DNV Landslide Risk Assessment

2377 Berkley Avenue

INSPECTION DATE: (mm/dd/yy)

11/10/05

WEATHER:

LOCATION:

Raining, heavy rain for several days

prior to visit.



BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY

500 - 1045 Howe Street Vancouver, BC Canada V6Z 2A9

THICKNESS OF LOOSE MATERIALS	<1 m	1-2 m	2-3 m	>3 m
CREST LINE		V		
10 m DOWNSLOPE FROM SLOPE CREST			V	

	SLOPE = 43° u	pper 15m of slope, 36	below 15m	
SLOPE BELOW FENCE/ RETAINING STRUCTURE	CRACKS	SLIDES	EROSION	
		K		
OBSERVATIONS: North side of the slope is adjacent to site of 1999 slide. Gully at south side of slope appears to be an 8 m wide, old				

scarp.

TREES BELOW FENCE/ RETAINING STRUCTURE		STRAIGHT	PISTOL-BUTT	LEANING	
PERCENT CONIFER: 50%		✓			
OBSERVATIONS: North side of slope is dominated by deciduous trees and shrubs. Some large coniferous fallen trees observed. South					

side of slope is dominated by coniferous trees.

RETAINING STRUCTU	JRES	YES☑	NO	HEIGHT= 1.6 m
TYPE	BLOCKS	CONCRETE	TIMBER CRIB	OTHER:
	✓	✓		
DEFORMATION	UNDEFORMED	CRACKED	SETTLED	BULGING

OBSERVATIONS: 8" crack in concrete block wall retaining garden and approx. ½ the yard. Wall is tilted down slope..

DEFORMATION IN BACKYARD	YES 🗹	NO				
LOCATION: Backyard garden at crest.						
DESCRIPTION: Minor circular settlement on lawn near deck. Garden retaining wall is cracks and displaced, causing some settlement in garden.						
POOLS	VES	NO 📶				

DESCRIPTION: None observed.

SEEPAGE/ SPRINGS IN OR YES 🗹 NO **BELOW FILL**

OBSERVATIONS: Considerable seepage observed 9 m down slope from garden retaining wall on north side of slope. No drainage pipe observed however seepage may be coming from an old drainage pipe.

FENCE LINE/ RETAINING WALL	10 m CRACK
GULLY/ OLD SCARP	GARDEN AH01 N
SETTLEMENT	HOUSE BERKLEY AVE.

HOUSE DISTANCE TO CREST = 8 m

RECEIVES SURFACE RUNOFF FROM	BACKYARD	½ ROOF	FULL ROOF	FRONT YARD	STREET
RECEIVES SURFACE RUNOFF FROM	✓	V	V		
OBSERVATIONS:					

UNSURE **CONNECTED TO STORM SEWER** ио 🗹 YES **OWNERS COMMENTS:** DNV reports that this property is not connected to storm sewer.

- Site of January 1999 slide at adjacent property to the north. (2391 Berkley)
- Small 0.6 m block retaining wall between crest and garden.
- House distance to crest is 8 m and house to edge of retaining wall ranges from 9.5 m to 19 m.



Figure 1. 2377 Berkley Avenue – Front of the house



Figure 2. 2377 Berkley Avenue – View of backyard



Figure 3. 2377 Berkley Avenue – View looking south along crest



Figure 4. 2377 Berkley Avenue – Concrete retaining wall

INSPECTION LOCATION # 2377 Berkley

Page 1 of 1

Project : DNV Landslide Risk AssessmentProject No. : 0404-002-01

Location: 2377 Berkley **Drill Method**: Dutch Hand Auger **Inspection Date**: 10 Nov 05

Logged by: SF/JB **Reviewed by**: MJP

Depth (m)	AUGERHOLE: BGC05-2377BER-AH01 on Slope Crest FINAL DEPTH OF AUGERHOLE: 1.15 m THICKNESS OF LOOSE MATERIALS: 1.15 m minimum Lithologic Description	Depth To Water Table	Depth (m)	AUGERHOLE: BGC05-2377BER-AH02 10 m Downslope FINAL DEPTH OF AUGERHOLE: 2.40 m THICKNESS OF LOOSE MATERIALS: 2.35 m Lithologic Description	Depth To Water Table
-0.0	SILT (ML) Organic, non plastic, very loose, dark brown, moist, homogeneous [TOPSOIL]		0.0 - - -	SILT (ML) Gravel sized angular glaciomarine silt clasts, non plastic, soft / loose, light grey, wet, homogeneous [FILL]	
1.0	SILT (ML) Gravelly, fine to coarse gravel, fine to coarse sand, trace clay, non plastic, soft, dark brown to brown, moist, homogeneous, trace organics [FILL] 1.15 m: EOH - Refusal of auger on gravel.		- - 0.5 - - - - - 1.0	O.40 m: Wood organics SILT (ML) Trace fine to medium sand, trace rounded fine gravel, non plastic, firm to stiff, light grey with orange brown mottling, trace organics [FILL] O.90 m: Dark brown lense of organics, some sand. Some fine gravel and decomposed organics, becomes red brown to dark brown. SILT (ML) Some fine to medium gravel, trace fine to coarse sand, gravel sized clasts of silt, non plastic, soft, red-orange brown, trace	
1.5			- - 1.5 - -	dark brown organics, wet, homogeneous, charcoal, roots [FILL] SILT (ML) Some fine to corse sand, trace fine to medium gravel, gravel sized silt clasts, low plastic, very soft, red brown, wet, homogeneous, roots [COLLUVIUM]	
2.0			- 2.0 - - - - 2.5 -	SILT (ML) Some fine sand, trace coarse sand, non plastic, stiff, homogeneous [Weathered GLACIOMARINE] 2.40 m: EOH - Refusal on dense sediments	
3.0			- - - 3.0		

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Vancouver, BC Phone: (604) 684 5900

DNV Landslide Risk Assessment

2391 Berkley Avenue

INSPECTION DATE: (mm/dd/yy)

11/10/05

WEATHER:

LOCATION:

Raining, heavy rain for several days

prior to visit.



BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COM PANY

500 - 1045 Howe Street Vancouver, BC Canada V6Z 2A9

THICKNESS OF LOOSE MATERIALS	<1 m	1-2 m	2-3 m	>3 m
CREST LINE		K		
10 m DOWNSLOPE FROM SLOPE CREST	✓			

		SLOPE = 42°		
SLOPE BELOW FENCE/ RETAINING STRUCTURE	CRACKS	SLIDES	EROSION	
	V	V	<u> </u>	
OBSERVATIONS: Surface water causing erosion and over-steepening in areas. Site of Jan. 1999 landslide. Evidence of slumping and				

OBSERVATIONS: Surface water causing erosion and over-steepening in areas. Site of Jan. 1999 landslide. Evidence of slumping and tension cracks at north end of crest.

TREES BELOW FENCE/ RETAINING STRUCTURE		STRAIGHT	PISTOL-BUTT	LEANING	
PERCENT CONIFER: 10%		✓			
OBSERVATIONS: Mostly small deciduous trees. No conifers in area immediately below crest.					

RETAINING STRU	CTURES	YES 🗹	NO	HEIGHT= 0.2 m
TYPE	BLOCKS	CONCRETE	TIMBER CRIB	OTHER: Rebar & small branches
				R
DEFORMATION	UNDEFORMED	CRACKED	SETTLED	BULGING
			V	Ø

OBSERVATIONS: Many small retaining structures present throughout slope. All structures made of rebar and 1" diameter branches.

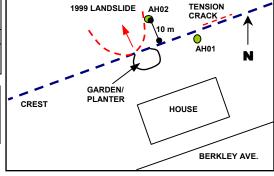
DEFORMATION IN BACKYARD	YES 🗹 NO					
LOCATION: Backyard						
DESCRIPTION: 40 cm high concrete and rock planter is cracked.						
POOLS	YES	ΝΟ☑				

POOLS YES NO ☑

DESCRIPTION: None observed

SEEPAGE/ SPRINGS IN OR BELOW FILL	YES 🗹	NO
OBSERVATIONS: Considerable seepage evid	dent at slope infled	ction point 10

m down slope from crest and below.



HOUSE DISTANCE TO CREST = 15.0 m

RECEIVES SURFACE RUNOFF FROM	BACKYARD	½ ROOF	FULL ROOF	FRONT YARD	STREET
RECEIVES SURFACE RUNOFF FROM	✓	K	K	K	K
OBSERVATIONS: Driveway slopes towards house					

CONNECTED TO STORM SEWER	YES	ио⊻	UNSURE
OWNERS COMMENTS: DNV reports that this property is not connected to sto	orm sewer.		

- Site of January 1999 slide
- A large 12' diameter rock and concrete planter (previously a complete circle) is now 2/3 of a circle. Planter is broken at crest of slope



Figure 1. 2391 Berkley Avenue – Front of the house



Figure 2. 2391 Berkley Avenue – Ponding of water from seepage



Figure 3. 2391 Berkley Avenue – Close up of rebar and stick retaining structure



Figure 4. 2391 Berkley Avenue – Retaining wall/fence line and small retaining structures made of rebar and small sticks



Figure 5. 2391 Berkley Avenue – View looking south of backyard

INSPECTION LOCATION # 2391 Berkley

Page 1 of 1

Project : DNV Landslide Risk AssessmentProject No. : 0404-002-01

Location: 2391 Berkley
Drill Method: Dutch Hand Auger
Inspection Date: 10 Nov 05

Logged by: MB/ES **Reviewed by**: MJP

	•				
(m)	AUGERHOLE: BGC05-2391BER-AH01 on Slope Crest FINAL DEPTH OF AUGERHOLE: 1.90 m THICKNESS OF LOOSE MATERIALS: 1.70 m	ater Table	(m)	AUGERHOLE: BGC05-2391BER-AH02 10 m Downslope FINAL DEPTH OF AUGERHOLE: 0.50 m THICKNESS OF LOOSE MATERIALS: 0.50 m minimum	iter Table
Depth (m)	Lithologic Description	Depth To Water Table	Depth (m)	Lithologic Description	◆Depth To Water Table
0.0 - - - -	SAND (SM) Fine sand, silty, poorly graded, loose, dark brown, no odour, moist, homogeneous, no cementation, trace rootlets [TOPSOIL]		0.0 - - -	SILT (ML) and SAND (SW) Fine to coarse sand, some fine to medium gravel, some cobbles, low plastic, soft, brown to grey, no odour, wet, homogeneous, no cementation, trace rootlets [COLLUVIUM]	
- 0.5 - -	SILT (ML) and SAND (SP) Mainly fine to medium sand, fine to medium gravel sized clasts of silt, low plastic, soft, grey and brown with some orange mottling, no odour, moist, homogeneous, no cementation, trace rootlets [FILL] ORGANIC LAYER - charcoal		- 0.5 - - -	0.50 m: EOH - Refusal on cobbles, five holes attempted with little or no recovery	
- - 1.0 - - -	SAND (SM) Fine to coarse sand, silty, well graded, loose, fine gravel sized clasts of silt, sub-rounded, brown, no odour, moist, homogeneous, no cementation [FILL/ COLLUVIUM]	J	- - 1.0 - - -		
- - 1.5 - -	SAND (SM) Fine to medium sand, silty, poorly graded, loose, fine to coarse gravel sized clasts of silt, sub-rounded, brown, no odour, moist, homogeneous, no cementation [COLLUVIUM] SILT (ML)		_ - 1.5 - -		
- - - 2.0 -	Some fine sand, trace clay, low plastic, stiff, grey with orange mottling, no odour, moist, homogeneous, no cementation, non dilatent [Weathered GLACIOMARINE] 1.90 m: EOH - Refusal as material is too stiff to auger through		- - - 2.0 -		
- - - - 2.5	No groundwater encountered		- - - - 2.5		
- -			_ _ _ _		
- - 3.0			- 3.0		

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DNV Landslide Risk Assessment

LOCATION: 2409 Berkley Avenue

INSPECTION DATE: (mm/dd/yy)

11/10/05

WEATHER:

Raining, heavy rain for several days

prior to visit.



BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COM PANY

500 - 1045 Howe Street Vancouver, BC Canada V6Z 2A9

THICKNESS OF LOOSE MATERIALS	<1 m	1-2 m	2-3 m	>3 m
CREST LINE		K		
15 m DOWNSLOPE FROM SLOPE CREST				✓

	SLOPE = 22° from crest to 15m down slope, 37° below 15m			
SLOPE BELOW FENCE/ RETAINING STRUCTURE	CRACKS	SLIDES	EROSION	
	✓			
OBSERVATIONS: Evidence of slumping just below crest.				

TREES BELOW FENCE/ R	ETAINING STRUCTURE	STRAIGHT	PISTOL-BUTT	LEANING	
PERCENT CONIFER:	30-50%	✓		∨	
OBSERVATIONS: Mostly straight, some leaning deciduous trees.					

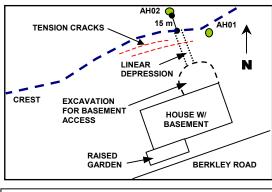
RETAINING STRUCTURES		YES	NO ☑	HEIGHT= n/a
TYPE	BLOCKS	CONCRETE	TIMBER CRIB	OTHER:
DEFORMATION	UNDEFORMED	CRACKED	SETTLED	BULGING

OBSERVATIONS: None observed.

DEFORMATION IN BACKYARD	YES 🗹	NO			
LOCATION: backyard					
DESCRIPTION: Minor differential settlement. Small linear depression runs from basement garden stairs to crest.					
2001.0	\/ T 0	[7]			
POOLS	YES	ио 🗹			

POOLS	YES	ΝΟ☑
DESCRIPTION: None observed		

SEEPAGE/ SPRINGS IN OR BELOW FILL	YES	NO ☑
OBSERVATIONS: None observed.	•	



HOUSE DISTANCE TO CREST = 20.0 m

RECEIVES SURFACE RUNOFF FROM	BACKYARD	½ ROOF	FULL ROOF	FRONT YARD	STREET
RECEIVES SURFACE RUNOFF FROM	✓	✓	✓	✓	✓
OBSERVATIONS:					

CONNECTED TO STORM SEWER	YES	NO☑	UNSURE			
OWNERS COMMENTS: DNV reports that this property is not connected to storm sewer.						

- Large area excavated for basement access. Timber crib retaining walls and block walls hold up backyard around the access. Lowest part of excavation is 3 m lower than backyard level.
- Slump blocks found just below crest

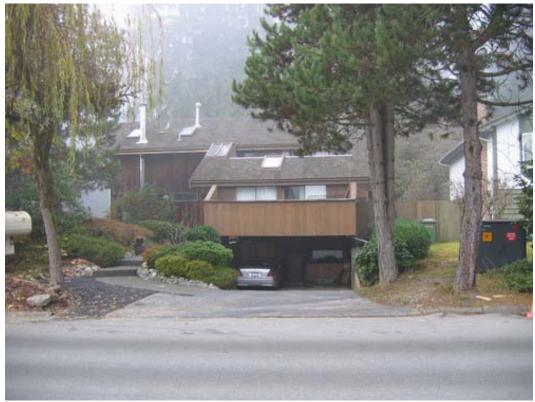


Figure 1. 2409 Berkley Avenue – Front of the house



Figure 2. 2409 Berkley Avenue – View looking north along crest



Figure 3. 2409 Berkley Avenue – View of backyard



Figure 4. 2409 Berkley Avenue – View down-slope from crest

INSPECTION LOCATION # 2409 Berkley

Page 1 of 2

Project : DNV Landslide Risk AssessmentProject No. : 0404-002-01

Location: 2409 Berkley **Drill Method**: Dutch Hand Auger **Inspection Date**: 10 Nov 05

Logged by: SF/JB **Reviewed by**: MJP

	AUGERHOLE: BGC05-2409BER-AH01 on Slope Crest FINAL DEPTH OF AUGERHOLE: 1.30 m THICKNESS OF LOOSE MATERIALS: 1.25 m	able		AUGERHOLE: BGC05-2409BER-AH02 15 m Downslope FINAL DEPTH OF AUGERHOLE: 3.25 m THICKNESS OF LOOSE MATERIALS: 3.25 m minimum	
	Lithologic Description	Depth To Water Table	Depth (m)	Lithologic Description	
		Depth 1			
)	ORGANICS and SILT (ML) Trace fine to medium gravel, non plastic, very loose, dark brown, moist [TOPSOIL] SILT (ML)		0.0 - -	SILT (ML) Trace fine gravel, low plastic, firm to stiff, light grey with trace orange mottling, no odour, homogeneous, non dilatant, trace charcoal, trace organics [FILL]	
	Trace fine to coarse sand, trace fine to medium gravel, non plastic, very loose, max particle size = 20 mm, sub-rounded, roots, some charcoal [FILL]		_ - 0.5		
	SILT (ML) Trace fine to coarse sand, trace clay, some gravel sized silt clasts, low plastic, soft to firm, light yellow to grey, moist, homogeneous, non dilatant, roots [FILL]	L	- - -		
)	0.80 m:1. Some orange brown mottling evident.2. Material is moist to wet		- - 1.0 -		
	SILT (ML) Trace clay, low plastic, stiff, light grey, moist, homogeneous [Weathered GLACIOMARINE] 1.30 m: EOH - Refusal - Material too stiff to auger through		- - -		
	1.50 m. Eom - Relasar - Material too sun to auger unough		- 1.5 - -		
			- - - 2.0		
			- - -	SILT (ML) Some to trace clay, low plastic, very soft, dark grey and brown, no odour, moist, homogeneous, slow dilatancy [FILL or COLLUVIUM]	
			- - 2.5		
			- -		
			_ - 3.0		

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INSPECTION LOCATION # 2409 Berkley

Page 2 of 2

Project : DNV Landslide Risk Assessment Project No. : 0404-002-01

Location: 2409 Berkley **Drill Method**: Dutch Hand Auger **Inspection Date**: 10 Nov 05

AN APPLIED EARTH SCIENCES COMPANY

Phone: (604) 684 5900

Vancouver, BC

Logged by: SF/JB **Reviewed by**: MJP

Nevi	lewed by . MJF				
Depth (m)	AUGERHOLE: BGC05-2409BER-AH01 on Slope Crest FINAL DEPTH OF AUGERHOLE: 1.30 m THICKNESS OF LOOSE MATERIALS: 1.25 m Lithologic Description	Depth To Water Table	Depth (m)	AUGERHOLE: BGC05-2409BER-AH02 15 m Downslope FINAL DEPTH OF AUGERHOLE: 3.25 m THICKNESS OF LOOSE MATERIALS: 3.25 m minimum Lithologic Description	Depth To Water Table
- - - 3.5			- - - 3.5 - -	3.25 m: EOH - Extent of auger	-
- - 4.0 - - -			- - 4.0 - - -		
- 4.5 - - - - 5.0			- 4.5 - - - - 5.0		
- - - - 5.5			_ _ _ _ _ 5.5		
- - - 6.0			- - - - 6.0		
	BGC ENGINEERING INC.			Client: District of North Vancouver	

DNV Landslide Risk Assessment

2425 Berkley Avenue

LOCATION: INSPECTION DATE: (mm/dd/yy)

11/10/05

WEATHER:

Raining, heavy rain for several days

prior to visit.



BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY

500 - 1045 Howe Street Vancouver, BC Canada V6Z 2A9

THICKNESS OF LOOSE MATERIALS	<1 m	1-2 m	2-3 m	>3 m
CREST LINE		K		
10 m DOWNSLOPE FROM SLOPE CREST	✓			

		SLOPE = 23°	
SLOPE BELOW FENCE/ RETAINING STRUCTURE	CRACKS	SLIDES	EROSION
		<u> </u>	✓
OBSERVATIONS: Site of previous landslide. Erosion around the bases of s	some fallen (uprooted)	trees.	

TREES BELOW FENCE/ RETAINING STRUCTURE		STRAIGHT	PISTOL-BUTT	LEANING	
PERCENT CONIFER:	20%	✓			
OBSERVATIONS: Most standing trees are straight; many trees have been topped or fallen.					

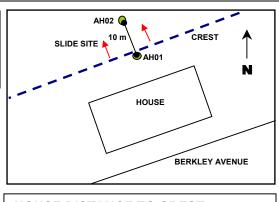
RETAINING STRUCTURES		YES	NO ☑	HEIGHT= n/a
TYPE	BLOCKS	CONCRETE	TIMBER CRIB	OTHER:
DEFORMATION	UNDEFORMED	CRACKED	SETTLED	BULGING

OBSERVATIONS: None observed.

LOCATION: Northwest corner of yard at crest.					
DESCRIPTION: Shed is bending due to settlement.					
_					

POOLS	YES	ио ☑
DESCRIPTION: None observed.		

SEEPAGE/ SPRINGS IN OR BELOW FILL	YES	NO ☑
OBSERVATIONS: None observed.	•	



HOUSE DISTANCE T	O CREST = 21.5 m
------------------	-------------------------

RECEIVES SURFACE RUNOFF FROM	BACKYARD	½ ROOF	FULL ROOF	FRONT YARD	STREET			
	✓	K	K					
OBSERVATIONS: Front yard dips towards street. Backyard dips slightly towards house and street.								

CONNECTED TO STORM SEWER	YES	ио⊻	UNSURE			
OWNERS COMMENTS: DNV reports that this property is not connected to storm sewer.						

- Site of previous landslide: some over-steepened scarps, many toppled trees
- Deck distance to crest is 17.0 m.
- Drainage of lawn may have been attempted; few corrugated pipes exposed, destination of pipes undetermined
- Eroded gully located at southwest side of property at top of slope



Figure 1. 2425 Berkley Avenue – Front of the house



Figure 2. 2425 Berkley Avenue – View looking south along fence



Figure 3. 2425 Berkley Avenue – View looking north along fence



Figure 4. 2425 Berkley Avenue – Shed settling on west side

INSPECTION LOCATION # 2425 Berkley

Page 1 of 1

Project : DNV Landslide Risk Assessment Project No. : 0404-002-01

Location: 2425 Berkley

Drill Method: Dutch Hand Auger
Inspection Date: 10 Nov 05

Logged by: MB/ES **Reviewed by**: MJP

Depth (m)	AUGERHOLE: BGC05-2425BER-AH01 on Slope Crest FINAL DEPTH OF AUGERHOLE: 1.70 m THICKNESS OF LOOSE MATERIALS: 1.60 m Lithologic Description	Depth To Water Table	Depth (m)	AUGERHOLE: BGC05-2425BER-AH02 10 m Downslope FINAL DEPTH OF AUGERHOLE: 0.70 m THICKNESS OF LOOSE MATERIALS: 0.70 m minimum Lithologic Description	Depth To Water Table
		De			De
0.0	SILT (ML) Sandy, fine sand, non plastic, very soft to soft, dark brown, no odour, dry to moist, homogeneous, no cementation, non dilatent, organic rich wood debris and charcoal, some rootlets [TOPSOIL] SAND (SM) Fine to medium sand, silty, trace fine gravel, trace clay, loose, poorly graded, max particle size = 3 mm, sub-rounded, brown with orange mottling, no odour, dry to moist, homogeneous, no cementation [FILL] SILT (ML) Sandy, fine to medium, low plastic, soft to firm, stiff in places, grey to light brown with orange mottling, no odour, dry to moist, homogeneous, no cementation, non dilatent [FILL] 1.0 m: Layer of charcoal and organics Material is soft, contains rotten wood and organics		0.0 - - - 0.5 - - - 1.0	SILT (ML) Sandy, fine, non plastic, very soft to soft, dark brown, moist, odourless, homogeneous, no cementation, non dilatent, organic, trace rootlets [TOPSOIL] SILT (ML) Sandy, fine to coarse, trace fine gravel, trace cobbles, non plastic, soft, brown, moist, no odour, homogeneous, no cementation, non dilatent, fine gravel sized silt clasts [COLLUVIUM] 0.70 m: EOH - Refusal on cobbles Five holes attempted	
- 1.5 - - -	SAND (SP) Fine sand, silty, trace fine gravel, compact to dense, poorly graded, max particle size = 3 mm, grey to light brown with orange mottling, no odour, moist, homogeneous, no cementation [Weathered GLACIOMARINE]		- 1.5 - - -		
- 2.0 - - -	1.70 m - EOH Refusal on compact material No groundwater encountered		- 2.0 - - -		
- 2.5 - - - - - 3.0			- 2.5 - - - - 3.0		
0.0					<u> </u>

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