



Whitehead & Associates

Environmental Consultants

197 Main Road Cardiff NSW 2285 Australia

Telephone +61 2 4954 4996 Facsimile +61 2 4954 4996

Email mail@whiteheadenvironmental.com.au

Preliminary Salinity Risk Assessment for 53 Dwyer Road, Bringelly NSW

Prepared for	Sasanadhaja Buddhist Association Inc.
Prepared by	Jasmin Kable Whitehead & Associates Environmental Consultants Pty Ltd 197 Main Road CARDIFF NSW 2285
Telephone:	02 4954 4996
Fax:	02 4954 4996
email:	jasminkable@whiteheadenvironmental.com.au

Document Control Sheet

Document and Project Details					
Document Title:	Preliminary Salinity Risk Assessment for 53 Dwyer Road, Bringelly NSW				
Author:	Jasmin Kable				
Project Manager:	Mark Saunders				
Date of Issue:	04/09/17				
Job Reference:	1816_Preliminary Salinity Assessment_002				
Synopsis:	This document presents the results of a preliminary 'soil salinity' risk assessment for the proposed development at 53 Dwyer Road, Bringelly NSW.				
Client Details					
Client:	Sasanadhaja Buddhist Association Inc.				
Document Distribution					
Version Number	Date	Status	DISTRIBUTION – NUMBER OF COPIES (p – print copy; e – electronic copy)		
			Client	Other	Other
001	31/08/17	Draft	1e	-	-
002	04/09/17	Final	1e	-	-
Document Verification					
Checked by: Mark Saunders			Issued by: Jasmin Kable		

Disclaimer

The information contained in this report is based on independent research undertaken by Jasmin Kable of Whitehead & Associates Environmental Consultants Pty Ltd (W&A). To our knowledge, it does not contain any false, misleading or incomplete information. Recommendations are based on an appraisal of the site conditions subject to the limited scope and resources available for this project, and follow relevant industry standards. The work performed by W&A included a desktop review and limited soil sampling only, and the conclusions made in this report are based on the information gained and the assumptions as outlined. Under no circumstances, can it be considered that these results represent the actual state of the site at all points, as subsurface conditions are inherently variable. Concentrations of contaminants may also change with time, and the conclusions in this report have a limited lifespan.

Copyright Note

© Whitehead & Associates Environmental Consultants Pty Ltd, 2017

This report and accompanying plans were prepared for the exclusive use of Sasanadhaja Buddhist Association Inc. (the "Client") and authorised representatives. No extract of text of this document may be reproduced, stored or transmitted in any form without the prior consent of Whitehead & Associates Pty Ltd. Plans accompanying this document may not be reproduced, stored or transmitted in any form unless this copyright note is included.

Table of Contents

1	Introduction	4
2	Scope of Works	4
3	Information Review	4
3.1	Regional Geology	4
3.2	Regional Soil Landscape	4
3.3	Regional Hydrology	5
3.4	Historical Aerial Imagery	6
3.5	Site and Soil Assessment	6
4	Assessment Criteria	6
5	Conclusions and Recommendations	8
6	References (Cited and Used)	9
Appendix A	10
Appendix B	13
Appendix C	17
Appendix D	19
Appendix E	25
Appendix F	27

1 Introduction

Whitehead & Associates Environmental Consultants Pty Ltd (“W&A”) were engaged by Edmund Lui from VT Architects on behalf of Sasanadhaja Buddhist Association Inc. (“the Client”) to prepare a Preliminary Salinity Risk Assessment for proposed development of a worship facility at 53 Dwyer Road, Bringelly (“the Site”).

This assessment has been undertaken with reference to the *Western Sydney Salinity Code of Practice* (WSROC, 2003), *Site Investigations for Urban Salinity* (DIPNR, 2002), and other regulatory guidelines currently in force by Liverpool City Council (“LCC” or “Council”).

The Client proposes to submit a Development Application (DA) to Council for the development of a multi-purpose facility, which ultimately will include: a temple / main shrine, a kitchen (for limited food preparation), amenities building and 28 space car park. The Site will also retain an existing two-storey residential dwelling for permanent private residential accommodation.

A review of the Salinity Potential in Western Sydney (2002) map indicates that the Site is located within the 'Moderate Salinity Potential' area with identified salinity regions approximately 100m to the southwest and 350m east of the Site.

2 Scope of Works

The following works were undertaken as part of the preliminary salinity risk assessment for the Site:

- Desktop assessment including a review of the salinity risk map, published geological and soil maps, published climate data and regional hydrogeology data;
- A review of historical aerial photographs (two) to assess changes in land use and vegetation history of the site;
- Review of the physical and laboratory soils data collected during the site and soil investigations, along with publicly available (local) soil information; and
- Preparation of this preliminary Salinity Risk Assessment report.

3 Information Review

3.1 Regional Geology

The (1:100,000) Geological Map of Penrith shows that the Site is underlain by the Bringelly Shale, belonging to the Wianamatta Group of shales (Middle Triassic). They are comprised of shale, carbonaceous claystone, laminates, fine to medium grained lithic sandstone and rare coal and tuff. The Wianamatta Shales were formed in coastal and marine environments and have a naturally high fossil (connate) salt content.

3.2 Regional Soil Landscape

The Penrith Soil Landscape Map (Bannerman and Hazelton, 1990) indicates that the Site (and surrounding properties) is underlain by the Blacktown soil landscape. The Blacktown ('bt') soil landscape is located on gently undulating rises on the Wianamatta Group Shales in the Cumberland Lowlands. The topography generally consists of rounded crests and ridges with gently inclined slopes (convex upper slopes grading onto concave lower slopes), with local relief of 10-30m and slopes <5%.

Soils are comprised of shallow to moderately deep (<100cm) of hardsetting mottled texture contrast (duplex) soils, comprising red and brown Podzolic soils on crests grading to yellow Podzolic soils on lower slopes and within drainage lines. A typical soil profile of the 'bt' soil landscape on upper slope/midslope position (<200cm total soil depth) is characterised as follows:

- (A1) 30cm moderately structured friable brownish black loam to clay loam (sometimes absent), overlying;
- (A2) 2-50cm massive to weakly structured hardsetting brown clay loam to silty clay loam with platy iron indurated shale fragments, overlying;
- (B) <100cm moderately structured light grey plastic silty clay to heavy clay, mottling, strongly weathered ironstone concretions, overlying;
- shale bedrock.

Reported landscape limitations include moderately reactive highly plastic subsoil, low soil fertility, and poor soil drainage.

3.3 Regional Hydrology

The LCC ePlanning portal and LCC DCP (2008) flood prone overlay mapping indicates that the Site is located well above the 1 in 100 year Annual Exceedance Probability (1% AEP) flood level.

The Site is located within the Greater Metropolitan Region Groundwater Sources - Central Sydney Basin region. A search of the NSW Office of Water's and Bureau of Meteorology groundwater bores, maps and records indicates that there are no registered groundwater bores on the Site. The two closest registered groundwater bores are GW106829 and GW016027, which are located approximately 800m to the north and south of the Site, respectively. A Summary Works detail for GW016027 (only) is available (copy attached in Appendix A).

The Site is underlain by the Bringelly Shale Aquifer, which has a low hydraulic conductivity and poor water quality which is typically very saline (DI&RD, 2016). There are also unconfined areas of alluvial groundwater identified within the weathered shale and clay throughout the locality. The Hawkesbury sandstone aquifer also underlies the region but at greater depths (>100m) and is considered a 'confined' aquifer and is not expected to be significantly influenced by surface water infiltration.

The Site is located to the west of a ridgeline running generally north-south (parallel) along Dwyer Road, resulting in the Site being located within the Duncans Creek surface water catchment. Duncans Creek is within the Wallacia Weir Management Zone (one of the Mid Nepean River Catchment Management Zones) and is a (3rd order) tributary of the Nepean River. The Site contains a series of dams and intermittent drainage lines that are lesser tributaries of Duncans Creek. There is also a constructed swale drain located along the southern Site boundary, draining into the larger central dam.

Surface water quality monitoring of Duncans Creek was undertaken as part of the Environmental Impact Study for the Western Sydney Airport at Badgerys Creek (Commonwealth Department of Infrastructure and Regional Development (DI&RD), 2016). The results of the water quality analyses were summarised as: 52.5% dissolved oxygen, 847µS/cm electrical conductivity, 89.2NTU turbidity, 14mg/L total suspended solids, 0.9mg/L total nitrogen, and 0.06mg/L total phosphorus.

3.4 Historical Aerial Imagery

A review of the historical aerial imagery from published sources (Nearmap and Google Earth) confirms that Site land use remained unchanged between 2002 and 2017, with the Site and surrounding areas predominantly used for either large-lot rural residential and/or agricultural purposes. There were no obvious signs of salinity (bare areas, tree die-off etc.) at the Site observed in the examined historical images (copies attached in Appendix B).

3.5 Site and Soil Assessment

The Site is located to the west of Bringelly, bordered by rural residential properties to the north, west and south and Dwyer Road to the east. The Site is approximately 3.28ha in area and is zoned R5 Large Lot Residential, as per the LCC LEP (LLEP, 2008). The Site is predominantly cleared with managed pasture. A residential dwelling and associated improvements (i.e. sheds/outbuildings, driveway) are located in the east of the Site near Dwyer Road. A large dam is located in the centre of the Site, with two smaller dams located adjacent to the eastern and western boundaries.

A site and soil assessment was undertaken on 6th June 2017 by Mark Saunders of Whitehead & Associates. A Site Plan was prepared and is attached in Appendix C. Site slopes were typically between 0-10%, as denoted on the Site Plan. The Site was primarily vegetated by a good cover of mown lawn/pasture grasses with no notable erosion observed. There were no obvious signs of potential salinity at the Site, with no physical features (scolds, waterlogging etc.) or vegetation (salt tolerant) indicators observed. There were also no notable areas of poor drainage outside of the delineated drainage lines and dams. There were no signs of staining or corrosion of brickwork/concrete structures associated with the existing dwelling at the Site.

Site soils were observed and examined to a general depth of 900mm by excavating four (4) test pits (TPs) using a hand auger. Three test pits were augured within the eastern portion of the Site, with TP4 located close to the eastern dam and Dwyer Road. One test pit (TP3) was augured within the western portion of the Site between the two major dams. Samples of discrete soil horizons were collected for subsequent laboratory analysis; pH, Electrical Conductivity (ECe) and Emerson Aggregate Class. Appendix D provides the soil bore log summaries for each test pit, with Appendix E providing soil analytical data and interpretation.

Site soils typically comprised of 250mm moderately structured light clay overlying weak to moderately structured medium clay to depths of 900mm. TP3 consisted of 300mm moderately structured silty clay loam overlying moderately structured light clay. The topsoil horizons described in the Blacktown Soil Landscape are generally absent from the observed soil (TP) profiles.

A search of the DIPNR NSW Soil and Land Information System (SALIS) database was also undertaken, with three test locations identified adjacent to the Site, and on the same 'bt' Soil Landscape. The soils were typically described as Yellow Podzols with light clay to sandy clay overlying moderately structured medium clay, overlying massive light to medium clay. No salting was evident at the SALIS soil test pit locations. The SALIS soil profile reports and a map showing their locations with respect to the Site are attached in Appendix F.

4 Assessment Criteria

The salinity potential of the Site was assessed according to the requirements of the Western Sydney Salinity Code of Practice (WSROC, 2004). In Western Sydney, salinity can be either a soil or groundwater issue that affects the ground surface. The Salinity CoP presents a number

of process models describing the occurrence of soil salinity in the Sydney urban environment. The model that most accurately reflects the likely scenario influencing the Site locality is the 'shale soil landscape salinity process model'. Under this regime shallow soil-water flows laterally along the (clay) subsoil / topsoil boundary. Localised 'salinity' is generally found to occur where this water intercepts the surface through seeps on lower slopes or constructed flats.

Soil Electrical Conductivity (EC) is the fundamental criteria for assessing soil salinity. The '*Site Investigations for Urban Salinity*' (OEH, 2002) and '*Book 2 Dryland Salinity: Identifying Saline Sites*' (OEH, 2008) defines various classes of saline soils as follows (Table 1):

Table 1: Soil Salinity Classification Indicators

Classification	EC _e (dS/cm)
Non-saline	<2
Slightly saline	2-4
Moderately saline	4-8
Very saline	8-16
Highly saline	>16

Electrical conductivity of the saturated extract (EC_e) was calculated for the sample soils at the Site by first measuring the electrical conductivity of 1:5 soil in water suspensions and using the appropriate multiplier factors (based on soil texture) to convert the 1:5 suspension EC to EC_e. The results of the electrical conductivity testing are provided in Table 2 (below):

Table 2: Soil Salinity Test Results

Sample ID	Sample Depth (mm)	Soil Texture	EC _e (dS/cm)	Salinity Classification
TP1/1	100	LC	0.26	Non-saline
TP1/2	250	LC	0.22	Non-saline
TP1/3	600	MC	0.10	Non-saline
TP1/4	900	MC	0.29	Non-saline
TP2/1	100	LC	0.10	Non-saline
TP2/2	250	LC	0.04	Non-saline
TP2/3	600	MC	0.70	Non-saline
TP2/4	900	LC	0.14	Non-saline
TP3/1	150	CL	0.04	Non-saline
TP3/2	300	CL	0.03	Non-saline
TP3/3	400	LC	0.10	Non-saline
TP3/4	700	LC	0.13	Non-saline
TP4/1	150	LC	1.14	Non-saline
TP4/2	300	MC	0.21	Non-saline
TP4/3	700	MC	1.37	Non-saline

All the soil horizons for the samples collected at the Site were considered to be non-saline. The presence of non-saline soils indicates that local expressions of salinity associated with identified 'salinity potential' are **not** present at the Site.

5 Conclusions and Recommendations

The results of the preliminary salinity risk assessment for the Site indicate that a further detailed investigation is not required. It should be noted that soil salinity is a dynamic process and although the preliminary assessment supports a 'low salinity potential' risk for the Site, future salinity potential should be considered. Our soil investigations at the Site only included sampling to a depth of 900mm. Soils encountered at greater depths may contain higher concentrations of salt and if exposed or disturbed during the development process may present a future salinity risk.

To reduce the risk of any localised salinity during the construction of the proposed development, the specific responses detailed in the Level One Response Checklist (WSROC, 2003) should be implemented. The requirements outlined in the Level One Salinity Management Response Checklist that should be considered include:

- Water Inputs:
 - Stormwater management
 - Permanent water storages (i.e. dams, ponds) should be lined and regularly maintained to limit infiltration
 - Underground water carrying pipes and on-site wastewater management system properly installed to eliminate leaks
 - Consideration given to salinity when designing and installing pools
- Drainage
 - Minimise the disturbance of natural drainage
 - Slab, foundations and retaining walls designed to allow good drainage and minimise water logging
 - Design and layout of retaining walls, driveways and service connections reduces cut and fill, minimises impediment of natural groundwater flows and provides for good drainage
 - Guttering and downpipes properly connected and maintained with resultant stormwater appropriately managed
- Vegetation
 - Areas of established vegetation maintained
 - Landscaping plans apply Waterwise gardening principles
 - Gardens designed so that they are not adjacent to the property
 - Irrigation is properly installed
- Building/ Engineering
 - Damp proof courses properly installed and maintained throughout construction, landscaping and finishing
 - Susceptible construction material avoided i.e. seconds, porous material

As the proposed development will result in an increase in water use and subsequent wastewater generation, a detailed on-site wastewater management plan should be prepared to ensure that sustainable effluent application rates are adopted.

Development construction should aim to minimise erosion and sediment loss, water pollution and maximise the re-use of materials on-site to reduce the risk of potential salinity.

Appendix B - Salinity Management Guidelines of the Liverpool Growth Centre Precincts DCP (2013) presents further management recommendations to control the effects of dryland salinity within the Camden and Liverpool Growth Centre Precincts.

This completes our Preliminary Salinity Assessment for proposed development at 53 Dwyer Road, Bringelly.

Please do not hesitate to contact me on 02 4954 4996 if you have any questions.

6 References (Cited and Used)

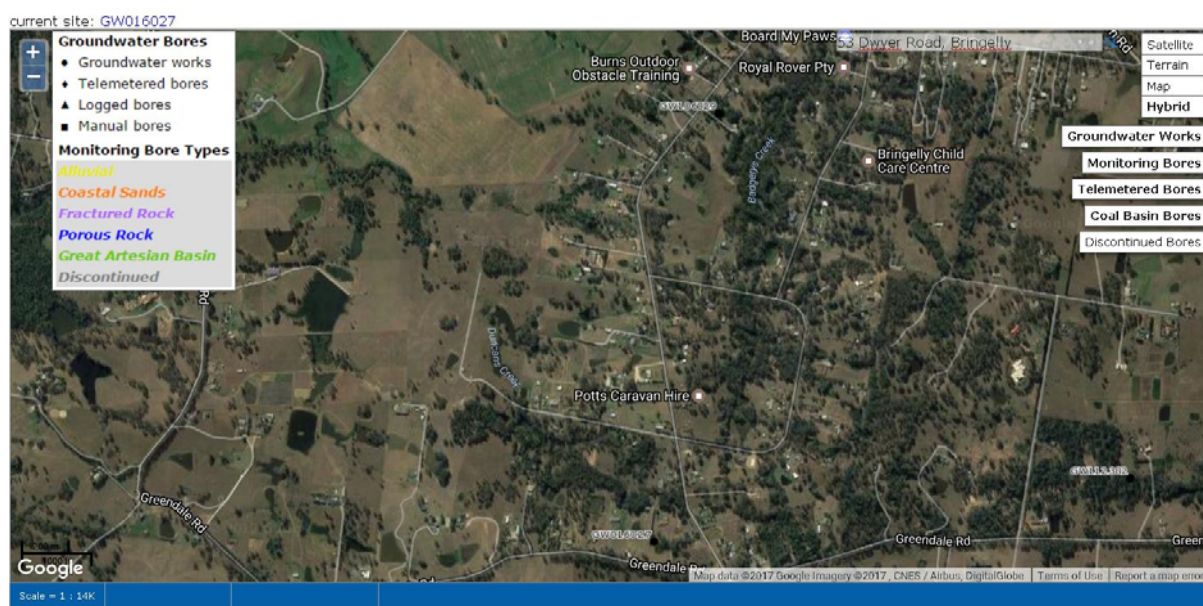
Bannerman, S. M. and Hazelton, P.A. (1990). *Soil Landscapes of the Penrith 1:100,000 Sheet*. Soil Conservation Service of NSW, Sydney. Hazelton, P. & Murphy, B. (2007) *Interpreting Soil Test Results, What do all the numbers mean?* CSIRO Publishing, Victoria.

Lillicrap, A. and McGhie, S. (2002), *Site Investigations for Urban Salinity*, Department of Land and Water Conservation, Sydney.

Western Sydney Regional Organisation of Councils (2003), *Western Sydney Salinity Code of Practice*, Department of Infrastructure, Planning and Natural Resources, Blacktown.

Appendix A

Figures & Site Plans



6/8/2017

allwaterdata.water.nsw.gov.au/wgen/users/313079833/gw016027.wsr.htm

NSW Office of Water Work Summary

GW016027

Licence: 10BL007884

Licence Status: CANCELLED

Authorised IRRIGATION, DOMESTIC

Purpose(s):

Intended Purpose(s): IRRIGATION

Work Type: Bore

Work Status: Supply Obtained

Construct.Method:

Owner Type: Private

Commenced Date:

Completion Date:

Final Depth:

Drilled Depth:

Contractor Name:

Driller:

Assistant Driller:

Property: BURINGILLA PARK

Standing Water Level

(m):

GWM A: 603 - SYDNEY BASIN

Salinity Description:

GW Zone: -

Yield (L/s):

Site Details

Site Chosen By:

County	Parish	Cadastre
Form A: CUMBE	CUMBE006	14
Licensed: CUMBERLAND	BRINGELLY	Whole Lot 8/752016

Region: 10 - Sydney South Coast

CMA Map: 9030-3S

River Basin: 212 - HAWKESBURY RIVER

Grid Zone:

Scale:

Area/District:

Elevation: 0.00 m (A.H.D.)

Northing: 6242223.0

Latitude: 33°56'20.3"S

Elevation (Unknown)

Easting: 287252.0

Longitude: 150°41'53.2"E

Source:

GS Map: -

MGA Zone: 0

Coordinate Source: PR., ACC. MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
------	------	-----------	------	----------	--------	-----------------------	----------------------	----------	---------

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
----------	--------	---------------	----------	------------	------------	-------------	----------------	---------------	-----------------

Geologists Log

Drillers Log

From	To	Thickness	Drillers Description	Geological Material	Comments
------	----	-----------	----------------------	---------------------	----------

<http://allwaterdata.water.nsw.gov.au/wgen/users/313079833/gw016027.wsr.htm>

1/2

8/31/2017

allwaterdata.water.nsw.gov.au/wgen/users/249481200/gw106829.gwgwpf_org.wsr.htm

NSW Office of Water Work Summary

GW106829

Licence: 10BL161394

Licence Status: CONVERTED

Authorised Purpose(s): STOCK, DOMESTIC
Intended Purpose(s): STOCK, DOMESTIC

Work Type: Bore

Work Status: Filled, Backfilled

Construct.Method: Rotary

Owner Type: Private

Commenced Date:

Completion Date: 08/04/2003

Final Depth: 249.00 m

Drilled Depth: 249.00 m

Contractor Name: Britt's Water Solutions

Driller: Thomas Garry Britt

Assistant Driller:

Property: N/A

GWMA: -

GW Zone: -

Standing Water Level: 85.000

Salinity: Salty

Yield: 1.180

Site Details

Site Chosen By:

County
Form A: CUMBE
Licensed: CUMBERLAND

Parish
CUMBE.6
BRINGELLY

Cadastre
130//27550
Whole Lot 130//27550

Region: 10 - Sydney South Coast

CMA Map: 9030-3S

River Basin: 212 - HAWKESBURY RIVER
Area/District:

Grid Zone:

Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown

Northing: 6243826.0
Easting: 287457.0

Latitude: 33°55'28.5"S
Longitude: 150°42'02.6"E

GS Map: -

MGA Zone: 0

Coordinate Source: GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel
Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	12.00	200			Rotary
1		Hole	Hole	12.00	153.00	162			Rotary
1		Hole	Hole	153.00	249.00	150			Rotary
1		Backfill	Cement Grout	3.00	150.00				
1		Backfill	Drilled Cuttings	150.00	249.00				

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.00	18.10	0.10	Unknown	6.00		0.04		00:05:00	
136.00	136.10	0.10	Unknown	85.00		0.04		00:05:00	
194.00	194.15	0.15	Unknown	85.00		1.10		01:00:00	

Geologists Log

Drillers Log

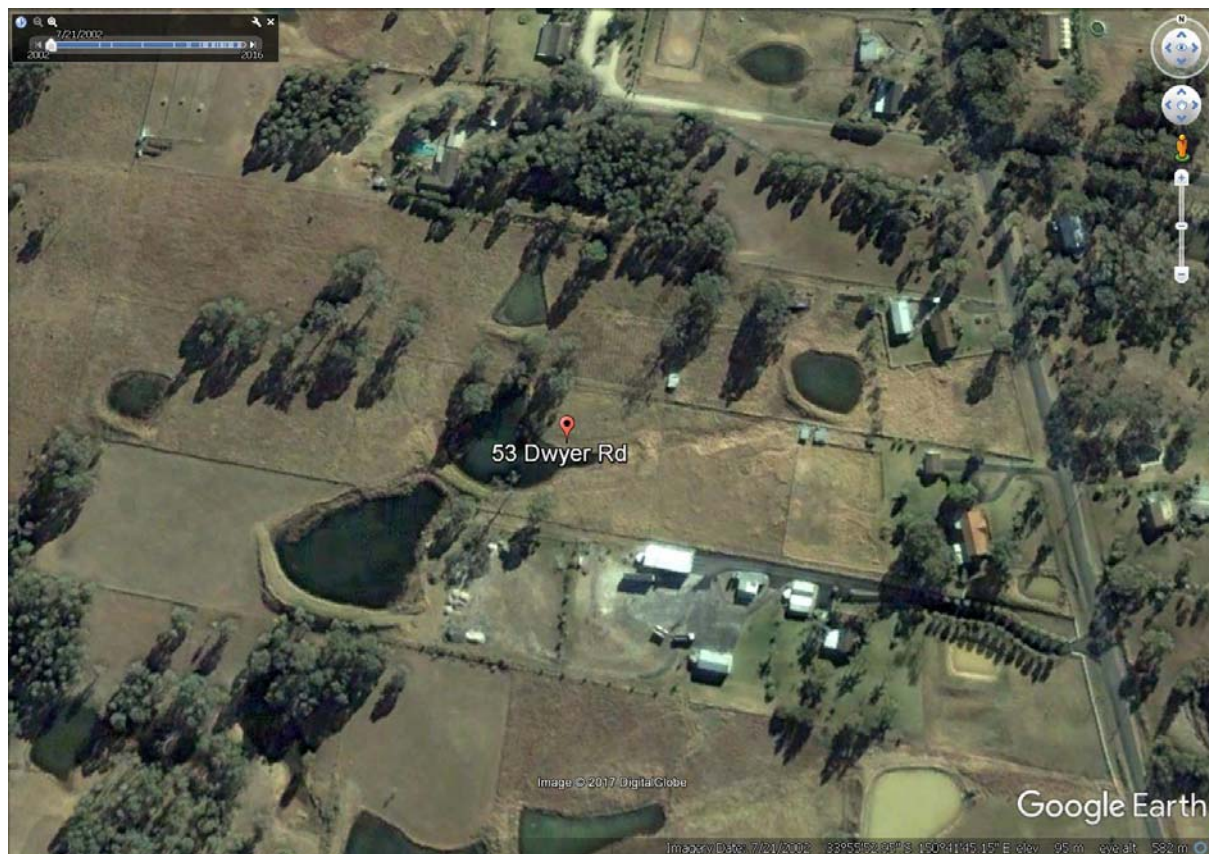
From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
----------	--------	---------------	----------------------	---------------------	----------

http://allwaterdata.water.nsw.gov.au/wgen/users/249481200/gw106829.gwgwpf_org.wsr.htm

1/2

Appendix B

Historical Aerial Imagery



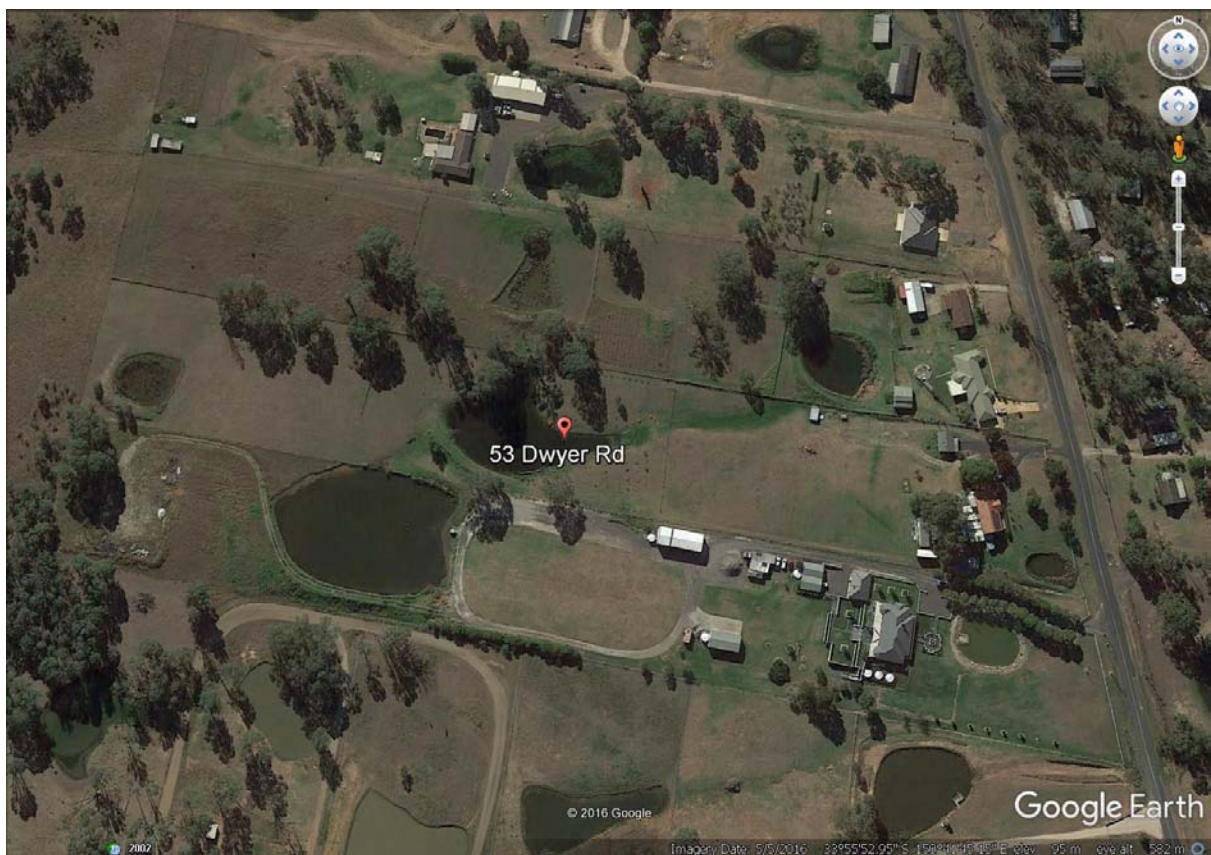
Google Earth Image 21/07/2002



Google Earth Image 20/01/2007



Nearmap Image 07/05/2010



Google Earth Image 05/05/2016



Nearmap Image 23/01/2017



Nearmap Image 09/04/2017

Appendix C

Site Plan



Figure 1: Constraints Map

1816: 53 Dwyer Road, Bringelly

W

Whitehead & Associates
Environmental Consultants



Revision	2
Drawn	BC & JK
Approved	MS

Appendix D

Soil Borelogs



Whitehead & Associates
Environmental Consultants Pty Ltd

Key to Soil Borelogs

Symbols











W Watertable depth ● Sample collected
X Depth of refusal



Moisture condition





D Dry
SM Slightly moist
M Moist
VM Very moist
W Wet / saturated



Graphic Log and Textures

	S - Sand LS - Loamy sand CS - Clayey sand		CL - Clay loam SCL - Sandy clay loam SiCL - Silty clay loam		Gravel (G)
	SL - Sandy loam		LC - Light clay SC - Sandy clay		Parent material (stiff)
	L - Loam LFS - Loam fine sandy SiL - Silty loam		MC - Medium clay HC - Heavy clay		Parent material (weathered)

SOILBORE LOG				 Whitehead & Associates Environmental Consultants Pty Ltd						
Client:	VT Architects			Test Pit No:	TP1					
Site:	53 Dwyer Road, Bringelly			Excavated/logged by:	Mark Saunders					
Date:	6 June 2017			Excavation type:	Auger					
Notes:										
PROFILE DESCRIPTION										
Depth (m)	Graphic Log	Sampling depth/name	Horizon	Texture	Structure	Colour	Mottles	Coarse Fragments	Moisture Condition	Comments
0.1			A1	LC	moderate	brown 7.5YR 4/2	nil	5-10% 5mm gravel	D	
0.2			A2	LC	moderate to well	brown 7.5YR 4/2	orange and grey	<10% 5mm gravel	SM	
0.3			B1	MC	weak to moderate	red 2.5YR 4/6	bright orange yellow and grey	<5%	M	
0.4										
0.5										
0.6										
0.7			B2	MC	moderate	red 2.5YR 4/6	bright orange yellow and grey	nil	SM	transitioning to yellow and grey beyond 0.9m
0.8										
0.9										
1.0		Test pit terminated at 0.9m depth								
1.1										
1.2										
1.3										
1.4										
1.5										

SOIL BORE LOG				 Whitehead & Associates Environmental Consultants Pty Ltd						
Client:	VT Architects			Test Pit No:	TP2					
Site:	53 Dwyer Road, Bringelly			Excavated/logged by:	Mark Saunders					
Date:	6 June 2017			Excavation type:	Auger					
Notes:										
PROFILE DESCRIPTION										
Depth (m)	Graphic Log	Sampling depth/name	Horizon	Texture	Structure	Colour	Mottles	Coarse Fragments	Moisture Condition	Comments
0.1			A1	LC	moderate	brown 7.5YR 4/2	nil	5-10% 5mm gravel	D	
0.2			A2	LC	moderate to well	strong brown 7.5YR 5/6	orange	<5% fine gravel	SM	
0.3			B1	MC	weak to moderate	light yellowish brown 10YR 6/4	orange yellow and grey	nil	SM	
0.4										
0.5										
0.6										
0.7			B2	MC	moderate to well	red 2.5YR 4/6	orange (50%) pale grey	nil	SM	
0.8										
0.9										
1.0		Test pit terminated at 0.9m depth								
1.1										
1.2										
1.3										
1.4										
1.5										

SOIL BORE LOG				 Whitehead & Associates Environmental Consultants Pty Ltd						
Client:	VT Architects			Test Pit No:	TP3					
Site:	53 Dwyer Road, Bringelly			Excavated/logged by:	Mark Saunders					
Date:	6 June 2017			Excavation type:	Auger					
Notes:										
PROFILE DESCRIPTION										
Depth (m)	Graphic Log	Sampling depth/name	Horizon	Texture	Structure	Colour	Mottles	Coarse Fragments	Moisture Condition	Comments
0.1			A1	SiCL	moderate to weak	dark brown 10YR 3/3	nil	<5% angular cobbles	D	
0.2			A2	SiCL	moderate	dark brown 10YR 3/3	red	<5% fine gravel	D	
0.3										
0.4			B1	LC	weak to moderate	yellowish red 5YR 4/6	red, orange and grey	<5% fine gravel	SM	
0.5			B2	LC	moderate to well	yellowish brown 10YR 5/6	minor yellow	30-40%	SM	
0.6										
0.7										
0.8		Test pit terminated at 0.7m depth								
0.9										
1.0										
1.1										
1.2										
1.3										
1.4										
1.5										

  <div style="display: inline-block; vertical-align: middle; margin-left: 10px;"> Whitehead & Associates Environmental Consultants Pty Ltd </div>										
Client:	VT Architects	Test Pit No:	TP4							
Site:	53 Dwyer Road, Bringelly	Excavated/logged by:	Mark Saunders							
Date:	6 June 2017	Excavation type:	Auger							
Notes:										
PROFILE DESCRIPTION										
Depth (m)	Graphic Log	Sampling depth/name	Horizon	Texture	Structure	Colour	Mottles	Coarse Fragments	Moisture Condition	Comments
0.1			A1	LC	moderate	dark reddish brown 5YR 3/2	nil	<2%	SM	
0.2			A2	MC	moderate	yellowish brown 10YR 5/6	nil	<2%	SM	
0.3										
0.4			B1	MC	moderate	yellowish brown 10YR 5/6	minor yellow and orange	<2%	SM	
0.5										
0.6										
0.7										
0.8		Test pit terminated at 0.7m depth								
0.9										
1.0										
1.1										
1.2										
1.3										
1.4										
1.5										

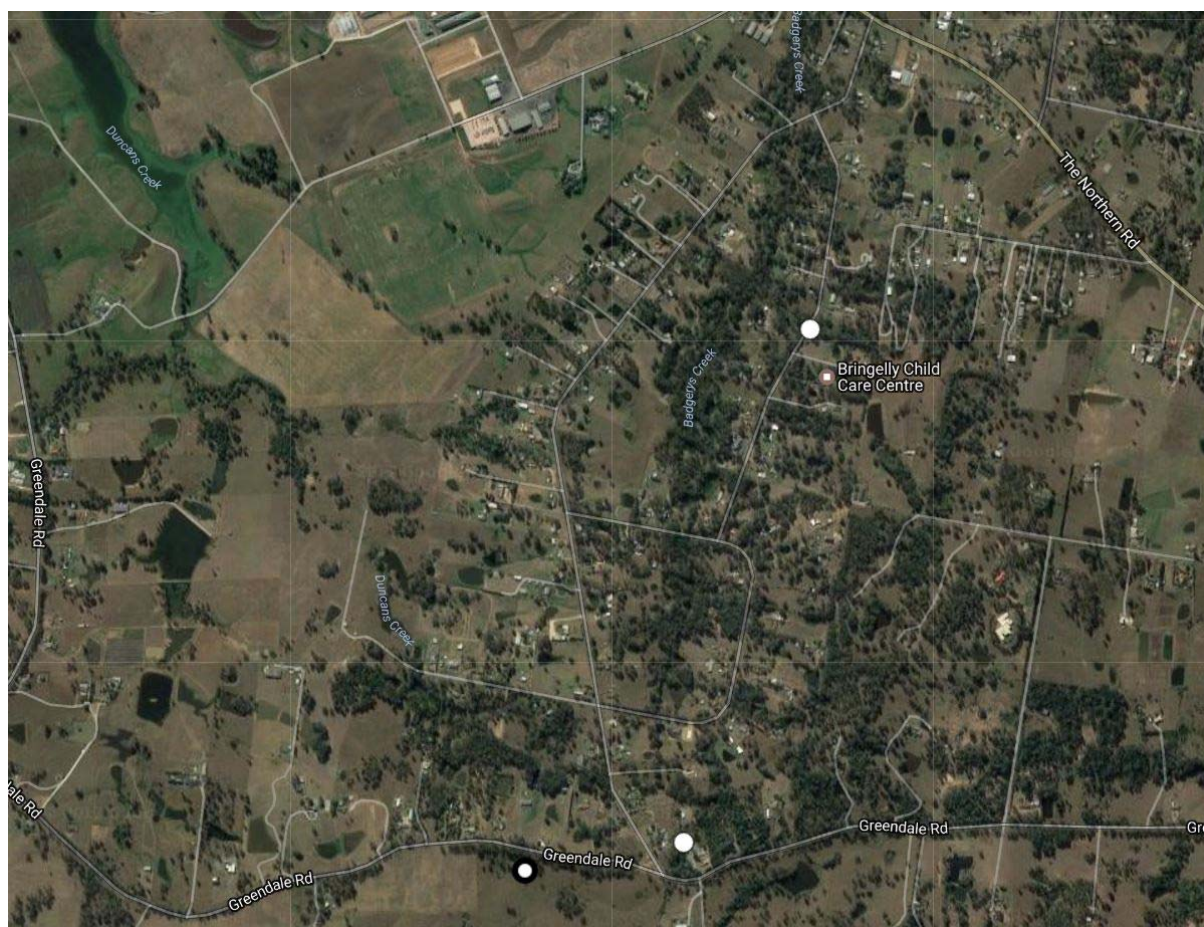
Appendix E

Soil Laboratory Data

53 Dwyer Road, Bringelly - Soil Sampling Schedule and Results of pH, EC and Emerson Aggregate Test Analysis											
Site	Sample Name	Sample Depth (mm)	Texture Class	EAT [1]	Rating [2]	pH 1:5 [4]	Rating	EC 1:5 (µS/cm)	ECe (dS/m) [5]	Rating	Other analysis [6]
TP1	1/1	100	LC	6	Low	6.6	Neutral	33	0.26	Non-saline	
	1/2	250	LC	6	Low	7.1	Neutral	27	0.22	Non-saline	
	1/3	600	MC	5	Low	7.3	Neutral	14	0.10	Non-saline	
	1/4	900	MC	5	Low	6.1	Slightly acid	42	0.29	Non-saline	
TP2	2/1	100	LC	6	Low	6.2	Slightly acid	12	0.10	Non-saline	
	2/2	250	LC	5	Low	6.2	Slightly acid	5	0.04	Non-saline	
	2/3	600	MC	5	Low	4.9	Very strongly acid	100	0.70	Non-saline	
	2/4	900	LC	5	Low	6.0	Moderately acid	17	0.14	Non-saline	
TP3	3/1	150	CL	6	Low	6.1	Slightly acid	4	0.04	Non-saline	
	3/2	300	CL	6	Low	5.9	Moderately acid	3	0.03	Non-saline	
	3/3	400	LC	5	Low	6.3	Slightly acid	12	0.10	Non-saline	
	3/4	700	LC	5	Low	6.7	Neutral	16	0.13	Non-saline	
TP4	4/1	150	LC	6	Low	6.3	Slightly acid	142	1.14	Non-saline	
	4/2	300	MC	5	Low	6.9	Neutral	30	0.21	Non-saline	
	4/3	700	MC	6	Low	7.8	Mildly alkaline	196	1.37	Non-saline	
Notes:- (also refer Interpretation Sheet 1) [1] The modified Emerson Aggregate Test (EAT) provides an indication of soil susceptibility to dispersion. [2] Ratings describe the likely hazard associated with land application of treated wastewater. [3] pH measured in the field using Raupac Indicator. [4] pH measured on 1:5 soil:water suspensions using a <i>Hanna Combo</i> hand-held pH/EC/temp meter. [5] Electrical conductivity of the saturated extract (ECe) = $EC_{1:5}(\mu S/cm) \times MF / 1000$. Units are dS/m. MF is a soil texture multiplication factor. [6] External laboratories used for the following analyses, if indicated: <ul style="list-style-type: none"> • CEC (Cation exchange capacity) • Psorb (Phosphorus sorption capacity) • Bray Phosphorus • Organic carbon • Total nitrogen 											

Appendix F

SALIS Soil Data Reports



NSW SOIL AND LAND INFORMATION SYSTEM



Soil Essentials Report

SITE DETAILS

Site Location:	Profile 217
Map Reference:	MGA Grid Reference: Zone 56, 287605E, 6242190N. 9030 PENRITH (1:100000) map sheet.
Profile Details:	Soil Landscapes of the Penrith 1:100 000 Sheet Survey (1000314), Profile 217, collected by Mrs Susan Abraham on May 18, 1988
Physiography:	dry sclerophyll forest on sandstone-quartz, siltstone/mudstone, shale lithology and used for improved pasture. Slope 10% (measured), aspect north west. profile drainage is imperfectly drained, erosion hazard is moderate, and no salting evident
Soil Type:	Yellow Podzolic Soil (GSG), Dy2.21 (PPF)
Base of observation:	
Profile Field Notes:	Sandstone outcrop in road cutting, Michenbury unit.

SOIL DESCRIPTION

Layer 0

Layer 1

0.00 - 0.03 m Horizon	dark reddish grey (greyish brown) (5YR 4/2) [moist] fine clay loam sandy with single grained, field pH is 6.5. Coarse fragments are very few (< 2%), not identified, fine gravel (2-6 mm), gravel (6-20 mm), pans are not evident, segregations are not evident; smooth clear (20-50 mm) boundary to ...
--------------------------	--

Layer 2

0.03 - 0.10 m A2 Horizon	brown (7.5YR 4/4) [moist] sandy clay with single grained, field pH is 6.5. Coarse fragments are not evident, pans are not evident, segregations are not evident; smooth clear (20-50 mm) boundary to ...
-----------------------------	--

Layer 3

0.10 - 0.83 m Horizon	red (bright reddish brown) (2.5YR 5/6) [moist] medium clay with strong pedality (20 - 50 mm, smooth-faced peds), field pH is 4.5. Coarse fragments are not evident, pans are not evident, segregations are not evident; smooth gradual (50-100 mm) boundary to ...
--------------------------	--

Layer 4

0.83 - 2.40 m Horizon	yellowish red (bright reddish brown) (5YR 5/6) [moist] light medium clay with massive structure (20 - 50 mm), field pH is 4.0. Coarse fragments are not evident, pans are not evident, segregations are not evident
--------------------------	---

Layer 99

NSW SOIL AND LAND INFORMATION SYSTEM



Soil Essentials Report

SITE DETAILS

Site Location:	BRINGELLY RD, 3.8KM FROM CNR N THERN RD
Map Reference:	MGA Grid Reference: Zone 56, 287105E, 6242090N. 9030 PENRITH (1:100000) map sheet.
Profile Details:	Soil Landscapes of the Penrith 1:100 000 Sheet Survey (1000314), Profile 229, collected by Mrs Susan Abraham on March 30, 1988
Physiography:	woodland grass understorey on shale lithology and used for volun./native pasture. Slope 5% (not recorded), aspect south. Surface condition is loose, profile drainage is mod. well drained, erosion hazard is moderate, and no salting evident
Soil Type:	Yellow Podzolic Soil (GSG), Gn3.71 (PPF)
Base of observation:	
Profile Field Notes:	

SOIL DESCRIPTION

Layer 0

Layer 1

0.00 - 0.05 m Horizon	brown (7.5YR 4/3) [moist] fine clay loam sandy with single grained, field pH is 6.0. Coarse fragments are very few (< 2%), not identified, fine gravel (2-6 mm), pans are not evident, segregations are not evident; smooth abrupt (5-20 mm) boundary to ...
--------------------------	--

Layer 2

0.05 - 0.20 m B1 Horizon	brown (7.5YR 4/4) [moist] light medium clay with moderate pedality (2 - 5 mm, smooth-faced peds), field pH is 6.5. Coarse fragments are very few (< 2%), not identified, gravel (6-20 mm), pans are not evident, segregations are not evident; irregular clear (20-50 mm) boundary to ...
-----------------------------	---

Layer 3

0.20 - 0.50 m B2 Horizon	brownish yellow (bright yellowish brown) (10YR 6/6) [moist] medium clay with moderate pedality (5 - 10 mm, smooth-faced peds), field pH is 5.0. Coarse fragments are not evident, pans are not evident, segregations are not evident; broken gradual (50-100 mm) boundary to ...
-----------------------------	--

Layer 4

0.50 - 1.00 m B22 Horizon	light grey (5Y 7/1) [moist] medium clay with massive structure, field pH is 5.5. Coarse fragments are not evident, pans are not evident, segregations are not evident. Layer notes are: 5YR 5/8 mixed.
------------------------------	--

NSW SOIL AND LAND INFORMATION SYSTEM



Soil Essentials Report

SITE DETAILS

Site Location:	Drainage line
Map Reference:	MGA Grid Reference: Zone 56, 287969E, 6243813N. 9030 PENRITH (1:100000) map sheet.
Profile Details:	Penrith Soil Landscapes II Survey (1004302), Profile 59, collected by Mrs Danielle Doughty on September 10, 2002
Physiography:	drainage depression under woodland shrub understorey on alluvium, colluvium lithology and used for timber/scrub/unused. Slope 1% (estimated), local relief extremely low (< 9m), elevation 90.0 m. Surface condition is hard set, profile drainage is imperfectly drained, erosion hazard is slight, and no salting evident
Soil Type:	Stratic Rudosol (ASC)
Base of observation:	layer continues
Profile Field Notes:	Not good for a type profile. Landscape in lu but very flat surroundings. Maybe in bt instead. Alluvial/colluvial soil RUER.

SOIL DESCRIPTION

Layer 0

Layer 1

0.00 - 0.30 m
A1 Horizon
brown (dull yellowish brown) (10YR 5/3) [moist] fine sandy clay loam with massive structure (earthy), abundant (>100/10x10cm) roots (<1mm), many (25-100/10x10cm) roots (1-2mm), field pH is 6.0. Layer notes are: A1 - pale brown hydrophobic; wavy clear (20-50 mm) boundary to ...

Layer 2

0.30 - 0.50 m
B2 Horizon
dark brown (10YR 3/3) [moist] silty clay loam with weak pedality (polyhedral, 20 - 50 mm, rough-faced peds), many (25-100/10x10cm) roots (<1mm), common (10-25/10x10cm) roots (1-2mm), field pH is 6.0. Layer notes are: B2 - Dark brown; wavy clear (20-50 mm) boundary to ...

Layer 99

LABORATORY TESTS

None available

For information on laboratory test data and units of measure, please see: [Soil survey standard test methods](#)

Report generated on 6/9/2017 at 10:55 AM
