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2 December, 2013
Ref: 725

The Briars at Greenlees Pty Ltd
c/- Figgis & Jefferson Architects
220 Willoughby Rd
Crows Nest NSW 2065

Attention: Stephen Figgis

Dear Stephen,

Re: Geotechnical Site Suitability Assessments
Proposed Community Facility & Amenities Builiding
Rothwell Park,
Concord NSW

This report presents the results of a Geotechnical and Site Suitability Assessment completed as part of the DA requirements for the project. The work was commissioned by Stephen Figgis on behalf of The Briars at Greenlees Pty Ltd.

This report describes the field and laboratory testing procedures and presents comments and recommendations on geotechnical and ground contamination issues relating to development of the site.

Investigation Procedures

The fieldwork for the investigation was limited to hand augering in view of the presently restricted drillrig access. The boreholes were located as shown on the attached Figure 1. Representative soil samples were recovered for laboratory testing to assess the possibility of any ground contamination.

All the boreholes were terminated upon refusal being met on either ironstone gravel bands or hard clayey soils.

Investigation Findings

Geotechnical

The field investigation disclosed the site to be underlain by a relativelty shallow cover of topsoil and clayey fill, and thereafter residual soils of moderate to high reactivity with changes in soil suction. The thickness of superficial topsoil/ fill cover ranged from approximately 0.15 to 0.4metres.

Ironstone gravel bands were a characteristic feature, particularly at depth, within the silty clay stratum.

Potential Ground Contamination

A slightly elevated Benzo(a) pyreme reading was detected in the topsoil sample recovered from BH1. As a regulatory requirement, further sampling and testing may be required and this is discussed in the attached Geotest Services Site Suitability Assessment report included in Appendix A.

Comments and Recommendations

Geotechnical Issues

It is understood that the proposed C F & A building will be of two storey concrete and steel frame construction, sited predominantly in hillside or embankment cut: the depth of cut is estimated to be between approximately 2.5 to 3.5 metres.

No significant geotechnical problems are anticipated at this site.

The specific recommendations are detailed as follows:

- Excavation: No significant problems are envisaged in the excavation to depths of 3 to 4 metres using a conventional track-mounted excavator .

- Excavation Cuts: Vertical unsupported excavation faces may be used for excavation heights of up to 2.5m. For greater depths of cut, batter slopes of 1H:3V are recommended.

- Earth Pressure on Basement Walls: The basement walls should be designed using an earth pressure coefficient of 0.4. All basement walls should be provided with permanent and effective backwall drainage.

- Building Foundations: The building may be supported on either a concrete raft, or pad or strip footings, founded within the natural very sitff to hard silty clays using an allowable bearing pressure of up to 400 kPa. The footing should be provided with a minimum embedment of 600m below final outside ground surface, from soil shrink/swell considerations. This design requirement may be reviewed upon finalisation of BEL's for the building.

Site Suitability Issues

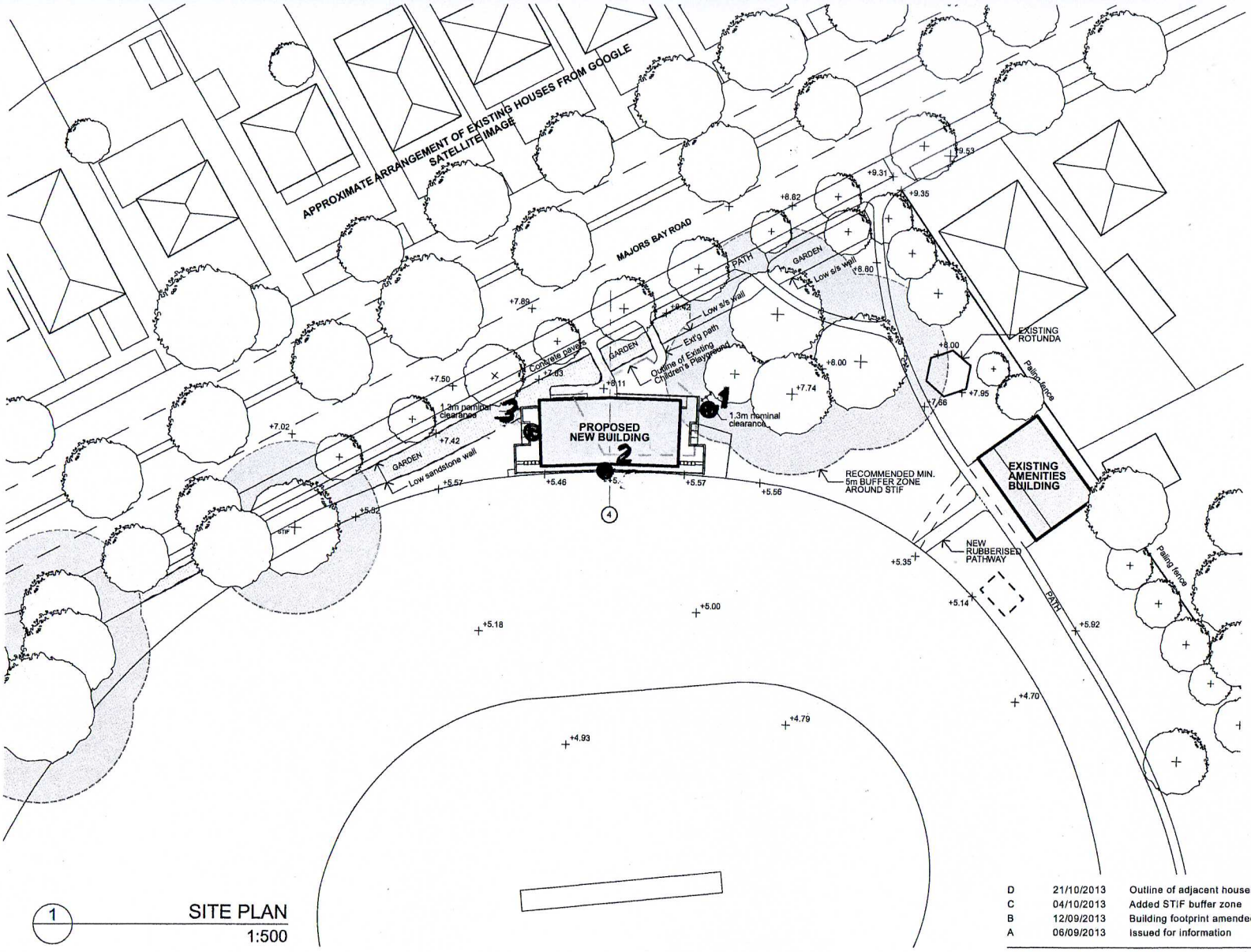
Reference should be made to the attached Site Suitability Assessment report included as Appendix A, herein.

If you have any queries regarding the above, please do not hesitate to call me,

Regards,

Don Katauskas

encl: Figure 1 – Site Plan and Test Locations
Borehole Logs 1 to 3
Explanatory Notes
Appendix A: Geotest Services Site Suitability Assessment Report



1 SITE PLAN
1:500

D	21/10/2013	Outline of adjacent houses added
C	04/10/2013	Added STIF buffer zone
B	12/09/2013	Building footprint amended
A	06/09/2013	Issued for information

ISSUE: DATE: DESCRIPTION:

PROJECT: COMMUNITY FACILITY AND AMENITIES BUILDING

FOR: BRIARS SPORTING CLUB

AT: ROTHWELL PARK, CONCORD, NSW

DRAWING TITLE: SITE PLAN

PROJECT NORTH / TRUE NORTH

ARCHITECT: SF | DRAWN: GG | LAST PRINTED: 18/10/2013

DRAWING NO.: 3391 SKA 100 | ISSUE: D

SCALE: 5 10 15 20 25 30 35 40 45 50 SCALE (m)

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ACN 002 825 105 NSW Architects Registration Board Nominated Architect Stephen Figgis 3255

D. Katauskas Geotechnical Consultant
Client: Figgis & Jefferson Architects
Proposed Community Facility & Amenities Building
Rothwell Park, Concord NSW
Site Plan & Test Locations

JOB NO. 725
FIGURE NO: 1

LEGEND: • Test Location
SCALE: As shown

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BH3

Borehole Log

Client: **Richard Crookes Constructions**
Project: **Proposed Community Facility & Amenities Building**
Location: **Rothwell Park, Concord NSW**

Sheet 1 of 1
Project No: **725**
Logged by: **DK**
Reviewed by: **DK**
Date started: **21.11.2013**
Date completed: **21.11.2013**

Drill model and Mounting: Hand Auger
Hole Diameter: 70 mm
Easting:
Northing
Datum: AHD
Slope: -90°
Bearing:
Elevation: 7.2 m approx

Information								Material					
Method	Drill Penetration 1 2 3	Hole Support	Water	Samples & Tests	RL	Depth (m)	Graphic Log	USCS	Material In general order: type - plasticity or particle characteristics, colour, secondary and minor components.	Moisture Level / Weathering	Density / Consistency	pocket penetro-meter kPa 100 200 300 400	Additional Observations
HA			DRY						Topsoil; Silty Clay, grey	M			
				E				SL	Clayey Sand; grey	M			
									grading to -				
						0.5		CH	Silty CLAY; high plasticity, orange brown with some ironstone bands	M<PL	VSt to H		
						1.0							
						1.5			Borehole BH3 terminated at 1.4m				Hand Auger Refusal
						2.0							
						2.5							
						3.0							

Method
AS Auger Screwing
AD Auger Drilling
CT Cable tool
DT Diatube
RR Roller/Tricone
Attachment -
B
T Blank bit
V TC bit
V bit

Support
M Drilling Mud
C Drill casing
Water
SWL
water inflow
water outflow
Drill Penetration
1 Minimal resistance
2
3
4 Refusal

Samples, Tests
Bs Bulk Test Sample
D Disturbed Sample
N Standard Penetration Test (SPT)
N=R (sample not recovered)
N* SPT - sample recovered
Nc SPT with solid cone
U_{50} Undisturbed sample 50mm diameter
U_{63} Undisturbed sample 63mm diameter
Vs Vane Shear measured in (kPa)

USCS
Classification Symbols and description are all based on the Unified Classification System

Moisture Condition
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

Density / Consistency
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

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BH1

Borehole Log

Client: **Richard Crookes Constructions**

Project: **Proposed Community Facility & Amenities Building**

Location: **Rothwell Park, Concord NSW**

Sheet 1 of 1
Project No: **725**
Logged by: **DK**
Reviewed by: **DK**
Date started: **21.11.2013**
Date completed: **21.11.2013**

Drill model and Mounting: Hand Auger
Hole Diameter: 70 mm
Easting:
Northing
Datum: AHD
Slope: -90°
Bearing:
Elevation: 7.6 m approx

Information								Material					
Method	Drill Penetration 1 2 3	Hole Support	Water	Samples & Tests	RL	Depth (m)	Graphic Log	USCS	Material In general order: type - plasticity or particle characteristics, colour, secondary and minor components.	Moisture Level / Weathering	Density / Consistency	pocket penetro-meter kPa 100 200 300 400	Additional Observations
HA			DRY	E		0.5			Topsoil; Silty Clay & Sand, grey, some gravels				
								CH	Silty CLAY; high plasticity, orange brown	M<PL	VSt		
						1.0		CH	As above but mottled, light brown and grey, some ironstone gravels	M<PL	H		
						1.5			Borehole BH1 terminated at 1.5m				Hand Auger Refusal
						2.0							
						2.5							
						3.0							

Method
AS Auger Screwing
AD Auger Drilling
CT Cable tool
DT Diatube
RR Roller/Tricone
Attachment -
B
T Blank bit
V TC bit
V bit

Support
M Drilling Mud
C Drill casing
Water
SWL
water inflow
water outflow
Drill Penetration
1 Minimal resistance
2
3
4 Refusal

Samples, Tests
Bs Bulk Test Sample
D Disturbed Sample
N Standard Penetration Test (SPT) N=R (sample not recovered)
N* SPT - sample recovered
Nc SPT with solid cone
U_{50} Undisturbed sample 50mm diameter
U_{63} Undisturbed sample 63mm diameter
Vs Vane Shear measured in (kPa)

USCS
Classification Symbols and description are all based on the Unified Classification System

Moisture Condition
D dry
M moist
W wet
Wp plastic limit
W_L liquid limit

Density / Consistency
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

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BH2

Borehole Log

Client: **Richard Crookes Constructions**
Project: **Proposed Community Facility & Amenities Building**
Location: **Rothwell Park, Concord NSW**

Sheet 1 of 1
Project No: **725**
Logged by: **DK**
Reviewed by: **DK**
Date started: **21.11.2013**
Date completed: **21.11.2013**

Drill model and Mounting: Hand Auger
Hole Diameter: 70 mm
Easting:
Northing
Datum: AHD
Slope: -90°
Bearing:
Elevation: 5.6 m approx

Information								Material					
Method	Drill Penetration 1 2 3	Hole Support	Water	Samples & Tests	RL	Depth (m)	Graphic Log	USCS	Material In general order: type - plasticity or particle characteristics, colour, secondary and minor components.	Moisture Level / Weathering	Density / Consistency	pocket penetro-meter kPa 100 200 300 400	Additional Observations
HA			DRY	E		0.5			Topsoil over Fill; Silty Clay, grey with some gravels	M>=PL			
								CH	Silty CLAY; medium to high plasticity, mottled orange brown then brown and grey	M>=PL	St to VSt		
						1.0		CH	As above, light grey	M<PL	H		
						1.5			Borehole BH2 terminated at 1.4m				Hand Auger Refusal
						2.0							
						2.5							
						3.0							

Method
AS Auger Screwing
AD Auger Drilling
CT Cable tool
DT Diatube
RR Roller/Tricone
Attachment -
B
T Blank bit
V TC bit
V bit

Support
M Drilling Mud
C Drill casing
Water
SWL
water inflow
water outflow
Drill Penetration
1 Minimal resistance
2
3
4 Refusal

Samples, Tests
Bs Bulk Test Sample
D Disturbed Sample
N Standard Penetration Test (SPT)
N=R (sample not recovered)
N* SPT - sample recovered
Nc SPT with solid cone
U_{50} Undisturbed sample 50mm diameter
U_{63} Undisturbed sample 63mm diameter
Vs Vane Shear measured in (kPa)

USCS
Classification Symbols and description are all based on the Unified Classification System

Moisture Condition
D dry
M moist
W wet
Wp plastic limit
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Density / Consistency
VS very soft
S soft
F firm
St stiff
VSt very stiff
H hard
Fb friable
VL very loose
L loose
MD medium dense
D dense
VD very dense

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LOG SYMBOLS

LOG COLUMN	SYMBOL	DEFINITION
Groundwater Record	▼	Standing water level. Time delay following completion of drilling may be shown.
	►	Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	ES	Soil sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated
	DS	Small disturbed bag sample taken over depth indicated.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'R' noted below
	N_c = 5 . 7 . 3R	Dynamic Cone Penetration Test performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60 degree solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of Undrained Shear Strength
	PID = 100	Photoionization detector reading in ppm (Soil sample headspace test)
Moisture Condition (Cohesive Soils)	MC > PL	Moisture content estimated to be greater than plastic limit.
	MC = PL	Moisture content estimated to be approximately equal to plastic limit.
	MC < PL	Moisture content estimated to be less than plastic limit.
(Cohesionless Soils)	D	DRY - runs freely through fingers
	M	MOIST - does not run freely but no free water visible on soil surface
	W	WET - free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS	VERY SOFT - Unconfined compressive strength less than 25 kPa.
	S	SOFT - Unconfined compressive strength 25 – 50 kPa.
	F	FIRM - Unconfined compressive strength 50 – 100 kPa
	St	STIFF - Unconfined compressive strength 100 – 200 kPa
	VSt	VERY STIFF - Unconfined compressive strength 200 – 400 kPa
	H	HARD - Unconfined compressive strength greater than 400 kPa.
	( )	Bracketted symbol indicates estimated consistency based on tactile examination or other tests.

Density Index/ Relative density (Cohesionless Soils)		Density Index (I_D)	Range (%)	SPT 'N' Value range (Blows/ 300mm)
	VL	Very loose	<15	0 – 4
	L	Loose	15 – 35	4 – 10
	MD	Medium Dense	35 – 65	10 – 30
	D	Dense	65 – 85	30 – 50
	VD	Very Dense	>85	>50
	( )	Bracketted symbol indicates estimated density based on ease of drilling or other tests		

Hand Penetrometer Readings	300 250	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' bit
	'TC' bit	Tungsten carbide wing bit
	T 60	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.

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GRAPHIC LOG SYMBOLS FOR SOILS AND ROCKS

SOIL


FILL


TOPSOIL


CLAY (CL, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CH)


SILTY CLAY (CL, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML)


PEAT AND ORGANIC SOILS

ROCK


CONGLOMERATE


SANDSTONE


SHALE


SILTSTONE, MUDSTONE, CLAYSTONE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

DEFECTS AND INCLUSIONS


CLAY SEAM


SHEARED OR CRUSHED SEAM


BRECCIATED OR SHATTERED SEAM/ZONE


IRONSTONE GRAVEL


ORGANIC MATERIAL

OTHER MATERIALS


CONCRETE


BITUMINOUS CONCRETE, COAL


COLLUVIUM

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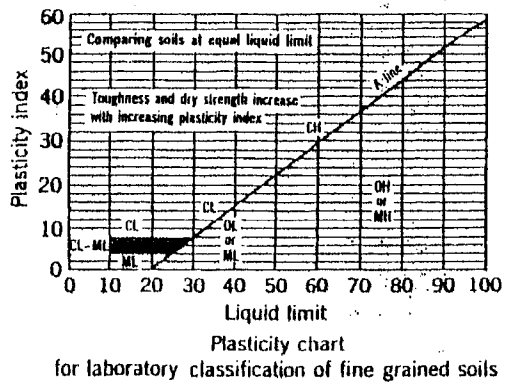
UNIFIED SOIL CLASSIFICATION TABLE

Field Identification Procedures (Excluding particles larger than 75 μm and basing fractions on estimated weights)						Group Symbols[a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria
Coarse-grained soils: More than half of material is *larger* than 75 μm sieve size[b] (The 75 μm sieve size is about the smallest particle visible to naked eye)	Gravels: More than half of coarse fraction is larger than 4 mm sieve size	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles 12 mm maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (*SM*)	Use grain size curve in identifying the fractions as given under field identification Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5%: *GW, GP, SW, SP* More than 12%: *GM, GC, SM, SC* 5% to 12%: *Borderline* cases requiring use of dual symbols
			Predominantly one size or a range of sizes with some intermediate sizes missing			*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines		
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)			*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures		
			Plastic fines (for identification procedures, see *CL* below)			*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures		
	Sands: More than half of coarse fraction is smaller than 4 mm sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes			*SW*	Well graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for *GW* Atterberg limits below "A" line, or *PI* less than 4 Atterberg limits above "A" line, with *PI* greater than 7 Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Predominantly one size or a range of sizes with some intermediate sizes missing			*SP*	Poorly graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for *SW* Atterberg limits below "A" line or *PI* less than 5 Atterberg limits above "A" line with *PI* greater than 7 Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)			*SM*	Silty sands, poorly graded sand-silt mixtures		
			Plastic fines (for identification procedures, see *CL* below)			*SC*	Clayey sands, poorly graded sand-clay mixtures		
Fine-grained soils: More than half of material is *smaller* than 75 μm sieve size (The 75 μm sieve size is about the smallest particle visible to naked eye)	Identification Procedures on Fraction Smaller than 380 μm Sieve Size:		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)				
	Silts and clays: liquid limit less than 50		None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)	
			Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity		
	Silts and clays: liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays		
			Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity		
Highly Organic Soils			Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils		



Plasticity chart
for laboratory classification of fine grained soils

NOTE: 1) Soils possessing characteristics of two groups are designated by combinations of group symbols (e.g. GW-GC, well graded gravel-sand mixture with clay fines).

2) Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity.