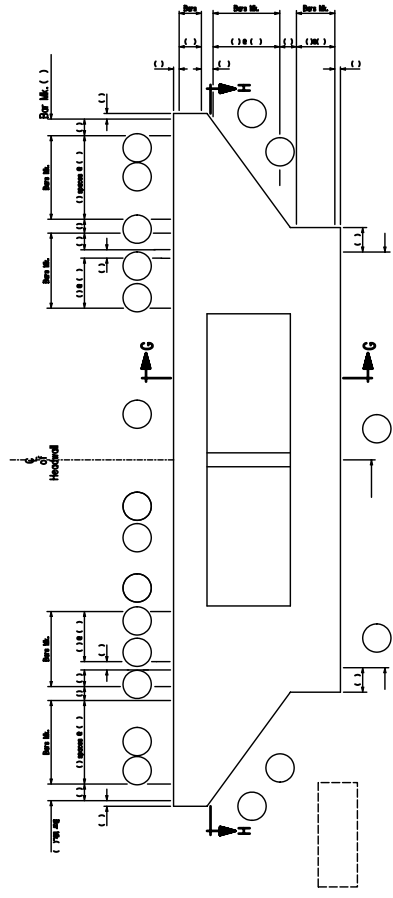
## SECTION F-F

NOTE :

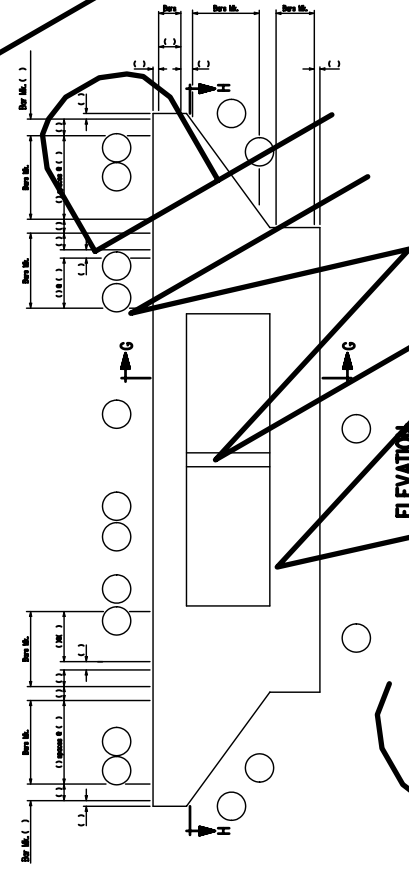
Scale 1:( )

For location of Section E-E & F-F see sheet No.

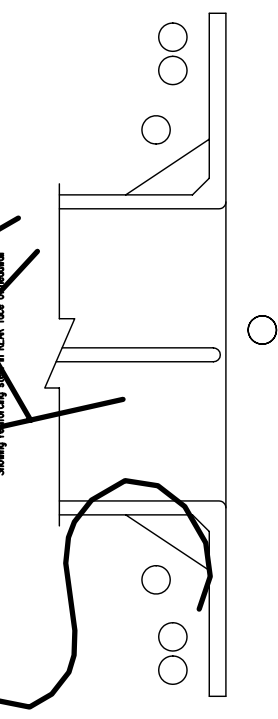
DETAIL DESCRIPTION		HEADWALL REINFORCING DETAILS TYPICAL LAYOUT	
LOCATION		DETAIL No.	
SITE No.	DATE	November 2007	1.8.1



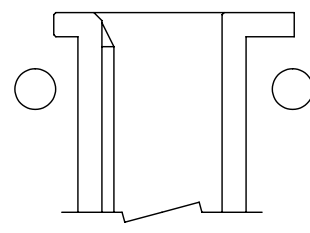
**ELEVATION**  
Showing reinforcing steel in FRONT face of headwall



**ELEVATION**  
Showing reinforcing steel in REAR face of headwall



**SECTION H-H**



**SECTION G-G**

**BILL OF REINFORCING STEEL**

BAR No.	TYPE	LENGTH	NO.	WEIGHT	
1522	BER1	90	3 000	8	37.68
1523	BER1	90	2 470	8	31.02
1524	BER1	90	2 190	12	41.28
1525	BER1	90	2 440	12	45.97
1526	BER1	1590	24	59.91	
1527	S1R	5 690	48	428.80	
2020	S1R	5 350	139	1625.59	
2021	S1R	4 720	139	1428.80	
2023	S1R	10 400	2	148.98	

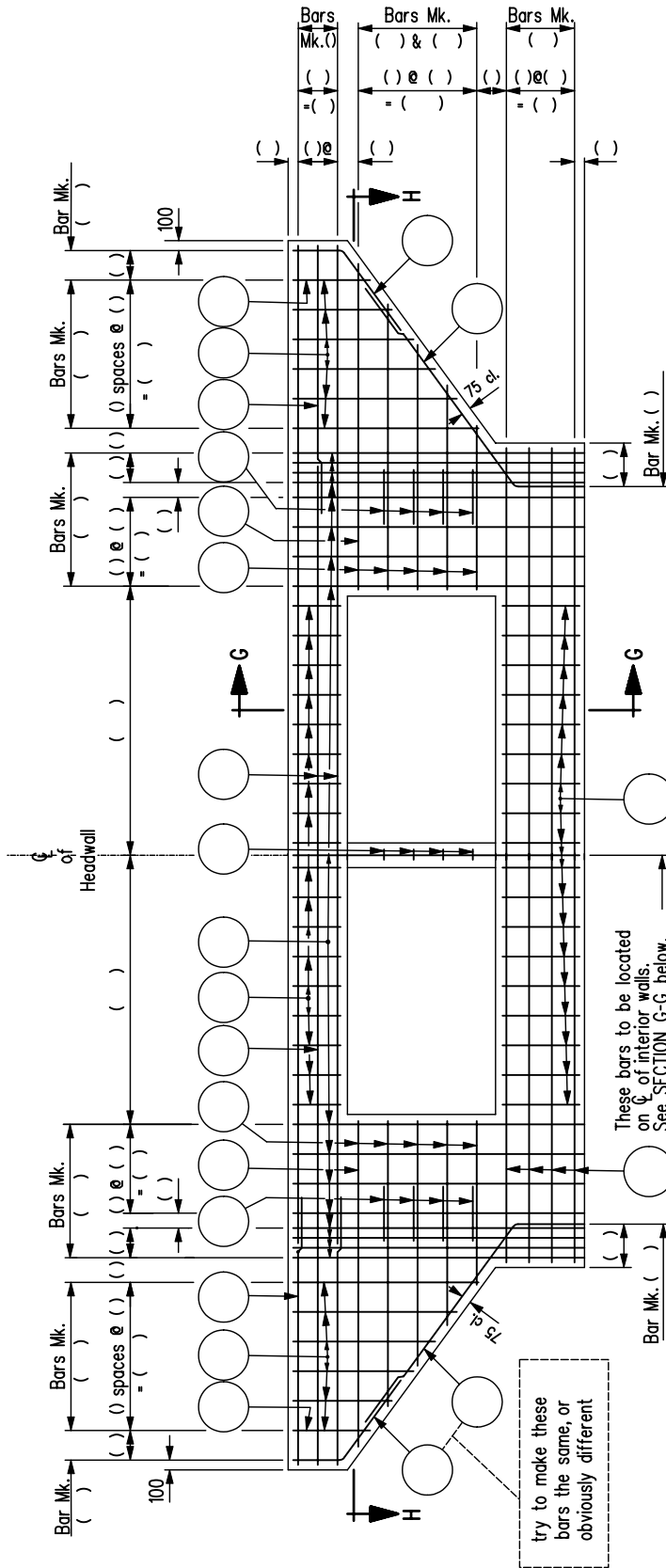
Total mass of reinforcing steel 21 955.10 kg  
Total volume of finished concrete

**NOTES:**

- All dimensions given in Working Diagram are not to scale, except radii and extensions on 90°, 120° & 180° bends. Extensions on 90°, 120° & 180° bends shall be as shown in Working Diagram. All dimensions shall be in millimeters and rounded to the nearest millimeter. All dimensions shall be in millimeters and rounded to the nearest millimeter.
- Reinforcing steel shall be deformed steel, unless noted otherwise in the BILL OF REINFORCING STEEL.
- All reinforcing steel shall conform to CSA G30.5-02 "High Strength Steel Bars for Concrete Reinforcement" Grade 400M, unless noted otherwise in the BILL OF REINFORCING STEEL.
- Like bars shall be lapped, securely tied and identified as to bar and Site No. by appropriate means. All other items to be identified in a similar fashion.
- All bars shall be bent in accordance with the following details:

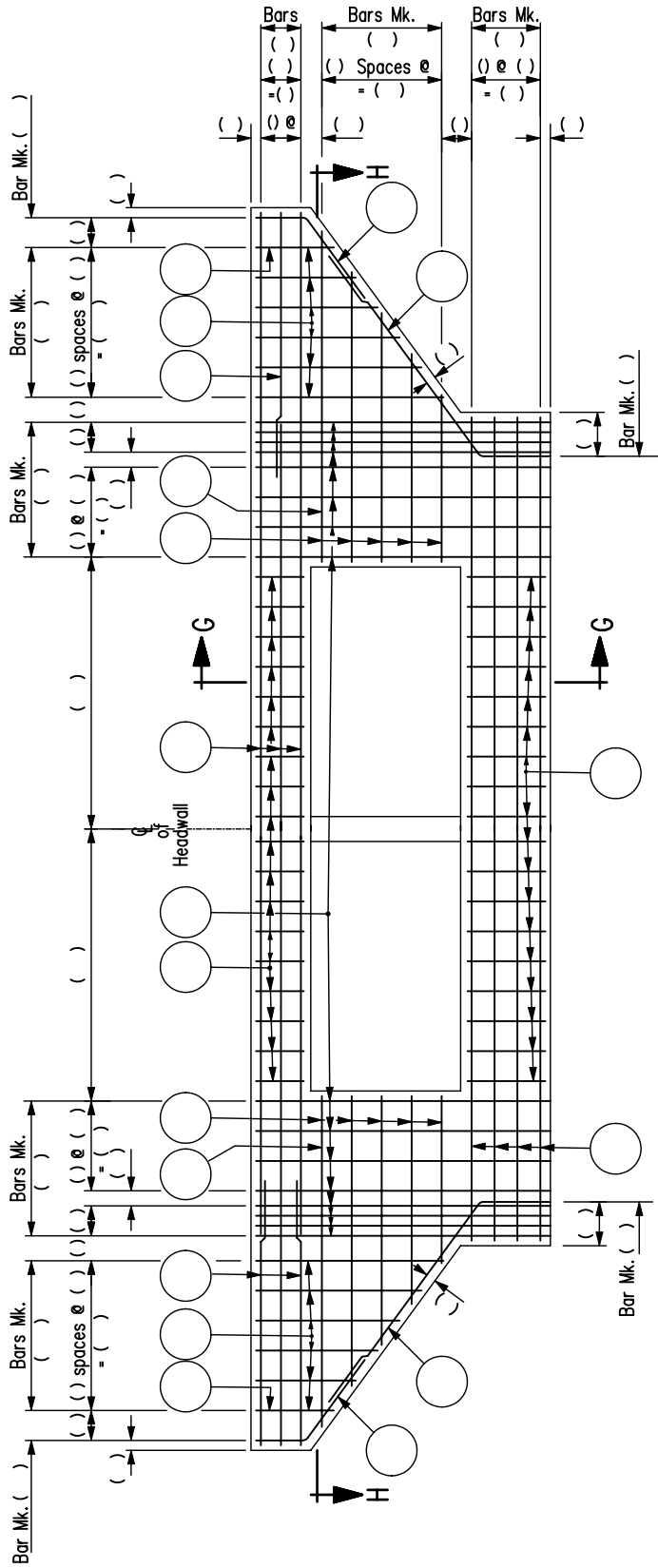






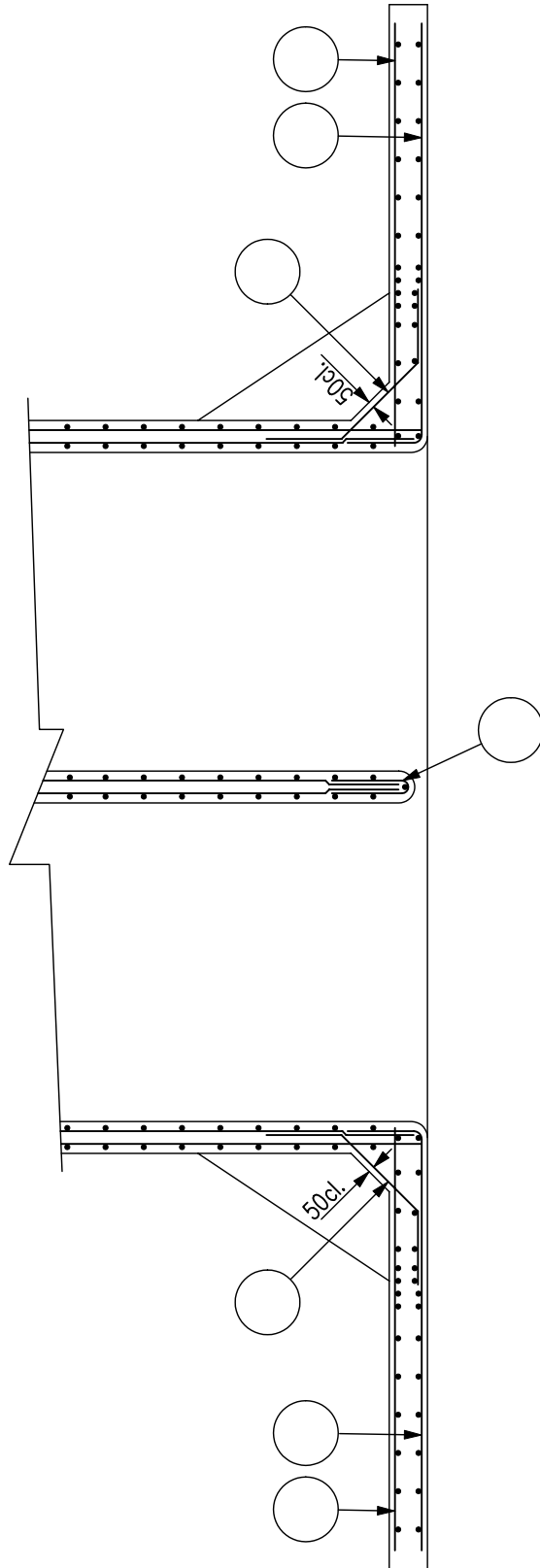
## ELEVATION

Showing reinforcing steel in FRONT face of headwall

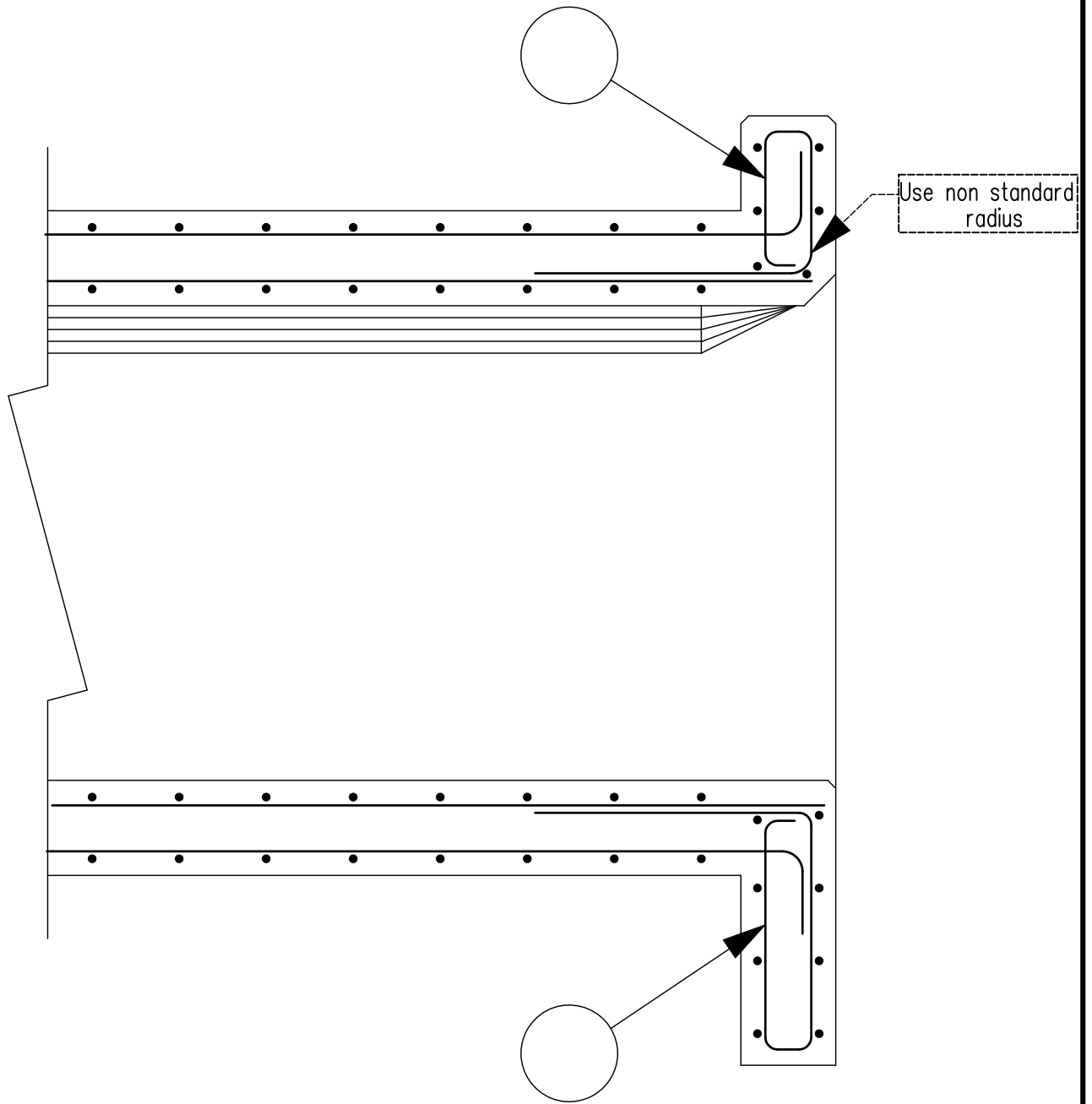


### ELEVATION


Showing reinforcing steel in REAR face of headwall



SECTION H-H



# SECTION G-G

 <b>Manitoba</b> Infrastructure and Transportation Water Control & Structures	DETAIL DESCRIPTION		HEADWALL REINFORCING DETAILS SECTION G-G
	LOCATION		DETAIL No.
	SITE No.	DATE	November 2007
			<b>1.8.5</b>

BILL OF REINFORCING STEEL

Site No.

MARK	TYPE	PIN DIAMETER	LENGTH	No.	MASS	BENDING DIAGRAM
1522	BENT	90	3 000	8	37.68	
1523	BENT	90	2 470	8	31.02	
1524	BENT	90	2 190	12	41.26	
1525	BENT	90	2 440	12	45.97	
1526	BENT		1 500	24	50.91	
1527	STR		5 690	48	428.80	
2001	STR		5 580	139	1826.59	
2002	STR		2 970	139	972.21	
2003	STR		10 400	2	48.98	

Total mass of reinforcing steel 21 165.10 kg  
 Total volume of structural concrete m<sup>3</sup>

- NOTES:**
- All dimensions given in bending diagram are out to out, except radii and extensions on 90°, 135° & 180° hooks. Extensions on 90°, 135° & 180° hooks are the "A" or "G" dimensions for the standard 90°, 135° & 180° hooks referenced from the RSIC "Manual of Standard Practice". Radii are inside dimensions. All reinforcing steel bends and hooks shall conform to Clause 6.6.2 of C.S.A. A23.1-04, unless noted otherwise in the BILL OF REINFORCING STEEL.
  - All reinforcing steel shall be deformed steel, unless noted otherwise in the BILL OF REINFORCING STEEL.
  - All reinforcing steel shall conform to CSA G30.18-M92 "Billet Steel Bars for Concrete Reinforcement" Grade 400W, unless noted otherwise in the BILL OF REINFORCING STEEL.
  - Like bars shall be bundled, securely tied and identified as to Mark and Site No. by appropriate means. All other items to be identified in a similar fashion.
  - All bars shall be bent in accordance with the following detail:
- 

- all lengths shall be to the nearest 10 mm
- all mass shall be rounded off to two decimals
- total volume of structural concrete to be rounded to first decimal & shown to two decimals eg. 74.10 m<sup>3</sup>
- total area of permeable formwork liner finish shall be to the nearest m<sup>2</sup> & shown to two decimals eg. 74.00 m<sup>2</sup>



Water Control & Structures

DETAIL DESCRIPTION

HEADWALL REINFORCING DETAILS  
 BILL OF REINFORCING STEEL

LOCATION

DETAIL No.

SITE No.

DATE November 2007

1.8.6