Modification of Project Approval

Lismore to Mullumbimby Electricity Network Upgrade

Modification of Project Approval
August 10
Prepared by: Justin Martin

Revision History	
Version	**Nature of Revision**
1	6 August 2010

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1. Introduction

1.1 The Modification

Country Energy is seeking a modification under section 75(W) of the Environmental Planning and Assessment Act 1979; to the Ministers approval for the Lismore to Mullumbimby Electricity Network Upgrade Part 3A Project Approval dated 6 September 2009 (File Number S07/01493). Country Energy is seeking an amendment to the scope of the project to include the upgrade of the emergency access road into the Suffolk Park Zone Substation. This Modification would form an addendum to the Lismore REF Annex Q - Suffolk Park Substation and Line Route Selection (FC 25562) Environmental Assessment.

2. Description of the Proposal

2.1 Proposed Works

In the environmental assessment for the Suffolk Park substation the proposed emergency road was originally to be 4WD access only, not requiring a formed road. It has later been assessed that access via this unformed track in an emergency would potentially be difficult (given the likelihood of an emergency event occurring during a heavy rainfall event) and the need to create a formed road has been determined.

The proposal is to construct a formed all weather road approximately 500 metres across Lot 9/588885 from Old Bangalow Road to the Suffolk Park Zone Substation site. The road is to be designed with suitable gully crossings and culverts/drainage to minimize impact to the natural gully flows into Belongil Creek and minimise environmental impact by limiting clearing and utilising the approved 11kV underground corridor. Works will commence from the substation site eastwards towards Old Bangalow Road over private property and will utilise excess fill from the Suffolk Park substation site and entry road, thus removing the need for an amended traffic management plan and ensuring fill material is consistent with the soil types found in the area. Plans for the proposed access road upgrade can be seen in Appendix A Suffolk Park Zone Substation Emergency Access Road Plans.

2.2 Electrical Network

The positioning of the new substation site requires removal of the majority of the overhead 11 kV and low voltage (LV) mains from the property, and these will be replaced with underground cables. Seven 11 kV feeders will be installed and ducting provision will be made for a further five feeders.

The proposed layout of these feeders relative to Site 7 (Suffolk Park substation) is shown in Figure 2-1. The site requires four feeders heading eastwards from the substation site for approximately 400 m. From this location, one feeder traverses north-east to connect to the existing overhead network on the eastern extremity of the property. The remaining three feeders head south with an underbore through the railway easement, onto the Old Bangalow Road reserve, and then onto the intersection with Bangalow Road. At this point, one feeder continues underground south along the west side of the Golf Course to behind Suffolk Park residential area where it connects to an existing padmount substation near Caniaba Crescent. The remaining two feeders head eastward as underground cables along Bangalow Road to Broken Head Road where they connect with the existing overhead network.

To complete the extent of these feeders, an additional underground section for one feeder is required along Bangalow Road between Ironbark Crescent and Cooper Street. The existing OH substation near the corner of Old Bangalow Road and Bangalow Road will be replaced by a small padmount substation and overhead LV mains along Bangalow Road will be replaced with underground LV cable.

There will also be three 11 kV feeders heading west from Site 7. Two of these will be underground to the western boundary of the property where they connect with existing overhead feeders. The third feeder traverses south west with an underbore of the railway easement and Bangalow Road before joining up with the overhead network heading west.

The road has been designed to utilise the same corridor as the proposed underground works east from the Suffolk Park substation site. This further minimises any potential for environmental impacts and maintains the assessments and principles of the original “Suffolk Park Substation and Line Route Selection (FC 25562) Environmental Assessment”.

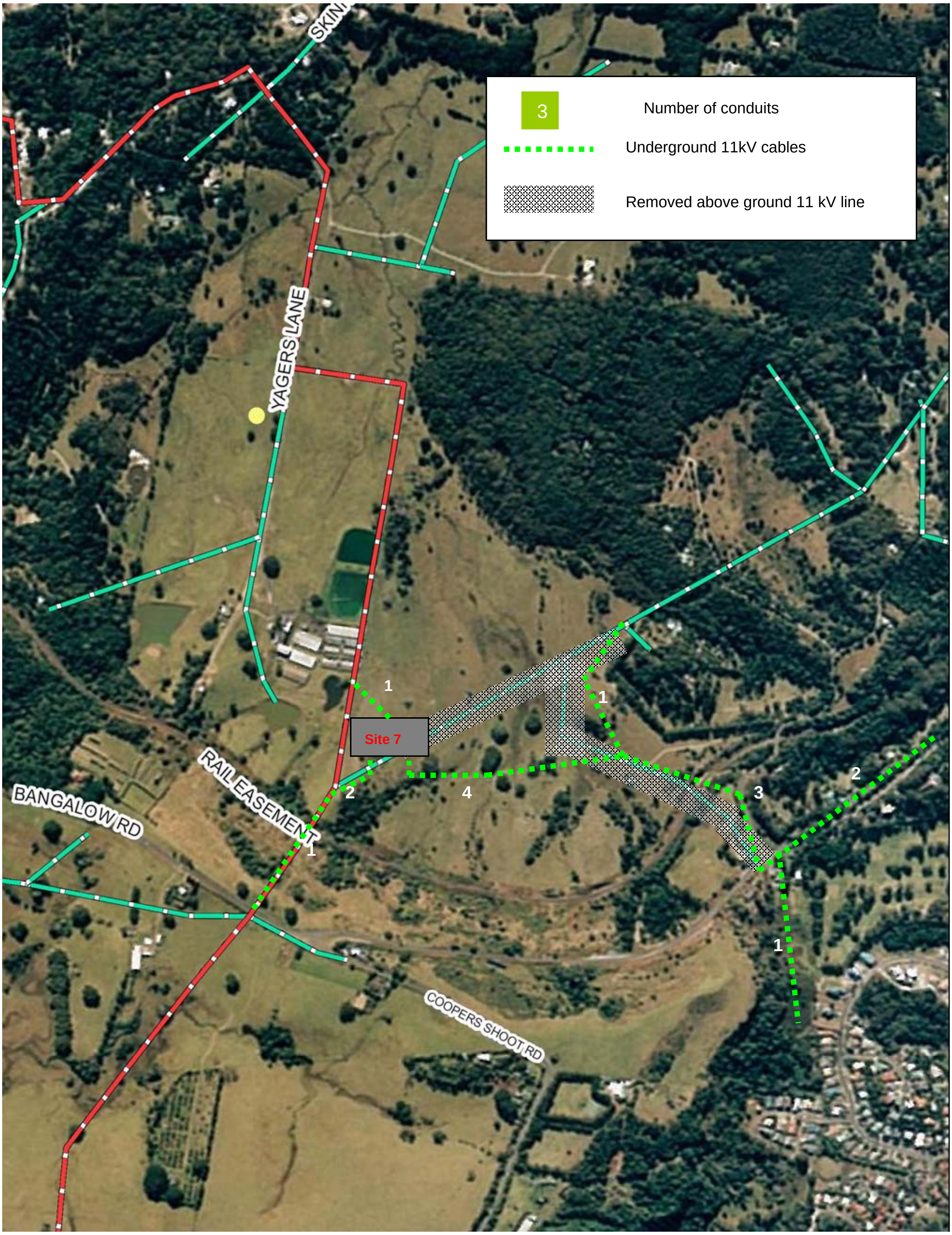


Figure 2-1: 11kV feeder works around Suffolk Park substation.

2.3 Rainfall

Byron Shire receives a mean annual rainfall of between 1700 and 2000 mm over much of the Shire. A comparatively narrow lowland area bounded by a high mountain range to the west together with a reliable annual rainfall results in a rapid runoff response in the coastal streams. This is clearly reflected in the long-section profiles of the tributary streams of Belongil Creek which are characterised by short (generally less than 250 m) upper sections draining the escarpment below Bangalow Road with long, low gradient mid and lower reaches draining to Cumbebin Swamp. It is likely that the lateral retreat of the upper reaches has almost reached equilibrium due to the headward controls imposed by the railway corridor and Bangalow Road (Figure 2), and the restricted catchment remaining upslope of the site. The implications of this feature is that the runoff from the upper catchment will tend to be rapid but of short duration leading to high velocity flows that will require careful attention to drainage design in site preparation.

There is a marked wet season occurring from December to April, during which over 60% of average annual rainfall occurs. Thunderstorms and cyclonic activity may cause intense rainfall events and resultant flooding during this season. Falls of up to 260 mm in 24 hours are not uncommon.

While numerous tributaries and gullies from the steep upper slopes feed Belongil Creek, these are not generally flowing and dry out during the warmer months (excluding rainfall events). The emergency access road has been designed to allow the current free flow of these gullies after rainfall events.

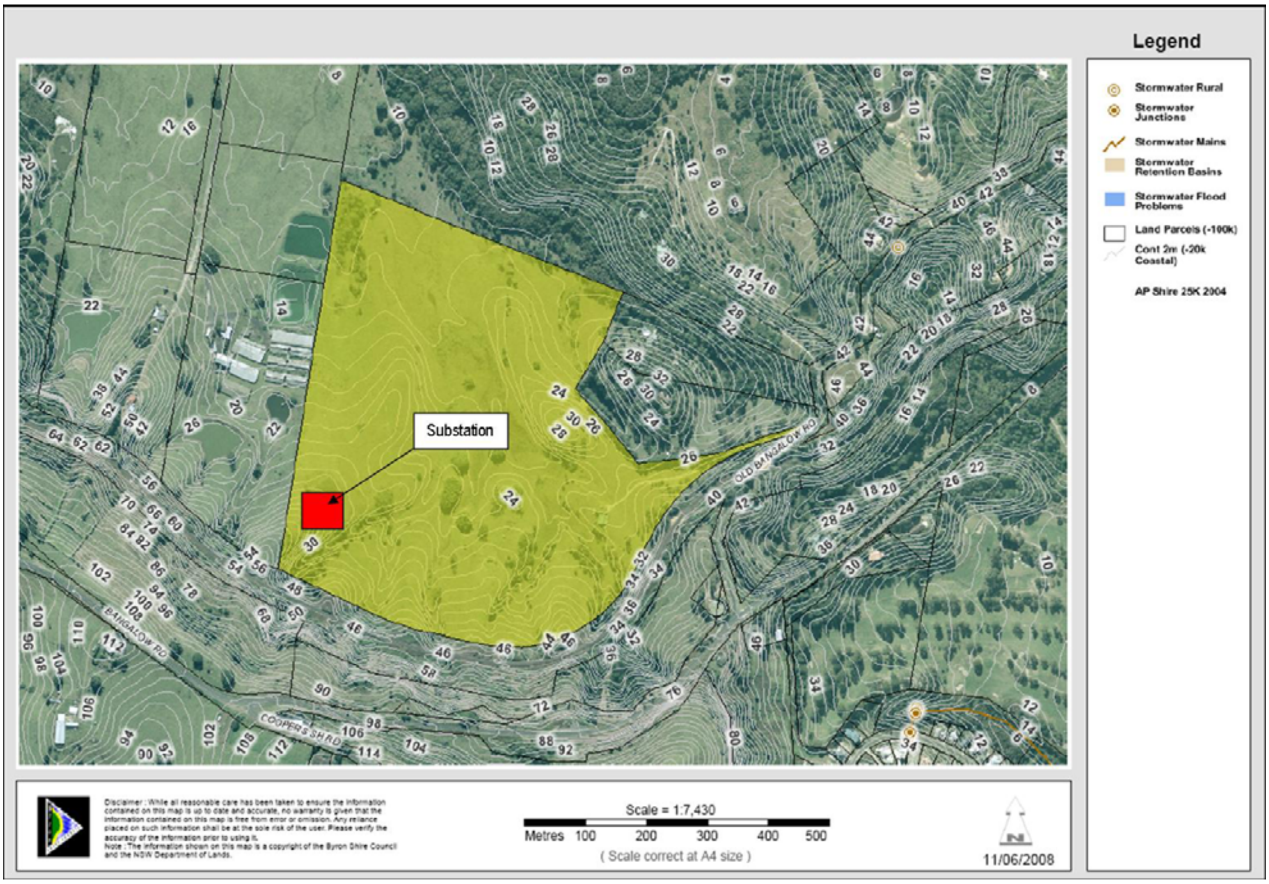


Figure 2-2: Topographic map of Suffolk Park substation area.

2.4 Acid Sulfate Soils Testing and Results

An Acid Sulphate Soil Investigation has been conducted by Australian Soil and Concrete Testing P/L for the 11kV underground works (Appendix B). Soils in the proposed underground area were found to be either mildly acidic or non-PASS/ASS soils. It was found that liming application would be required between 0.3 and 5.2kg CaCo3/t of soil. Any soil disturbed during creation of the formed road would also be lime dosed at the recommended rate.

2.5 Flora and Fauna

As previously noted in the Suffolk Park Environmental Assessment no significant impact was identified for flora or fauna species in the project area. This remains true for the proposed upgrade of the emergency upgrade track. No threatened flora species are located in the area and the identified fauna species do not have critical habitat within the proposed track location (Suffolk Park Substation and Line Route Selection (FC 25562) Environmental Assessment: Appendix G).

The proposed works will have no disturbance upon areas mapped as High Conservation Value by Byron Shire Council (Figure 2-3), and will be restricted to the removal of eleven trees and shrubs comprising of seven Coast Banksia (Banksia integrifolia) and one each of Southern Brown Bolly Gum (Litsea australis), Brown Kurrajong (Commersonia bartramia), an exotic Slash Pine (Pinus elliottii) and a Small-leaved Fig (Ficus obliqua). These are not threatened species and are present in the areas of significant vegetation in the surrounding area. The removal of these small trees and shrubs will not result in a significant environmental impact.

The disturbance area identified in red in Figure 2-3 was part of a previous site selection that is no longer relevant. The figure focuses on the units mapped by the Byron Shire Council and the new area of disturbance for the upgraded road is marked in yellow (the same alignment as the previously approved underground trench work).

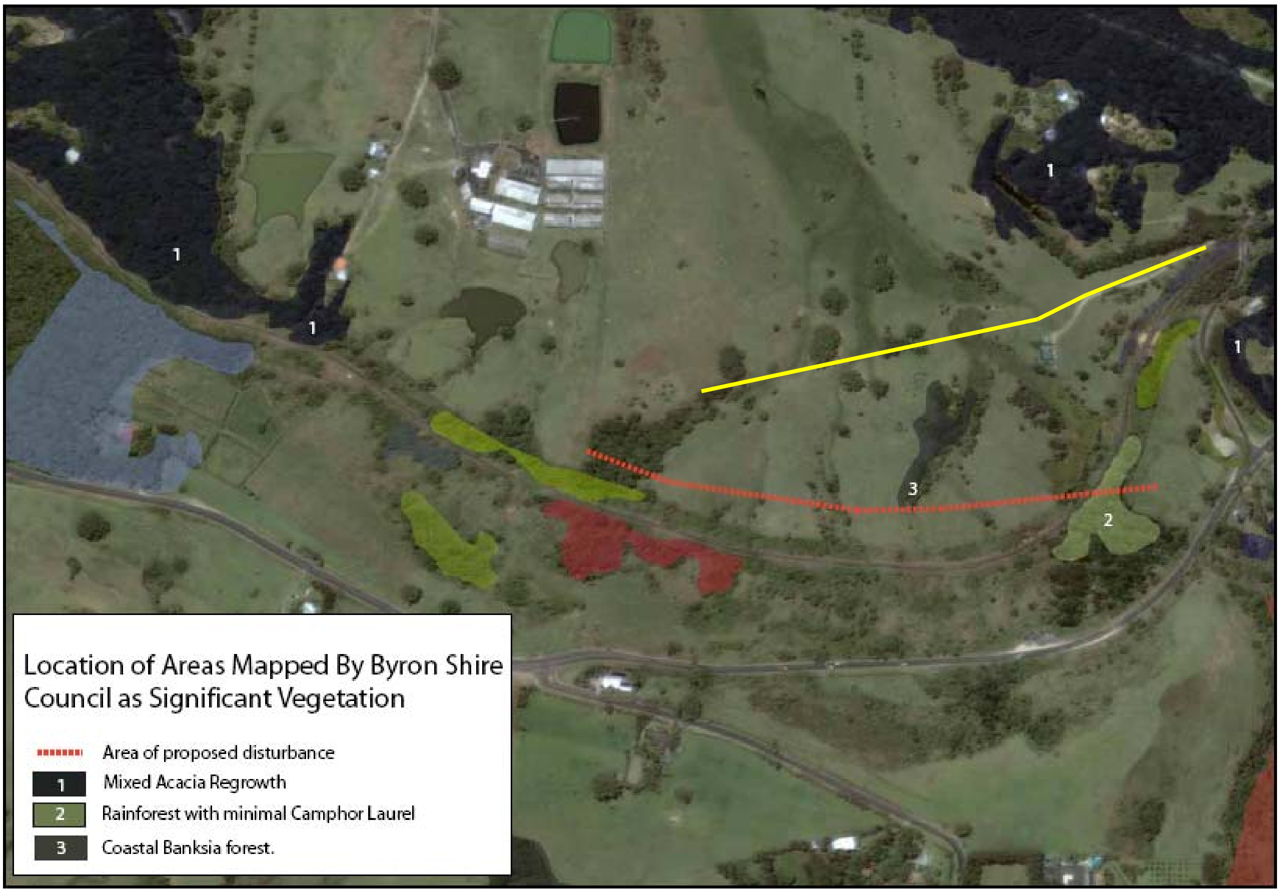
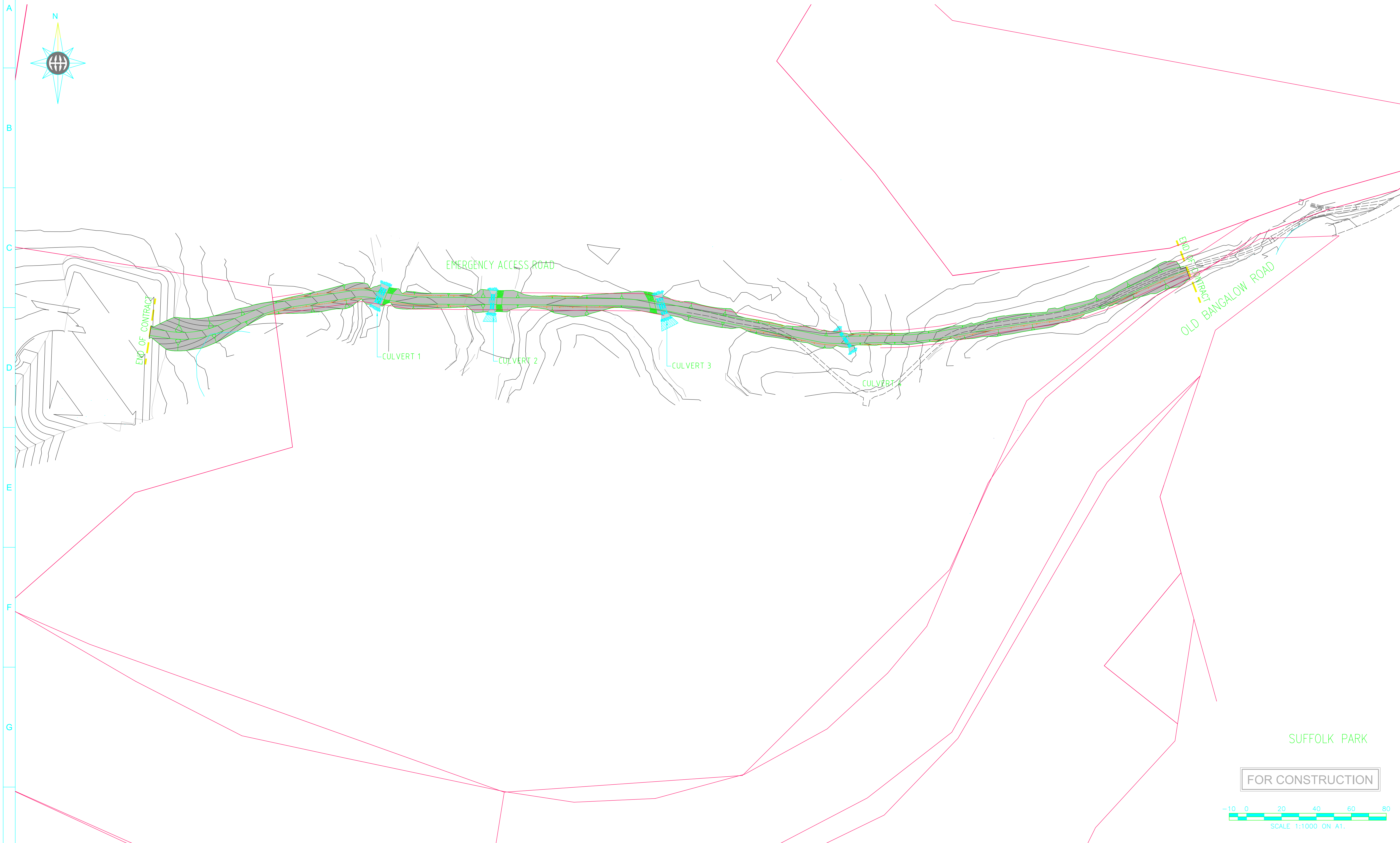


Figure 2-3: Byron Shire Council Significant Vegetation.

3. Conclusion

Country Energy believes that the proposed modification is a necessary improvement to the Lismore to Mullumbimby Electricity Network Upgrade Part 3A Project Approval. It will not result in any significant environmental impacts and is consistent with other works in the area. Country Energy is seeking the Ministers approval to include the upgrade of the emergency access track to the Suffolk Park Zone Substation in the project approval for the Lismore to Mullumbimby Electricity Network Upgrade.

Appendix A – Suffolk Park Zone Substation Emergency Access Road Plans



AMENDMENT	DRN	CHK	DATE	
A	RJE	IM	18.11.09	
0	lalexand	G.Leman	25.3.10	FOR CONSTRUCTION

REFERENCE FILES

DRAWN :	RJE
DATE	16.11.09
DGN/CKD :	IM
DATE	17.11.09
APPRD :	T.Knapczyk
DATE	25.3.10

SUFFOLK PARK SUBSTATION EMGERGENCY ACCESS ROAD
OVERALL LAYOUT PLAN

country energy

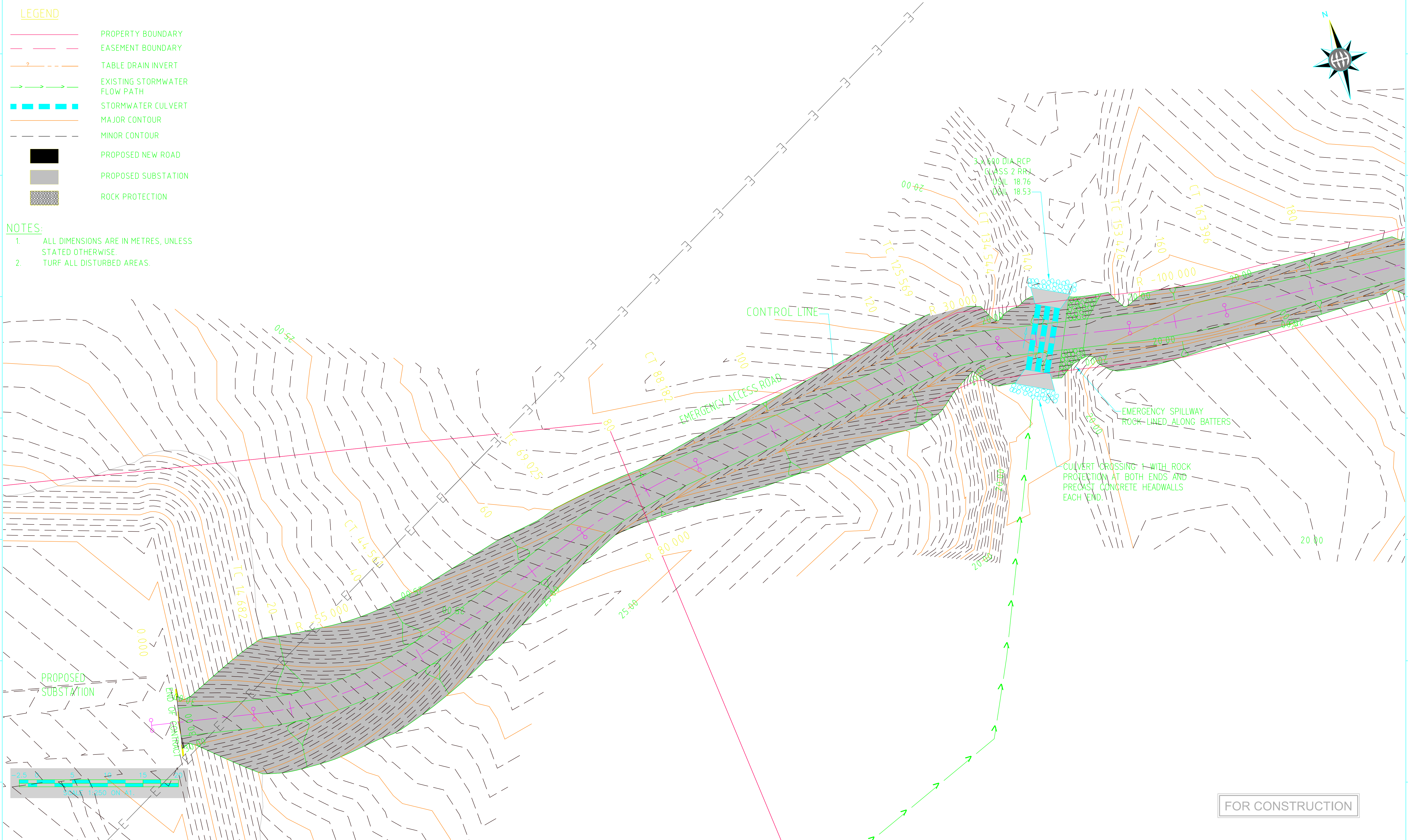
SIZE : A1	SCALE : 1:1000 @ A1	
SHT	DRAWING NUMBER	AMD
A1	A1024100-C-103	0

LEGEND

(solid pink line)	PROPERTY BOUNDARY
(dashed pink line)	EASEMENT BOUNDARY
(orange dash line)	TABLE DRAIN INVERT
(green arrows)	EXISTING STORMWATER FLOW PATH
(cyan dashes)	STORMWATER CULVERT
(orange line)	MAJOR CONTOUR
(dashed line)	MINOR CONTOUR
(black fill)	PROPOSED NEW ROAD
(grey fill)	PROPOSED SUBSTATION
(hatched fill)	ROCK PROTECTION

NOTES:

1. ALL DIMENSIONS ARE IN METRES, UNLESS STATED OTHERWISE.
2. TURF ALL DISTURBED AREAS.



FOR CONSTRUCTION

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0	Ialexand	G.Leman	25.3.10

FOR CONSTRUCTION

REFERENCE FILES

DRAWN :	RJE
DATE	11.11.09
DGN/CKD :	IM
DATE	17.11.09
APPRD :	T.Knopczyk
DATE	25.3.10

SUFFOLK PARK SUBSTATION EMGERGENCY ACCESS ROAD
LAYOUT PLAN
SHEET 1 OF 5

country energy

SIZE : A1 SCALE : 1:250 @ A1

SHT	DRAWING NUMBER	AMD
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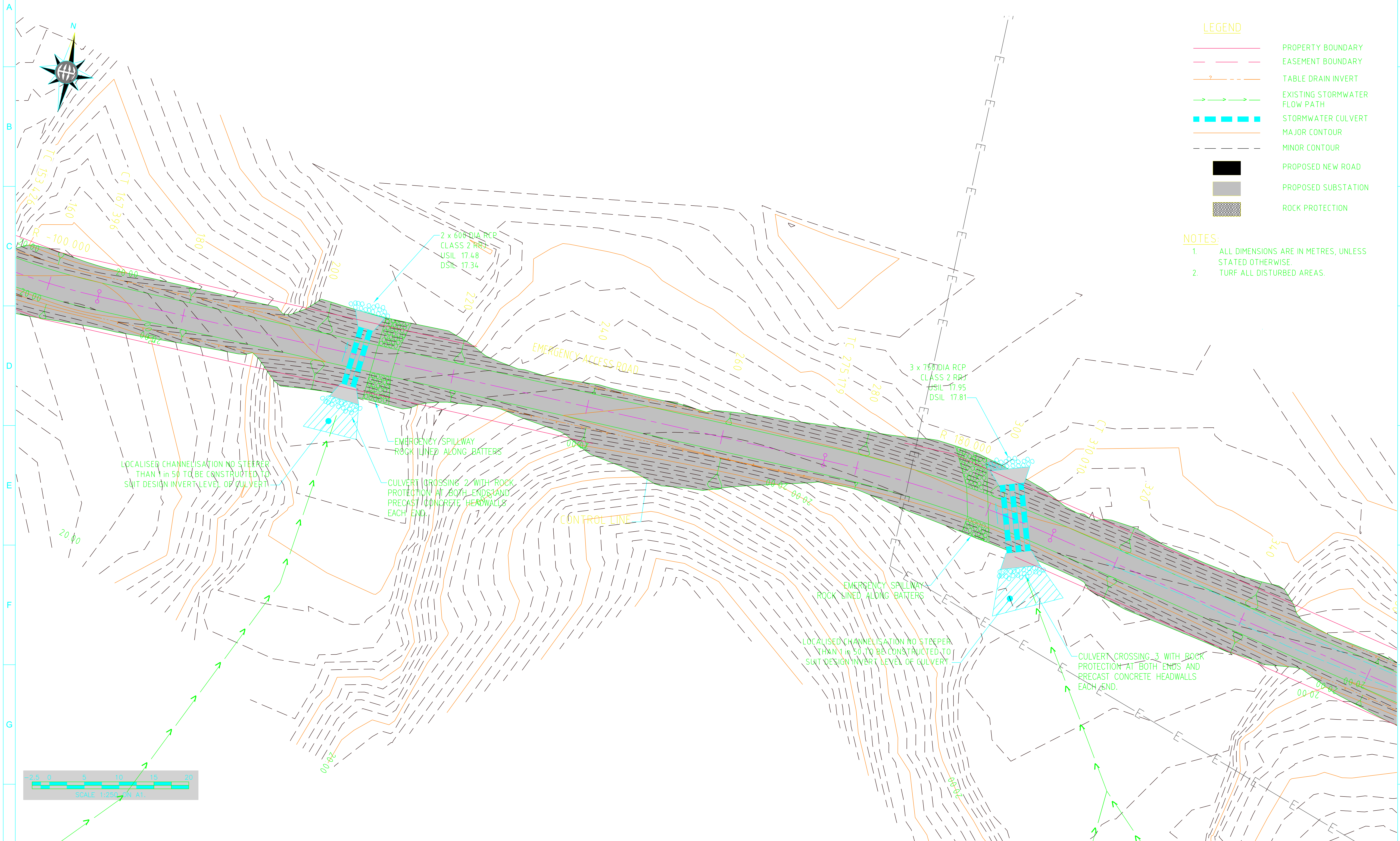
FOR CONSTRUCTION



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0	lalexand	G.Leman	26.3.10

FOR CONSTRUCTION

REFERENCE FILES

DRAWN :	RJE
DATE	11.11.09
DGN/CKD :	IM
DATE	17.11.09
APPRD :	T.Knapczyk
DATE	26.3.10

SUFFOLK PARK SUBSTATION EMGERGENCY ACCESS ROAD
LAYOUT PLAN
SHEET 2 OF 5

countryenergy

SIZE : A1	SCALE : 1:250 @ A1	
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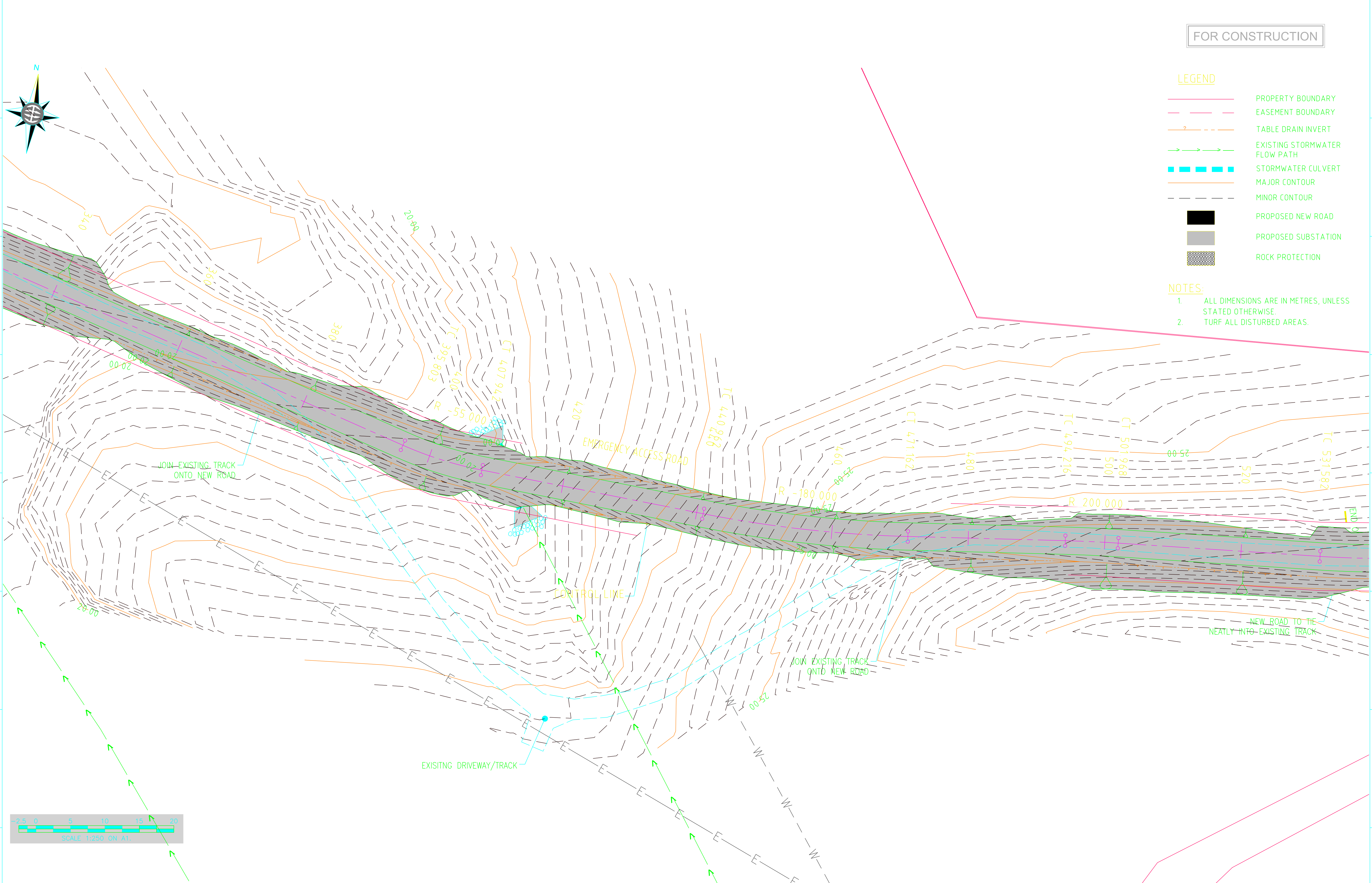

AMENDMENT	DRN	CHK	DATE
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0	lalexand	G.Leman	26.3.10

FOR CONSTRUCTION

REFERENCE FILES

DRAWN :	RJE
DATE	11.11.09
DGN/CKD :	IM
DATE	17.11.09
APPRD :	T.Knapczyk
DATE	26.3.10

SUFFOLK PARK SUBSTATION EMGERGENCY ACCESS ROAD
LAYOUT PLAN
SHEET 3 OF 5

country energy

SIZE : A1 SCALE : 1:250 @ A1

SHT	DRAWING NUMBER	AMD
A1	A1024100–C–106	0

LEGEND

(solid line)	PROPERTY BOUNDARY
(dashed line)	EASEMENT BOUNDARY
(dash line)	TABLE DRAIN INVERT
(arrow line)	EXISTING STORMWATER FLOW PATH
(heavy dashed line)	STORMWATER CULVERT
(solid line)	MAJOR CONTOUR
(dashed line)	MINOR CONTOUR
(black fill)	PROPOSED NEW ROAD
(grey fill)	PROPOSED SUBSTATION
(hatched fill)	ROCK PROTECTION

NOTES:

1. ALL DIMENSIONS ARE IN METRES, UNLESS STATED OTHERWISE.
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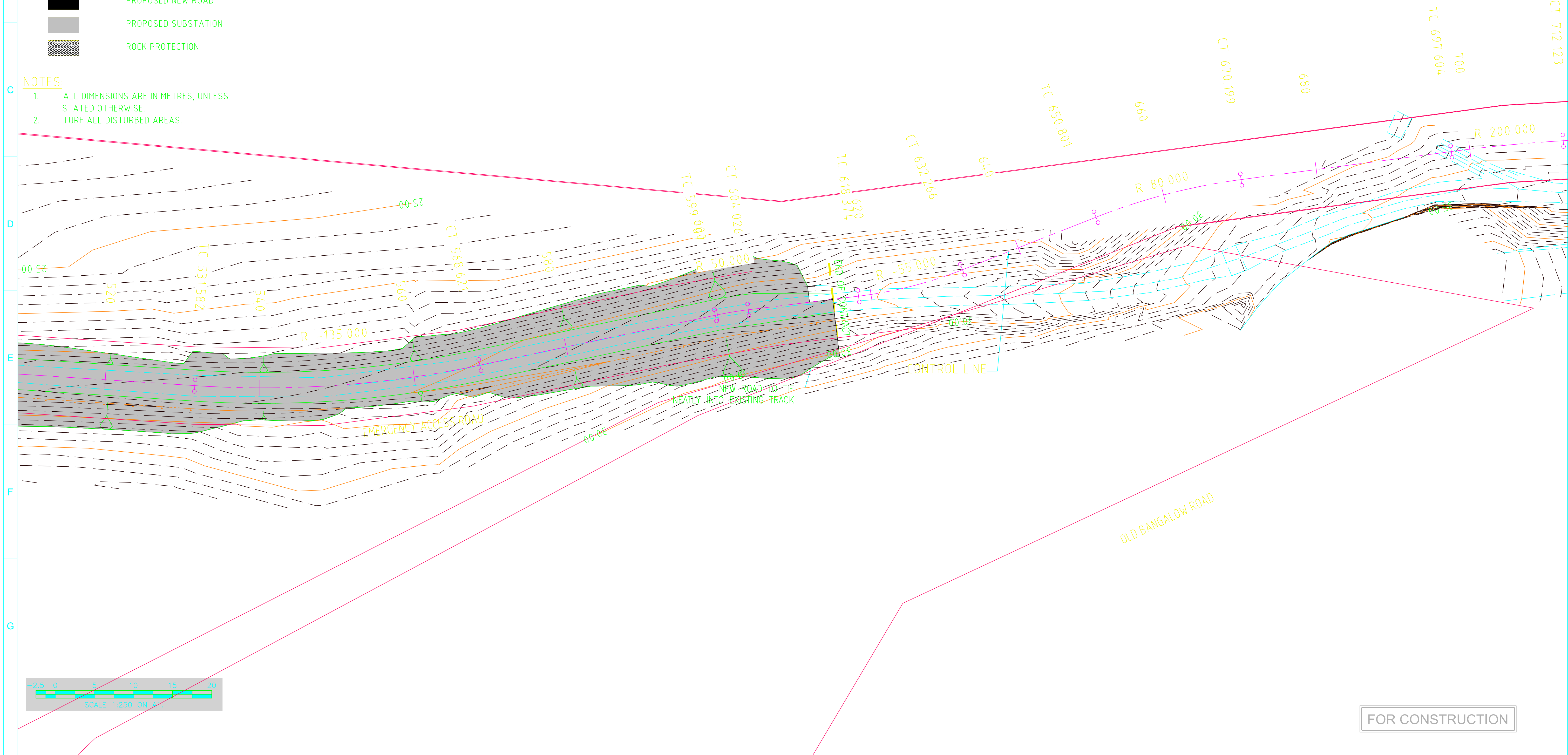

FOR CONSTRUCTION

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0 FOR CONSTRUCTION	lalexand	G.Leman	28.3.10

REFERENCE FILES

DRAWN :	RJE
DATE	11.11.09
DGN/CKD :	IM
DATE	17.11.09
APPRD :	T.Knopczyk
DATE	26.3.10

SUFFOLK PARK SUBSTATION EMERGENCY ACCESS ROAD
LAYOUT PLAN
SHEET 4 OF 5

country energy

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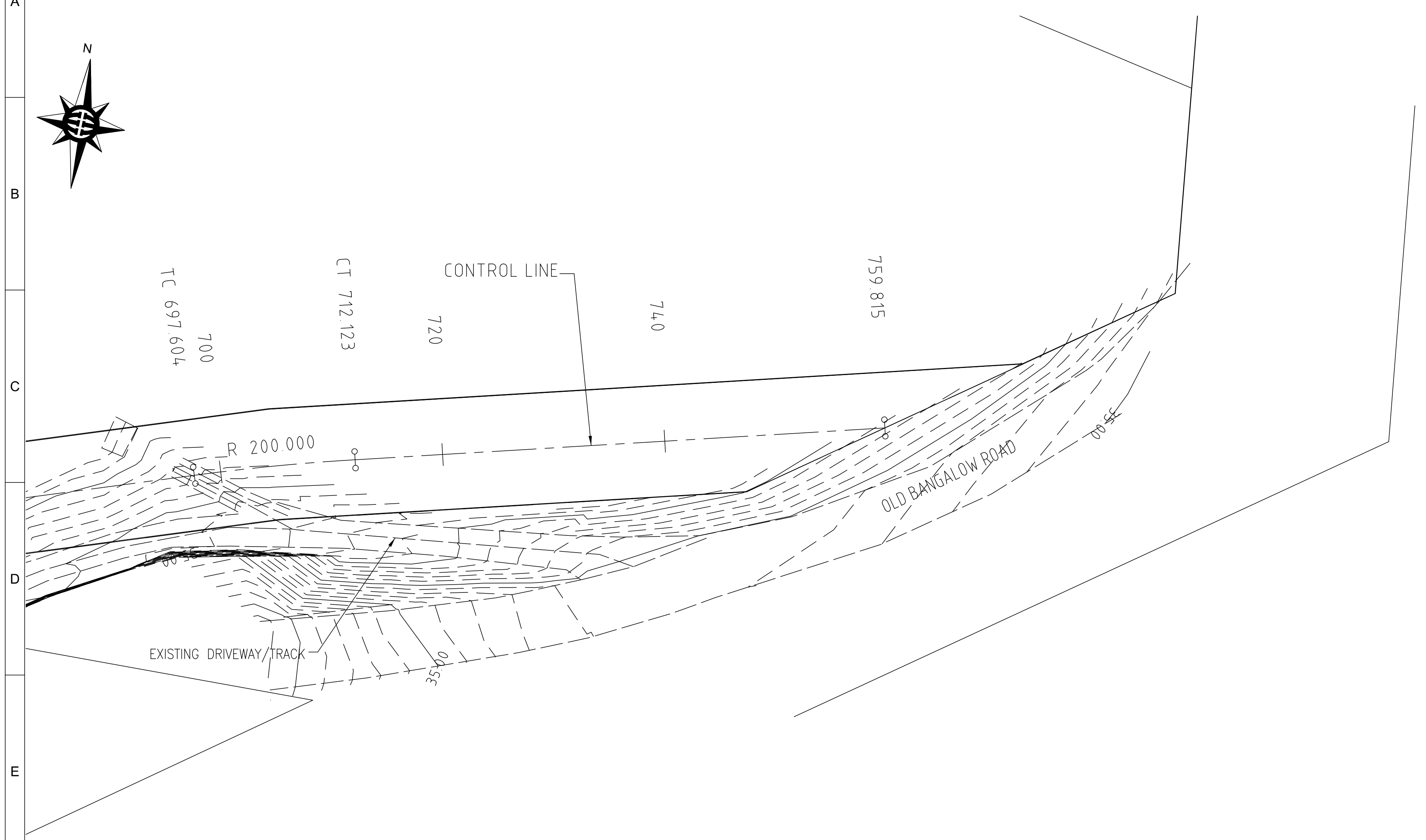

LEGEND

- PROPERTY BOUNDARY
- EASEMENT BOUNDARY
- TABLE DRAIN INVERT
- EXISTING STORMWATER FLOW PATH
- STORMWATER CULVERT
- MAJOR CONTOUR
- MINOR CONTOUR
- PROPOSED NEW ROAD
- PROPOSED SUBSTATION
- ROCK PROTECTION

NOTES:

1. ALL DIMENSIONS ARE IN METRES, UNLESS STATED OTHERWISE.
2. TURF ALL DISTURBED AREAS.

-2.5 0 5 10 15 20
SCALE 1:250 ON A1.

FOR CONSTRUCTION

AMENDMENT	DRN	CHK	DATE	DRN	CHK	DATE	
A	RJE	IM	18.11.09				
0				lalexand	G.Lenan	26.3.10	FOR CONSTRUCTION

REFERENCE FILES

DRAWN :	RJE
DATE	11.11.09
DGN/CKD :	IM
DATE	17.11.09
APPRD :	T.Knopczyk
DATE	26.3.10

SUFFOLK PARK SUBSTATION EMGERGENCY ACCESS ROAD
LAYOUT PLAN
SHEET 5 OF 5

countryenergy

SIZE : A1	SCALE : 1:250 @ A1	
SHT	DRAWING NUMBER	AMD
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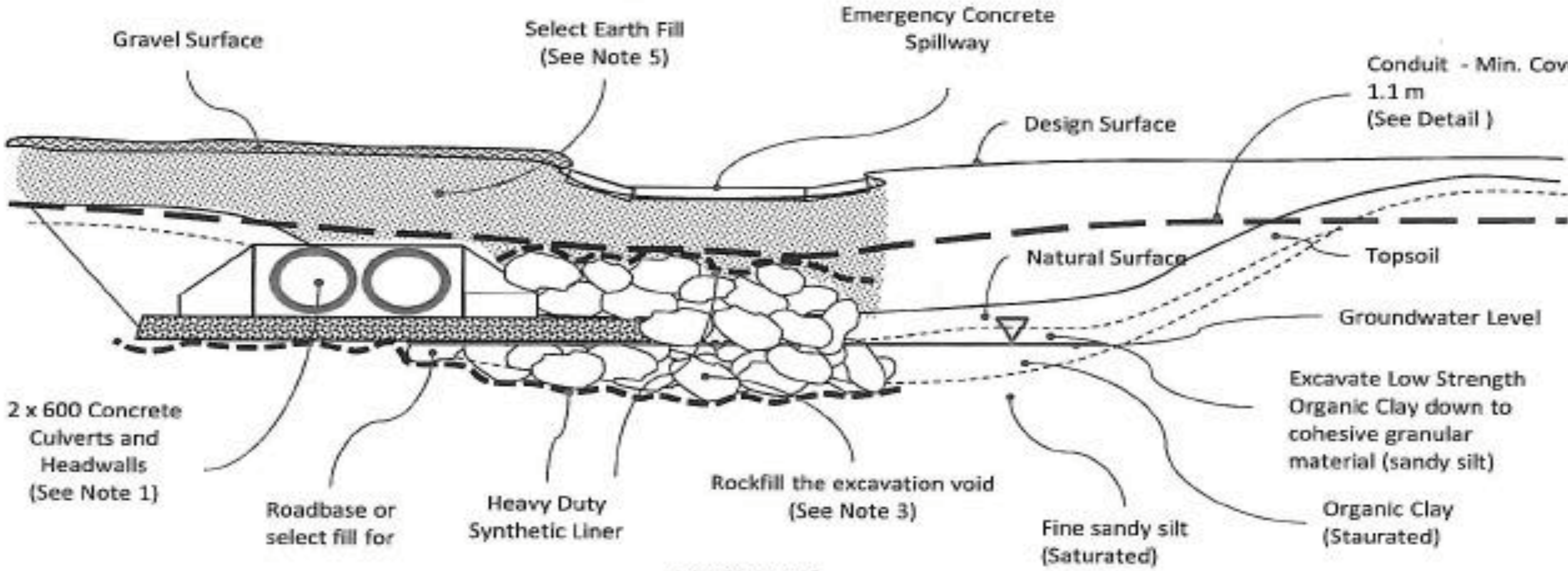
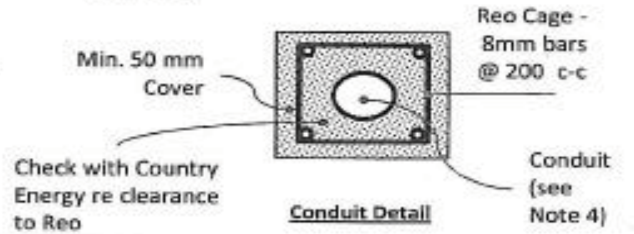


Crossing Detail

NOTES:

1. Ensure Invert Level of concrete piped culverts is above the existing surface level of the wetland
2. Concrete spillway to be rock lined on both batters
3. Rockfill to 0.5 m above existing groundwater height or swamp surface water level.
4. Conduit to be fully concrete encased with full cage reinforcement to resist settlement stresses. Concrete encasement and cage to extend to solid ground
5. Earth fill to be minimum 1.2 deep to provide minimum cover for power conduit



Conduit Detail

Copyright ©	
Author	CC
Checked	TE
Size	A4

Land and Property Management Authority
36 Marina Drive Coffs Harbour P: (02) 6691 9610

Client	Country Energy
Address	

Project:	SUFFOLK PARK SUBSTATION ACCESS ROAD
Drawing:	Revised Culvert Design - Chainage 190 - 230

Proj. No:	5007211		
Scale:	N.T.S.		
Date:	22/07/2010		
Dwg No:	3	Rev:	0

Appendix B – Acid Sulfate Soil Investigation for Underground Power Lines at Emergency Access Road Suffolk Park

AUSTRALIAN SOIL AND CONCRETE TESTING P/L
A.S.C.T.

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A.B.N. 49 050 539 930

Acid Sulfate Soil Investigation

For

Proposed Underground Power Line

At

Emergency Access Road
Zone Sub-station
Yagers Lane
Suffolk Park NSW 2481

Prepared For
Country Energy

Reference Number: 984-022-ASS
30th July 2010

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ACID SULFATE SOIL INVESTIGATION

1 Introduction

Australian Soil and Concrete Testing P/L (ASCT) have been engaged by Country Energy to undertake an acid sulfate soil investigation for a proposed underground power line at various sections of the emergency access road for the Zone Sub-station, Yagers Lane, Suffolk Park, NSW. The broad aim of the acid sulfate soil investigation is to determine whether acid sulfate soil (ASS) is present at the site. If so, the extent, severity and type of ASS will need to be ascertained. The investigation also aims to determine the liming rate required to neutralise ASS should it be present on site.

2 Acid Sulfate Soil

2.1 Background

ASS typically occurs in low-lying coastal areas. Developments involving excavation or lowering of the water table may result in the oxidation of sulfur (predominately in the form of pyrite) contained within these soils and the subsequent generation of acid discharge from the soil. The resultant discharge may find its way into the groundwater or stormwater and eventually into natural aquatic environments. The acidic run-off may lower the pH of the receiving water system, increase the concentration of metals and reduce the natural buffering capacity of the receiving waters.

There are two basic types of ASS. actual acid sulfate soils (AASS) are soils where the pyrites have been oxidised and sulfuric acid is present. Potential acid sulfate soils (PASS) have not been oxidised and sulfuric acid has not yet been generated.

PASS in anaerobic conditions such as below the water table do not present an environmental hazard. However, if conditions change from anaerobic to aerobic, the pyrite in PASS will oxidise to form sulfuric acid. Oxidation can occur by either lowering the water table or removing the soil from below the water table, such as excavation.

2.2 ASS Management Principles and Guidelines

The following principles are in accordance with the Acid Sulfate Soil Management Advisory Committee (ASSMAC) Management Guidelines (1998) and are the fundamental strategies that underpin the management of ASS.

2.2.1 Avoidance

This is the soundest strategy and the proposed works should always attempt to modify work practices in order to avoid unnecessarily exposing or disturbing ASS. The proposed works should also where possible avoid activities that result in the fluctuation of the groundwater, in particular the lowering of groundwater.

2.2.2 Minimisation

Appropriate handling techniques and treatment of excavated soil are to be used to minimise and or prevent the disturbance of ASS. Furthermore, earthworks activities should be managed to minimise or mitigate the potential of ASS to impact on the surrounding environment.

2.2.3 Neutralisation

Sufficient neutralising agent should be incorporated into excavated soils in order to neutralise acid that is generated over time due to the gradual oxidation of ASS. Neutralising agent should also be applied to acidified water run-off and any remaining water ‘in-situ’ (within the pore spaces of the material being excavated) that has become acidified.

The management and remediation of the excavated soil for earth works will usually be achieved using a combination of the management strategies outlined above.

3 The Proposed Development

The proposed development will involve the construction of an emergency access road from Old Bangalow Road to the Suffolk Park Zone Sub-station. The emergency access road will be approximately 500m long and has several small gully crossings. It is understood that underground power will be installed at four gully crossing along the length of the proposed road at chainages 140, 210, 320 and 400. The maximum excavation depth for underground power at each of the crossings is anticipated to be approximately 1m below the existing surface level.

4 The Site

4.1 Site Description

The site is located at the base of a large north-facing coastal escarpment on the southern fringe of the Byron Bay/Suffolk Park built-up area. More specifically, the proposed emergency access road traverses gentle to moderately sloping, cleared grazing country. The gully crossings at the time of the investigation all contained small, gently flowing streams. Furthermore, access to the site at the time of the investigation was limited to 4WD travel due to recent rains. The local setting of the site is displayed in figure 1 below.

4.2 Subsurface Conditions

The sub-surface conditions at the test sites were found to be variable and included alluvial soil, slope-wash soil, residual soil and weathered bedrock. Shallow groundwater was also encountered at each test site and ranged in depth from 0.3 – 0.6m below the existing surface level. A summary of the sub-surface conditions found at each test site is displayed in table 1 and the complete geotechnical borehole logs have been included in appendix B.

The investigation site is identified on the Byron Shire Council Acid Sulfate Soil Planning Map in figure 1. The site has not been classified as a potential acid sulfate soil area.

5 The Investigation

5.1 Scope of Work

The scope of work for the acid sulfate investigation included:

- Drilling of four boreholes at the investigation site.
- Collection of soil samples from the boreholes at 0.5m intervals or soil type changes to a final drilling depths of 2.0m.
- Analysis of all samples for field pH (pH_f) and field peroxide pH (pH_{fox}) to provide initial indication of PASS/AASS.
- Laboratory analysis of soil to determine % chromium reducible sulfur ($\%S_{cr}$), total actual acidity (TAA), net acidity and liming rates.
- Collection of groundwater and water samples across the site.
- Analysis of water samples for pH, chloride/sulfate ratio and dissolved iron and aluminium.
- Summary of ASS analysis results.

5.2 Soil and Water Sampling

Soil and water sampling was conducted in accordance with the ASSMAC guidelines (1998) and included:

- The drilling of four boreholes at the investigation site on 13/7/10. One borehole was drilled at each of the proposed underground power sites (gully crossings) along the emergency access road from Old Bangalow Road to the Suffolk Park Zone Sub-station.
- Sampling was undertaken by staff of ASCT, namely Ben Hart (Environmental Officer) and Stephen Hart (Trainee Technician).
- The boreholes conducted at gully crossings corresponding to the emergency access road chainages 210, 320 and 400 were drilled to a depth of 2.0m below the existing surface level which is 1.0m beyond the maximum depth of excavation for the proposed underground power. The borehole conducted at the gully crossing corresponding to emergency access road chainage 140 was drilled to a depth of 1.6m below the existing surface level as drilling at this located was unable to penetrate weathered siltstone bedrock below this depth.
- Soil samples were collected from the boreholes at 0.5m depth intervals or soil type changes to yield a total of 19 samples overall.
- Drilling and sampling was conducted with a hand held Jarret auger. The sampling augers were cleaned between each sample and sampling location.
- All samples were placed in zip lock plastic bags and transferred immediately to an esky with ice for storage. Samples were stored on ice before being tested the next day for field pH (pH_f) and field peroxide pH (pH_{fox}) in accordance with ASSMAC test method codes 21Af and 21Bf respectively. Furthermore, pH_{fox} testing was carried out using 30 % hydrogen peroxide adjusted to pH 5.5.
- On the basis of field testing, six samples were submitted to the Environmental Analysis Laboratory, Lismore (EAL) for analysis of % chromium reducible sulfur (%S_{cr} – Method 22B), total actual acidity (TAA), net acidity and liming requirements.
- Three water samples were collected from the site at the time of the investigation. Two groundwater samples were collected from the boreholes at chainages 210 and 400 and one water sample was taken from the stream flowing through the test site at chainage 320. Groundwater samples were collected from the boreholes using a clean plastic bailer for each location and all water samples were placed in clean plastic bottles. The water samples were submitted to the EAL to be analysed for a range of indicative acid sulfate parameters, including pH, chloride/sulfate ratio and dissolved iron and aluminium. The chain of custody documentation for the soil and water samples are included in appendix C.

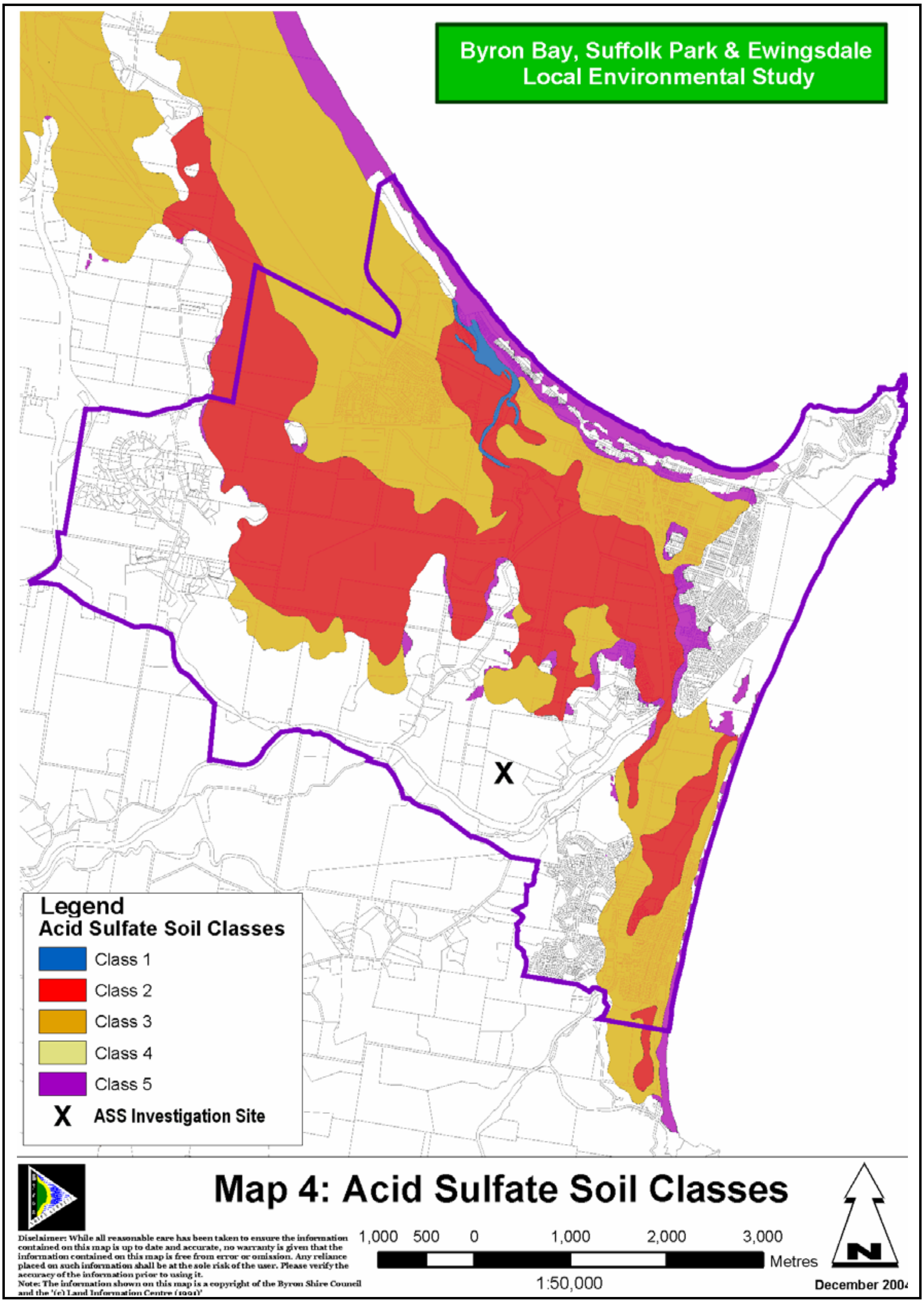


Figure 1: The Byron Shire Councils Acid Sulfate Soil Planning Map with an **X** showing the approximate location of the investigation site.

6 Field Testing

A summary of the field testing results are displayed in table 1. The results of field testing indicate the site may contain ASS at chainages 210, 320 and 400. However, the results indicate that the soil profile at chainage 140 does not contain ASS. The soil profile at chainage 210 was only found to be reactive at a depth of 1.5m and the remainder of the soil profile at this location was generally found to be non-reactive. Soil samples from the entire soil profile (0.0 – 2.0m) at chainages 320 and 400 were found to undergo significant reactions with hydrogen peroxide. On the basis of the field testing results, the most reactive soil samples form each test site were submitted for full laboratory analysis, including sample numbers 3, 8, 11, 13, 15 and 18.

Table 1: Summary of field testing results.

Sample Number	Sample Source	Sample Depth (m)	Sample Description	pH_f	pH_{fox}	$pH_f - pH_{fox}$	PASS/AASS Indication*
1	CH 140	0.2	Silty Clay Topsoil: Mottled Brown Orange	5.67	4.72	0.95	**Non-PASS/AASS**
2	"	0.5	Gravelly Sand: Pale Brown	5.90	5.46	0.44	"
3	"	1.0	Clayey Sand: Grey	5.47	4.58	0.89	"
4	"	1.5	Sandy Gravelly Clay: Brown	5.61	5.03	0.58	"
5	CH 210	0.1	Silty Clay Topsoil: Brown	5.76	5.17	0.59	"
6	"	0.5	Sandy Silty Clay: Brown	5.21	4.75	0.46	"
7	"	1.0	"	5.67	4.92	0.75	"
8	"	1.5	Gravelly Clayey Sand: Grey Brown	5.45	**4.37**	**1.08**	**Possible PASS**
9	"	2.0	"	5.63	5.02	0.61	**Non-PASS/AASS**
10	CH 320	0.1	Silty Clay Topsoil: Brown	6.00	**4.12**	**1.88**	**Possible PASS**
11	"	0.5	Clayey Sand: Pale Brown Grey	5.15	**3.49**	**1.66**	"
12	"	1.0	Sandy Clay: Grey	6.08	**3.58**	**2.50**	"
13	"	1.5	"	6.24	**3.57**	**2.67**	"
14	"	2.0	"	6.40	**3.52**	**2.88**	"
15	CH 400	0.1	Silty Clay Topsoil: Brown	5.03	**3.15**	**1.88**	"
16	"	0.5	Gravelly Sand: Grey	5.72	**4.30**	**1.42**	"
17	"	1.0	"	5.72	**4.26**	**1.46**	"
18	"	1.5	"	5.75	**3.98**	**1.77**	"
19	"	2.0	Sandy Gravel: Grey	6.00	4.90	**1.10**	"

* Indications are based on the ASSMAC guidelines and are determined as follows:

- Non-PASS/AASS if → $pH_f - pH_{fox} < 1.0$, $pH_f > 4.0$
- Possible PASS if → $5 < pH_f > 3$, and $pH_f - pH_{fox} > 1.0$
- PASS very likely if → $pH_f - pH_{fox} > 2.0$
- AASS present if → $pH_f < 4.0$

The field peroxide test is only an indicative test that is used to guide the selection of laboratory test samples. Care must be taken when interpreting the reaction with hydrogen peroxide as organic matter and other constituents such as manganese oxide can also cause a reaction.

7 Laboratory Testing

7.1 Soil

On the basis of field testing the most reactive soil samples from each test site were submitted to EAL for analysis of % chromium reducible sulfur (%S_{cr}), titratable actual acidity (TAA), net acidity and liming rate. A summary of the laboratory results are displayed in table 2 and the complete results have been included in appendix A of this report. The laboratory results are based on the following:

- **Non-Actual Acid Sulfate Soils** (Non-AASS) – Laboratory testing indicates these soils have a titratable actual acidity (TAA) and reduced inorganic sulfur (%S_{crs}) below the ASSMAC action criteria and are not considered to present an environmental hazard.
- **Non-Potential Acid Sulfate Soils** (Non-PASS) – Laboratory testing indicates these soils have a reduced inorganic sulfur content (%S_{cr}) below the ASSMAC action criteria and are not considered to present an environmental hazard
- **Potential Acid Sulfate Soils** (PASS) – Laboratory testing indicates these soils have a reduced inorganic sulfur content (%S_{crs}) above the ASSMAC action criteria they may generate sulfuric acid and may present an environmental hazard. Management of these soils will be required.
- **Actual Acid Sulfate Soils** (AASS) – Laboratory testing indicates that these soils have a titratable actual acidity (TAA) and reduced inorganic sulfur content (%S_{crs}) above the ASSMAC action criteria. These soils may leach acid and will require management.
- **Acidic Soils** – Laboratory testing indicates that these soils have a net acidity (based on %S_{cr}) above the ASSMAC action criteria, but they have reduced inorganic sulfur below the ASSMAC action criteria. These soils may present an environmental hazard and may require management.

Table 2: Summary of laboratory soil analysis.

Sample Number	3	8	11	13	15	18
Sample Location	CH 140	CH 210	CH 320	CH 320	CH 400	CH 400
Depth (m)	1.0	1.5	0.5	1.5	0.1	1.5
Texture	Fine	Medium	Medium	Medium	Fine	Coarse
Titratable Actual Acidity (TAA) (mole H^+/tonne)	24	23	23	**38**	**64**	3
ASSMAC AASS Action Criteria[1] (mole H^+/tonne)	62	36	36	36	62	18
Reduced Inorganic Sulfur (%S_{cr})	0.03	0.02	<0.01	0.02	0.01	<0.01
ASSMAC PASS Action Criteria[1] (%S_{cr})	0.1	0.06	0.06	0.06	0.1	0.03
Net Acidity (based on %S_{cr})	42	**36**	23	**50**	**70**	3
Acidic Soil Action Criteria[1] (mole H^+/tonne)	62	36	36	36	62	18
Acid Sulfate Potential	**Non-PASS/AASS**	**ACIDIC**	**Non-PASS/AASS**	**ACIDIC**	**ACIDIC**	**Non-PASS/AASS**
Limining Rate[2] (kg $CaCO_3$/tonne DW[3])	**3.2**	**2.7**	**1.7**	**3.8**	**5.2**	**0.3**

1 Action criteria taken from the ASSMAC guidelines and is based on less than1000 tonnes of soil to be disturbed and is also dependent on soil texture.
2 The laboratory calculated liming rate is based on the results of testing and has been determined using a safety factor of 1.5.
3 DW – Dry Weight.

The laboratory testing shows that soil sample 3 from chainage 140 has TAA and net acidity of 24 mole H^+/tonne and 42 mole H^+/tonne respectively which is below the relevant ASSMAC action criteria of 62 mole H^+/tonne for fine textured soil. Furthermore, sample 3 had a reduced inorganic sulfur content of 0.03% which is below the ASSMAC action criteria of 0.1%. Soil samples 11 (CH 320, 0.5m) and 18 (CH 400, 1.5m) also TAA, net acidity and reduced inorganic sulfur levels below the relevant ASSMAC action criteria. Therefore, based on laboratory analysis samples 3, 11 and 18 can be classed as non-PASS/AASS.

Soil samples 8 (CH 210, 1.5m), 13 (CH 320, 1.5m) and 15 (CH 400, 0.1m) all had net acidity above the relevant ASSMAC action criteria, but their reduced inorganic sulfur contents were below the ASSMAC action criteria. Therefore, based on laboratory analysis these samples contain mild actual acidity. This acidity may be the result of previously oxidised ASS soils or soluble aluminium and iron from other acid forming coastal processes. Soils with actual acidity are common in coastal areas of Northern NSW, and based on the data available soil samples 8, 13 and 15 would be classed as “acidic” rather than “acid sulfate”.

The laboratory analysis has also determined liming application rates for the soil samples (with a safety factor of 1.5) and they range from 0.3 to 5.2 kg $CaCo_3$ (lime)/t of soil. It is recommended that the maximum calculated liming rate of 5.2 kg $CaCo_3$ (lime)/t of soil be used for the neutralisation process during the excavation activities for the proposed development. The maximum calculated liming rate will be sufficient to neutralise the ‘worst case’ PASS/AASS detected in the investigation.

7.2 Water

The water samples collected from CH210, 320 and 400 were submitted to EAL and were analysed for a range of indicative acid sulfate parameters, including pH, chloride/sulfate ratio and dissolved iron and aluminium. A summary of the water results are displayed in table 3 below and the complete laboratory analysis is included in appendix A.

Table 3: Summary of laboratory water analysis.

Sample Number	**1**	**2**	**3**
Location	CH 210	CH 320	CH 400
Depth (m)	0.6m	Stream	0.5m
pH	5.16	6.27	5.38
Chloride/Sulfate Ratio	0.8	3.6	1.9
Dissolved Iron (mg/L)	0.739	0.904	0.742
Dissolved Aluminium (mg/L)	1.258	0.055	0.502

The groundwater samples taken from the boreholes at chainages 210 and 400 had mildly acidic pH results of 5.16 and 5.38 respectively, therefore indicating the groundwater at these locations were not significantly effected by acid sulfate material at the time of the investigation. The concentrations of dissolved iron were found to be about 0.7mg/L at both sites and aluminium concentrations were found to be 1.258mg/L and 0.502 mg/L at chainages 210 and 400 respectively. Higher concentrations of these analytes would also be expected if significant acid sulfate conditions were prevalent. However, the chloride/sulfate ratio in the groundwater at CH 210 is sufficiently low to be indicative of a possible acid sulfate presence.

The water sample taken from the stream at CH 320 had a relatively neutral pH of 6.27. Furthermore, the other analysed parameters do not indicate any significant acid sulfate influences.

8 Acid Sulfate Soil Summary

In summary, the site was found to contain two main soil types including mildly acidic soil and non-PASS/AASS. All soil types analysed were found to have a lime requirement for neutralisation and application rates ranged from 0.3 to 5.2 kg $CaCo_3$ (lime)/t of soil. Excavation of acidic soils may facilitate the release of acid into the surrounding environment which in turn may pose an environmental hazard. It is recommended that all soil excavated for the proposed underground power development be neutralised at the maximum calculated liming rate of 5.2 kg $CaCo_3$ (lime)/t of soil.

Groundwater sampled at the site provided some indication of the presence of low-level acid sulfate material. It is anticipated that some dewatering may be required for the proposed development and dewatering activities should be conducted to meet the Byron Shire Council's dewatering requirements.

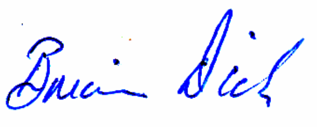
9 Limitations

This report relies on information supplied by the client and the results of investigations conducted in accordance with accepted practices and standards. The report is intended to represent a reasonable interpretation of the appropriate legislation and the condition of the site at the time of the investigation. However, due to these elements being subject to change over time the report under no circumstances can be considered to represent the definitive state of the site at all times.

Finally, should any problem or concern arise that needs clarification or assistance the client should not hesitate to contact this office.

Yours Faithfully,
Australian Soil and Concrete Testing Pty.Ltd.

Ben Hart
<u>Environmental Officer</u>
(B. App. Sc)



Brian Dick
<u>Managing Director</u>

10 References

DPI Qld, 2003. *Acid Sulfate Soils Laboratory Methods Guidelines*.

Stone, Y, Ahern C R, and Blunden B (1998). *Acid Sulfate Soils Manual 1998. Acid Sulfate Soil Management Advisory Committee* (ASSMAC), Wollongbar, NSW, Australia.

APPENDIX A – Results of Laboratory Analysis

RESULTS OF ACID SULFATE SOIL ANALYSIS

6 samples supplied by Australian Soil and Concrete Testing on the 15th July, 2010 - Lab. Job No. A9638

Analysis requested by Brian Dick. - **Your Project: Pro#984-022. Country Energy**

(Australian Soil and Concrete, PO Box 5120, BALLINA NSW 2478)

Sample Site	EAL lab code	TEXTURE	MOISTURE CONTENT		TITRATABLE ACTUAL ACIDITY (TAA) (To pH 6.5)		REDUCED INORGANIC SULFUR (% chromium reducible S)		ACID NEUTRALISING CAPACITY (ANC_{BT}) required if pH_{KCl} > 6.5		NET ACIDITY Chromium Suite mole H^+/tonne	LIME CALCULATION Chromium Suite kg $CaCO_3$/tonne DW
		(note 6)	(% moisture of total wet weight)	(g moisture / g of oven dry soil)	pH_{KCl}	(mole H^+/tonne)	(%Scr)	(mole H^+/tonne)	(% $CaCO_3$)	(mole H^+/tonne)	(based on %Scrs)	(includes 1.5 safety Factor when liming rate is +ve)
Method No.											*note 5*	*note 4 and 6*
CH 140 @ 1.0	*A9638/1*	Fine	23.3	0.30	4.59	24	0.03	19	..	0	42	3.2
CH 210 @ 1.5	*A9638/2*	Medium	19.7	0.25	4.72	23	0.02	12	..	0	36	2.7
CH 320 @ 0.5	*A9638/3*	Medium	22.9	0.30	4.53	23	<0.01	0	..	0	23	1.7
CH 320 @ 1.5	*A9638/4*	Medium	20.5	0.26	4.43	38	0.02	12	..	0	50	3.8
CH 400 @ 0.1	*A9638/5*	Fine	42.3	0.73	4.39	64	0.01	6	..	0	70	5.2
CH 400 @ 1.5	*A9638/6*	Coarse	9.7	0.11	5.85	3	<0.01	0	..	0	3	0.3

NOTE:

1 - All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)

2 - Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr - Method 22B)

3 - Methods from Ahern, CR, McElnea AE , Sullivan LA (2004). ***Acid Sulfate Soils Laboratory Methods Guidelines.*** QLD DNRME.

4 - Bulk Density is required for liming rate calculations per soil volume. Lab. Bulk Density is no longer applicable - field bulk density rings can be used and dried/ weighed in the laboratory.

5 - **ABA Equation: Net Acidity = Potential Sulfidic Acidity (ie. Scrs or Sox) + Actual Acidity + Retained Acidity - measured ANC/FF (with FF currently defaulted to 1.5)**

6 - The neutralising requirement, lime calculation, includes a 1.5 safety margin for acid neutralisation (an increased safety factor may be required in some cases)

7 - For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays

8 - .. denotes not requested or required. '0' is used for ANC and Snag calcs if TAA pH <6.5 or >4.5

9 - SCREENING, CRS, TAA and ANC are NATA accredited but other SPOCAS segments are currently not NATA accredited

10- Results at or below detection limits are replaced with '0' for calculation purposes.

11 - **Projects that disturb >1000 tonnes of soil, the ≥0.03% S classification guideline would apply (refer to acid sulfate management guidelines).**

12 - Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.

(Classification of potential acid sulfate material if: coarse Scr≥0.03%S or 19mole H^+/t; medium Scr≥0.06%S or 37mole H^+/t; fine Scr≥0.1%S or 62mole H^+/t) - as per QUASSIT Guidelines

NATA

checked: ....

Graham Lancaster

Laboratory Manager

Environmental Analysis Laboratory, Southern Cross University,

Tel. 02 6620 3678, website: scu.edu.au/eal

RESULTS OF WATER ANALYSIS (Page 1 of 1)

3 samples supplied by Australian Soil & Concrete Testing on the 15th July, 2010 - Lab. Job No. A9639

Analysis requested by Brian Dick- **Your Project: #984-022. Country Energy**

PARAMETER	METHODS REFERENCE	Sample 1 CH 210	Sample 2 CH 320	Sample 3 CH 400
	Job No.	*A9639/1*	*A9639/2*	*A9639/3*
pH	APHA 4500-H^+	5.16	6.27	5.38
CONDUCTIVITY (EC) (dS/m)	APHA 2510-B	0.16	0.15	0.12
TOTAL DISSOLVED SALTS (mg/L)	calculation using EC x 680	105	103	81
CHLORIDE (mg/L)	APHA 4500-Cl^-	33.6	22.6	18.6
SULPHATE (mg/L SO_4^{2-})	APHA 3120 ICPOES*note 2	42	6	10
CHLORIDE/ SULPHATE RATIO	Calculation	0.8	3.6	1.9
DISSOLVED IRON (mg/L)	APHA 3120 ICPMS/OES*note 1&2	0.734	0.904	0.742
DISSOLVED ALUMINIUM (mg/L)	APHA 3120 ICPMS/OES*note 1&2	1.258	0.055	0.502

Notes:

1b. **Dissolved metals** - samples filtered through 0.45μm cellulose acetate and then acidified with nitric acid prior to analysed

2. Metals analysed be ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) or ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry)

3. 1 mg/L (milligram per litre) = 1 ppm (part per million) = 1000 μg/L (micrograms per litre)= 1000 ppb (part per billion)

4. For conductivity - 1 dS/m = 1 mS/cm = 1000 μS/cm

5. Analysis performed according to APHA, 2005, "Standard Methods for the Examination of Water & Wastewater", 21st Edition, except where stated otherwise.

checked: ....

APPENDIX B – Geotechnical Borehole Logs

ASCT Doc. W40 Rev. No. 03-30/4/08 BH

BOREHOLE LOG

Client: Country Energy	**Project No**: 984-022	**Project**: Zone Sub-station, Yagers Lane, Suffolk Park.		
Lab No: 12555		**Borehole No**: 1	**Page**:	**Of**:

Borehole Inclination: 90	**Borehole Direction**: Vertical	**Date Drilled**: 13/7/10
Surface Elevation: ESL	**Drilling Method**: Hand Auger	**Drill Type**: 100mm Auger
Borehole Location: Emergency Access Road CH 140		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY CLAY TOPSOIL: medium plastic, medium dry strength, some organic material, trace fine to coarse sand, soft, very moist to wet. Alluvial soil.	- 0.0		CL	S	
GRAVELLY SAND: pale brown, low to non-plastic, low dry strength, fine to coarse sand, fine gravel, trace of silt and clay, loose, very moist to wet below 0.5m. Slope-wash.	- 0.2		SW	L	
Groundwater Inflow @ 0.5m	- ***0.5***				
CLAYEY SAND: grey, low plastic, low dry strength, fine to coarse sand, loose, wet. Slope-wash.	- 0.75		SC	L	
SANDY GRAVELLY CLAY: brown, low plastic, low dry strength, fine to coarse sand and gravel, firm, wet. Residual Soil.	- 1.2		GC/SC	F	
Refusal – extremely to distinctly weathered siltstone bedrock.	- 1.6				

ASCT Doc. W40 Rev. No. 03-30/4/08 BH

BOREHOLE LOG

Client: Country Energy	**Project No**: 984-022	**Project**: Zone Sub-station, Yagers Lane, Suffolk Park.		
Lab No: 12555		**Borehole No**: 2	**Page**:	**Of**:

Borehole Inclination: 90	**Borehole Direction**: Vertical	**Date Drilled**: 13/7/10
Surface Elevation: ESL	**Drilling Method**: Hand Auger	**Drill Type**: 100mm Auger
Borehole Location: Emergency Access Road CH 210		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY CLAY TOPSOIL: brown, medium plastic, medium dry strength, some organic material, trace of fine gravel, soft, wet. Alluvial Soil.	0.0		CL	S	
SANDY SILTY CLAY: brown, medium plastic, medium dry strength, fine to coarse sand, some fine to coarse gravel, soft to firm, wet. Alluvial Soil.	0.2		CL	S-F	
Groundwater Inflow @ 0.4m	***0.4***				
GRAVELLY CLAYEY SAND: grey brown, low plastic, low dry strength, fine to coarse sand and gravel, loose to medium dense, wet.	1.1		SC/GC	L-MD	
Stopped – No Change.	2.0				

ASCT Doc. W40 Rev. No. 03-30/4/08 BH

BOREHOLE LOG

Client: Country Energy	**Project No**: 984-022	**Project**: Zone Sub-station, Yagers Lane, Suffolk Park.		
Lab No: 12555		**Borehole No**: 3	**Page**:	**Of**:

Borehole Inclination: 90	**Borehole Direction**: Vertical	**Date Drilled**: 13/7/10
Surface Elevation: ESL	**Drilling Method**: Hand Auger	**Drill Type**: 100mm Auger
Borehole Location: Emergency Access Road CH 320		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY CLAY TOPSOIL: brown, medium plastic, medium dry strength, some organic material, trace of fine gravel, soft, wet. Alluvial Soil.	0.0		CL	S	
CLAYEY SAND: pale brown grey, low plastic, low dry strength, fine to coarse sand, some fine gravel, loose, wet. Alluvial Soil.	0.2		SC	L	
Groundwater Inflow @ 0.6m	***0.6***				
SANDY CLAY: grey, medium to high plastic, medium dry strength, fine to medium sand, soft, wet. Alluvial Soil.	0.8		CL/CH	S	
SANDY CLAY: grey, low to medium plastic, low dry strength, fine to medium sand, loose, wet. Alluvial Soil.	1.3		CL/SC	L	
Stopped – No Change.	2.0				

ASCT Doc. W40 Rev. No. 03-30/4/08 BH

BOREHOLE LOG

Client: Country Energy	**Project No**: 984-022	**Project**: Zone Sub-station, Yagers Lane, Suffolk Park.		
Lab No: 12555		**Borehole No**: 4	**Page**:	**Of**:

Borehole Inclination: 90	**Borehole Direction**: Vertical	**Date Drilled**: 13/7/10
Surface Elevation: ESL	**Drilling Method**: Hand Auger	**Drill Type**: 100mm Auger
Borehole Location: Emergency Access Road CH 400		

TEST DATA

Soil Description	Depth (m)	Graphic Symbol	Group Symbol	Consistency/ Strength	Sample
SILTY CLAY TOPSOIL: brown, medium plastic, medium dry strength, some organic material, trace of fine gravel, soft, wet. Alluvial Soil.	- 0.0		CL	S	
GRAVELLY SAND: grey, low plastic, low dry strength, fine to coarse sand and gravel, some silt and clay, loose to medium dense, wet. Slope-wash.	- 0.15		SW/GW	L-MD	
Groundwater Inflow @ 0.3m	***- 0.3***				
SANDY GRAVEL: grey, non-plastic, no dry strength, fine to coarse gravel and sand, some silt and clay, medium dense, wet. Slope-wash.	- 1.6		GW	MD	
Stopped – No Change.	- 2.0				

APPENDIX C – Chain of Custody Documentation

AUSTRALIAN SOIL AND CONCRETE TESTING P/L A.B.N.49 050 539 930
Unit 7/17 Southern Cross Drive, P.O. Box 5120 Ballina NSW 2478. Telephone: 02 6686 8567, Fax: 02 6686 8396

ASCT Doc. No. A18 Rev. 03- 3/7/07 - CC

Laboratory Test Program

Client : COUNTRY ENERGY	Project no : 984-022	Project : ZONE SUB-STATION SUFFOLK PARK
Location : CONDUIT CROSSINGS FOR EMERGENCY ACCESS ROAD	Requested By: . ASCT	Test methods : CAL
Sampled By : BH/SH	Sample Type : SOIL + WATER.	Date Sampled : 13/7/10.

Lab Sample No	Sample Source	Sample Description	Depth of Sample (m)	AS-PACK 01	SW-PACK 16
12555	CH140	Clayey Sand: Grey.	1.0	/	
"	CH210	Gravelly Clayey Sand: Brown	1.5	/	
"	CH320	Clayey Sand: Pale Brown Grey	0.5	/	
"	CH320	Sandy Clay: Grey	1.5	/	
"	CH400	Silty Clay Topsoil: Brown	0.1	/	
"	CH400	Gravelly Sand: Grey	1.5	/	
"	CH210	WATER	0.6		/
"	CH320	"	Stream		/
"	CH400	"	0.5		/

> A9639

Comments:

Signed: [signature] (Approved Signatory) Date: 15/7/10

Signed: [signature] (Receiving Authority) Date: 15.7.10.

Sampling performed at ASCT P/L Ballina
NATA Accredited Laboratory Number 3229

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