

**DRAFT**  
**FOUNDATION INVESTIGATION AND DESIGN REPORT**  
**STRAWBERRY CREEK BRIDGE 3 REHABILITATION**  
**HIGHWAY 102**  
**THUNDER BAY DISTRICT, ONTARIO**

**G.W.P. 6073-09-00, SITE NO. 48W-3**

**Geocres Number:**

**Report to:**

**MMM GROUP LIMITED**

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**PART 1: FACTUAL INFORMATION**

**1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted at the existing Strawberry Creek Bridge 3 along Highway 102, in the District of Thunder Bay, Ontario.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, stratigraphic profile and cross-sections, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions was developed from the data obtained in the course of the investigation.

Thurber carried out the investigation as a sub-consultant to MMM Group Limited, under the Ministry of Transportation Ontario (MTO) Agreement Number 6010-E-0011.

**2 SITE DESCRIPTION**

The existing Strawberry Creek Bridge 3 is located on Highway 102 in the community of Kaministiquia, approximately 5.5 km east of the intersection of Highways 102 and 11/17, and 25 km northwest of Thunder Bay. The existing bridge is a single-span structure with a concrete deck and steel girders supported on steel H-piles. The bridge spans a length of approximately 18.3 m and is 11 m wide.

Strawberry Creek flows from north to south at this bridge site, and flows in an overall northeast to southwest direction in the area, crossing Highway 102 at three locations before draining into the Kaministiquia River. The creek channel is approximately 12 m wide and 1.5 m deep at the site. The



surrounding lands are heavily wooded with occasional clearings for residential and commercial land usage along the highway.

Photographs in Appendix C show the general nature of the site and the existing bridge.

The site lies within the physiographic region known as the Wawa Subprovince of the Superior Province of the Canadian Shield. The soil deposits in the area comprise glaciofluvial outwash sands and gravels. Bedrock at depth is formed of mafic to felsic metavolcanic rocks.

### **3 SITE INVESTIGATION AND FIELD TESTING**

The site investigation and field testing for this project were carried out between July 23 and 26, 2013 and consisted of drilling and sampling four boreholes, identified as Boreholes SBC3-01 to SBC3-04, through the highway embankment in the area of the existing west and east abutments and approaches. Boreholes SBC3-02 and SBC3-03 were drilled near the abutments to depths of 34.1 to 33.1 m, and Boreholes SCB3-01 and SBC3-04 were drilled through the approach embankments to depths of 9.8 m.

The approximate locations of the boreholes are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix E.

The borehole locations were marked in the field and utility clearances were obtained prior to drilling. The coordinates and ground surface elevations for the boreholes were derived from topographic plans provided to Thurber by MMM Group Limited.

A truck-mounted CME 75 drill rig was used to advance the boreholes using NW casing/wash boring techniques. Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). Dynamic Cone Penetration Tests (DCPTs) were conducted below the sampled portion of Boreholes SBC3-02 and SBC3-03 and adjacent to these boreholes on completion of drilling.

The drilling and sampling operations were supervised on a full time basis by a member of Thurber's technical staff. The supervisor logged the boreholes and processed the recovered soil samples for transporting to Thurber's laboratory for further examination and testing.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Groundwater conditions observed after completion of drilling were not representative of site conditions as water was used during wash boring and coring operations. Standpipe piezometers were installed in two boreholes to monitor the groundwater level after drilling. The piezometers were subsequently decommissioned and the boreholes without piezometers were backfilled in general accordance with MOE Regulation 903. Completion details of the piezometers and boreholes are summarized in Table 3.1.



**Table 3.1 – Borehole Completion Details**

<b>Foundation Unit</b>	<b>Boreholes</b>	<b>Piezometer Tip Depth/ Elevation (m)</b>	<b>Completion Details</b>
West Approach	SBC3-01	None installed	Borehole backfilled with bentonite holeplug from 9.8 m to 0.15 m, then asphalt to surface.
West Abutment	SBC3-02	30.5/ 284.0	Sand from 34.1 m to 26.8 m, bentonite holeplug from 26.8 m to 0.5 m, sand from 0.5 m to 0.15 m, then asphalt to surface.
East Abutment	SBC3-03	30.5/ 284.0	Sand from 33.1 m to 26.5 m, bentonite holeplug from 26.5 m to 0.15 m, then asphalt to surface.
East Approach	SBC3-04	None installed	Borehole backfilled with bentonite holeplug from 9.8 m to 0.15 m, then asphalt to surface.

#### **4 LABORATORY TESTING**

All recovered soil samples were subjected to visual identification and natural moisture content determination. Selected samples were also subjected to grain size distribution analyses (sieve and hydrometer). The results of this testing program are summarized on the Record of Borehole sheets included in Appendix A and on the figures presented in Appendix B.

#### **5 DESCRIPTION OF SUBSURFACE CONDITIONS**

Reference is made to the Record of Borehole sheets included in Appendix A. Details of the encountered soil stratigraphy are presented in these sheets and on the “Borehole Locations and Soil Strata” drawing included in Appendix E. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole sheets governs any interpretation of the site conditions. It must be recognized that soil conditions may vary between and beyond the borehole locations.

The soil stratigraphy typically comprises a sand and gravel embankment fill, underlain by a layer of native sandy gravel, over a deep deposit of sands and silts. More detailed description of the individual strata are presented below.

##### **5.1 Asphalt and Concrete**

Asphalt was encountered in all the boreholes, which were drilled from the existing Highway 102 roadway. The asphalt layer ranged from 90 to 125 mm thick at the borehole locations. A concrete slab (125 to 150 mm thick) was encountered below the asphalt in Boreholes SBC3-02 and SBC3-03 near the bridge abutments.

##### **5.2 Embankment Fill**

The existing highway embankment fill beneath the asphalt typically comprised a brown sand and gravel containing trace silt and occasional cobbles. The lower portion of the embankment



fill (below 3.2 m depth) transitioned to sandy, silty clay in Borehole SBC3-02. The embankment fill has a total thickness of 4.3 to 4.5 m with a lower boundary at a depth of 4.6 m (Elev. 310.0 to 309.9).

SPT 'N' values recorded in the sand and gravel fill typically ranged from 10 to 58 blows per 0.3 m penetration, indicating a compact to very dense relative density. The lower silty clay fill was firm, based on an SPT 'N' value of 5 blows per 0.3 m penetration. High 'N' values of 98 blows per 0.225 m penetration and 50 blows per 0.125 m penetration were obtained upon probable cobbles. An 'N' value of 5 (loose) was recorded at 3.0 m depth in Borehole SBC3-03.

Measured moisture contents ranged from 4% to 16% in the sand and gravel fill, and was 30% in the sandy silty clay fill.

The results of grain size analyses conducted on the embankment fill are summarized below. These results are also presented on the Record of Borehole sheets included in Appendix A and on Figures B1 and B2 of Appendix B.

Sand and Gravel Fill:

Gravel %	35 to 61
Sand %	35 to 58
Silt & Clay %	4 to 15

Sandy Silty Clay Fill:

Gravel %	7
Sand %	29
Silt %	29
Clay %	35

### **5.3 Sandy Gravel to Sand and Gravel**

A native deposit of brown sandy gravel ranging in composition to sand and gravel was encountered below the embankment fill in Boreholes SBC3-02 to SBC3-04. This layer contained trace silt and occasional cobbles and boulders. Where fully penetrated, the cohesionless deposit had a thickness of 1.5 and 3.2 m, with a lower boundary at depths of 6.1 and 7.8 m (Elev. 308.4 and 306.7). Borehole SBC3-04 was terminated within sand and gravel at a depth of 9.8 m (Elev. 304.8).

SPT 'N' values obtained in the deposit ranged from 17 to 55 blows for 0.3 m penetration, indicating a compact to very dense relative density. Measured moisture contents ranged from 11% to 25%.



Two samples of the sandy gravel to sand and gravel deposit underwent laboratory grain size analysis testing, the results of which are summarized below. These results are also presented on the Record of Borehole sheets included in Appendix A. The grain size distribution curves for these samples are shown on Figure B3 of Appendix B.

Gravel %	39 to 72
Sand %	27 to 53
Silt & Clay %	1 to 8

#### 5.4 Sands and Silts

A deep native deposit of sands and silts was encountered below the fill or native sand and gravel layers in Boreholes SBC3-01 to SBC3-03. The deposit mainly consisted of sandy silt or sand and silt with trace gravel and trace clay, however zones of silt with some sand and trace clay, and sand with trace silt and trace gravel were also encountered within the deposit. The boreholes were terminated within the sands and silts at depths of 9.8 to 34.1 m (Elev. 304.7 to 280.4).

SPT 'N' values obtained in the sands and silts typically ranged from 4 to 26 blows for 0.3 m penetration, indicating a loose to compact relative density. Below depths of 27.4 and 24.4 m in Boreholes SBC3-02 and SBC3-03, the sands and silts become dense to very dense with 'N' values of 33 to 64 blows for 0.3 m penetration. Measured moisture contents ranged from 18% to 31%.

Selected samples of the sands and silts underwent laboratory grain size analysis testing, the results of which are summarized below. These results are also presented on the Record of Borehole sheets included in Appendix A. The grain size distribution curves for these samples are shown on Figures B4 to B7 of Appendix B.

##### Sandy Silt to Silt:

Gravel %	0 to 4
Sand %	12 to 37
Silt %	60 to 84
Clay %	2 to 4

##### Sand and Silt to Silty Sand:

Gravel %	0 to 3
Sand %	54 to 65
Silt %	27 to 43
Clay %	2 to 5



## 5.5 Water Levels

Where possible, water levels were monitored in the open boreholes during drilling operations. Wash boring methods were used to advance the boreholes and therefore water levels recorded during or upon completion of drilling may not reflect natural groundwater levels. Standpipe piezometers were installed in two boreholes to monitor the groundwater level after completion. The water levels measured in the piezometers are summarized in Table 5.1.

**Table 5.1 – Water Level Measurements**

Borehole	Date	Water Level		Comment
		Depth (m)	Elev. (m)	
SBC3-02	August 1, 2013	3.8	310.7	In piezometer
	May 2, 2014	3.4	311.1	In piezometer
SBC3-03	August 1, 2013	3.9	310.6	In piezometer
	May 2, 2014	3.1	311.4	In piezometer

The preliminary GA drawing provided by MMM Group Limited indicates a water level at approximate Elev. 310.7 in Strawberry Creek in March 1972. In general, the groundwater level is expected to be at or slightly above the water level in the creek.

The above values are short-term readings and seasonal fluctuations of the groundwater and creek level are to be expected. In particular, the water levels may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.



## **6 MISCELLANEOUS**

Borehole locations were selected and established in the field by Thurber Engineering Ltd. The coordinates and the ground surface elevations for the boreholes were established based on topographic survey information provided by MMM Group Limited.

Thurber obtained utility clearances for the borehole locations prior to drilling.

Eastern Ontario Diamond Drilling of Hawkesbury, Ontario supplied a truck-mounted CME-75 drill rig and conducted the drilling, sampling and in-situ testing operations for the boreholes. The drilling operations were supervised by Ms. Eckie Siu of Thurber.

Overall supervision of the field program, interpretation of the data, and preparation of the report were carried out by Mr. Mark Farrant P.Eng.

The report was reviewed by Mr. Murray Anderson, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

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**PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS**

**7 GENERAL**

This report presents interpretation of the geotechnical data in the factual report and provides geotechnical recommendations for the proposed rehabilitation of the existing Strawberry Creek Bridge 3 on Highway 102, in the District of Thunder Bay, Ontario.

At present, the bridge carries Highway 102 over Strawberry Creek on a single-span structure with a span length of 18.3 m and a deck width of 11 m. Archive drawings dated May 1973 indicate that the existing bridge abutments are supported on two rows of battered steel HP310x79 driven to a design load of 70 tons (700 kN) per pile based on the Hiley Formula. The existing approach fill heights above the surrounding ground are approximately 3 m at both abutments.

Based on the GA drawing dated August 2014, rehabilitation of the bridge will consist of replacement of the existing deck slab with a new precast concrete deck. The rehabilitation will include modification of the tops of the abutments and wingwalls, and replacement of the approach slabs. Grade raises of about 90 mm and 150 mm are proposed at the west and east approaches, respectively. Widening of the bridge deck is not proposed.

The discussion and recommendations presented in this report are based on the information provided by MMM Group Limited and on the factual data obtained in the course of the investigation.

**8 ASSESSMENT OF EXISTING ABUTMENT FOUNDATIONS**

The subsurface stratigraphy encountered at this site generally consists of sand and gravel fill underlain by a layer of compact to very dense sandy gravel over a deep deposit of typically loose to compact



sands and silts. The fill and gravelly sand contain occasional cobbles and possible boulders. Bedrock was not encountered within the drilling depths of 34.1 and 33.1m (Elev. 280.4 and 281.4) at the abutments.

The archive drawings for the existing bridge indicate that each abutment is supported on seven HP310x79 piles battered at inclinations varying from 1H: 4V to 1H: 10V. Pile lengths of 27.4 and 24.4 m are indicated for the west and east abutment, respectively. The pile caps are 760 mm thick with a top at elevation 310.4, and the top of pile is embedded 300 mm into the bottom of the pile cap.

Assuming installation of the full length of supplied pile, the design pile tip levels would be at approximate elevation 282.7 to 283.4 at the west abutment and elevation 285.7 to 286.3 m at the east abutment. Pile driving records were not available to confirm the actual pile tip elevations as driven. Based on the borehole data, it is likely that the piles were driven into dense to very dense silty sand to sand and silt encountered below approximate elevation 287 m in the boreholes.

As the depth of pile penetration cannot be confirmed and the design allowable pile capacity for pile driving was 700 kN per pile, it is recommended that resistances of 1,000 kN per pile at factored ULS and 800 kN per pile at SLS be employed to assess the capability of the existing piles to support the rehabilitated bridge loads.

It is understood from MMM that the expected increase in load for Strawberry Creek Bridge 3 is going to be minimal as the old deck will be completely removed and replaced by a new one. Supporting the new deck on the existing pile foundations is therefore considered to be acceptable from a geotechnical viewpoint. The Structural Designer must verify that the strength and integrity of the existing foundations is adequate to carry the foundation loads.

Resistance to lateral loads will be provided by the horizontal component of the batter piles.

In view of the cohesionless soil conditions at this site, downdrag on the piles due to the slight grade raise is not an issue.

The design depth of frost penetration at this site is 2.2 m. Existing pile caps constructed over the native sand and gravel are not considered to be susceptible to frost action.

## 9 ABUTMENT BACKFILL AND LATERAL EARTH PRESSURES

Any new backfill behind the modified abutment and wing walls should be placed in accordance with OPSS 902. All backfill material should consist of Granular A, Granular B Type II or Granular B Type III material meeting the specifications of OPSS.PROV 1010. Compaction equipment to be used adjacent to the walls should be restricted in accordance with OPSS 501.

Lateral earth pressures acting on the abutment walls may be assumed to be distributed triangularly and to be governed by the characteristics of the wall backfill. For a fully drained condition, the pressures should be computed in accordance with the CHBDC but generally are given by the expression:

$$p_h = K (\gamma h + q)$$

Where:  $p_h$  = horizontal pressure on the wall at depth  $h$  (kPa)



$K$  = earth pressure coefficient (see Table 9.1)

$\gamma$  = unit weight of retained soil (see Table 9.1)

$h$  = depth below top of fill where pressure is computed (m)

$q$  = value of any surcharge (kPa)

Earth pressure coefficients for backfill to the abutment wall are dependent on the material used as backfill and the existing material adjacent to the wall. Typical values are given in Table 9.1.

**Table 9.1 – Earth Pressure Coefficients (K)**

Condition	OPSS Granular A or Granular B Type II $\phi = 35^\circ, \gamma = 22.8 \text{ kN/m}^3$		OPSS Granular B Type I or Existing Granular Fill $\phi = 32^\circ, \gamma = 21.2 \text{ kN/m}^3$	
	Horizontal Surface Behind Wall	Sloping Backfill (2H:1V)	Horizontal Surface Behind Wall	Sloping Backfill (2H:1V)
Active (Unrestrained Wall)	0.27	0.38*	0.31	0.46*
At Rest (Restrained Wall)	0.43	-	0.47	-
Passive	3.7	-	3.3	-

\* For wing walls.

The use of a material with a high friction angle and low active pressure coefficient (Granular A, Granular B Type II) is preferred as it results in lower earth pressures acting on the wall.

The earth pressure coefficients in Table 9.1 are “ultimate” values and require certain movements for the respective conditions to be mobilized. The values to use in design may be estimated from Figure C6.16 in the Commentary to the Canadian Highway Bridge Design Code.

In accordance with Clause 6.9.3 of the CHBDC, a compaction surcharge should be added. The magnitude should be 12 kPa at the top of fill and decreasing to 0 kPa at a depth of 2.0 m for Granular B Type I or III, or at a depth of 1.7 m for Granular A or Granular B Type II.

## 10 SEISMIC CONSIDERATIONS

The following seismic parameters should be used for design:

- Velocity Related Seismic Zone                      0
- Zonal Velocity Ratio                                      0.0
- Acceleration Related Seismic Zone                0
- Zonal Acceleration Ratio                              0.0
- Peak Horizontal Acceleration                        0.036



The soil profile type at this site has been classified as Type IV. Therefore, according to Table 4.4 of the CHBDC, a Site Coefficient “S” (ground motion amplification factor) of 2.0 should be used in seismic design.

In accordance with Clause 4.6.4 of the CHBDC, retaining structures should be designed using active ( $K_{AE}$ ) and passive ( $K_{PE}$ ) earth pressure coefficients that incorporate the effects of earthquake loading. The coefficients of horizontal earth pressure for seismic loading presented in Table 10.1 may be used.

**Table 10.1 – Earth Pressure Coefficients for Earthquake Loading ( $K_E$ )**

Conditions	OPSS Granular A or Granular B Type II $\phi = 35^\circ; \gamma = 22.8 \text{ kN/m}^3$		OPSS Granular B Type I or Existing Granular Fill $\phi = 32^\circ, \gamma = 21.2 \text{ kN/m}^3$	
	Horizontal Surface Behind Wall	Sloping Backfill (2H:1V)	Horizontal Surface Behind Wall	Sloping Backfill (2H:1V)
Active ( $K_{AE}$ )*	0.28	0.42	0.32	0.51
Passive ( $K_{PE}$ )	3.6	-	3.2	-
At Rest ( $K_{OE}$ )**	0.47	-	0.52	-

\* After Mononobe and Okabe, passive case assumes a horizontal surface in front of the wall.

\*\* After Woods

Based on review of the SPT and DCPT data, the cohesionless foundation soils at this site may be prone to liquefaction during seismic events. However, considering the acceleration related seismic zone of 0, liquefaction is not expected to be an issue.

## 11 SCOUR AND EROSION CONTROL

Erosion protection must be provided along any soil surfaces that may be in contact with the river flow. In particular, erosion should be provided along the toe of the embankment slopes where not protected by wingwalls.

A vegetation cover should be established on all other exposed earth surfaces to protect against surficial erosion, in general accordance with OPSS 804.

## 12 EXCAVATION AND GROUNDWATER CONTROL

Excavation to carry out modifications to the existing abutments is expected to be limited to the existing granular embankment fill above the river and groundwater levels.

All excavations must be carried out in accordance with OPSS 902 and the requirements of the Occupational Health and Safety Act (OHSA). For the purposes of the OHSA, the approach fill within the depth of excavation may be classed as Type 3 soil above the water table.

The selection of the method of excavation is the responsibility of the Contractor and must be based on his equipment, experience and interpretation of the site conditions. It is anticipated that a hydraulic excavator will be suitable. Provision must be made for the handling of pavement materials, potential obstructions in the fill, and cobbles and boulders.



Bridge rehabilitation will be carried out in stages to maintain one traffic lane operational at all times. Roadway protection will be required to facilitate staging. Roadway protection should be provided in accordance with OPSS 539 and designed for Performance Level 2.

The design of any road protection or dewatering system that may be required is the responsibility of the Contractor. All shoring systems should be designed by a Professional Engineer experienced in such designs.

### **13 APPROACH EMBANKMENTS**

Grade raises of about 90 mm and 150 mm are planned at west abutment and east abutment, respectively. In view of the soil conditions at this site, settlement or stability issues are not anticipated for the existing approach embankments.

### **14 CONSTRUCTION CONCERNS**

Potential construction concerns include, but are not necessarily limited to:

- The existing embankment fill contains occasional cobbles which may interfere with excavation or installation of temporary roadway protection system.
- Water levels in the creek may fluctuate during construction.



## **15 CLOSURE**

Engineering analysis and preparation of the report were carried out by Mr. Keli Shi, P.Eng. The report was reviewed by Mr. Murray Anderson, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

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**Appendix A**  
**Record of Borehole Sheets**

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## SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

### 1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

### 2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

### 3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT <sup>(1)</sup> 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer

### 4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

### 5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$



Water Level

C<sub>pen</sub>

Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.



## EXPLANATION OF ROCK LOGGING TERMS

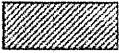




### ROCK WEATHERING CLASSIFICATION

<b>Fresh (FR)</b>	No visible signs of weathering.
<b>Fresh Jointed (FJ)</b>	Weathering limited to the surface of major discontinuities.
<b>Slightly Weathered (SW)</b>	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
<b>Moderately Weathered (MW)</b>	Weathering extends throughout the rock mass, but the rock material is not friable.
<b>Highly Weathered (HW)</b>	Weathering extends throughout the rock mass and the rock is partly friable.
<b>Completely Weathered (CW)</b>	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

### DISCONTINUITY SPACING

<b>Bedding</b>	<b>Bedding Plane Spacing</b>
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

### SYMBOLS

	CLAYSTONE
	SILTSTONE
	SANDSTONE
	COAL
	BEDROCK

### STRENGTH CLASSIFICATION

<b>Rock Strength</b>	<b>Approximate Uniaxial Compressive Strength</b>		<b>Field Estimation of Hardness*</b>
	<b>(MPa)</b>	<b>(psi)</b>	
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

### TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a % of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.



# UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ( $W_L < 30\%$ ).
		CI	Inorganic clays of medium plasticity, silty clays. ( $30\% < W_L < 50\%$ ).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			





# RECORD OF BOREHOLE No SBC3-01

1 OF 2

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 229.1 E 335 773.3 ORIGINATED BY ES  
 HWY 102 BOREHOLE TYPE NW Casing COMPILED BY AN  
 DATUM Geodetic DATE 2013.07.24 - 2013.07.24 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)									
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE					W <sub>P</sub> W      W <sub>L</sub>									
314.5	GROUND SURFACE							20	40	60	80	100		20	40	60						
0.0	ASPHALT: (90mm)  SAND and GRAVEL, trace silt, occasional cobbles Very Dense to Compact Brown Moist (FILL)  Cobbles (150mm)						314															
0.1			1	SS	98/ 0.225		313															
			2	SS	26		312															
			3	SS	13		311															
			4	SS	10		310															
309.9	Sandy SILT, trace clay Loose to Compact Grey Wet						309															
4.6			5	SS	4		308															
			6	SS	6		307															
			7	SS	16		306															
			8	SS	16		305															
304.7																						
9.8	END OF BOREHOLE AT 9.8m.																					

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No SBC3-01

2 OF 2

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 229.1 E 335 773.3 ORIGINATED BY ES  
 HWY 102 BOREHOLE TYPE NW Casing COMPILED BY AN  
 DATUM Geodetic DATE 2013.07.24 - 2013.07.24 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page													
	BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.15m, THEN ASPHALT TO SURFACE.													



# RECORD OF BOREHOLE No SBC3-02

1 OF 4

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 239.0 E 335 782.8 ORIGINATED BY ES  
 HWY 102 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2013.07.24 - 2013.07.25 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
314.5	GROUND SURFACE							20 40 60 80 100		20 40 60				
0.0	ASPHALT: (125mm)							20 40 60 80 100						
314.2	CONCRETE: (125mm)							20 40 60 80 100						
0.3	SAND and GRAVEL, trace silt, occasional cobbles Very Dense to Compact Brown (FILL)		1	SS	56		314							35 58 7 (SI+CL)
			2	SS	21		313							61 35 4 (SI+CL)
			3	SS	21		312							
311.3	Silty CLAY, sandy, trace gravel Firm Brown (FILL)		4	SS	5		311							7 29 29 35
309.9	Sandy GRAVEL, trace silt Compact Brown		5	SS	17		310							
308.4	Sandy SILT, trace gravel and clay Loose to Compact Grey Moist		6	SS	4		308							4 29 63 4
			7	SS	4		307							
			8	SS	6		306							

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



## METRIC

SOIL PROFILE			SAMPLES		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
<div>Continued From Previous Page</div> <div>Sandy <b>SILT</b>, trace gravel and clay Loose to Compact Grey Moist</div> <div>Silt layer</div>					
295.6			9	SS	4
18.9	<b>SAND</b> and <b>SILT</b> , trace gravel and clay Compact Grey Moist				

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

ONTMT4S 1197.GPJ 2012TEMPLATE(MTO).GDT 10/10/14



## METRIC

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity



# RECORD OF BOREHOLE No SBC3-02

4 OF 4

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 239.0 E 335 782.8 ORIGINATED BY ES  
HWY 102 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
DATUM Geodetic DATE 2013.07.24 - 2013.07.25 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page													
	SAND and SILT, trace clay Dense to Very Dense Grey Moist Occasional cobbles		18	SS	59		284							
							283							
							282							
							281							
280.4														
34.1	END OF BOREHOLE AT 34.1m UPON DCPT REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Aug. 01/13 3.8 310.7 May 02/14 3.4 311.1													



# RECORD OF BOREHOLE No SBC3-03

1 OF 4

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 239.6 E 335 808.1 ORIGINATED BY ES  
HWY 102 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
DATUM Geodetic DATE 2013.07.23 - 2013.07.26 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
314.5	GROUND SURFACE							20 40 60 80 100	PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>		
0.0	ASPHALT: (125mm)							20 40 60 80 100	WATER CONTENT (%)				
310.2	CONCRETE: (150mm)							20 40 60 80 100					
0.3	SAND and GRAVEL, trace silt Very Dense Brown Moist (FILL)		1	SS	58		314						
	Occasional cobbles		2	SS	52		313						
			3	SS	50/ 0.125		312						
	Loose		4	SS	5		311						
309.9							310						
4.6	Sandy GRAVEL, trace silt, occasional cobbles Compact Brown Wet		5	SS	25		309						
			6	SS	26		308						72 27 1 (SI+CL)
306.7							307						
7.8	SILT, some sand, trace clay Loose Grey Wet		7	SS	4		306						0 12 84 4
			8	SS	5		305						
304.7													
9.8	Sandy SILT												

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity 20  
15 10  
(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No SBC3-03

2 OF 4

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 239.6 E 335 808.1 ORIGINATED BY ES  
HWY 102 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
DATUM Geodetic DATE 2013.07.23 - 2013.07.26 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				w <sub>p</sub> w      w <sub>L</sub>				GR	SA	SI	CL		
								20   40   60   80   100	○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE				WATER CONTENT (%)								
	Continued From Previous Page																				
299.3	Sandy <b>SILT</b> Loose to Compact Grey Moist						304														
			9	SS	8																
			10	SS	13																
			11	SS	9																
15.2	<b>SAND</b> , trace silt Compact Grey moist		12	SS	26		299														
			13	SS	25																
18.3	<b>SAND</b> and <b>SILT</b> , trace clay Compact Grey Moist		14	SS	20		296										0	55	43	2	
							295														

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity 20  
15 10 5 10 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No SBC3-03

3 OF 4

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 239.6 E 335 808.1 ORIGINATED BY ES  
HWY 102 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
DATUM Geodetic DATE 2013.07.23 - 2013.07.26 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
								20 40 60 80 100						
Continued From Previous Page							20 40 60 80 100				20 40 60			
	<b>SAND</b> and <b>SILT</b> , trace clay Compact Grey Moist  <													

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No SBC3-03

4 OF 4

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 239.6 E 335 808.1 ORIGINATED BY ES  
 HWY 102 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2013.07.23 - 2013.07.26 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	W P	W	W L			
	Continued From Previous Page													
	Silty <b>SAND</b> , trace clay, trace gravel Dense to Very Dense Brown Moist		18	SS	64		284							3 65 27 5
							283							
							282							
281.4														
33.1	END OF BOREHOLE AT 33.1m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen.  WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Aug. 01/13 3.9 310.6 May 02/14 3.1 311.4													



# RECORD OF BOREHOLE No SBC3-04

1 OF 2

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 249.5 E 335 817.6 ORIGINATED BY ES  
 HWY 102 BOREHOLE TYPE NW Casing COMPILED BY AN  
 DATUM Geodetic DATE 2013.07.25 - 2013.07.25 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				GR	SA	SI	CL	
								20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>						
314.6	GROUND SURFACE																				
0.0	ASPHALT: (100mm)																				
0.1	SAND and GRAVEL, trace to some silt, occasional cobbles Dense to Compact Brown (FILL)		1	SS	42							○									
			2	SS	35							○						35	50	15 (SI+CL)	
			3	SS	13																
			4	SS	11																
310.0																					
4.6	SAND and GRAVEL, trace silt, occasional cobbles Compact to Very Dense Brown Wet		5	SS	27							○									
	Boulder (200mm) from 5.6m to 5.9m																				
			6	SS	55							○									
	Cobbles and boulders																				
	becoming Grey		7	SS	47							○						39	53	8 (SI+CL)	
			8	SS	53							○									
304.8																					
9.8	END OF BOREHOLE AT 9.8m.																				

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE



RECORD OF BOREHOLE No SBC3-04

2 OF 2

METRIC

WP# 6073-09-00 LOCATION Strawberry Creek Bridge 3 N 5 377 249.5 E 335 817.6 ORIGINATED BY ES  
 HWY 102 BOREHOLE TYPE NW Casing COMPILED BY AN  
 DATUM Geodetic DATE 2013.07.25 - 2013.07.25 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.15m, THEN ASPHALT TO SURFACE.							20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60 WATER CONTENT (%)					



**Appendix B**  
**Laboratory Test Results**

**DRAFT**

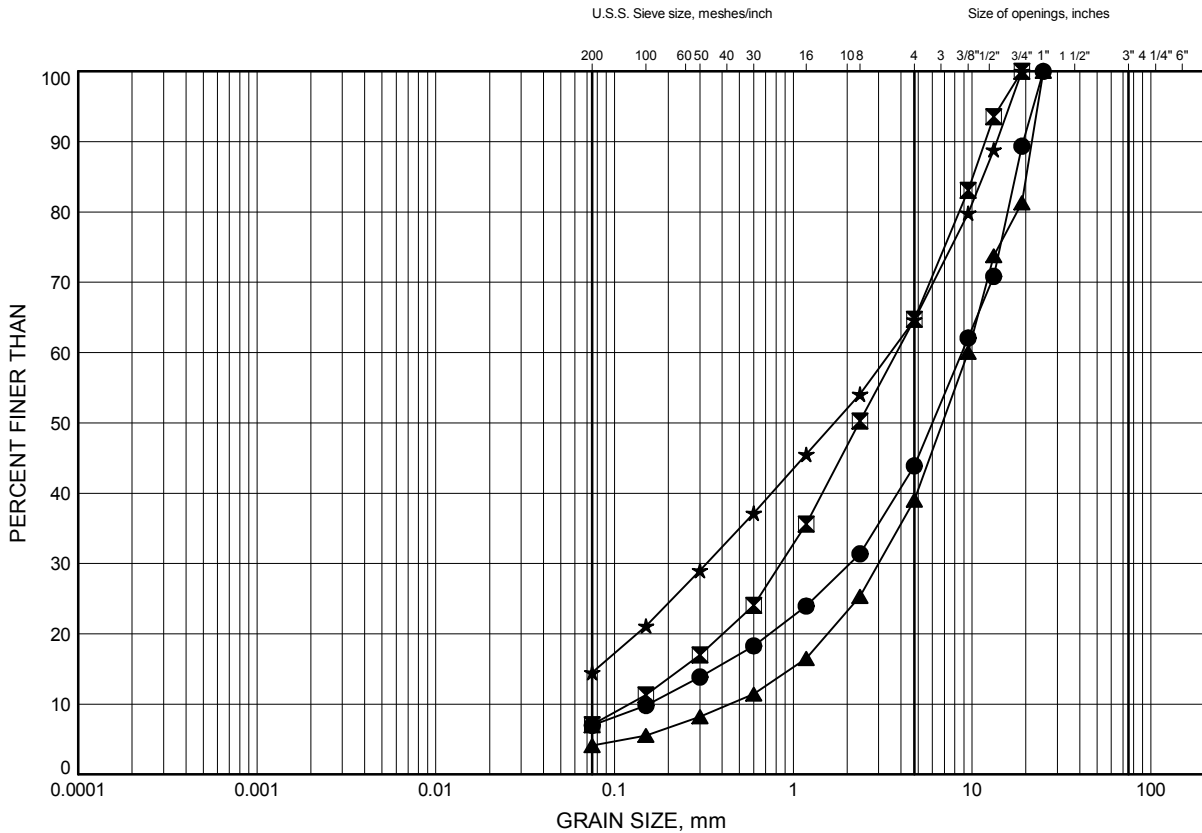




# Strawberry Creek Bridge 3 GRAIN SIZE DISTRIBUTION

FIGURE B1

## SAND & GRAVEL FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	SBC3-01	1.83	312.67
⊠	SBC3-02	1.07	313.43
▲	SBC3-02	1.83	312.67
★	SBC3-04	1.83	312.77

Date October 2014  
WP# 6073-09-00



Prep'd AN  
Chkd. MFA

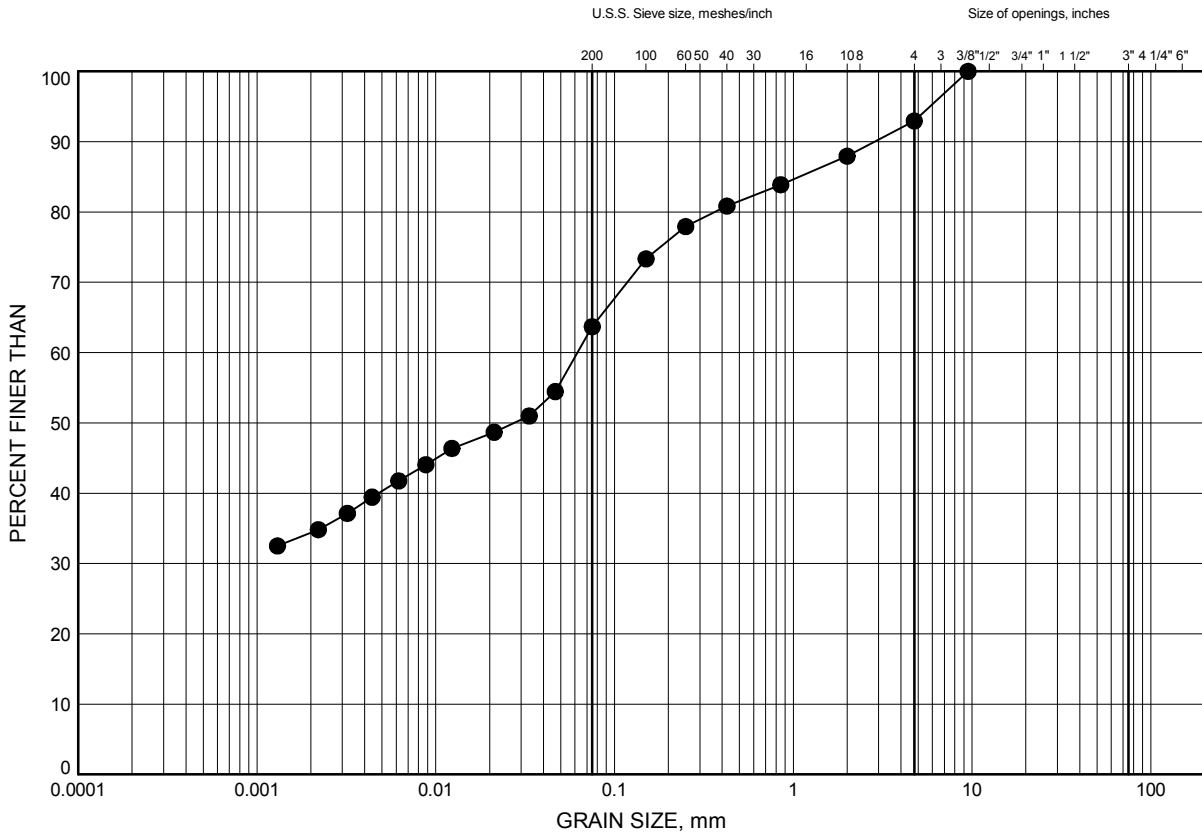


# Strawberry Creek Bridge 3

## GRAIN SIZE DISTRIBUTION

FIGURE B2

### SILTY, SANDY CLAY FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	SBC3-02	3.35	311.15

Date ..October 2014.....  
 WP# ..6073-09-00.....



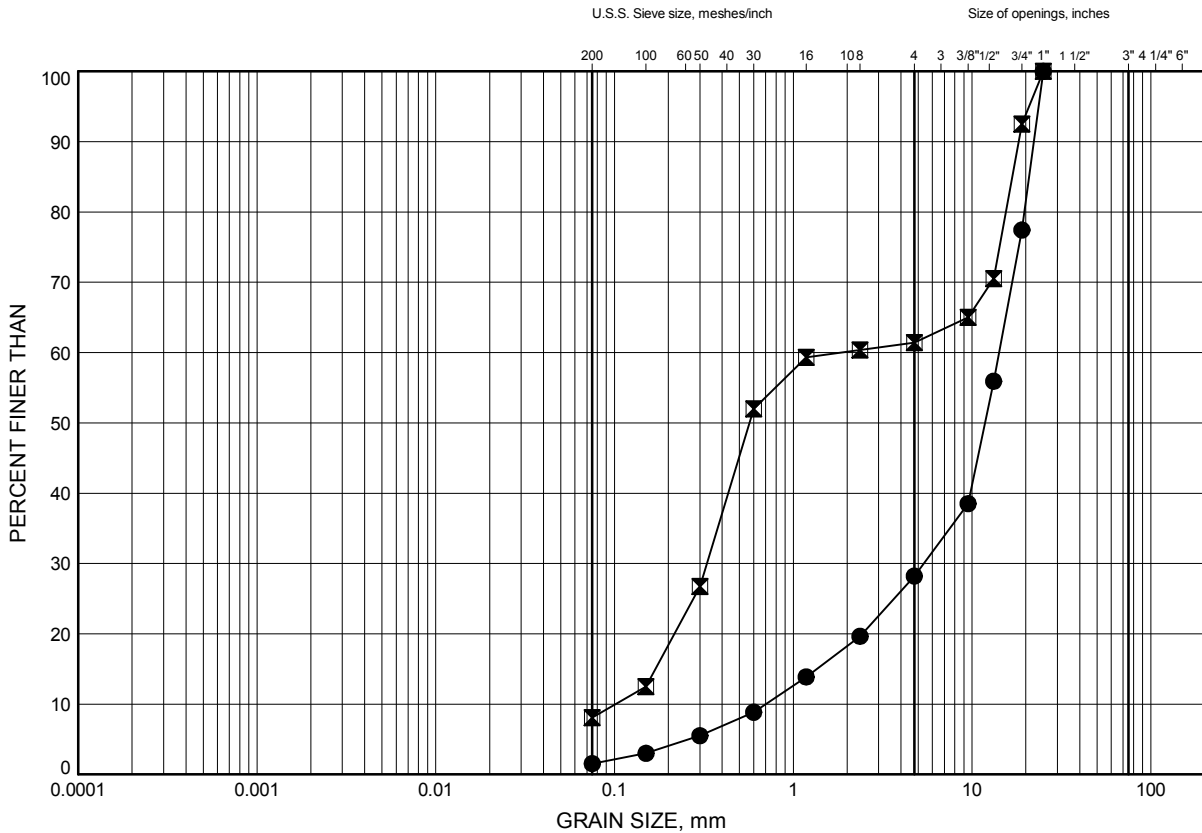
Prep'd .....AN.....  
 Chkd. ....MFA.....



# Strawberry Creek Bridge 3 GRAIN SIZE DISTRIBUTION

FIGURE B3

## SANDY GRAVEL to SAND & GRAVEL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	SBC3-03	6.40	308.10
⊠	SBC3-04	7.92	306.68

Date October 2014  
WP# 6073-09-00



Prep'd AN  
Chkd. MFA

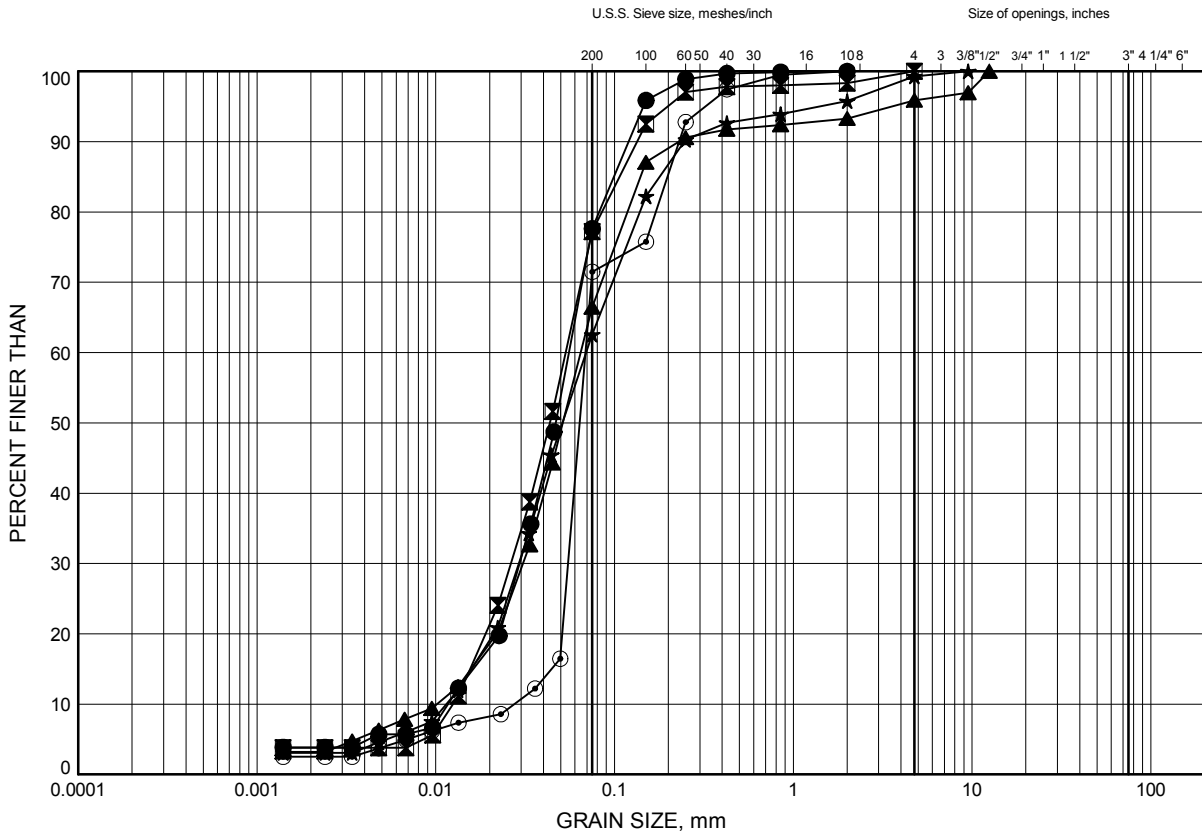


# Strawberry Creek Bridge 3

## GRAIN SIZE DISTRIBUTION

FIGURE B4

### SANDY SILT



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	SBC3-01	4.88	309.62
⊠	SBC3-01	7.92	306.58
▲	SBC3-02	6.40	308.10
★	SBC3-02	10.97	303.53
⊙	SBC3-02	12.50	302.00

Date ..October 2014.....  
 WP# ..6073-09-00.....



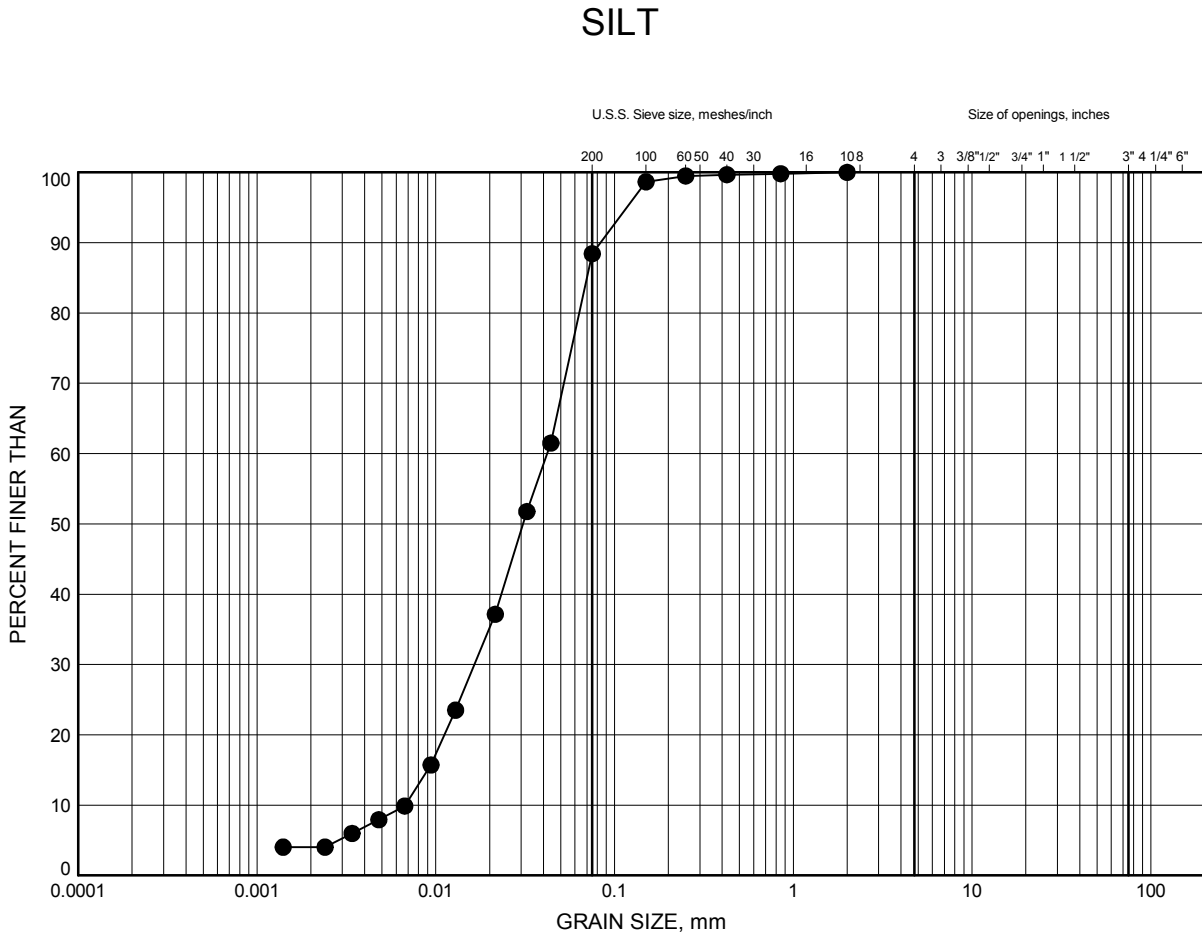
Prep'd .....AN.....  
 Chkd. ....MFA.....



# Strawberry Creek Bridge 3

## GRAIN SIZE DISTRIBUTION

FIGURE B5



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	SBC3-03	7.92	306.58

Date October 2014  
 WP# 6073-09-00



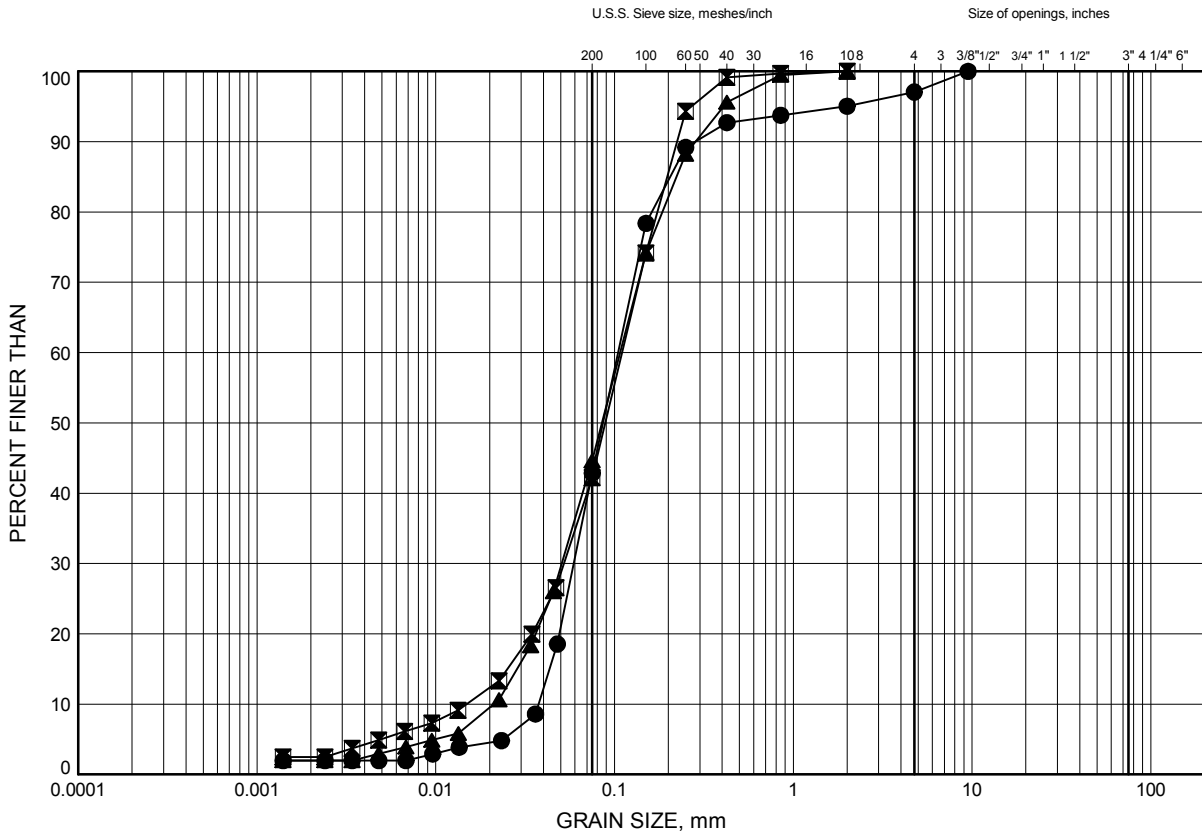
Prep'd AN  
 Chkd. MFA



# Strawberry Creek Bridge 3 GRAIN SIZE DISTRIBUTION

FIGURE B6

## SAND & SILT



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

## LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	SBC3-02	21.64	292.86
⊠	SBC3-02	27.74	286.76
▲	SBC3-03	18.59	295.91

Date ..October 2014.....  
WP# ..6073-09-00.....



Prep'd .....AN.....  
Chkd. ....MFA.....

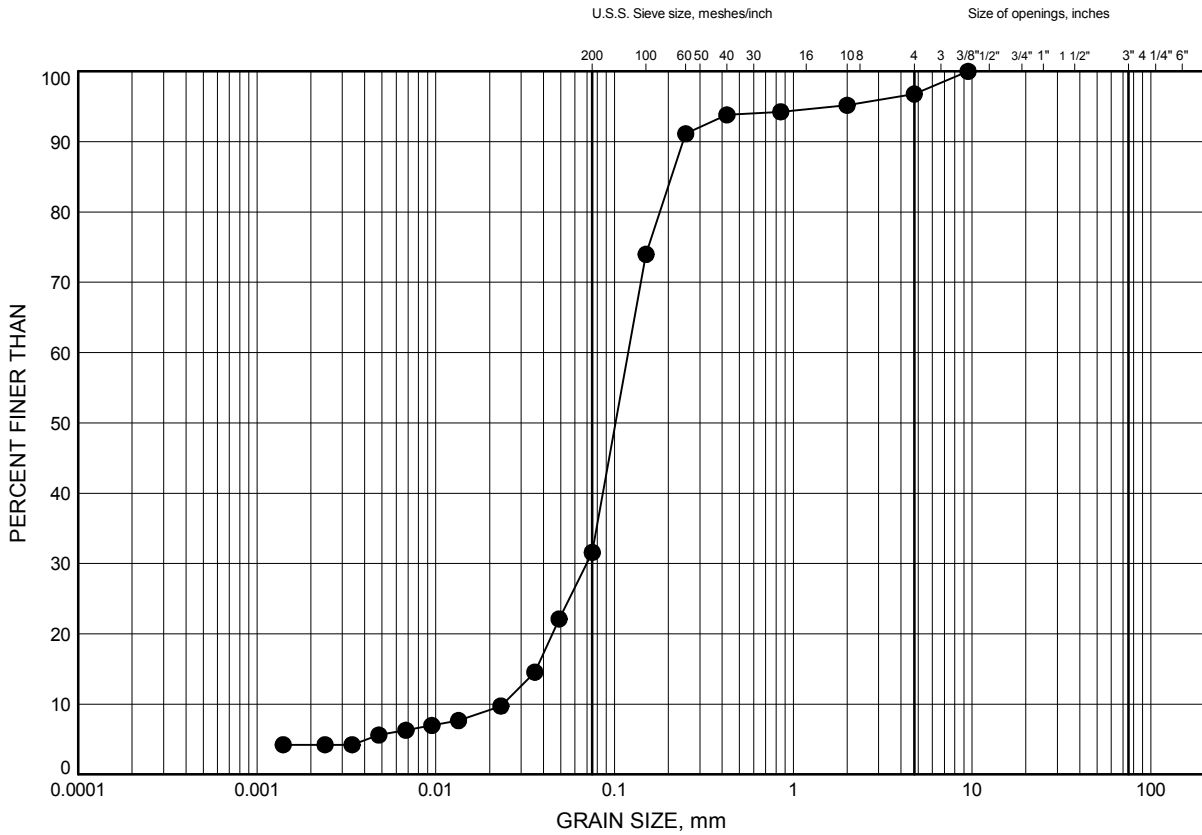


# Strawberry Creek Bridge 3

## GRAIN SIZE DISTRIBUTION

FIGURE B7

### SILTY SAND



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

### LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	SBC3-03	30.78	283.72

Date October 2014  
 WP# 6073-09-00



Prep'd AN  
 Chkd. MFA



**Appendix C**  
**Site Photographs**

**DRAFT**







**Photograph 1 – East approach, looking west**



**Photograph 2 – West approach, looking east**





**Photograph 3 – West Abutment**



**Photograph 4 – North Elevation, looking east**



## **Appendix D**

### **List of SPs and OPSS, and Suggested Text for Selected NSSP**

**DRAFT**





**1. List of Special Provisions and OPSS Documents Referenced in this Report**

- OPSS 501
- OPSS 539
- OPSS 804
- OPSS 902
- OPSS.PROV 1010

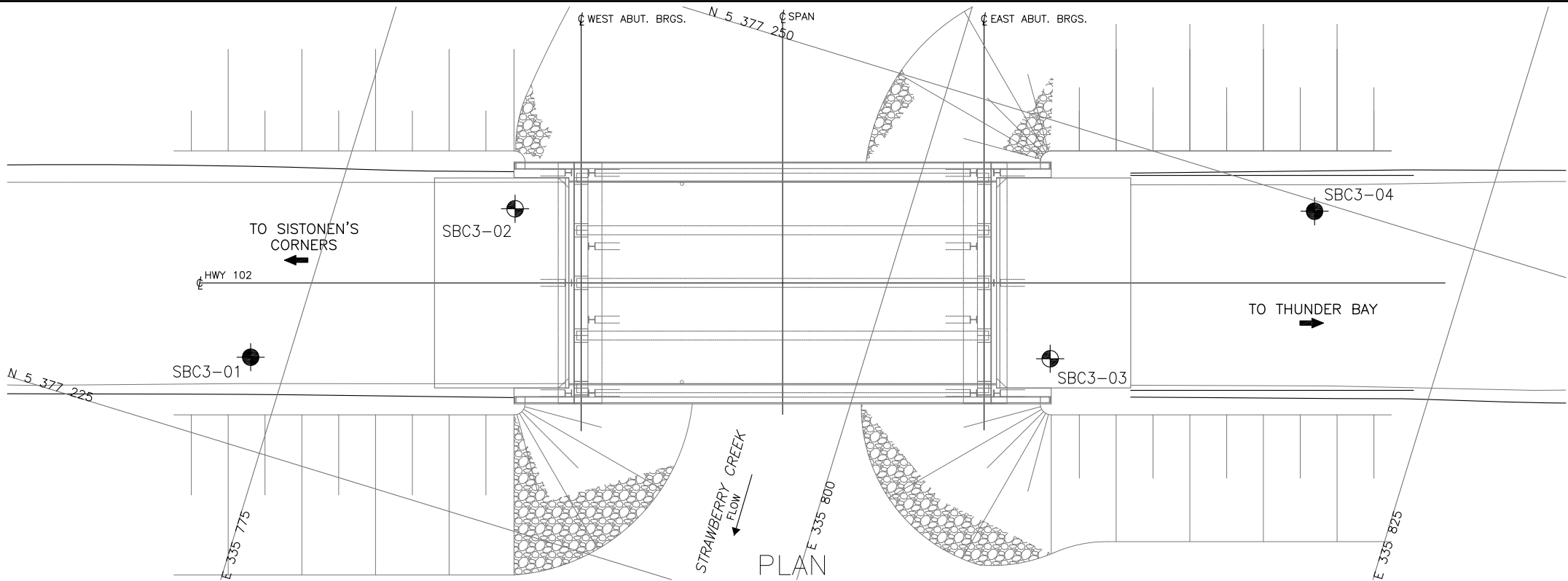


**Appendix E**  
**Borehole Locations and Soil Strata Drawing**

**DRAFT**







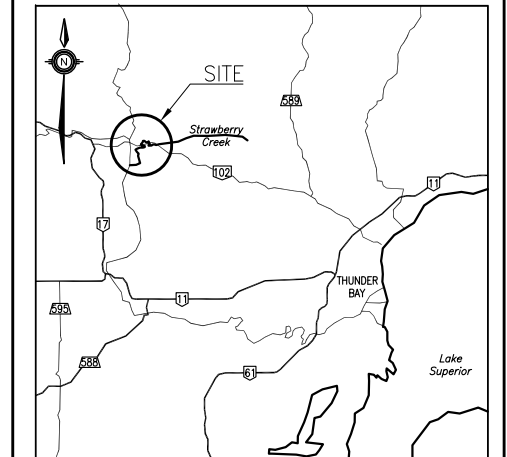
METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

CONT No  
WP No 6073-09-00

HIGHWAY 102  
STRAWBERRY CREEK BRIDGE 3  
REHABILITATION  
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET  
S02



KEYPLAN

LEGEND

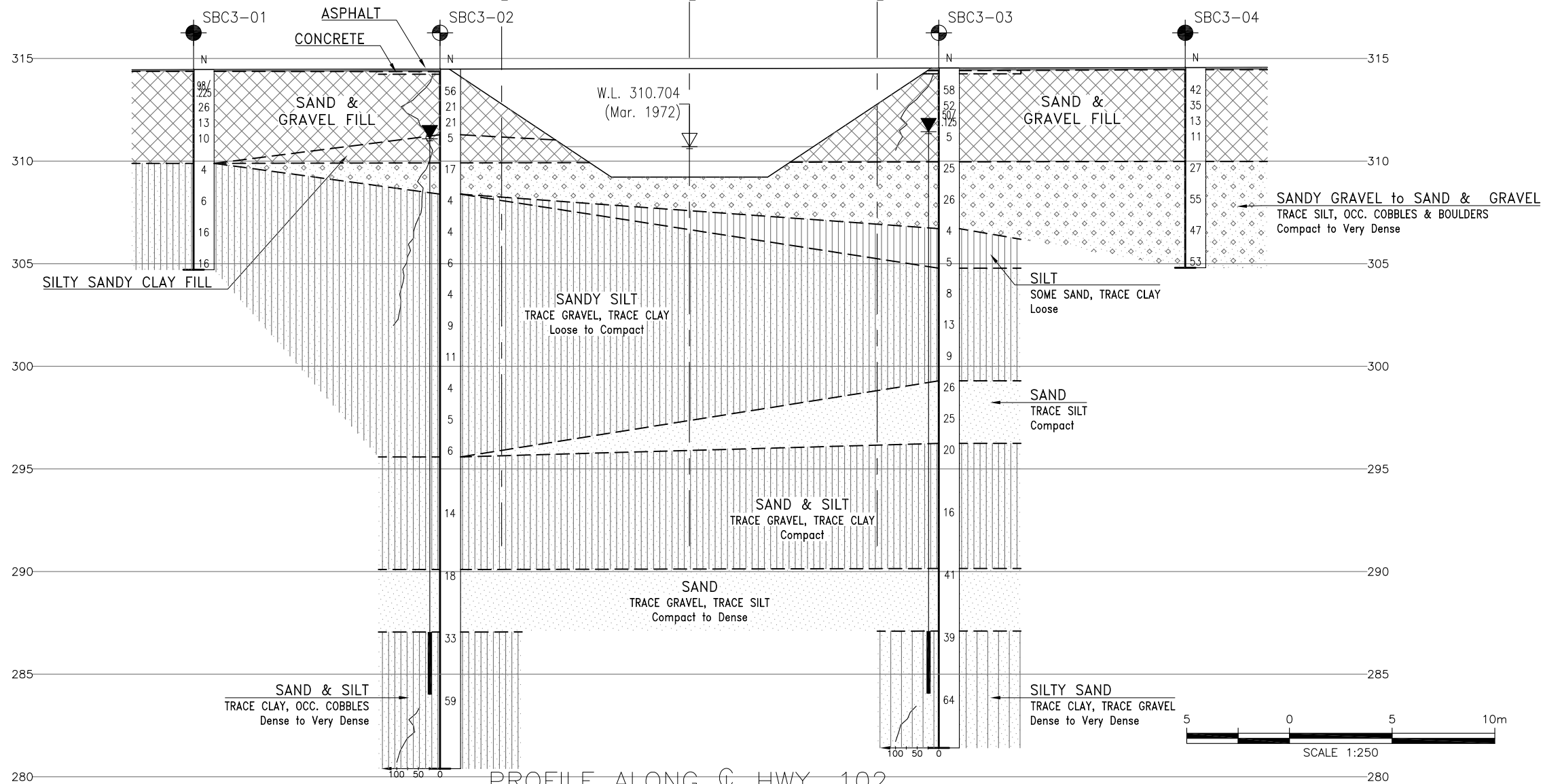
	Borehole
	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60" Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level In Open Borehole
	Water Level In Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
SBC3-01	314.5	5 377 229.1	335 773.3
SBC3-02	314.5	5 377 239.0	335 782.8
SBC3-03	314.5	5 377 239.6	335 808.1
SBC3-04	314.6	5 377 249.5	335 817.6

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No.



PROFILE ALONG C HWY. 102

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MEF	CHK PKC	CODE
DRAWN	MFA	CHK MEF	SITE 48W-3
LOAD		STRUCT	DWG 1
DATE	OCT 2014		