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<td>Initial Update</td>
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<td>01/11/2017</td>
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Document Approvals

<table>
<thead>
<tr>
<th>Name</th>
<th>Position Title</th>
<th>Date</th>
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<tbody>
<tr>
<td>Russell Gordon</td>
<td>Manager Network Operations Standards and Engineering</td>
<td>01/11/2017</td>
</tr>
<tr>
<td>Colin Lee</td>
<td>Principal Engineer Asset Management. RPEQ 5059</td>
<td>30/10/2017</td>
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1 INTRODUCTION

1.1 Overview

Energex is committed to the achievement of good practice asset management strategies to ensure the safe and reliable operation of its network. A key component of this strategy is to manage the risk to its assets and customer supply reliability during times of major and moderate flood events.

Energex has obligations under the National Electricity Rules (NER) and the Queensland Electricity Industry Code (The Code) to produce the Distribution Annual Planning Report (DAPR) to manage the network. This is supplemented with the annual Summer Preparedness Plan (SPP) to prepare for severe weather events.

This Flood Risk Management Plan is a subset of the SPP and targets specific issues and initiatives relating to flood events.

Peter Price  
Executive General Manager  
Asset Safety and Performance

Paul Jordon  
Executive General Manager  
Distribution
1.2 **Scope**

The Flood Risk Management Plan covers the following areas:

- Identification of electricity assets which may be affected by a major or moderate flood
- Asset maintenance procedures
- Review of business continuity plans
- Network Operations response to major floods
- Pre-emptive disconnection and optimisation of switching
- Liaison with other organisations regarding flood related issues
- Restoration of supply process and dispatch of generators, and
- Information to be provided to customers relating to flood risk and public safety.

1.3 **Availability of Plan**

The Flood Risk Management Plan will be available to Energex internal staff, contractors, local Councils and the Queensland Fire and Emergency Service.

2 **IDENTIFICATION AND RECORDING OF HIGH FLOOD RISK AREAS**

To identify major and moderate flood risk areas, Energex will utilise information supplied by local Councils and the Queensland Fire and Emergency Service. Major floods are considered to be typically a 1 in 100 year event (Q100) or the Defined Flood Level (DFL). The DFL corresponds to a Defined Flood Event (such as the 1974 Brisbane floods). Brisbane and Ipswich City Councils have recently revised town planning guidelines and have adopted the 2011 flood event as the new Defined Flood Event (DFE) and have set planning guidelines on DFL’s which occurred along the Brisbane and Bremer rivers. A moderate flood event is typically a 1 in 20 year event (Q20), however for some creek systems in localised events the levels may exceed the Q100 or DFL levels. Creek flood generally occurs in quite short times frames while riverine flooding typically provides at least 24 hours’ notice. Creek flooding can impact on businesses and residences more frequently and are encouraged to have specific business continuity plans.

The major flood risk areas have been overlayed into Energex’s Geographical Information System (GIS) and network maps can be produced which identify network assets which may be affected in a major flood event. In the future, the moderate flood risk areas will be overlayed in the GIS system.

The equipment which can be affected by these flood events include:

- Bulk and zone substations
- C&I substations
- Overhead lines
- Padmount and ground transformers
- Underground pillars, and
- Streetlights
2.1 Asset Management Information Facilities

In order to maintain an up-to-date record of its asset information and their characteristics, Energex has in place the following management tools:

**Ellipse and NFM Equipment Register**

Energex maintains an equipment register in an enterprise computer system. The equipment register stores technical information about the power assets and allows tracking of the various transferable assets such as transformers.

**Geographical Information System (GIS)**

Energex also uses a GIS which records, stores and enables the retrieval of relevant information about its electricity assets. This includes the physical location and layout of the assets, and types and lengths of overhead and underground lines. At present, the GIS system has captured the DFL layer for the Brisbane and Bremer rivers and the Q100 layer for other regional Councils. Additional flood layers covering moderate flooding for the Brisbane, Gold Coast, Logan and Moreton Bay river systems are available for operational purposes.

3 BUSINESS CONTINUITY PLANS REVIEW

Business Continuity Plans have been developed for business critical sections of the business, and current versions of these Business Continuity Plans are available Energex Document storage system (RED). The relevant Business Continuity Plans include:

- Network Operations
- Strategic Communications
- Data, Services, Demand Management
- Eagle Farm Distribution Centre
- Connected Customer Services
- Payroll Services – HR
- Southern Distribution Centre

4 NETWORK OPERATIONS FLOOD RESPONSE

4.1 Introduction

Each natural disaster (flood, bushfire and storm) can present different problems to the electricity network, which require different solutions. The main processes to follow during an emergency are to ensure:

a) Safety at all times - members of the public, emergency services staff, and employees.

b) A co-ordinated response to the emergency.
c) Speedy restoration of adequate supply to customers.

d) Timely restoration of the network to its normal operating condition.

e) Resumption of normal operations as quickly as possible.

### 4.2 Operating Procedures

#### 4.2.1 Flood Warnings

Network Operations will monitor the flood event using information from the Bureau of Meteorology and local Councils. When moderate to major flood warnings are given on rivers and creeks in the Energex network, the Network Control Shift Manager is to alert the Regional and Area Managers of the flood warning.

The Field Service Managers are to advise the Hub Work Group Leaders to commence river height monitoring using the BoM website, WeatherWatch, Floodwise system and/or SES information and commence making preparations for the flood response. Specific preparations may include the movement of crews and equipment to areas expected to be isolated by floodwaters.

The Flood Warning Centre websites for information relating to flood heights provided by BoM are:


Network Operations will have access to the Brisbane City Council (BCC) Flood Management system, which has a number of rainfall stations and river and creek gauges across South East Queensland. The Flood Management System can also provide information on roads and areas in BCC, which are in flood.

In a potential major flood event, an Energex liaison officer will be located at the BCC Local Disaster Coordination centre.

#### 4.2.2 Flood Maps

Local Council’s in South East Queensland have provided flood maps based on a Defined Flood Event (like the 2011 flood event in Brisbane) or a Q100 which is a one in 100 year probability of exceedance. Some Councils have also provided moderate to major flood levels at Q20 and Q50 levels. This information is available in the Energex GIS system.

#### 4.2.3 Level of Emergency and Organisation Structure

A major prolonged flood that would affect many parts of South East Queensland would invoke the Corporate Emergency Management Plan (CEMP), be declared a Level 3 emergency and communicated by a Purple Alert.

Some Energex offices and depots, like Newstead and Oxley may not be accessible in a major flood event (like 2011). The backup location at Victoria Park can be used for the CEMP team, Contact Centre, Control Centre, Dispatch and other business critical teams.
Energex staff can find information about the status of the business areas during a flood event by phoning the Hotline on (07) 3664 6000.

4.2.4 Communications with Emergency Services and Disaster Management Groups

Energex has responsibilities under the Disaster Management Act which are covered in RED Procedure 0348 - Disaster Management Plan and Responsibilities. Energex endeavours to provide representatives (primary and backup) to all three levels: Local, District, and State.

It is vital during a flood event that close contact be maintained with all emergency services, in particular Police, SES and local disaster management groups.

A list of Energex officers (primary and backup) nominated for the disaster management organisations is found under the internal link:

4.2.5 Advice to the Public

Close liaison should be maintained with media organisations and social network sites. The public should be told to treat all electrical equipment as live unless advised to the contrary, and to stay clear.

4.3 Asset Manager and Field Services Resource Manager Response to Floods

During a major flood event, the Asset and Field Services Managers with staff are to:

- Ensure all items on Flood Operational Plans are being carried out and the resources are available to deal with the threat of flood. Arrange external resources such as contractors, helicopters, boats etc.

- Liaise with State and Local Disaster Management and District Disaster Groups, and Queensland Fire and Emergency Service as is necessary.

- Resource and liaise with the Network Operations Storm Room.

- Ensure communication lines are in place between Corporate Communications, Network Operations, and Hub depots.

- Communicate with Network Operations on the state of the network belonging to that Hub.

- Monitor river heights using data from BOM and forecast future resource requirements.

- Arrange for vehicles and equipment to be positioned to suit anticipated river levels.

- In conjunction with Network Operations and Customer and Market Operations, ensure that premises are isolated in a timely manner before water reaches wiring or switchboards.
• In conjunction with Network Operations and Customer and Market Operations, arrange for disconnects and reconnects and removal of meters.

• Arrange for street patrols to identify areas of disconnection if energised circuits are within required clearances to flood waters.

• Dispatch generators to pre-determined connection points, including fuel and associated logistics such as security services.

4.4 **Network Operations**

Energex assets in proximity of the Brisbane River have generally been made resilient to a moderate flood level (approximately 2.5 metres at the City Gauge), but there may be assets on other rivers systems which may be impacted. When a major flood event is predicted for the Brisbane River (above 3.0 metres at the City Gauge) the Control Centre, Contact Centre and Central Dispatch should consider relocation to the back-up Victoria Park Network Operations Centre. The Storm Room should also accompany the relocation to Victoria Park.

4.4.1 **Bulk and Zone Substations**

Flood resilience works are being undertaken for bulk and zone substations which have potential to be affected by a major flood event. Works have been completed for Jindalee, Archerfield, Oxley and Milton (110 kV), with resilience works underway at Palm Beach.

Until the identified flood resilience works are completed operational plans should be considered for Palm Beach substation. These may incorporate the following:

(i) Temporary bunding (sandbagging/barriers) may be installed to protect electrical equipment and substation buildings in the event of moderate flooding in the substation yard (where flood waters are less than 500 mm). Sump pumps may be required to address water seepage.

(ii) Switching should commence immediately to transfer as much load as possible from the substations which will be affected by flooding to other substations.

(iii) Each affected substation should be brought down to the minimum necessary number of transformers and feeder circuits.

(iv) An Emergency Management boat may be required in the vicinity of each substation where Energex staff are working to ensure staff are not trapped by the flood waters.

(v) Capacitor banks should be disconnected when the flood level is at the base of the capacitor banks and expected to rise further. Before re-energisation, the capacitor banks should be hosed and dried out and insulation tested.

(vi) Field crews should be organised to remove from site all withdrawable spare CBs, capacitor CBs, the CBs of the transformers that have been switched out, and the CBs of any feeders that have been deoloaded. Where removal from site is not possible, withdrawable CBs should be left connected to the bus.
(vii) Field crews should remove from site all withdrawable protection relays which are not in service at the substations. Relays must be tagged before they are removed from their service position so as to expedite later reconnection.

(viii) All DC links from batteries should be disconnected to avoid DC shocks.

(ix) All DC supply should be isolated from the main supply fuses. Minor DC supplies (SACS and communications) should be removed if possible, along with chargers.

(x) Substations should be de-energised as soon as water begins to enter the substation yard and expected to rise further. This will give field crews time to remove the remaining withdrawable protection relays and other equipment.

(xi) Transformers that will be covered by water should have the breather removed and plugged, but only after the transformer has been de-energised, isolated under SAHV and allowed to cool.

(xii) The SACS units should be powered down and all circuit boards, PCs, VDUs, etc removed from site after the substations are de-energised.

**Longer Term Operational Plan**

Consideration should be given to relocation of critical substation assets above the Q200 level or installing permanent or temporary bunding or barriers around key substation equipment such as capacitor banks and neutral earthing resistors or reactors.

Consideration should also be given to sealing wall and floor penetrations in substation buildings to withstand a major flood event.

**4.4.2 CBD Substations**

An Operational Plan has been developed for C&I substations in CBD areas which may be impacted by a major flood event.

In the Brisbane CBD, the substations which were impacted by the January 2011 floods, the new Defined Flood Event (DFE) for Brisbane where flood waters reached 4.46 metres on the City Gauge are given in Appendix A.

The Operational Plan for the CBD should include the following:

1. A switching plan to ensure city buildings which are not flood affected by the DFE have power supply restored as soon as practical.

2. A temporary bunding and sump pump arrangement for city buildings which had a small amount of water affect the electricity substation (up to 1.5 metres).

3. A disconnection and recovery plan for those substations where electrical plant will be completely submerged.

Flood waters can damage some substation equipment and others can be washed and dried to restore functionality. A certain amount of substation material will need to be kept in stores to cover
a major flood event. Appendix B details the relays and equipment which were required to rehabilitate C&I substations in the CBD during the January 2011 floods.

4.4.3 Dry Disconnection Switching Points for Flood Prone Distribution Assets

Distribution electrical assets which were impacted by the 2011 flood event on the Brisbane River for Brisbane and Ipswich areas have been identified along with an upstream dry disconnection switching point on the supplying feeder. A similar list of distribution assets has been identified for a DFE on the Gold Coast. Following the major flooding on the Logan and Albert rivers in 2017, there have been additional switching points identified for these river systems, and further flood resilience works are planned.

This list will need to be updated when a significant wet season is forecasted or when there are major changes to the network (such as the addition of a new substation).

4.4.4 Operational Plan to Optimise Switching Points and Generator Connection Points

Operational plans has been developed for Metro North, Central West, Metro South, Western and South Coast Hub areas to optimise switching points and generator connection points. Appendix C outlines these operational plans which provide the following information and actions:

1. Feeder supplying assets in a flood affected area
2. Number of customers on the feeder
3. Pre-flood actions
4. Generator Connection Points for the Dry Islands (more coverage in Clause 4.4.13)
5. Any access or evacuation issues on the feeder route
6. Isolation process during emergency flood event
7. Critical Infrastructure on the feeder
8. Post flood actions

4.4.5 Priority List for Pre-Emptive Disconnection and Reconnection

Critical or sensitive customers which are affected by a defined flood event in Brisbane, Ipswich and Gold Coast have been identified and placed on a priority list. The list of critical or sensitive customers are also given in Appendix C.

Energex has developed a number of MOU’s with critical telecommunications and water supply companies, such as Telstra, Optus, SEQ Water and Urban Utilities. A list of their infrastructure in flood affected locations are given in Appendix C.
4.4.6 Distribution Assets

**Padmounted Transformers**

Power should be disconnected when the flood level is 300 mm below the HV cable terminations and expected to rise further.

Flood affected transformers should be hosed, dried and insulation tested prior to re-energisation.

**Ground Transformers**

Power should be disconnected when the flood level is at the base of ground transformers and expected to rise further (above 300 mm). Transformers with breathers should have the breathers removed and plugged to prevent the ingress of water.

**Ring Main Units**

Power should be disconnected when the flood level is at the base of ring main units and expected to rise further (above 300 mm).

Flood affected RMU’s should be hosed, dried and insulation tested prior to re-energisation. If water ingresses into the oil of Ring Main Units, the oil should be replaced.

**Dry Type Transformers**

Power should be disconnected when the flood level is at the base of the dry type transformer and expected to rise further. The temperature monitor should be removed from the transformer to aid in the restoration of the transformer.

Flood affected transformers should be hosed, dried and insulation tested prior to re-energisation in accordance with manufacturer’s recommendations (e.g ABB Dry-Type Transformer Operating Manual OAS.460.123E).
4.4.7 Overhead Network

All overhead lines and apparatus from HV through to LV (including services) must be de-energised before the clearances from flood water are encroached.

<table>
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<tr>
<th>Nominal System Voltage (kV)</th>
<th>Major Flood Level – Large Catchments¹ (m)</th>
<th>Major Flood Level – Small Catchments² (m)</th>
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<td>4.0</td>
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<tr>
<td>Above 33 - up to and including 132</td>
<td>4.5</td>
<td>3.5</td>
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</table>

Notes:
1. It is assumed in large catchments, the rivers will remain at major flood for a number of days and there will be craft or emergency vessels in the waterway.
2. It is assumed that for small catchments, the creek rise and fall in short time (hours) and there will be no vessel or craft in the waterway.

Table 1 – Clearances Over Waterways for Uninsulated Energised Crossings

4.4.8 Individual Premises

Power should be disconnected and meters removed before switchboards are flooded.

On flood affected premises, switchboards and wiring should be inspected individually and an insulation resistance test performed.

Re-connection shall not occur until advice is received from a licensed electrical contractor.

Solar PV systems should be considered as “live” during sunlight hours. The PV systems should be disconnected if the equipment is at risk of flooding. Any flood affected wiring, switches and inverter should also be treated as “live”.

The restoration process is covered in Clause 5 of this Plan.

4.4.9 Pillars

Power should be disconnected when the flood level is at the base of pillars and expected to rise further. It is likely that the padmounted transformer supplying the pillar will be disconnected before the flood level reaches the base of pillars.

Flood affected pillars should be inspected individually and hosed out if necessary.

Without IPCs, a minimum insulation resistance of 100 MΩ at 2.5kV for 1 minute between each phase and phase to neutral should be achieved before re-energisation.

With IPCs, a minimum insulation resistance of 5 MΩ at 2.5kV for 1 minute between each phase and phase to neutral should be achieved before re-energisation.
4.4.10 **Streetlights**

When the network is disconnected during a flood event, so too will be the streetlights. When supply is restored to an area, street light patrols should be initiated to check whether the streetlight has been impacted by the flood.

4.4.11 **Mary River Flood Plan**

A detailed Disaster Management Plan for a flood of the Mary River affecting the Gympie area can be accessed from the intranet on the Network Asset Management site (Other links).

4.4.12 **Moggill Flood Plan**

A detailed Disaster Management Plan for the Moggill area has been prepared and outlined in Appendix D.

The Plan includes the dispatch of a 2 x 1 MVA generators and 1 x 20,000 litre fuel tank to an appropriate site at Moggill.

4.4.13 **Strategic Deployment of Generators**

Energex has a fleet of generators available in the emergency flood event. These consist of:

- 5 x 11 kV, 1250 KVA generators
- 32 x 240 volt, 500 kVA (LV) generators
- 10 x 60 kVA (LV) generators
- 3 x 150 kVA (LV) generators

Smaller generators (in range 30 kVA to 120 kVA) are available from local hire companies and/or local Energex depots.

Generators will generally be dispatched on a priority basis and approved by senior management (following advice from Disaster Management Groups). Where there is a major flood and access to communities is likely to be inaccessible, generators should be dispatched to strategic locations during the flood event. Communities which may be islanded in a major flood event are:

- Bellbowrie
- Karana Downs
- Moggill/Pullenvale

Appendix C outlines optimal switching and suitable placement of generators (by Hub location) to restore supply to the maximum number of customers. These customers are typically those whose feeder has been pre-emptively disconnected and are out of the flood affected areas.
5  RESTORATION OF ENERGEX ASSETS

The restoration of Energex assets should be undertaken in accordance with standard business emergency processes plus the additional flood process documentation:

Work Practice

- WP - 1134 Re-energisation of Flood Affected Distribution Equipment
- WP - 1133 Installation Disconnection and Reconnection Procedure after Natural Disaster
- WP - 1132 Reinstating Pole Mounted Equipment

Energex will coordinate with Master Electricians Australia for the restoration of electrical supply to residential properties affected by floods in south east Queensland. This plan will see Energex managing the restoration of electricity supply through the distribution network and an initial assessment of and damage to homes that may affect the installation's electrical safety. If through a visual inspection Energex is able to assess the premises as not affected by flooding, reenergisation will be effected. If the premises has been affected, Energex will advise Master Electricians Australia who will coordinate an electrical contractor to assess the damage and effect repairs (which may be temporary). If Energex meters have been affected by the flooding, Energex will coordinate their replacement on a prioritised basis.

Works Practice 1133 - Installation Disconnection and Reconnection Procedure after Natural Disaster has been developed to guide Energex field staff on this process. If a Form 3 has been issued, details must be recorded by calling 1300 762 075. The Form 3 information will then be coordinated with Master Electricians Australia who will arrange for an Electrical Contractor to be despatched to the customers premises as soon as possible.

Inspection of Structures and Underground Cable Routes

Structures (towers and poles) which are located in flood plains and have been flood affected should be inspected to ensure structural members have not been damaged and the foundation has not been compromised.

Underground cables which traverse along river banks may become exposed during a flood event. To reduce further damage, an inspection of the underground cable route shall be arranged at the earliest convenient time.

6  REVIEW AND REPORTING

Energex will undertake a review of the Flood Risk Management plan on an annual basis. Operational Plans will be continually developed for key critical infrastructures such as zone substations.

Energex will prepare reports for the Executive on a needs basis for aspects of flood preparedness such as;

- Upgrades of overhead line crossing of waterways
- Specific projects for critical infrastructure to address flood risk, and
- Liaisons with other emergency organisations to address flood risk
### APPENDIX A - CBD OPTIMISATION OF SWITCHING POINTS AND FLOOD PROOFING

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<td>QUTTR1S8</td>
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<td>SG3675-H</td>
<td>Riverside Expressway</td>
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<tr>
<td>QUTTR1S7</td>
<td>QUT Law / Health Science</td>
</tr>
<tr>
<td>SC6517-F</td>
<td>Botanic Gardens</td>
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<td>SSAMM</td>
<td>42-60 Albert St</td>
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<tr>
<td>SSAMS</td>
<td>53 Albert St</td>
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## APPENDIX B - MATERIALS LIST FOR CBD SUBSTATIONS IMPACTED BY 2011 BRISBANE RIVER FLOOD

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9  APPENDIX C - OPERATIONAL PLAN BY HUB FOR OPTIMISING SWITCHING POINTS AND GENERATION CONNECTION POINTS (INCLUDES CRITICAL INFRASTRUCTURE)