Memo

Date: August 11, 2010

To: City Manager

From: Community Sustainability Division

APPLICATION NO. DVP07-0100 **OWNER:** Anthony Otto

AT: 1415-1417 Edgewood Dr **APPLICANT:** Anthony Otto

PURPOSE: Supplemental Report to vary the height of a retaining wall from 1.2 m required to 5 m proposed and to vary the combined height of a retaining wall and fence from 2.0 m to 5.2 m.

EXISTING ZONE: RU6 - Two Dwelling Housing

SUPPLEMENTAL REPORT PREPARED BY: Birte Decloux

1.0 RECOMMENDATION

THAT Council receives for information the Supplemental Report of the Community Sustainability Division dated August 11, 2010 with respect to the information requested from Staff for DVP07-0100;

AND THAT Council authorize the issuance of Development Variance Permit No. DVP07-0100 for Lot 1, District Lot 137, Osoyoos Division Yale District, Plan KAP81211 located at 1415-1417 Edgewood Dr, Kelowna, B.C.;

AND THAT variances to the following sections of Zoning Bylaw No. 8000 be granted:

Section 7.5.9 Fencing and Retaining Walls - Retaining Wall Height
Vary the retaining wall height from 1.2 m required to 5 m proposed

Section 7.5.11 Fencing and Retaining Walls - Retaining Wall Height
Vary the combined retaining wall and fence height from 2.0 m required to 5.2 m proposed;

AND THAT a building permit be applied for the retaining walls prior to issuance of the Development Variance Permit.

2.0 COUNCIL DIRECTION

At the January 13th, 2009 regular meeting of Council, the following resolution was adopted:

R047/09/01/13 THAT Council defer consideration of Development Variance Permit No. DVP07-0100;

AND THAT should the Applicant wish to proceed with the requested variances, Council direct staff to conduct a further technical and legal review with respect to the geotechnical concerns in the area;

AND THAT a copy of the Applicant's geotechnical report be circulated to Council;

AND THAT FURTHER Council directs staff to re-notify, or otherwise deliver notice, of the proposed Council consideration of the Development Variance Permit to the owners and occupiers located within 30m of the subject property.

3.0 LAND USE MANAGEMENT DEPARTMENT COMMENTS

A geotechnical report (dated August 18, 2006) by EBA Engineering Consultants Ltd was reviewed by City Staff to determine what additional information would be required. A list of concerns from the Development Engineering Branch and the Building and Permitting Branch was forwarded to the applicant. Bjarne Carlsen of Geotecknik provided the requested geotechnical reports on behalf of the applicant, dated July 13, 2009, March 25, 2010 and April 21, 2010. These reports were circulated to various City departments and the following technical comments were received:

3.1 Building and Permitting Branch

No comment

3.2 Risk Management Branch

No comment

3.3 Development Engineering Branch

Development Engineering Services have the following comments with regard to the Geotechnical Investigation Report provided by Geoteknik Consultants Ltd., Ref .: 209-223. Mr. Bjarne Carlsen, M. Asc., P.Eng. has addressed the concerns raised by Development Engineering. The engineer has also completed and sealed the APEGBC appendix-D schedule (Landslide Assessment Assurance Statement)
Development Engineering has no further comments regarding this application

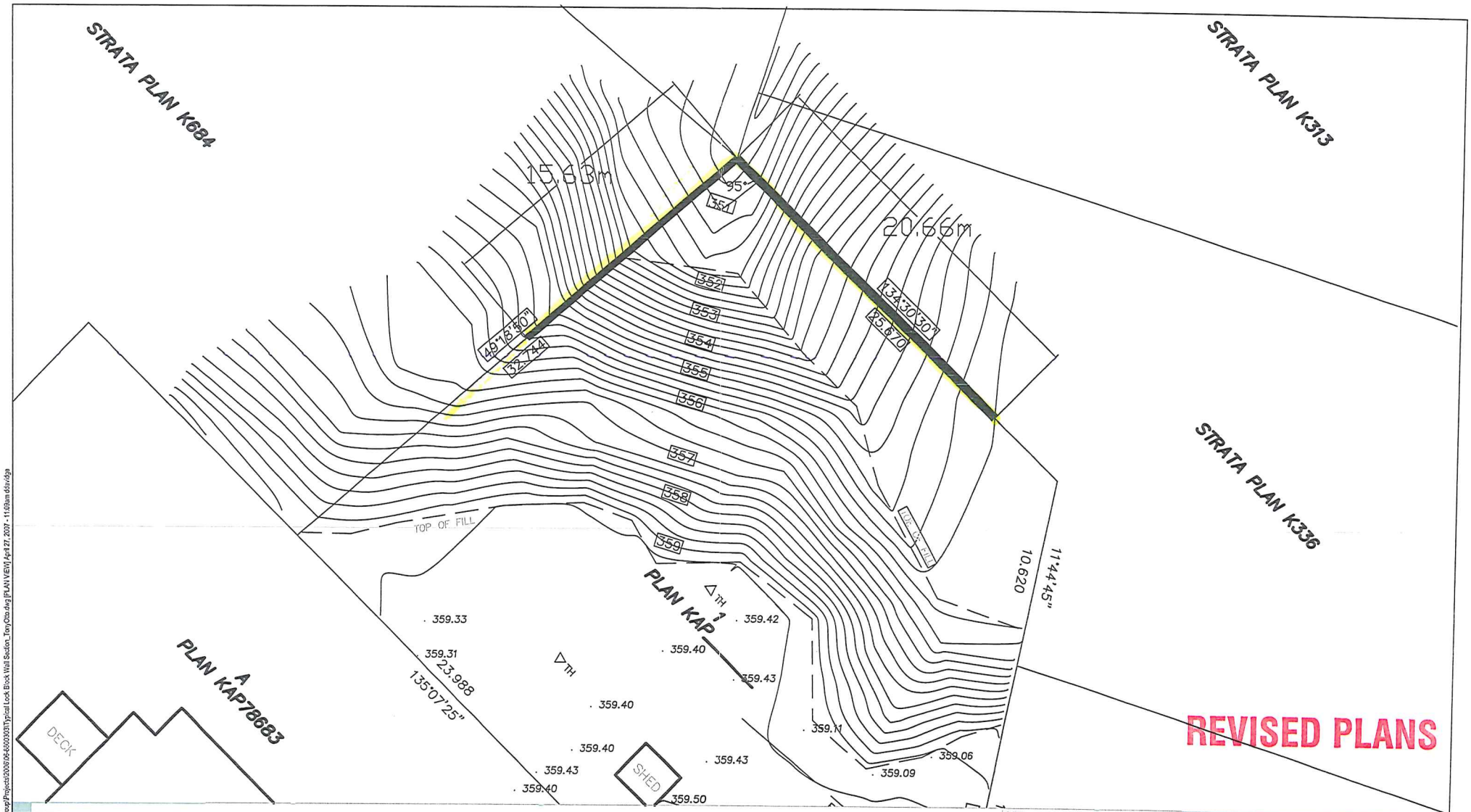
The applicant was able to satisfy City Staff's concerns regarding the safety and stability of the proposed retaining wall. Through the Building Permit process all walls that exceed the height permitted by the zoning bylaw are required to be engineered, ensuring the structural integrity of the wall. Given these assurances the Land Use Management department recommends support for this variance application.

Should Council approve this variance, a Development Permit for the form and character will be reviewed at a staff level for the proposed dwellings.

Danielle Noble
Manager, Urban Land Use

Approved for inclusion:
Shelley Gambacort
Director, Land Use Management

Attachments:
Subject Property Map
Site plan - location of retaining walls
Cross section of proposed wall
Geotechnical report by Geo teknik Consulting ltd. dated October 28, 2004
Geotechnical report by EBA Engineering Consultants Ltd. dated August 18, 2006
Geotechnical Investigation by Geo teknik Consulting ltd. dated March 25, 2010
Geotechnical review by Geo teknik Consulting ltd. dated April 21, 2010
Appendix D: Landslide Assessment Assurance Statement dated May 10, 2010



Design parameters

-Design of the reinforced soil structure is based on the following geotechnical parameters.

-The design is based on 10 kPa dead load surcharge.

	Effective Friction Angle	Effective Cohesion	Moist Unit Weight
Reinforced Backfill	36.0 degrees	0 kPa	20.6 kN/m^3
Retained Soil	32.0 degrees	0 kPa	20 kN/m^3
Foundation Soil	32.0 degrees	0 kPa	20 kN/m^3

SCALE 1:200

2 0 2 4 8m

CLIENT

Tony Otto

Tony Otto Subdivision

PLAN VIEW

EBA Engineering Consultants Ltd.

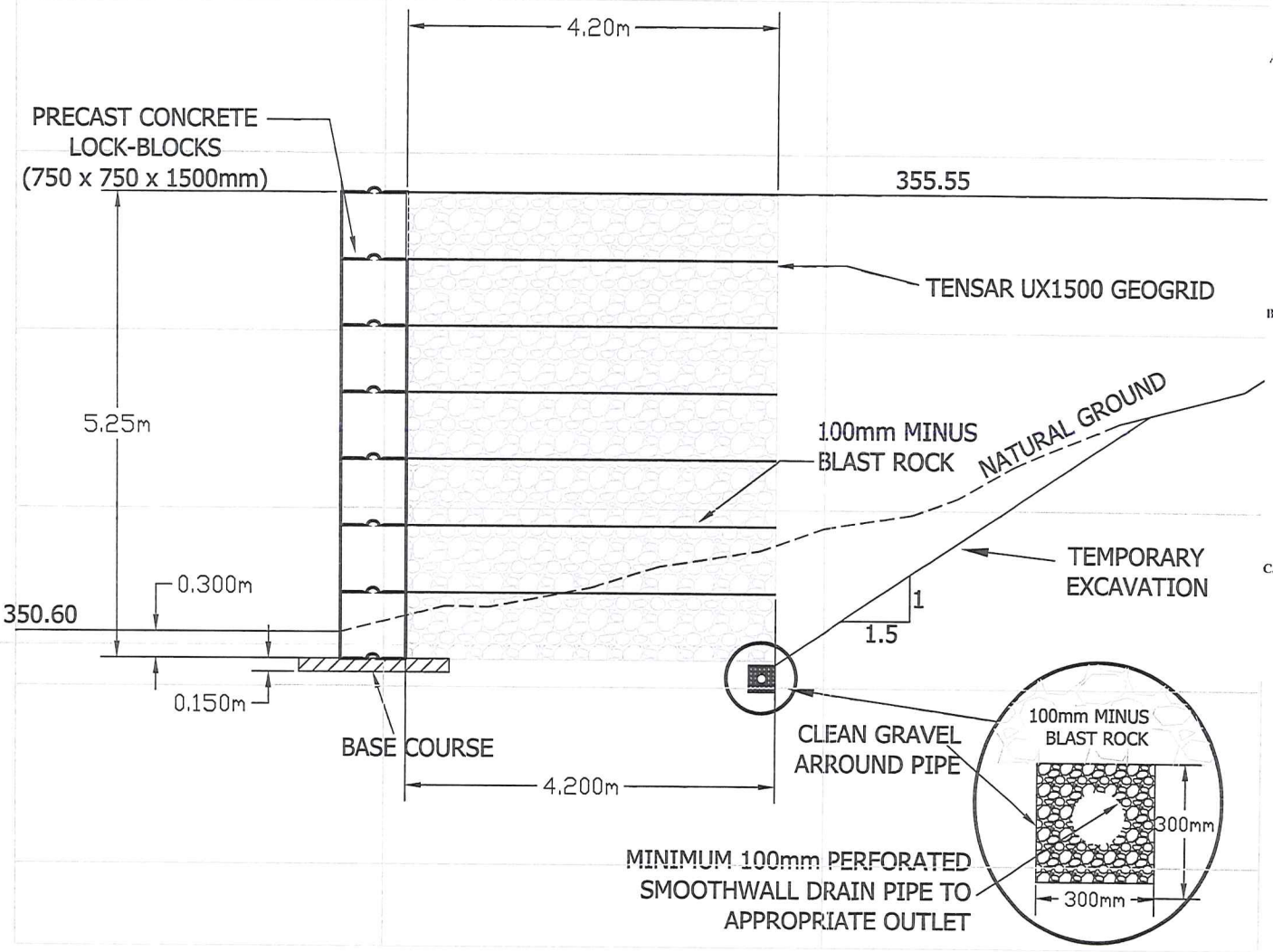
PROJECT NO.	DWN	CKD	REV
8800303	CC	GM	2

OFFICE: KELOWNA

DATE: April 27, 2007

Figure 1

Q:\Kelowna\Data\0303-Kelowna\Geotechnical Group\Projects\2006\06-8800303\Typical Lock Block Wall Section_TonyOtto.dwg [PLAN VIEW] April 27, 2007 - 11:59am ddsavdga



CONSTRUCTION NOTES FOR LOCK BLOCK WALLS

A. Ground Preparation and Backfill Materials

A1. The base of the excavation shall be cleaned of all loose material. The base should consist of compacted granular material or prepared as directed by the geotechnical engineer representing the owner.

A2. Backfill material placed in the reinforced zone, shall consist of site soils having at least the friction angle specified in Table 1.

A3. Backfill material must be placed and compacted in lifts not exceeding 250 *mm*.

A4. Backfill material placed in the reinforced zone shall be compacted to minimum of 98% of Standard Proctor Density (ASTM D698), and 95% Standard Proctor Density (ASTM D698) within 1.0 *m* of wall face.

B. Placement of Tensar Geogrids

B1. Geogrid reinforcement should be Tensar Uniaxial Geogrid manufactured by the Tensar Corporation.

B2. Tensar geogrid lengths specified on the design drawings shall be placed at the locations and elevations shown on the design drawings.

B3. No changes shall be made to the length or type of Tensar geogrids, without the written consent of the design engineer.

B3. The lengths of the geogrids are measured from the front face of the form.

B4. Tensar geogrid reinforcement shall be continuous throughout the embedment lengths, and splicing is not allowed.

C. Drainage

C1. The reinforced soil structure has been designed on the basis that the reinforced backfill material shall be free of ponding water, seepage, and subsurface water. The design, collection and diversion of ponding water, seepage and subsurface water shall be the responsibility of others.

REVISED PLANS

SCALE 1:50

0.5 0 0.5 1 2m

CLIENT: Tony Otto

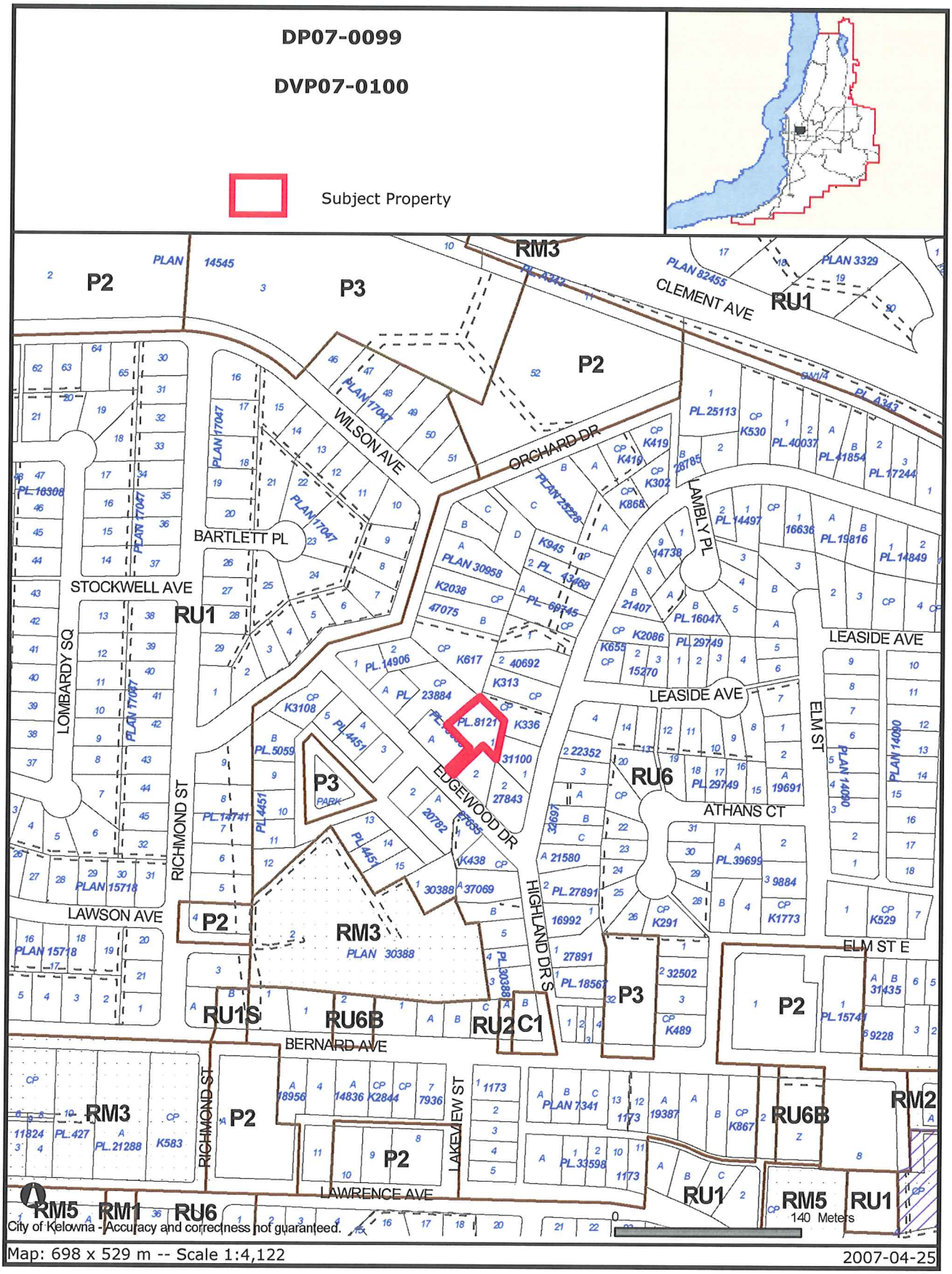
Tony Otto Subdivision

TYPICAL CROSS SECTION-1
LOCK BLOCK WALL

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
8800303	CC	GM	2
OFFICE: KELOWNA	DATE: April 27, 2007		

Figure 2



Certain layers such as lots, zoning and dp areas are updated bi-weekly. This map is for general information only. The City of Kelowna does not guarantee its accuracy. All information should be verified.

geoteknik
consulting•ltd
324 clifton road north
kelowna, b.c.
canada, v1v 1n4
tel: 250.763.1079
fax: 250.763.1079
cell: 250.212.8711
email: geoteknik@telus.net

REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED DUPLEX RESIDENCE
1415-1417 ~~1405~~ EDGEWOOD DRIVE
KELOWNA, BRITISH COLUMBIA

Submitted to:

Mr. T. Otto
#502 – 1586 Abbott Street
Kelowna, BC
V1Y 1A8

DISTRIBUTION:

2 Copies -	Mr. T. Otto Kelowna, British Columbia
1 Copy -	Geoteknik Consulting Ltd. Kelowna, British Columbia

October 28, 2004

204-152

geoteknik
consulting ltd
324 clifton road north
kelowna, b.c.
canada, v1v 1n4
tel: 250.763.1079
fax: 250.763.1079
cell: 250.212.8711
email: geoteknik@telus.net

October 28, 2004

Our Ref.: 204-152

Mr T. Otto
#502 – 1585 Abbott Street
Kelowna, BC
V1Y 1A8

RE: GEOTECHNICAL INVESTIGATION
PROPOSED DUPLEX RESIDENCE
1405 EDGEWOOD DRIVE
KELOWNA, BRITISH COLUMBIA

Dear Sir:

As requested, Geoteknik Consulting Ltd has completed a geotechnical investigation for the above referenced project. It is understood that it is proposed to construct a duplex residence on the property. The purpose of the investigation was to identify the subsurface soil and groundwater conditions and based on our interpretation of this information, to provide comments and recommendations pertaining to the geotechnical aspects of the proposed project.

1.0 SITE INVESTIGATIONS

The geotechnical investigation consisted of a total of five boreholes which were advanced to depths varying between 4.5 m and 10 m on September 18, 2004, using a truck mounted auger drill rig. The locations of the boreholes are shown on Figure 1. The soil and groundwater conditions encountered at each borehole are summarized on the attached Record of Borehole sheets. Penetration tests were extended into the dense sand and gravel deposits, which were encountered in the lower regions of the boreholes. An experienced geotechnical engineer from Geoteknik logged the boreholes in the field. Representative soil samples were collected at regular intervals from the boreholes, and were returned to our laboratory for further detailed examination.

In addition, four test pits were excavated at the approximate locations shown on Figure 1 on September 30, 2004. The test pits were extended to depths between 1.8 m and 4.0 m below the existing ground surface using an extended backhoe. Representative samples of

the various insitu soil deposits were taken and brought back to our laboratory for further examination. Detailed descriptions of the subsurface conditions encountered in the test pits are summarized on the attached Record of Test Pit log sheets.

2.0 SITE CONDITIONS

The proposed duplux residence is located on the north side of Edgewood Drive in Kelowna, British Columbia as shown in detail in Figure 1. The site is located within a sloped area with a maximum height of about 8 m and the fill materials have been placed over the slope some years ago. The site surface is level within the southern portion of the site which measures an average of 12 m in width. The existing slope is an average 6 m high and stands at an average angle of 2 horizontal to 1 vertical.

The results of the Boreholes indicate that the level ground surface is underlain by silty sand and gravel fill materials varying in thickness between 2.3 and 5.3 m. These materials are generally loose to compact and contain some cobbles and boulders. The fill materials are underlain by compact deposits of silty sand with some gravel to a depth of greater than 10 m below the site surface. The results of the penetration tests within the sandy deposits indicate that the penetration resistance increased from an average of 10 blows per 0.3m in the upper portion and an average of 25 blows per 0.3 m in the lower portion of the deposit. This indicates compact and competent deposits exist at depths.

The results of the test pit located in the region of the slope as shown in Figure 1 indicate that the slope surface is underlain by silty sand and gravel materials varying in thickness between 1.5 m and 3.3 m. These materials are generally loose to compact and contain occasional pieces of angular bedrock to 0.9 m in diameter and occasional pieces of asphalt pavement. The test pits were terminated in compact deposits of sand with some gravel at depths varying between 2.1 m and 4.5 m below the ground surface

3.0 DISCUSSION

This section of the report provides engineering information for the geotechnical design aspects of the project based on our interpretation of the test pit information and project requirements. The information in this portion of the report is provided for the guidance of the design engineers. Where comments are made on construction, they are provided only in order to highlight aspects of construction, which could affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

3.1 Site Preparation

All fill, disturbed, or organic soils must be removed down to undisturbed native strata for placement of footings or engineered fills for the proposed building. It is expected that across the majority of the site the excavation depth will vary between 3 m and 5 m. The excavation limits should extend horizontally beyond the perimeter of the proposed buildings, a distance equal to the depth of the compacted granular fill beneath the footings.

Temporary excavation side slopes in the soils observed at the site should be developed at angles no steeper than 1.5 horizontal to 1 vertical for vertical heights no greater than 3.0 m for dry conditions.

Any grade fills used beneath the structures should consist of 75 mm minus pitrun sand and gravel having less than 8 percent passing of a USS 200 sieve. Some of the existing sand and gravel fill materials may be reused if selectively excavated to ensure that all deleterious materials are removed. All grade fill should be placed in 300 mm maximum thick horizontal lifts. The granular fills should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D698). This compaction standard can also be obtained by four passes of a heavy vibratory roller with a drum diameter greater than 1 m, provided the above noted procedures are strictly adhered to during placement.

3.2 Foundation Design

The results of the investigation indicate that the sand deposits will provide a suitable bearing stratum on which to construct conventional spread and/or strip footings. An allowable bearing pressure of 150 kPa may be used in design of the footings. Alternatively, the footings may be constructed on well compacted granular fill placed and compacted as described in Section 3.1 and designed using an allowable bearing pressure of 150 kPa.

It is recommended that all exterior footings or footings in unheated sections of the proposed buildings be provided a minimum of 0.6 m of soil cover for frost protection purposes.

3.3 Seismic Design Consideration

The proposed sites are considered to be located within Seismic Zone 1 of the current B.C. Building Code (1992), one of the lower risk zones. Based on the results of this investigation, it is recommended that the foundations be designed using a foundation factor, F of 1.3.

3.4 Slab on Grade

It is recommended that grade supported floor slabs be founded on an underslab base course consisting of at least 100 mm of 19 mm minus crushed gravel. This material should be compacted to 100 percent of standard Proctor maximum dry density (ASTM D698).

The slabs on grade should be structurally separate from all foundation elements and should include a cross joint system to control post construction cracking.

3.5 Retaining or Basement Walls

For design of walls that are restrained against movement, it is recommended that a coefficient of earth pressure at rest, K_o of 0.45 be used. If the walls are permitted to tilt freely 25 mm or more in 3.0 m of wall height, a coefficient of active pressure K_a of 0.3 may be used in design. A soil unit weight of 2000 kg per cubic meter may be utilized in the design calculations.

A positive drainage system should be provided behind retaining walls to eliminate potential build-up of hydrostatic pressures. It is not required to provide drainage along footings and basement walls within the building area due to the coarse nature of the granular soils.

3.6 Roadways and Parking Areas

The fills within the parking areas/roadways need not be subexcavated. It is recommended, however, that prior to pavement construction, the subgrade soils be proofrolled by at least 4 passes of a heavy vibratory roller. Any soft or loose zones encountered should be subexcavated and replaced with granular fills as discussed in Section 3.1. Upon completion of the above subgrade preparation, the following minimum pavement design for light traffic can be constructed.

Asphalt	50 mm
Crushed Gravel Base Coarse	100 mm
Pit run Subbase	200 mm

The base and subbase material should be compacted to 100 percent of standard Proctor maximum dry density (ASTM D698).

3.7 Inspection and Testing

It is recommended that Geoteknik Consulting review the final design prior to start of construction to confirm that the geotechnical aspects are suitably incorporated. It is also recommended that Geoteknik carry out periodic inspections during site preparation, and placement of granular fills to confirm that actual site and subsurface conditions are as anticipated and our recommendations are adhered to during construction.

We trust the foregoing provides the information you require at this time. Should you have any questions, please do not hesitate to contact the undersigned.

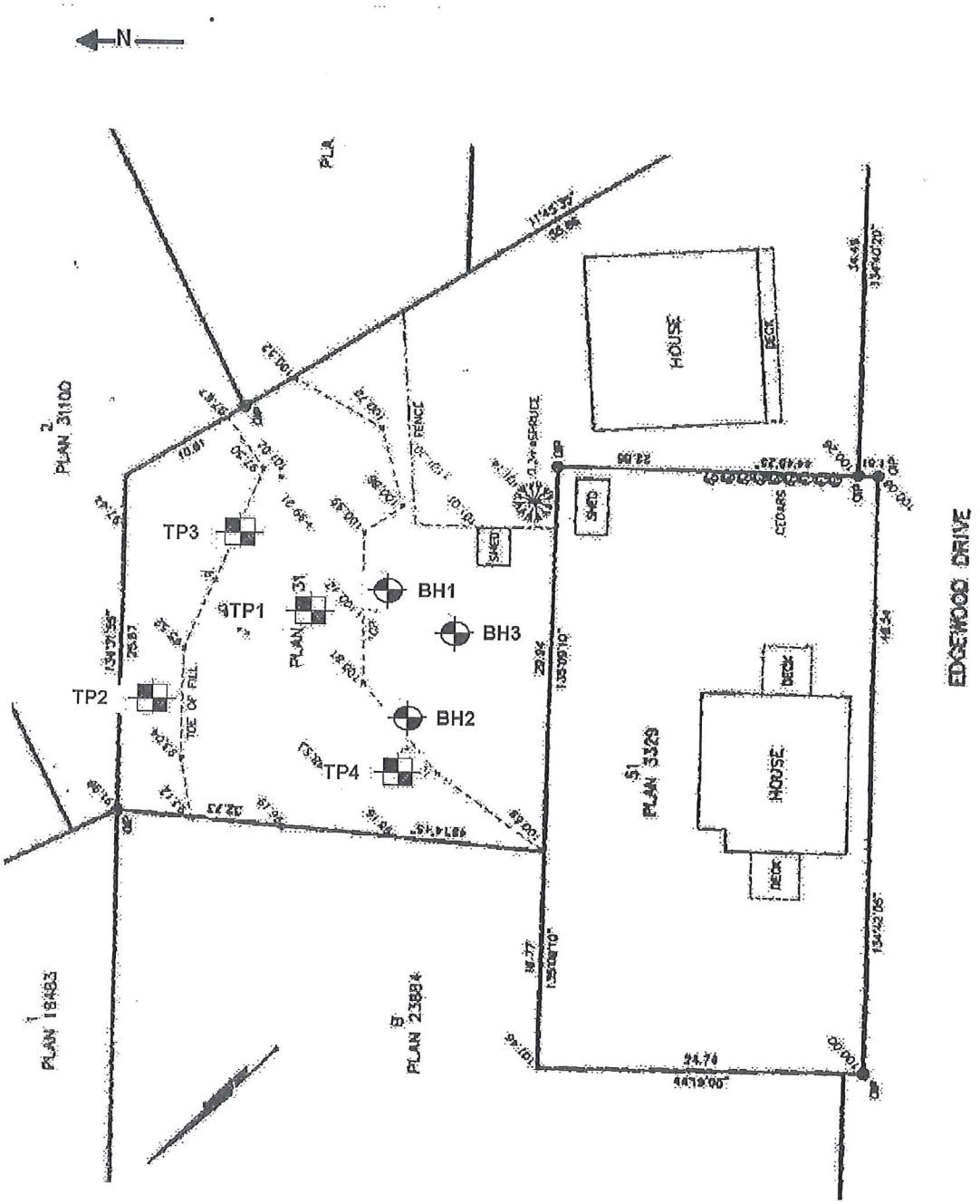
Yours very truly,

GEOTEKNIK CONSULTING LTD.

Bjarne Carlsen, M. Asc., P.Eng.

SITE PLAN

FIGURE 1



LEGEND

TP1 TEST PIT

BH1 BOREHOLE

SCALE 1:500 (Approx.)

PROJECT NO. 204-152 DRAWN mtc REVIEWED BC DATE OCTOBER 14, 2004

geoteknik

RECORD OF TEST PITS

September 30, 2004 204-152

Test Pit No.	Depth (m)	Description	Sample/ Depth
1	0.0 – 3.3	Compact brown silty **SAND AND GRAVEL** with some cobbles and boulders. Occasional pieces of asphalt. (Fill)	
	3.3 – 4.5	Compact brown **SAND** with some gravel.	Sa # 1 3.5-4.0
2	0.0 – 1.5	Loose brown silty **SAND** with pieces of angular bedrock to 3 ft in diameter. (Fill)	
	1.5 – 2.1	Compact brown **SAND** with some gravel.	Sa # 1 1.5-1.8
3	0.0 - 3.3	Compact brown silty **SAND AND GRAVEL** with some cobbles and boulders. Occasional pieces of asphalt. (Fill)	
	3.5 - 4.3	Compact brown **SAND** with some gravel	Sa # 1 3.5- 4.0
4	0.0 – 1.5	Compact brown silty **SAND** with some cobbles and boulders. (Fill)	
	1.5 – 2.4	Compact brown **SAND** with some gravel	Sa # 1 1.5- 1.8

BOREHOLE No 1

Location: see Figure 1
Borehole Type Augerdrill Sandwell
Sampler Hammer Wt 63.5 kg, Drop 0.75 m

Project No. 204-152
Date: September 18, 2003

ELEVATION / DEPTH (m)	DESCRIPTION	SAMPLE NO	SAMPLE TYPE	BLOWS / 0.3M	PENETRATION RESISTANCE BLOWS/0.3m (10 20 30 40)	PIEZO METER
	Ground Surface					
0.0	Compact brown silty **SAND AND GRAVEL** (FILL)	1	AS			
2.4	Loose brown silty **SAND** (FILL)	2	AS			
5.3	Compact grey silty **SAND** with some gravel	3	AS			
		4	AS			
10.0	End of Borehole					

Date 20/10/2004 Reviewed BC 1 of 1

BOREHOLE No 2

Location: see Figure 1
Borehole Type Augerdrill Sandwell
Sampler Hammer Wt 63.5 kg, Drop 0.75 m

Project No. 204-152
Date: September 18, 2003

ELEVATION / DEPTH (m)	DESCRIPTION	SAMPLE NO	SAMPLE TYPE	BLOWS / 0.3M	PENETRATION RESISTANCE BLOWS/0.3 m (10 20 30 40)	PIEZO M ETER
	Ground Surface					
0.0	Compact brown silty **SAND AND GRAVEL** (FILL) Occasional cobbles and boulders	1	AS			
		2	AS			
4.0	Compact grey silty **SAND** with some gravel	3	AS			
		4	AS			
		5	AS			
8.0	End of Borehole					

Date 20/10/2004 Reviewed BC 1 of 1

BOREHOLE No 3

Location: see Figure 1
Borehole Type Augerdrill Sandwell
Sampler Hammer Wt 63.5 kg, Drop 0.75 m

Project No. 204-152
Date: September 18, 2003

ELEVATION DEPTH (m)	DESCRIPTION	SAMPLE NO	SAMPLE TYPE	BLOWS / 0.3M	PENETRATION RESISTANCE BLOWS/0.3 m 10 20 30 40	PIEZO M ETER
	Ground Surface					
0.0	Compact brown silty **SAND** (FILL)	1	AS			
2.3	Compact grey silty **SAND** with some gravel	2	AS			
		3	AS			
4.5	End of Borehole					

Date 20/10/2004 Reviewed BC 1 of 1

GEOTEKNIK

Aug 18, 2006

EBA File: 8800303

Attention: Tony Otto

Dear Mr. Otto:

Subject: Retaining wall design for Proposed subdivision
Kelowna, British Columbia

1.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) has carried out the retaining wall design for Tony Otto's Lot in Kelowna, B.C. This letter summarizes our presents recommendations with respect to the design and construction of the proposed lock block retaining wall.

2.0 RECOMMENDATION

Based on the information provided by British Columbia Land Surveyors and the geotechnical investigation report (Geoteknik Consultants) we have the following recommendations for the lock block retaining walls:

- The site is suitable for the lock-block retaining wall construction.

-The construction guidelines provided in the drawings should be followed.

-The top 2 feet fill material underneath the levelling pad should be replaced with structural fill. The structural fill should be compacted to a minimum of 100% of "Standard Proctor" maximum dry density (SPMDD) in accordance with ASTM D698 and within 2% of optimum moisture content. The on-site material can be re-used as a structural fill.

-The slope stability results are based on the structural drawings provided by Mr. Otto. In case of any change in the structural drawings and the location of building, EBA should be contacted and the analyses should be revised.

3.0 LIMITATIONS

This report has been prepared for the exclusive use of Mr. Tony Otto, or their agents, for specific application to the development described in this report. It has been prepared in accordance with generally accepted foundation engineering practice. No other warranty is made, either expressed or implied.

The conditions indicated in this report are considered to provide a reasonable representation of the site geotechnical characteristics sufficient for design purposes.

EBA Engineering Consultants Ltd.
p. 250.862.4832 • f. 250.862.2941
150, 1715 Dickson Avenue • Kelowna, British Columbia V1Y 9G6 • CANADA

If such variations are encountered, EBA should be notified and given the opportunity to review whether our recommendations are still appropriate.

Recommendations presented herein may not be valid unless an adequate level of inspection is provided during construction and relevant Building Code requirements are met.

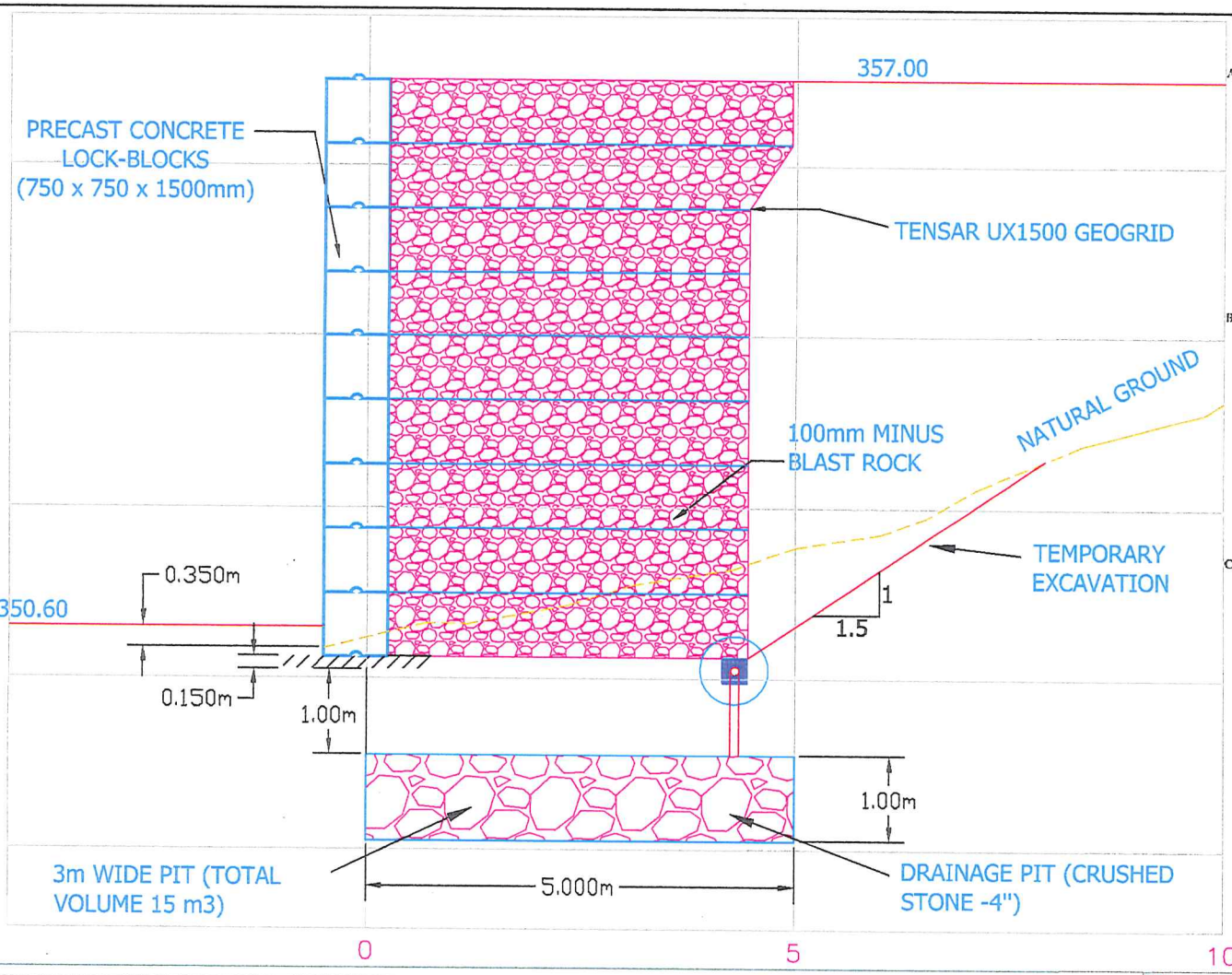
4.0 CLOSURE

We trust this report meets your present requirements. We would be pleased to provide any further information that may be needed during design and to advise on the geotechnical aspects of specifications for inclusion in contract documents. Should you require any additional information or inspection services, please do not hesitate to contact the undersigned at your earliest convenience.

EBA Engineering Consultants Ltd.

M. Cevat Catana, M.Sc.
Geotechnical Engineer
Geotechnical Practice
Direct Line: 250.862.4832 x260
smartin@eba.ca

reviewed by:
German Martinez, P.Eng.
Senior Geotechnical Engineer
Geotechnical Practice
Direct Line: 250.862.4832 x255
gmartinez@eba.ca



CONSTRUCTION NOTES FOR LOCK BLOCK WALLS

A. Ground Preparation and Backfill Materials

A1. The base of the excavation shall be cleared of all loose material. The base should consist of compacted granular material or prepared as directed by the geotechnical engineer representing the owner

A2. Backfill material placed in the reinforced zone, shall consist of site soils having at least the friction angle specified in Table 1.

A3. Backfill material must be placed and compacted in lifts not exceeding 250 *mm*.

A4. Backfill material placed in the reinforced zone shall be compacted to minimum of 98% of Standard Proctor Density (ASTM D698), and 95% Standard Proctor Density (ASTM D698) within 1.0 *m* of wall face.

B. Placement of Tensar Geogrids

B1. Geogrid reinforcement should be Tensar Uniaxial Geogrid manufactured by the Tensar Corporation.

B2. Tensar geogrid lengths specified on the design drawings shall be placed at the locations and elevations shown on the design drawings.

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B3. The lengths of the geogrids are measured from the front face of the form.

B4. Tensar geogrid reinforcement shall be continuous throughout the embedment lengths, and splicing is not allowed.

C. Drainage

C1. The reinforced soil structure has been designed on the basis that the reinforced backfill material shall be free of ponding water, seepage, and subsurface water. The design, collection and diversion of ponding water, seepage and subsurface water shall be the responsibility of others.

Design parameters

-Design of the reinforced soil structure is based on the following geotechnical parameters.

-The drainage pit (infiltration pit) is designed for 5 m^3 storm water. The drain pipes running underneath the reinforced fill should be connected to the drainage pit at the lowest elevation of the lock-block retaining wall.

	Effective Friction Angle	*Effective Cohesion*	*Moist Unit Weight*
Reinforced Backfill	36.0 degrees	0 kPa	20.6 kN/m^3
Retained Soil	32.0 degrees	0 kPa	20 kN/m^3
Foundation Soil	32.0 degrees	0 kPa	20 kN/m^3

SCALE 1:50

0.5 0 0.5 1 2m

CLIENT: Tony Otto

Tony Otto Subdivision

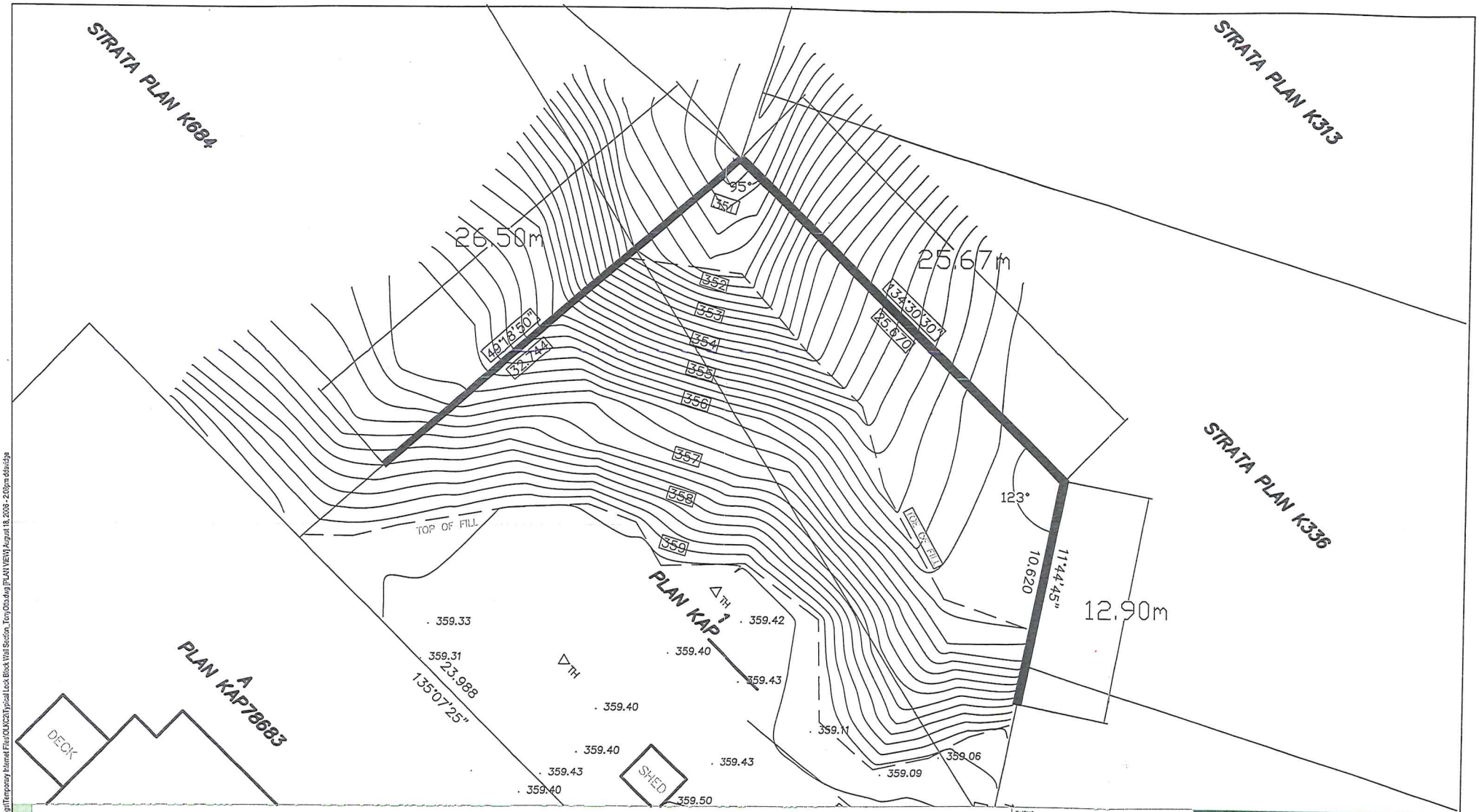
TYPICAL CROSS SECTION-1
LOCK BLOCK WALL

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
8800303	CC	GM	1
OFFICE: KELOWNA	DATE: August 16, 2006		

Figure 1

\\Shaw\corp\Kelowna\Data\8308-Kelowna\Geotechnical Group\Projects\2006\8800303\01\typical Lock Block Wall Section Tony Otto.dwg [Drainage Pit] September 25, 2006 - 9:32am cstone



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SCALE 1:200

2 0 2 4 8m

CLIENT

Tony Otto

Tony Otto Subdivision

PLAN VIEW

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
8800303	CC	GM	1
OFFICE: KELOWNA	DATE: August 16, 2006		

Figure 1

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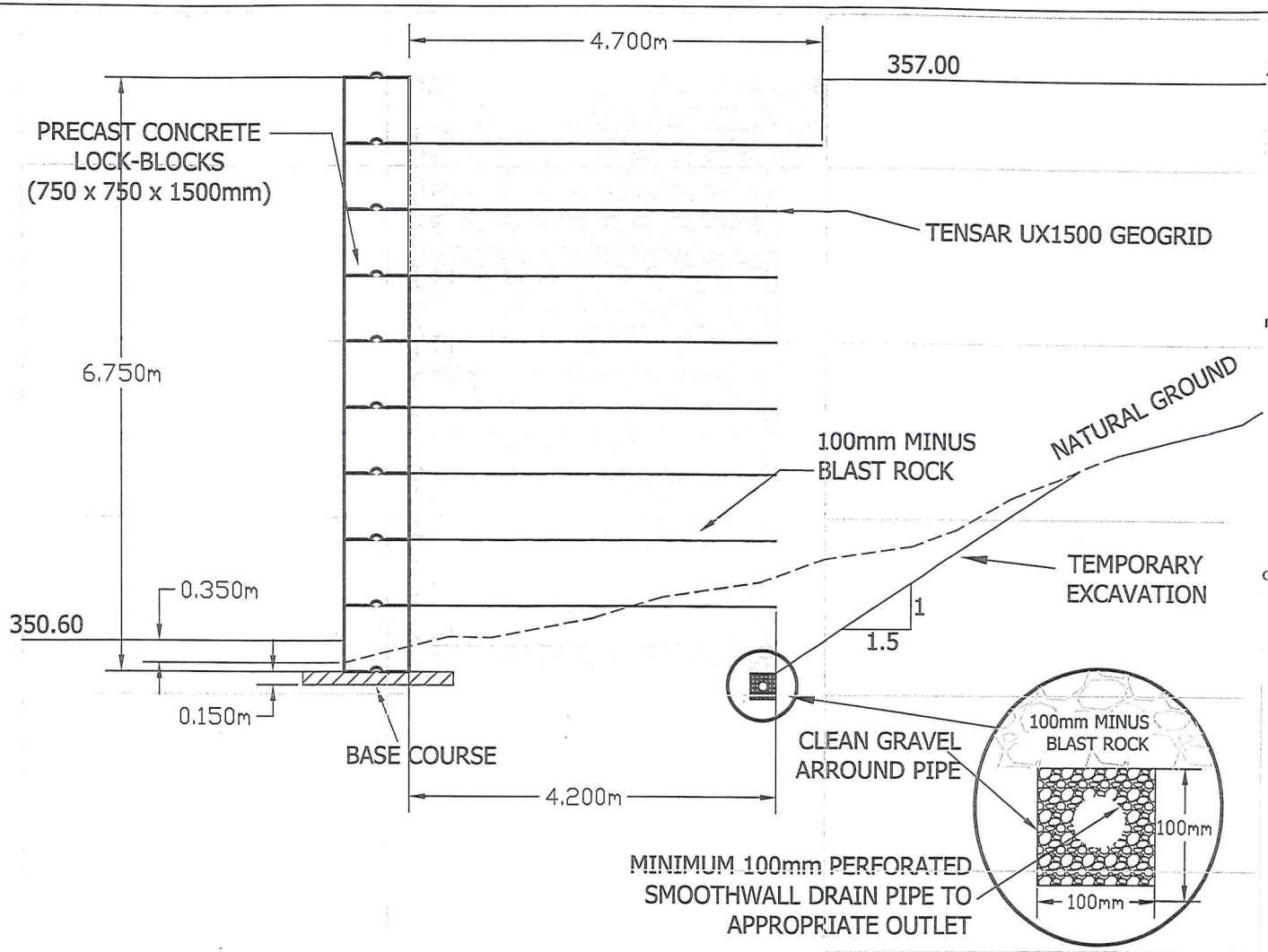

CONSTRUCTION NOTES FOR LOCK BLOCK WALLS

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B. Placement of Tensar Geogrids

B1. Geogrid reinforcement should be Tensar Uniaxial Geogrid manufactured by the Tensar Corporation.

B2. Tensar geogrid lengths specified on the design drawings shall be placed at the locations and elevations shown on the design drawings.

B3. No changes shall be made to the length or type of Tensar geogrids, without the written consent of the design engineer.

B3. The lengths of the geogrids are measured from the front face of the form.

B4. Tensar geogrid reinforcement shall be continuous throughout the embedment lengths, and splicing is not allowed.

C. Drainage

C1. The reinforced soil structure has been designed on the basis that the reinforced backfill material shall be free of ponding water, seepage, and subsurface water. The design, collection and diversion of ponding water, seepage and subsurface water shall be the responsibility of others.

10

Design parameters

-Design of the reinforced soil structure is based on the following geotechnical parameters.

-The design is based on 10 kPa dead load surcharge.

	Effective Friction Angle	*Effective Cohesion*	*Moist Unit Weight*
Reinforced Backfill	36.0 degrees	0 kPa	20.6 kN/m^3
Retained Soil	32.0 degrees	0 kPa	20 kN/m^3
Foundation Soil	32.0 degrees	0 kPa	20 kN/m^3

SCALE 1:50

0.5 0 0.5 1 2m

CLIENT

Tony Otto

Tony Otto Subdivision

TYPICAL CROSS SECTION-1
LOCK BLOCK WALL

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
8800303	CC	GM	1
OFFICE: KELOWNA	DATE: August 16, 2006		

Figure 1

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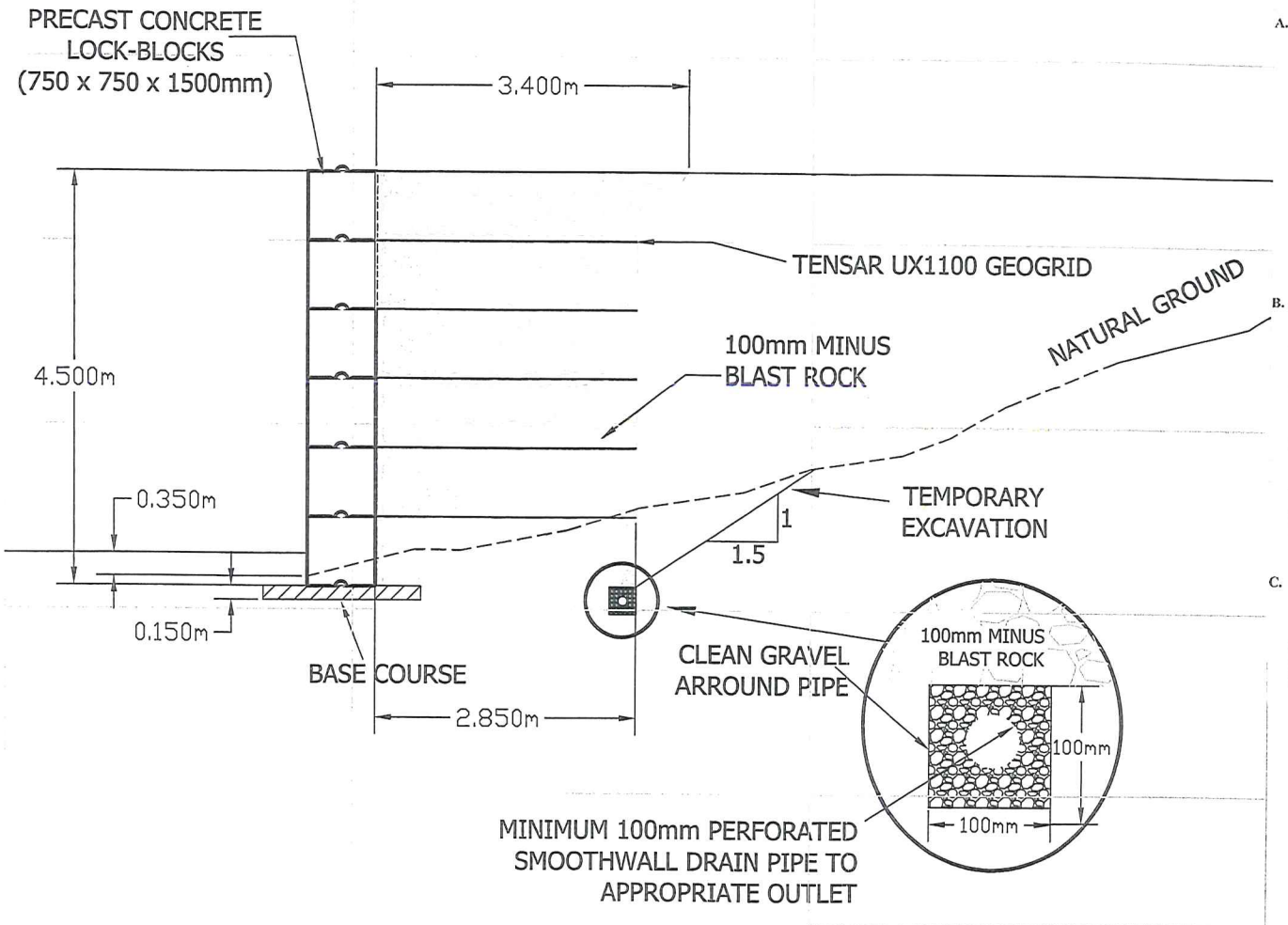


CONSTRUCTION NOTES FOR LOCK BLOCK WALLS

A. Ground Preparation and Backfill Materials

A1. The base of the excavation shall be cleaned of all loose material. The base should consist of compacted granular material or prepared as directed by the geotechnical engineer representing the owner.

A2. Backfill material placed in the reinforced zone, shall consist of site soils having at least the friction angle specified in Table 1.

A3. Backfill material must be placed and compacted in lifts not exceeding 250 *mm*.

A4. Backfill material placed in the reinforced zone shall be compacted to minimum of 98% of Standard Proctor Density (ASTM D698), and 95% Standard Proctor Density (ASTM D698) within 1.0 *m* of wall face.

B. Placement of Tensar Geogrids

B1. Geogrid reinforcement should be Tensar Uniaxial Geogrid manufactured by the Tensar Corporation.

B2. Tensar geogrid lengths specified on the design drawings shall be placed at the locations and elevations shown on the design drawings.

B3. No changes shall be made to the length or type of Tensar geogrids, without the written consent of the design engineer.

B3. The lengths of the geogrids are measured from the front face of the form.

B4. Tensar geogrid reinforcement shall be continuous throughout the embedment lengths, and splicing is not allowed.

C. Drainage

C1. The reinforced soil structure has been designed on the basis that the reinforced backfill material shall be free of ponding water, seepage, and subsurface water. The design, collection and diversion of ponding water, seepage and subsurface water shall be the responsibility of others.

Design parameters

-Design of the reinforced soil structure is based on the following geotechnical parameters.

-The design is based on 10 kPa dead load surcharge.

	Effective Friction Angle	*Effective Cohesion*	*Moist Unit Weight*
Reinforced Backfill	36.0 degrees	0 kPa	20.6 kN/m^3
Retained Soil	32.0 degrees	0 kPa	20 kN/m^3
Foundation Soil	32.0 degrees	0 kPa	20 kN/m^3

SCALE 1:50

0.5 0 0.5 1 2m

CLIENT: Tony Otto

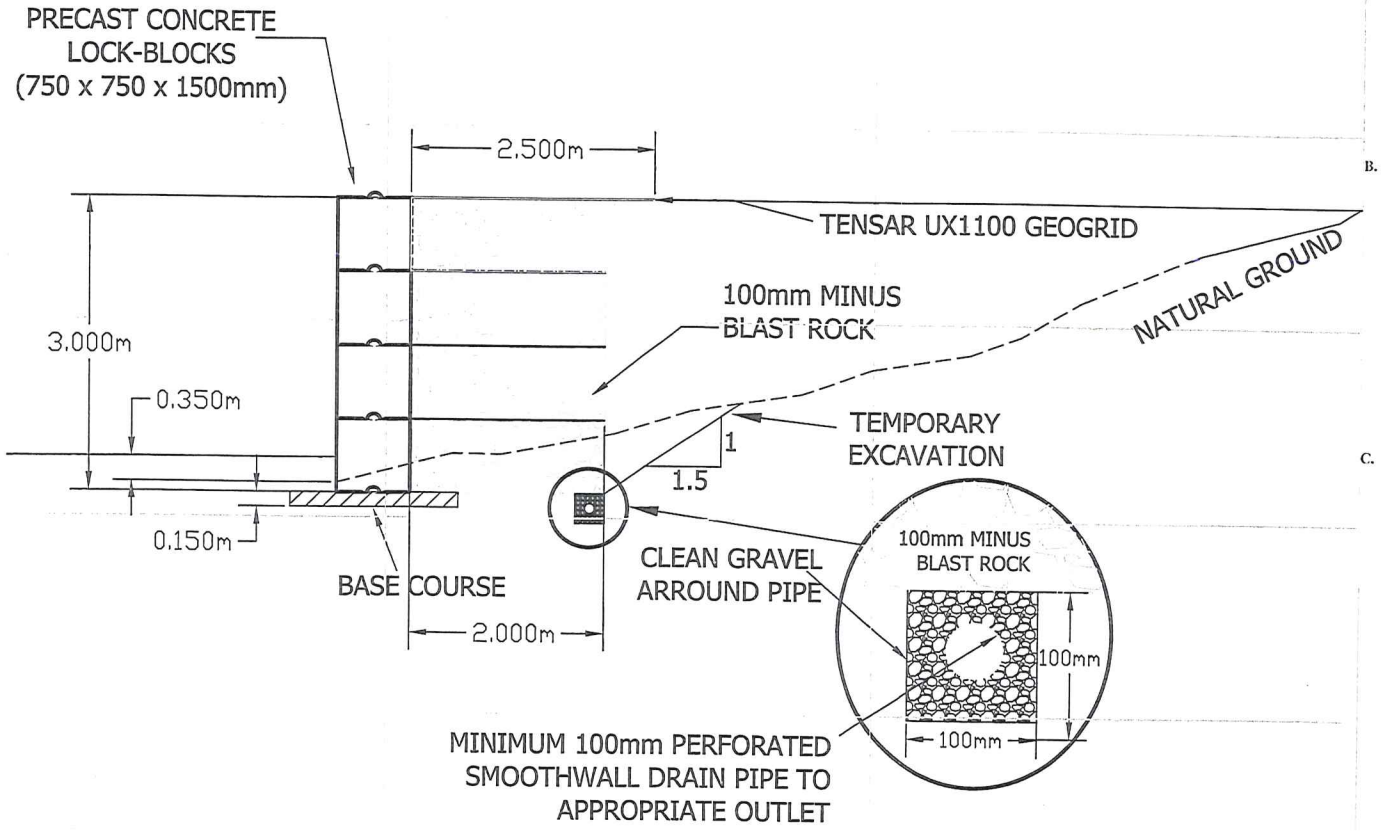
Tony Otto Subdivision

TYPICAL CROSS SECTION-2
LOCK BLOCK WALL

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CHD	REV
8800303	CC	GM	1
OFFICE: KELOWNA	DATE: August 16, 2006		

Figure 1



CONSTRUCTION NOTES FOR LOCK BLOCK WALLS

A. Ground Preparation and Backfill Materials

A1. The base of the excavation shall be cleaned of all loose material. The base should consist of compacted granular material or prepared as directed by the geotechnical engineer representing the owner.

A2. Backfill material placed in the reinforced zone, shall consist of site soils having at least the friction angle specified in Table 1.

A3. Backfill material must be placed and compacted in lifts not exceeding 250 *mm*.

A4. Backfill material placed in the reinforced zone shall be compacted to minimum of 98% of Standard Proctor Density (ASTM D698), and 95% Standard Proctor Density (ASTM D698) within 1.0 *m* of wall face.

B. Placement of Tensar Geogrids

B1. Geogrid reinforcement should be Tensar Uniaxial Geogrid manufactured by the Tensar Corporation.

B2. Tensar geogrid lengths specified on the design drawings shall be placed at the locations and elevations shown on the design drawings.

B3. No changes shall be made to the length or type of Tensar geogrids, without the written consent of the design engineer.

B3. The lengths of the geogrids are measured from the front face of the form.

B4. Tensar geogrid reinforcement shall be continuous throughout the embedment lengths, and splicing is not allowed.

C. Drainage

C1. The reinforced soil structure has been designed on the basis that the reinforced backfill material shall be free of ponding water, seepage, and subsurface water. The design, collection and diversion of ponding water, seepage and subsurface water shall be the responsibility of others.

Design parameters

-Design of the reinforced soil structure is based on the following geotechnical parameters.

-The design is based on 10 kPa dead load surcharge.

	Effective Friction Angle	*Effective Cohesion*	*Moist Unit Weight*
Reinforced Backfill	36.0 degrees	0 kPa	20.6 kN/m^3
Retained Soil	32.0 degrees	0 kPa	20 kN/m^3
Foundation Soil	32.0 degrees	0 kPa	20 kN/m^3

SCALE 1:50

0.5 0 0.5 1 2m

CLIENT

Tony Otto

Tony Otto Subdivision

TYPICAL CROSS SECTION-3
LOCK BLOCK WALL

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
8800303	CC	GM	1
OFFICE: KELOWNA	DATE: August 16, 2006		

Figure 1

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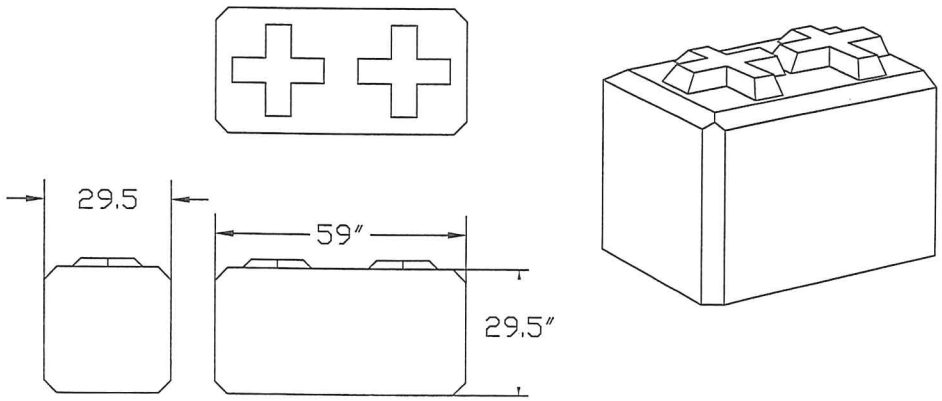
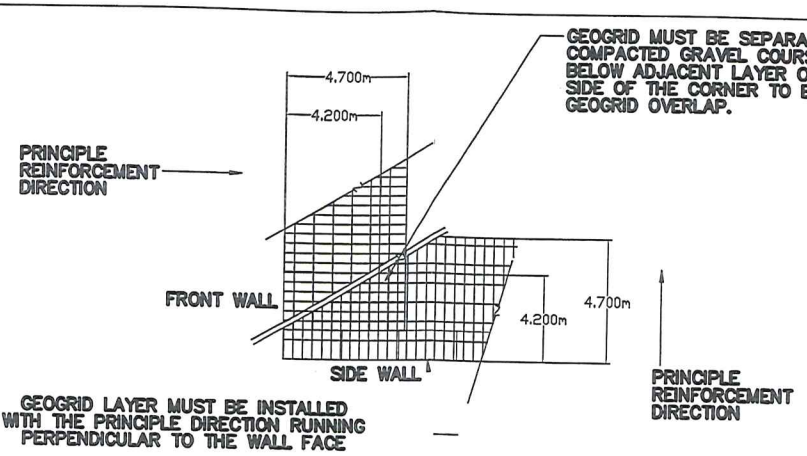
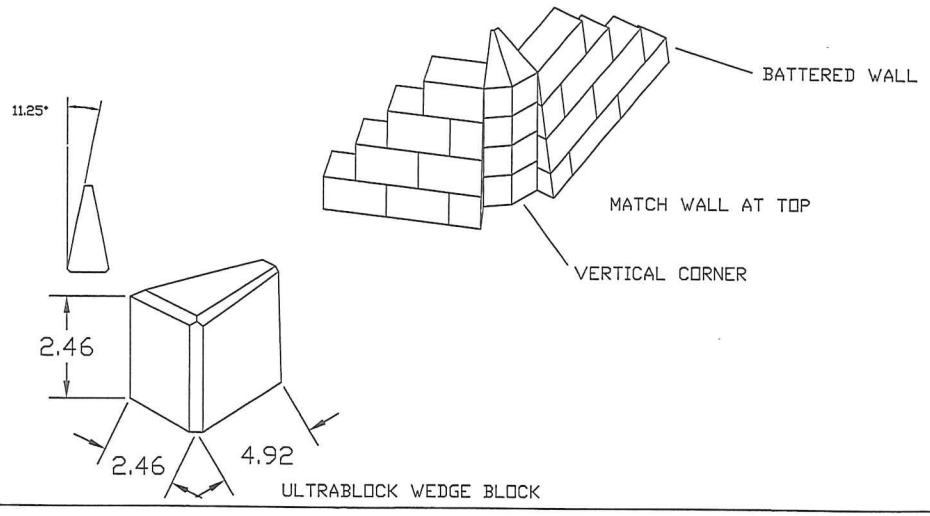
STANDARD BLOCK



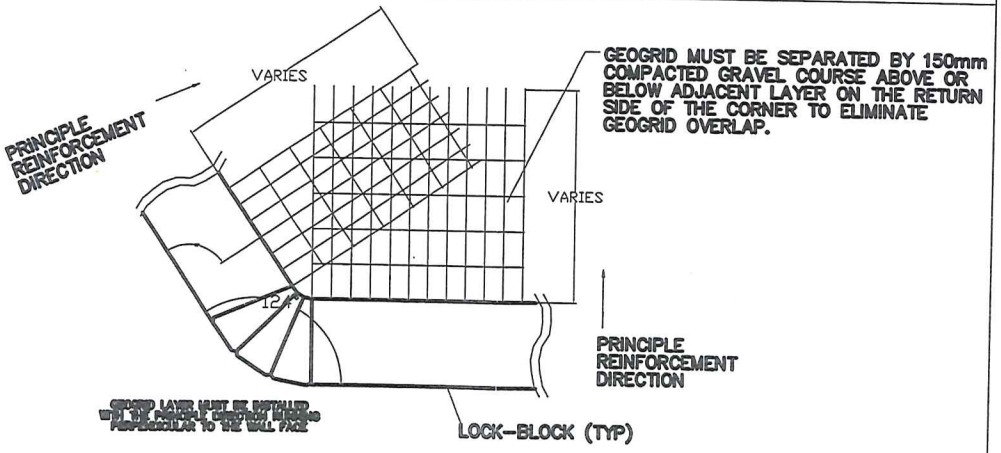


GEOGRID PLACEMENT PLAN

WEDGE BLOCK



ULTRABLOCK WEDGE BLOCK



GEOGRID PLACEMENT PLAN

Design parameters

-Design of the reinforced soil structure is based on the following geotechnical parameters.

-The design is based on 10 kPa dead load surcharge.

	Effective Friction Angle	*Effective Cohesion*	*Moist Unit Weight*
Reinforced Backfill	36.0 degrees	0 kPa	20.6 kN/m^3
Retained Soil	32.0 degrees	0 kPa	20 kN/m^3
Foundation Soil	32.0 degrees	0 kPa	20 kN/m^3

CLIENT

Tony Otto

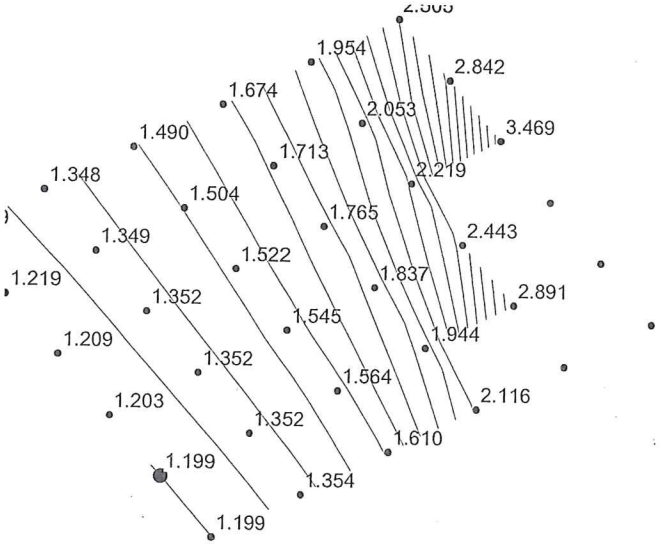
Tony Otto Subdivision

DESIGN DETAILS OF
LOCK BLOCK WALL (NOT TO SCALE)

EBA Engineering Consultants Ltd.

PROJECT NO.	DWN	CKD	REV
8800303	CC	GM	1
OFFICE: KELOWNA	DATE: August 16, 2006		

Figure 1



Tony Otto
Retaining Wall Analysis
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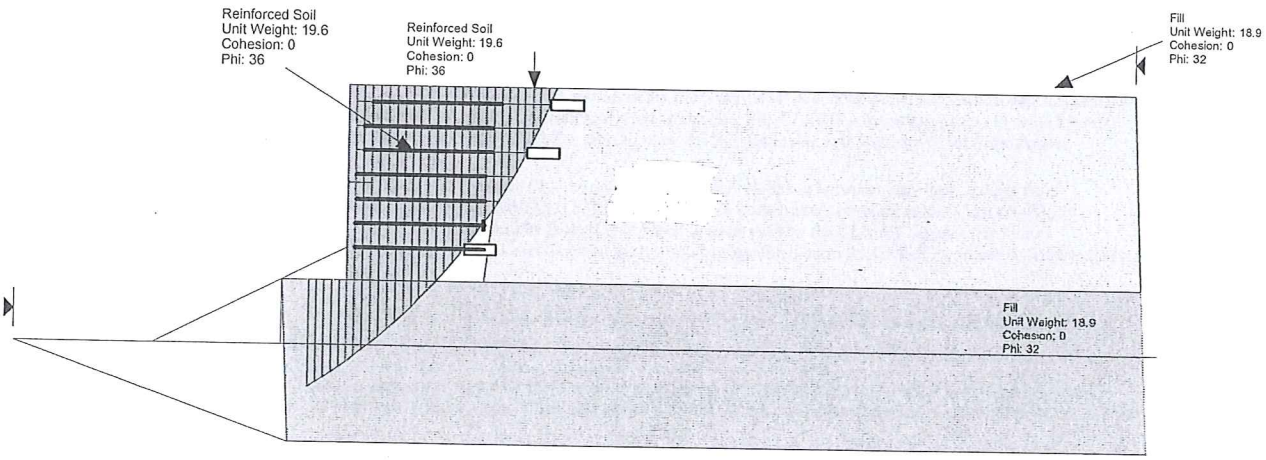


EBA ENGINEERING CONSULTANTS LTD.
CONFIRMATION OF ASSIGNMENT

14940 - 123 Avenue, Edmonton, Alberta T5V 1B4 Tel: (780) 451-2121 Fax: (780) 454-5688

Project Name: Tony Otto Subdivision

Project Location: Kelowna

Client Name: Tony Otto

Client Contact: Tony Otto **Phone:** 1-250 868 98 14 **Fax:** **Cell Phone:**

Client Address: Kelowna, Kelowna, British Columbia V1W 6V9

Invoice To: Tony Otto, Tony Otto

Purchase Order No.:

EBA Services:

EBA Project Manager: German Martinez **Phone Number:** (780) 451-2121

Project/Proposal No.: 8800303 **Charge GST:** Yes

Agreed Budget: **Fees:** $2,400.00 **Disbursements:** $100.00 **Other:** $0.00 **Total Budget:** $2,500.00

GENERAL CONDITIONS

1.0 GENERAL

These General Conditions shall be binding on the CLIENT and EBA Engineering Consultants Ltd. (hereinafter referred to as the CONSULTANT) unless within five (5) business days from the date written hereon, the CLIENT gives written notice to the CONSULTANT that it rejects any of the following terms.

2.0 SCOPE OF WORK

The scope of work for services shall be as agreed in the above noted proposal unless the CONSULTANT is notified in writing within five (5) business days from the date written hereon.

3.0 PAYMENT

The compensation to the CONSULTANT for services shall be as agreed in the above noted proposal or, in the absence of a proposal, in accordance with the CONSULTANT's Schedule of Rates in effect at the time of the signing of this Agreement.

4.0 BILLING

Invoices will be issued monthly or as outlined in the proposal. Invoices are payable within 30 days unless otherwise agreed in writing. Interest of 1.5% per month, compounded monthly, shall be payable on all amounts not paid within 30 days.

5.0 STANDARDS OF CARE AND WARRANTY

5.1 In the performance of professional services, the CONSULTANT will use the degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession practicing in the same or similar localities, based on the current state of practice. No other warranty or guarantee expressed, implied or statutory is made or intended by this Agreement.

5.2 The CLIENT recognizes that conditions may vary from those encountered at the locations where tests, borings or samplings are made by the CONSULTANT and that the data, interpretation and recommendations of the CONSULTANT are based solely on the information available. There is no warranty expressed or implied by the CONSULTANT, that any investigation can fully delineate all subsurface features and characteristics.

5.3 The CONSULTANT is not responsible for the interpretation by others of the information developed under this Agreement.

5.4 The CLIENT shall be responsible for reporting the results of any investigation to the relevant regulatory agency if such reporting is required and the CLIENT acknowledges that the CONSULTANT may be required by law to disclose information to regulatory agencies and hereby consents to such disclosure.

6.0 SITE INFORMATION AND DISCLOSURE

The CLIENT agrees to fully cooperate with the CONSULTANT with respect to the provision of all available information on the past, present and proposed conditions of the Site including historical information respecting the use of the site. The CLIENT acknowledges that in order for the CONSULTANT to properly provide the service, the CONSULTANT is relying upon the full disclosure and accuracy of this information.

7.0 LIMITATION OF LIABILITY

In consideration of the provision of services the CLIENT agrees that any and all claims which it has or hereafter may have against the CONSULTANT in any way arising out of or related to the CONSULTANT□s duties and responsibilities pursuant to this Confirmation of Assignment, whether such claims are in contract or in tort, shall be limited to the total amount paid by the CLIENT for services of the CONSULTANT under this Confirmation of Assignment. Increased liability limits may be negotiated upon the CLIENT's request in consideration of an additional fee.

8.0 INSURANCE

If, during the construction period, the CLIENT has a course of construction insurance policy, the CLIENT shall maintain and keep in force the joint names of the CONSULTANT and the CLIENT on that policy.

9.0 AGREEMENT

This agreement is binding and will enure to the benefit of the CLIENT and the CONSULTANT, including the CONSULTANT's employees, servants and agents and their respective successors and assigns. These General Conditions form a part of the proposal, with the same effect as if set forth therein.

GMC

EBA Engineering Consultants Ltd.

AUG 18, 2006.

Date

geoteknik
consulting ltd
324 clifton road north
kelowna. b.c.
canada. v1v 1n4
tel&fax: 250.763.1079
cell: 250.212.8711
email: geoteknik@telus.net

March 25, 2010 Our Ref.: 209-223

Mr T. Otto
#502 – 1585 Abbott Street
Kelowna, BC
V1Y 1A8

RE: GEOTECHNICAL INVESTIGATION
PROPOSED TWO UNIT RESIDENTIAL DEVELOPMENT
1415-1417 EDGEWOOD DRIVE
KELOWNA, BRITISH COLUMBIA

Dear Sir:

As requested, Geoteknik Consulting Ltd has completed a geotechnical investigation for the above referenced project. It is understood that it is proposed to construct a two unit residential development on the property. The purpose of the investigation was to identify the subsurface soil and groundwater conditions and based on our interpretation of this information, to provide comments and recommendations pertaining to the geotechnical aspects of the proposed project.

1.0 SITE INVESTIGATIONS

The geotechnical investigation consisted of a total of five boreholes which were advanced to depths varying between 4.5 m and 10 m on September 18, 2004, using a truck mounted auger drill rig. The locations of the boreholes are shown on Figure 1. The soil and groundwater conditions encountered at each borehole are summarized on the attached Record of Borehole sheets. Penetration tests were extended into the dense sand and gravel deposits, which were encountered in the lower regions of the boreholes. An experienced geotechnical engineer from Geoteknik logged the boreholes in the field. Representative soil samples were collected at regular intervals from the boreholes, and were returned to our laboratory for further detailed examination.

In addition, four test pits were excavated at the approximate locations shown on Figure 1 on September 30, 2004. The test pits were extended to depths between 1.8 m and 4.0 m below

the existing ground surface using an extended backhoe. Representative samples of the various insitu soil deposits were taken and brought back to our laboratory for further examination. Detailed descriptions of the subsurface conditions encountered in the test pits are summarized on the attached Record of Test Pit log sheets.

2.0 SITE CONDITIONS

The proposed duplux residence is located on the north side of Edgewood Drive in Kelowna, British Columbia as shown in detail in Figure 1. The site is located within a sloped area with a maximum height of about 8 m and the fill materials have been placed over the slope some years ago. The site surface is level within the southern portion of the site which measures an average of 12 m in width. The existing slope is an average 6 m high and stands at an average angle of 2 horizontal to 1 vertical. A detailed survey was carried out in 2008 as shown on Figure 2. The ground surface of the upper level is located at an average elevation of 359 m and the ground slopes to the north and west to the lowest elevation of 351 m in the northwest corner of the property.

The results of the Boreholes indicate that the level ground surface is underlain by silty sand and gravel fill materials varying in thickness between 2.3 m and 5.3 m. These materials are generally loose to compact and contain some cobbles and boulders. The fill materials are underlain by compact deposits of silty sand with some gravel to a depth of greater than 10 m below the site surface. The results of the penetration tests within the sandy deposits indicate that the penetration resistance increased from an average of 10 blows per 0.3m in the upper portion and an average of 25 blows per 0.3 m in the lower portion of the deposit. This indicates compact and competent deposits exist at depths. The ground water table was not encountered within the 10 m depth of the boreholes.

The results of the test pit located in the region of the slope as shown in Figure 1 indicate that the slope surface is underlain by silty sand and gravel materials varying in thickness between 1.5 m and 3.3 m. These materials are generally loose to compact and contain occasional pieces of angular bedrock to 0.9 m in diameter and occasional pieces of asphalt pavement. The test pits were terminated in compact deposits of sand with some gravel at depths varying between 2.1 m and 4.5 m below the ground surface

2.0 DISCUSSION

Based on the results of the site investigation, construction of the proposed development is considered geotechnically feasible for two storey residences including a concrete lock block retaining structure along the north and west property boundaries with a height varying between 2 m and 3 m.. The proposed development is shown on the plan in Figure 2 and on the two sections in Figure 3 and 4. It is proposed to construct the ground floor of the residence at elevation 359 m and have a walk out lower floor. It is understood that two alternatives are being considered with floor elevations at about 355 m and 356.6 m. The retaining wall may vary in height between 2 m and 5 m. It is required to connect this wall to a concrete retaining wall along the west side of the house as shown in detail on Figure 4.

The main geotechnical issues facing the proposed site include varying thicknesses of granular fill materials which should be reworked and/or removed and structural granular fill should be placed and compacted. Comments on site preparation and details of foundation recommendations for the proposed structure are discussed in the following sections.

This section of the report provides engineering information for the geotechnical design aspects of the project based on our interpretation of the test pit information and project requirements. The information in this portion of the report is provided for the guidance of the design engineers. Where comments are made on construction, they are provided only in order to highlight aspects of construction, which could affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

2.1 Site Preparation

All fill, disturbed, or organic soils must be removed down to undisturbed native strata for placement of footings or engineered fills for the proposed building. It is expected that across the majority of the site the excavation depth will vary between 3 m and 5 m. The excavation limits should extend horizontally beyond the perimeter of the proposed buildings, a distance equal to the depth of the compacted granular fill beneath the footings.

Temporary excavation side slopes in the soils observed at the site should be developed at angles no steeper than 1.5 horizontal to 1 vertical for vertical heights no greater than 3.0 m for dry conditions.

Any grade fills used beneath the structures should consist of 75 mm minus pitrun sand and gravel having less than 8 percent passing of a USS 200 sieve. Some of the existing sand and gravel fill materials may be reused if selectively excavated to ensure that all deleterious materials are removed. All grade fill should be placed in 300 mm maximum thick horizontal lifts. The granular fills should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D698).

2.2 Foundation Design

The results of the investigation indicate that the sand deposits will provide a suitable bearing stratum on which to construct conventional spread and/or strip footings. An allowable bearing pressure of 150 kPa may be used in design of the footings. Alternatively, the footings may be constructed on well compacted granular fill placed and compacted as described in Section 3.1 and designed using an allowable bearing pressure of 150 kPa. The location and elevation of the footings should be determined during the site preparation works as the footings may be located on structural compacted fill materials or original undisturbed soil deposits. The load

on the footings will not affect the lock block wall as shown in the section on Figure 3 and 4. The location of the footings are outside the influence of the retaining structure.

It is recommended that all exterior footings or footings in unheated sections of the proposed buildings be provided a minimum of 0.6 m of soil cover for frost protection purposes.

2.3 Seismic Design Consideration

The proposed site is considered to be located within Seismic Class C of the current B.C. Building Code (2006). It is recommended to use a design peak ground acceleration of 0.14 m/s^2 for the area of the proposed site with a 7.5 magnitude earthquake. This value is based on a 2 percent probability of exceedence in fifty years.

2.4 Floor Slabs

It is recommended that all floor slabs be founded on an underslab base course consisting of at least 100 mm of 19 mm minus crushed gravel. This material should be compacted to 100 percent of standard Proctor maximum dry density (ASTM D698).

The slabs on grade should be structurally separate from all foundation elements and should include a cross joint system to control post construction cracking.

2.5 Retaining or Basement Walls

For design of walls that are restrained against movement, it is recommended that a coefficient of earth pressure at rest, K_o of 0.45 be used. If the walls are permitted to tilt freely 25 mm or more in 3.0 m of wall height, a coefficient of active pressure K_a of 0.3 may be used in design. A soil unit weight of 2000 kg per cubic meter may be utilized in the design calculations. The lock block or Keystone retaining structures have been designed by EBA Engineering Consultants Ltd as reported in their letter dated August 18, 2006 and March 12, 2010.

A positive drainage system has provided behind and below the retaining walls to eliminate potential build-up of hydrostatic pressures. It is required to provide drainage along footings and basement walls within the building. The drains may be discharged into the drainage system along the block wall. The water will not affect the wall due to the coarse nature of the underlying granular soils which will ensure that the infiltration of water take place in a vertical direction.

The construction of the retaining structures will not affect any of the nearby residences and will not cause any settlements of these houses. Any drainage from the roads and driveways on the site will be taken to rock pits on the site. The underlying granular deposits will ensure the drainage take place in vertical direction and will not cause any flooding on the site.

2.6 Roadways and Parking Areas

The fills within the parking areas/roadways need not be subexcavated. It is recommended, however, that prior to pavement construction, the subgrade soils be proofrolled by at least 4 passes of a heavy vibratory roller. Any soft or loose zones encountered should be subexcavated and replaced with granular fills as discussed in Section 3.1. Upon completion of the above subgrade preparation, the following minimum pavement design for light traffic can be constructed.

Asphalt	50 mm
Crushed Gravel Base Course	100 mm
Pit run Subbase	200 mm

The base and subbase material should be compacted to 100 percent of standard Proctor maximum dry density (ASTM D698).

2.7 Surface Drainage Control

Few, if any surface drainage difficulties are anticipated. No evidence of surface water drainage channels or paths of concentrated flow leading onto or off of the property were observed at the site. The results of the boreholes indicate the ground water table is not located within the upper 10m of the ground surface. No signs of significant runoff flows crossing onto or off of the property were observed. It is considered that these conditions reflect the generally pervious sand and gravel soils at the site which would encourage infiltration, thereby limiting surface runoff flows. It is understood that retaining wall structure is required in the north corner of the property. In this area the wall it is recommended that the a 1 m thick layer of coarse stone fill be placed on the existing ground surface to ensure that any water seepage will be intercepted and allowed flow to the north as shown in detail on the contour plan in Figure 2. Any surface drainage from road and parking areas together should be taken to the storm drainage system. The roof drainage water should be taken to rock pits in the level area to the south of the proposed residences. The location of these pits should be determined during the construction.

2.8 Slope Stability

We have carried out a detailed review of the stability of the area of the subdivision as shown in detail on the contour plan in Figure 2. No terrain or drainage features were observed on the property that could pose a natural hazard to the site, nor were any conditions observed on the property which could pose a natural hazard to adjacent or down slope properties. As discussed in Section 2.1 it is recommended that the existing fill materials be removed from the slope in the center portion of the lot down to a depth of some 3 m to 5 m.

No signs of any slope instability were observed on the site. Specifically the frictional strength of the insitu granular deposits would be in excess of about 42 degrees as opposed

to the 2 horizontal to 1 slope grades on the proposed development area. Accordingly, factors of safety with respect to slope stability would typically exceed about 2, and consequently there is not a concern relative to slope stability on the site. The slopes are all stable with a factor of safety that is greater than 2.0 when considering 10 % probability in 50 years as per rate of occurrences. At present there are no concerns besides any standards following the building codes.

2.9 Inspection and Testing

It is recommended that Geoteknik Consulting review the final design prior to start of construction to confirm that the geotechnical aspects are suitably incorporated. It is also recommended that Geoteknik carry out periodic inspections during site preparation and placement of granular fills to confirm that actual site and subsurface conditions are as anticipated and our recommendations are adhered to during construction. We suggest that a specific site review be carried at the time of construction of the house and retaining structures (including B1 and B2 Schedules).

We trust the foregoing provides the information you require at this time.

Yours very truly,
GEOTEKNIK CONSULTING LTD.

Bjarne Carlsen, M. Asc., P.Eng.

geoteknik
consulting ltd
324 clifton road north
kelowna. b.c.
canada. v1v 1n4
tel&fax: 250.763.1079
cell: 250.212.8711
email: geoteknik@telus.net

April 21, 2010 Our Ref.: 209-223

Mr T. Otto
#502 – 1585 Abbott Street
Kelowna, BC
V1Y 1A8

RE: GEOTECHNICAL REVIEW
PROPOSED TWO UNIT RESIDENTIAL DEVELOPMENTS
1415-1417 EDGEWOOD DRIVE
KELOWNA, BRITISH COLUMBIA

Dear Sir:

As requested, Geoteknik Consulting Ltd has completed a review of the geotechnical questions which have been raised by the City of Kelowna Building Department. We wish to confirm that the report has been prepared by the highest geotechnical standards which have been in effect during the practice of Mr. Bjarne Carlsen of Geoteknik Consulting who has carried out numerous projects in Geotechnical Engineering for the last 45 years and in the Okanagan area since 1978. Our responses are presented below:

1) Is the site suitable for the development of proposed building structures with respect to the stability of soil onsite and adjacent lands nearby?

Yes the site is suitable as addressed in detail in the report.

2) Provide at least two cross-sections showing the location of Footing and Foundation of the houses in reference to proposed retaining wall. Verify in extreme case, should the retaining wall fail, what the impact is on the structure and the adjacent properties.

The sections are shown in the report of Geoteknik Consulting Ltd. and EBA Engineering Consultants Ltd. . The retaining walls are designed and no failures will take place. If failures do occur the walls can be rebuilt without influencing the adjacent properties.

3) The report identifies fills material have been places some years ago. What is the clear recommendation for placement of Footing and Foundation of proposed structure? Is it recommended to excavate down to native soil and construct structure from that point or to remove the fills and place layers of engineered fills compacted and supervised to the required geotechnical standards?

All fill materials will be removed as stated in the report and all new fill placement will be carried out following the recommendations given in our report. All work will be supervised by a geotechnical engineer.

4) What is the effect of the soil fill and construction of retaining wall on footing and foundation of the proposed building onsite and on adjacent lots?

The fill and construction of the retaining wall has been taken into consideration in the design and all footings and foundations are safe when considering the geotechnical aspect of the design

5) What is the effect of change in the level of safety for the change in overall slope and soil stability as a result of the proposed development?

The proposed development is designed and is safe. It will be constructed to the code of design of geotechnical engineering which is in place for the City of Kelowna and Canada Building Code.

6) How would the offsite slope instability be mitigated by owner/developer to provide safe occupation and use of the land onsite and adjacent lands nearby?

All slopes are safe and will be constructed and supervised by a professional engineer. The development will provide safe occupation and use of the land onsite and adjacent lands nearby.

7) Is there any special requirement for construction of the buildings, roads or utilities?

Yes and they are all presented in our report. All constructions will follow the guidelines of City of Kelowna Building Codes.

8) In the report it is recommended that, roof drainage may be taken to rock pits. What impact it would have on engineered fills?

Water infiltration will not have any influence on compacted fills as they are placed to the standard criteria acceptable in geotechnical engineering.

9) What are the measures taken to address the disposal of the excess of water beyond the capacity of drainage pit (15 m3)? What is the effect of this hydrostatic pressure on proposed retaining wall and on adjoining lots?

The walls have been designed to take into account any hydrostatic pressures and all drainage will be in a vertical direction and will not have an influence of nearby properties.

10) Is there any consideration made for the construction of any structure above the retaining wall or the retained area incorporated in design to permit any accessory structure i.e. Swimming Pool etc. in future?

Swimming pools should only be allowed if approved by a Geotechnical Engineer. At present no pools are allowed.

We trust the foregoing provides the information you require at this time.

Yours very truly,
GEOTEKNIK CONSULTING LTD.

Bjarne Carlsen, M. Asc., P.Eng.

BOREHOLE No 1

Location: see Figure 1
Borehole Type Augerdrill Sandwell
Sampler Hammer Wt 63.5 kg, Drop 0.75 m

Project No. 204-152
Date: September 18, 2003

ELEVATION DEPTH (m)	DESCRIPTION	SAMPLE NO	SAMPLE TYPE	BLOWS / 0.3M	PENETRATION RESISTANCE BLOWS/0.3m 10 20 30 40	PIEZO METER
	Ground Surface					
0.0	Compact brown silty **SAND AND GRAVEL** (FILL)	1	AS			
2.4	Loose brown silty **SAND** (FILL)	2	AS			
5.3	Compact grey silty **SAND** with some gravel	3	AS			
		4	AS			
10.0	End of Borehole					

Date 20/10/2004 Reviewed BC 1 of 1

BOREHOLE No 2

Location: see Figure 1
Borehole Type Augerdrill Sandwell
Sampler Hammer Wt 63.5 kg, Drop 0.75 m

Project No. 204-152
Date: September 18, 2003

ELEVATION / DEPTH (m)	DESCRIPTION	SAMPLE NO	SAMPLE TYPE	BLOWS / 0.3M	PENETRATION RESISTANCE BLOWS/0.3 m (10 20 30 40)	PIEZO METER
	Ground Surface					
0.0	Compact brown silty **SAND AND GRAVEL** (FILL) Occasional cobbles and boulders	1	AS			
		2	AS			
4.0	Compact grey silty **SAND** with some gravel	3	AS			
		4	AS			
		5	AS			
8.0	End of Borehole					

Date 20/10/2004 Reviewed BC 1 of 1

BOREHOLE No 3

Location: see Figure 1
Borehole Type Augerdrill Sandwell
Sampler Hammer Wt 63.5 kg, Drop 0.75 m

Project No. 204-152
Date: September 18, 2003

ELEVATION / DEPTH (m)	DESCRIPTION	SAMPLE NO	SAMPLE TYPE	BLOWS / 0.3M	PENETRATION RESISTANCE BLOWS/0.3 m 10 20 30 40	PIEZO METER
	Ground Surface					
0.0	Compact brown silty **SAND** (FILL)	1	AS			
2.3	Compact grey silty **SAND** with some gravel	2	AS			
		3	AS			
4.5	End of Borehole					

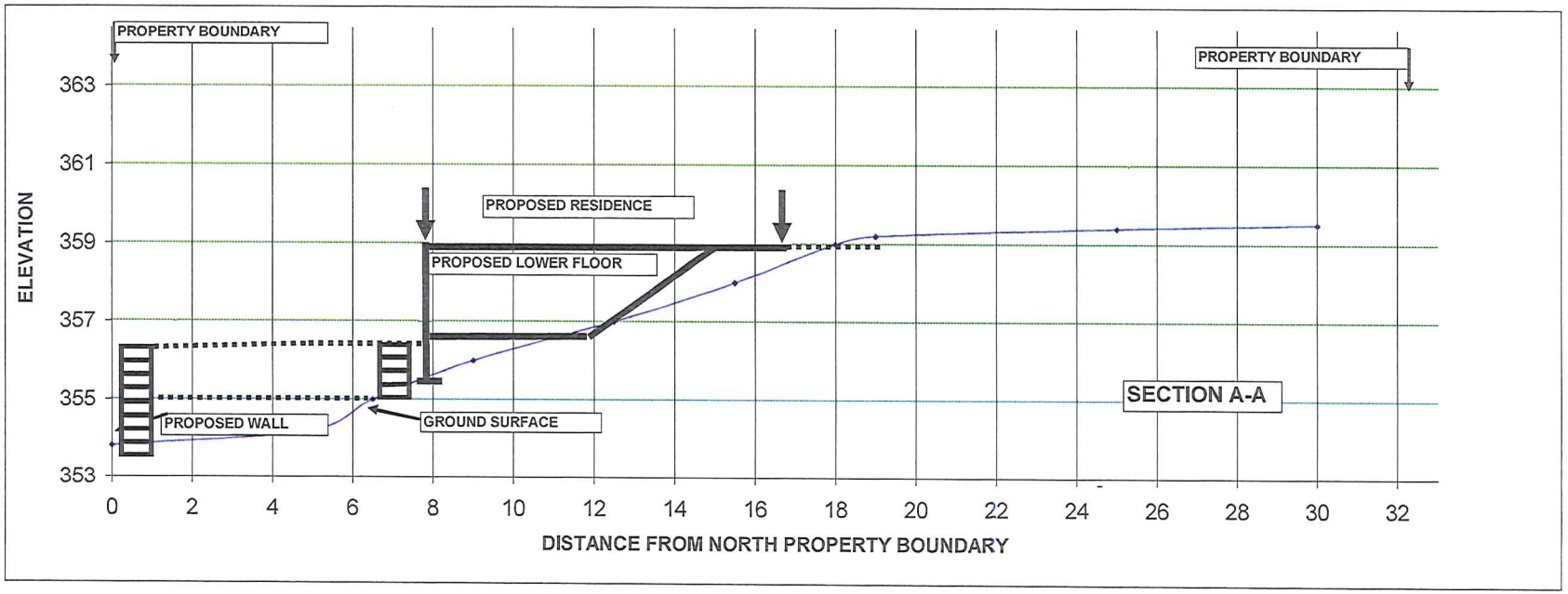
Date 20/10/2004 Reviewed BC 1 of 1

RECORD OF TEST PITS

September 30, 2004 204-152

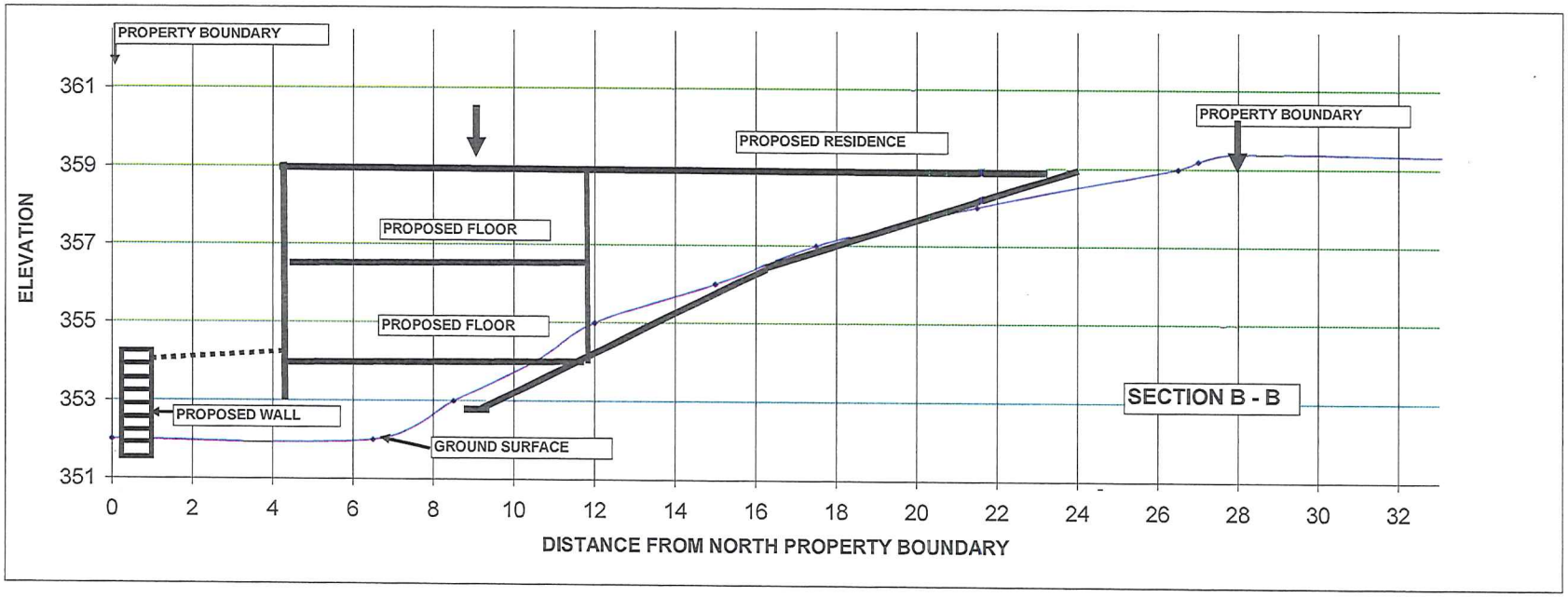
Test Pit No.	Depth (m)	Description	Sample/ Depth
1	0.0 – 3.3	Compact brown silty **SAND AND GRAVEL** with some cobbles and boulders. Occasional pieces of asphalt. (Fill)	
	3.3 – 4.5	Compact brown **SAND** with some gravel.	Sa # 1 3.5-4.0
2	0.0 – 1.5	Loose brown silty **SAND** with pieces of angular bedrock to 3 ft in diameter. (Fill)	
	1.5 – 2.1	Compact brown **SAND** with some gravel.	Sa # 1 1.5-1.8
3	0.0 - 3.3	Compact brown silty **SAND AND GRAVEL** with some cobbles and boulders. Occasional pieces of asphalt. (Fill)	
	3.5 - 4.3	Compact brown **SAND** with some gravel	Sa # 1 3.5- 4.0
4	0.0 – 1.5	Compact brown silty **SAND** with some cobbles and boulders. (Fill)	
	1.5 – 2.4	Compact brown **SAND** with some gravel	Sa # 1 1.5- 1.8

SECTION A - A	FIGURE 3



PROJECT NO 209-223 DRAWN pjc REVIEWED bc DATE December 14, 2009

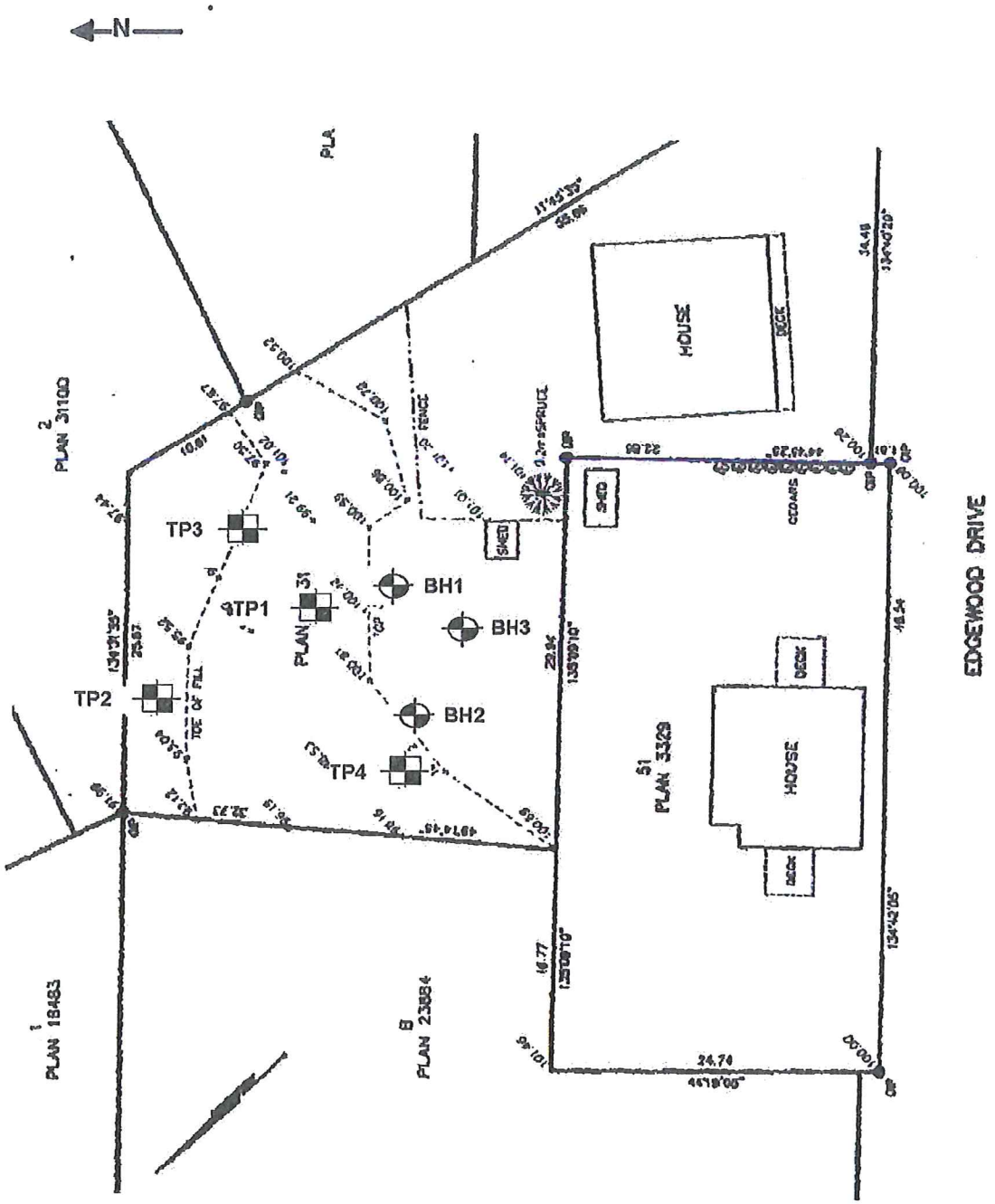
SECTION B - B	FIGURE 4



PROJECT NO 209-223 DRAWN pjc REVIEWED bc DATE December 14, 2009

SITE PLAN

FIGURE 1



LEGEND

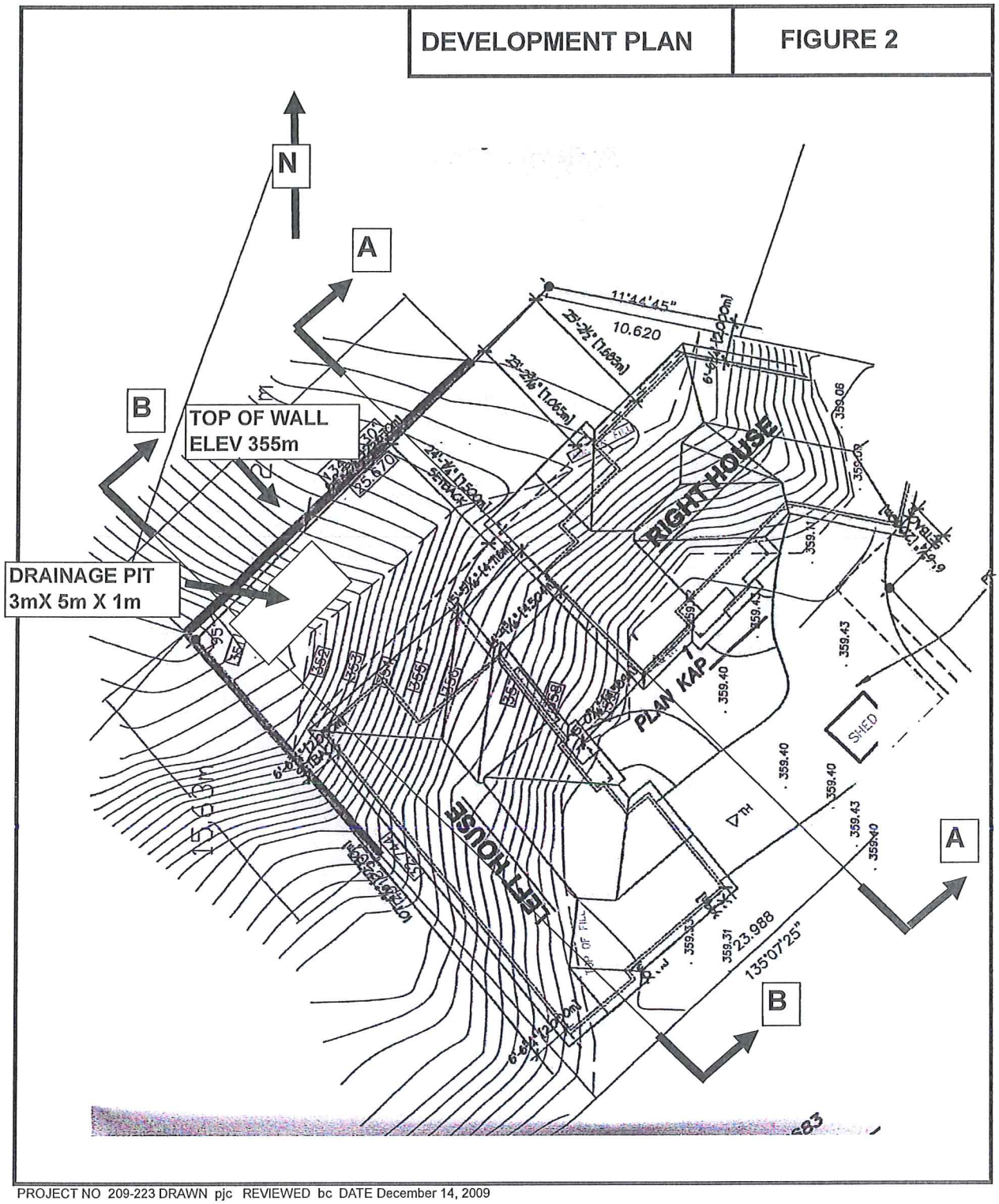
TP1 TEST PIT

BH1 BOREHOLE

SCALE 1:500 (Approx.)

PROJECT No. 204-152 DRAWN mtc REVIEWED BC DATE OCTOBER 14, 2004

geoteknik



PROJECT NO 209-223 DRAWN pjc REVIEWED bc DATE December 14, 2009

APPENDIX D: LANDSLIDE ASSESSMENT ASSURANCE STATEMENT

Note: This Statement is to be read and completed in conjunction with the "APEGBC Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia", March 2006/Revised September 2008 ("APEGBC Guidelines") and the "2006 BC Building Code (BCBC 2006)" and is to be provided for *landslide assessments* (not floods or flood controls) for the purposes of the Land Title Act, Community Charter or the Local Government Act. Italicized words are defined in the APEGBC Guidelines.

To: The *Approving Authority*
CITY OF KELOWNA

Date: MAY 10,2010

1435 WATER STREET KELOWNA
Jurisdiction and address

With reference to (check one):

- ☒ Land Title Act (Section 86) – Subdivision Approval
- ☐ Local Government Act (Sections 919.1 and 920) – Development Permit
- ☐ Community Charter (Section 56) – Building Permit
- ☐ Local Government Act (Section 910) – Flood Plain Bylaw Variance
- ☐ Local Government Act (Section 910) – Flood Plain Bylaw Exemption
- ☒ Local Government Act (Section 692 (D)) – Provincial Regulation M268, Geotechnical Slope Stability (Seismic) Regulation

For the Property:
LOT 2, PLAN 30134, DL 3529, 1138 OLD HEDLEY ROAD
Legal description and civic address of the Property

The undersigned hereby gives assurance that he/she is a *Qualified Professional* and is a *Professional Engineer* or *Professional Geoscientist.*

I have signed, sealed and dated, and thereby certified, the attached *landslide assessment* report on the Property in accordance with the *APEGBC Guidelines.* That report must be read in conjunction with this Statement. In preparing that report I have:

Check to the left of applicable items

X 1. Collected and reviewed appropriate background information
X 2. Reviewed the proposed *residential development* on the Property
X 3. Conducted field work on and, if required, beyond the Property
X 4. Reported on the results of the field work on and, if required, beyond the Property
___ 5. Considered any changed conditions on and, if required, beyond the Property
6. For a *landslide hazard analysis* or *landslide risk analysis* I have:
   - X 6.1 reviewed and characterized, if appropriate, any *landslide* that may affect the Property
   - X 6.2 estimated the *landslide hazard*
   - X 6.3 identified existing and anticipated future *elements at risk* on and, if required, beyond the Property
   - X 6.4 estimated the potential *consequences* to those *elements at risk*
7. Where the *Approving Authority* has adopted a *level of landslide safety* I have:
   - ___ 7.1 compared the *level of landslide safety* adopted by the *Approving Authority* with the findings of my investigation
   - ___ 7.2 made a finding on the *level of landslide safety* on the Property based on the comparison
   - ___ 7.3 made recommendations to reduce *landslide hazards* and/or *landslide risks*
8. Where the *Approving Authority* has **not** adopted a *level of landslide safety* I have:
   - X 8.1 described the method of *landslide hazard analysis* or *landslide risk analysis* used
   - X 8.2 referred to an appropriate and identified provincial, national or international guideline for *level of landslide safety*
   - X 8.3 compared this guideline with the findings of my investigation

X 8.4 made a finding on the *level of landslide safety* on the Property based on the comparison
X 8.5 made recommendations to reduce *landslide hazards* and/or *landslide risks*
X 9. Reported on the requirements for future inspections of the Property and recommended who should conduct those inspections.

Based on my comparison between

Check one

- ☐ the findings from the investigation and the adopted *level of landslide safety* (item 7.2 above)
- x the appropriate and identified provincial, national or international guideline for *level of landslide safety* (item 8.4 above)

I hereby give my assurance based on the conditions[18] contained in the attached *landslide assessment* Report

Check one or more where appropriate

- x for subdivision approval, as required by the Land Title Act (Section 86), "that the land may be used safely for the use intended"

Check one

- ☐ with one or more recommended registered *covenants.*
- ☐ without any registered *covenant.*
- ☐ for a development permit, as required by the Local Government Act (Sections 919.1 and 920), my report will "assist the *local government* in determining what conditions or requirements under [Section 920] subsection (7.1) it will impose in the permit"
- ☐ for a building permit, as required by the Community Charter (Section 56), "the land may be used safely for the use intended"

Check one

- ☐ with one or more recommended registered *covenants.*
- ☐ without any registered *covenant.*
- ☐ for flood plain bylaw variance (for debris flows only), as required by the "Flood Hazard Area and Use Management Guidelines" associated with the Local Government Act (Section 910),"the development may occur safely."
- ☐ for flood plain bylaw exemption (for debris flows only), as required by the Local Government Act (Section 910), "the land may be used safely for the use intended."

Bjarne Carlsen, P.Eng.
Name (print)

Signature

324 Clifton Road North, Kelowna, BC, V1V 1N4
Address

250-763-1079
Telephone

MAY 10, 2010
Date

(Affix Professional seal here)

If the *Qualified Professional* is a member of a firm, complete the following.

I am a member of the firm Geoteknik Consulting Ltd
and I sign this letter on behalf of the firm. (Print name of firm)

[18] When seismic slope stability assessments are involved, level of landslide safety is considered to be a "life safety" criteria as described in the National Building Code of Canada (NBCC 2005), Commentary on Design for Seismic Effects in the User's Guide, Structural Commentaries, Part 4 of Division B. This states:
"The primary objective of seismic design is to provide an acceptable level of safety for building occupants and the general public as the building responds to strong ground motion; in other words, to minimize loss of life. This implies that, although there will likely be extensive structural and non-structural damage, during the DGM (design ground motion), there is a reasonable degree of confidence that the building will not collapse nor will its attachments break off and fall on people near the building. This performance level is termed 'extensive damage' because, although the structure may be heavily damaged and may have lost a substantial amount of its initial strength and stiffness, it retains some margin of resistance against collapse".