NWIS Planning Standards

Contingency Planning Criteria

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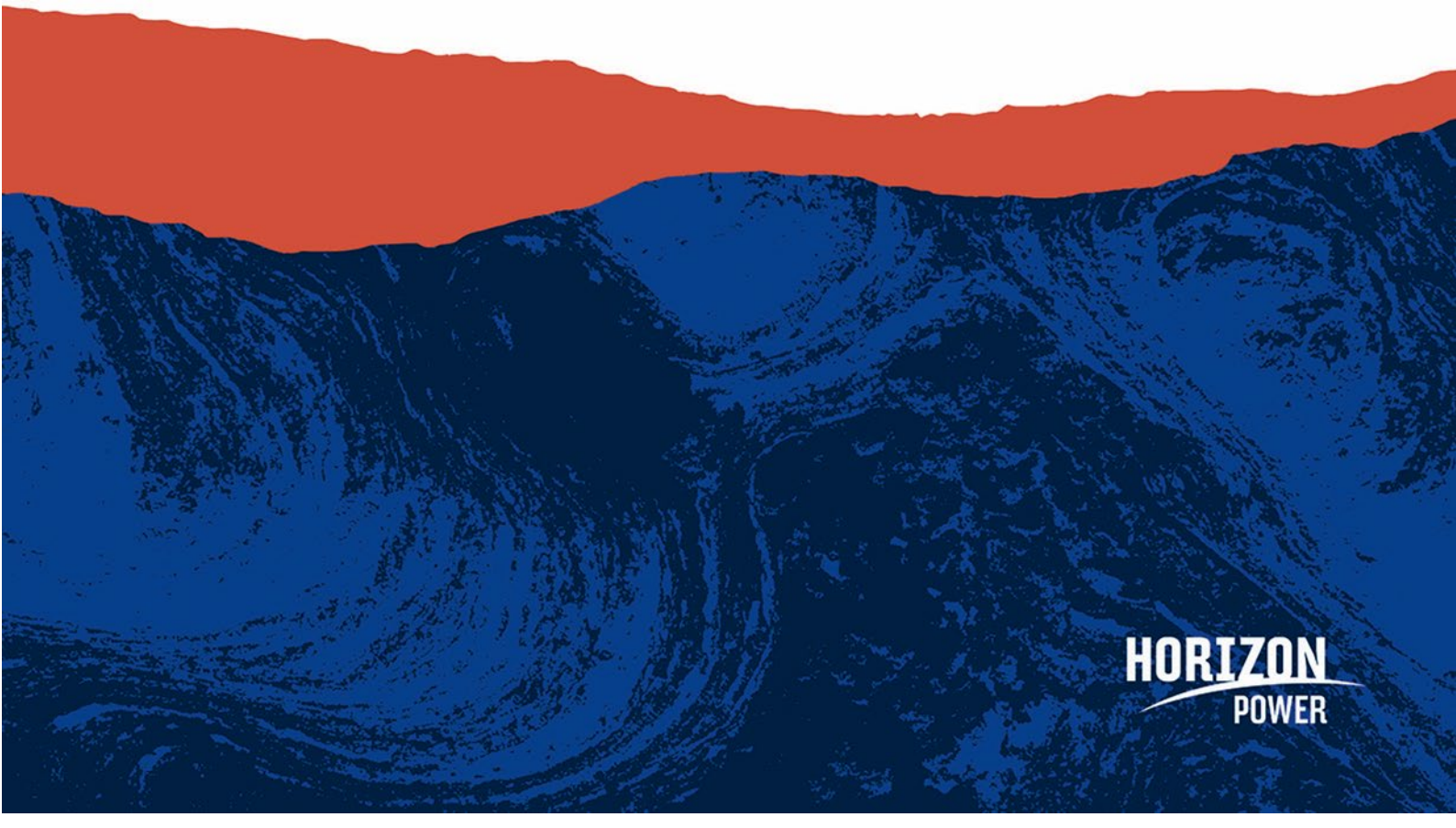

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1. ABBREVIATIONS AND DEFINED TERMS

The following abbreviations are used in this document and have the meaning provided in the table below.

Table 1.1: Document Abbreviations

Abbreviation	Meaning
DTC	Distribution Transfer Capacity
HV	High Voltage
kV	kilo Volt Amps, which is 1,000 Volt Amps
LV	Low Voltage
MV	Medium Voltage
MVA	Mega Volt Amps, which is 1 million Volt Amps
NCR	Normal Cyclic Rating

The following defined terms are used in this document and have the meaning provided in the table below.

Table 1.2: Document Defined Terms

Defined term	Meaning
Act	Electricity Industry Act 2004 (WA)
distribution	has the same meaning given to 'distribution system' in the *Act*. {As at 20 August 2026, the Act defines 'distribution system' as – means electricity infrastructure used, or to be used, for, or in connection with, or to control, the transportation of electricity at nominal voltages that are less than the prescribed voltage.} {Explanatory note: As at 20 August 2026, the prescribed voltage is 66 kV under regulation 55A of the *Electricity Industry (Electricity System and Market) Regulations 2004*.}
Harmonised Technical Rules	the 'Harmonised Technical Rules' included in the *PNR*. {Explanatory note: The currently published Harmonised Technical Rules are dated 1 July 2021.}
Independent System Operator (ISO)	has the same meaning given to 'Pilbara ISO' in regulation 14 of the Electricity Industry (Pilbara Networks) Regulations 2021 (the regulations). {Note: As at 30 October 2025, the regulations defined 'Pilbara ISO' as Pilbara ISOCo Limited ACN 650 785 783.}

Defined term	Meaning
limit advice	has the meaning given to it in the *PNR*. {As at 18 June 2025, the *PNR* defines 'Limit Advice' as – means the notice given by Covered *NSP* to the *ISO* under rule 248(2), setting out Limit Rules, ratings for Listed *Network* Elements and other Constraint Information.}
network	has the same meaning given to 'network infrastructure facilities' in the *Act*. {As at 20 August 2026, the *Act* defines 'network infrastructure facilities' as— (a) electricity infrastructure used, or to be used, for the purpose of transporting electricity from generators of electricity to other electricity infrastructure or to end users of electricity; and (b) includes stand-alone power systems, or storage works, used, or to be used, as an adjunct to electricity infrastructure.}
Network Service Provider (NSP)	has the same meaning as 'Pilbara network service provider' in the *Act* . {As at 20 August 2026, the *Act* defines 'Pilbara network service provider' as a person who— (a) owns, controls or operates a Pilbara network or any part of a Pilbara network; or (b) proposes to own, control or operate a Pilbara network or any part of a Pilbara network.}
NWIS	has the meaning given to it in the *PNR*. {As at 18 June 2025, the *PNR* defines 'NWIS' as – the interconnected Pilbara System which includes the Horizon Power coastal network.}
PNR	the Pilbara Networks Rules. {Note: As at 20 August 2026, the *Act* defines 'Pilbara Networks Rules' as the Pilbara networks rules for the time being in force under Part 8A Division 3.}
transmission	Means a 'transmission element' as defined in the *PNR*. {As at 18 June 2025, the *PNR* defines 'transmission element' as – a network element which operates at transmission voltage, and includes an interconnector regardless of voltage."}

2. APPLICATION

These planning contingency criteria apply only to the *network* and not to connection assets. The *Network Service Provider* must design connection assets in accordance with a User's requirements and the relevant requirements of the *Harmonised Technical Rules*.

3. TRANSMISSION SYSTEM

Horizon Power will trigger *network* planning and design processes based on the deterministic contingency criteria detailed in this document.

These contingency criteria apply to the criteria detailed in section 2 of the *Harmonised Technical Rules*:

3.1 Transmission N-1 Criteria

The N-1 criterion applies to all *transmission* lines and major items of plant on Horizon Power's *transmission network*s, except those covered by the N-0 criterion under Section 3.2. The N-1 criterion simply means that the consequences of an outage of any one of the N components that make up the *transmission* system must be examined.

N-1 criterion:

The *transmission* system must be capable of withstanding the loss of any single component at any load level and for a given generation schedule.

Notes:

1. Under the *PNR*, the Horizon Power Pilbara Coastal Network operates within a regime that limits the output of generators to maintain the system within a secure state. A secure state is where system parameters remain within the criteria defined by the *Harmonised Technical Rules* for the loss of any single system element identified as a credible contingency. Horizon Power is required to provide the *Independent System Operator* a "*limit advice*" that details the nature of the required generation limits. Horizon Power develops this *limit advice* by determining the generation schedules that meet the N-1 criterion.
2. The Horizon Power *network* planning process adopts a probabilistic approach to quantify the net impact of *network* constraints, and proposed mitigations, as the basis of *network* investment (Probabilistic Risk Assessment). The Probabilistic Risk Assessment may include consideration of either the total cost of generation, supply reliability outcomes or safety impacts.

The single component referred to in the above criteria include those listed in the following table:

Table 3: Transmission Elements Qualified as Single Contingency (N-1 Criterion)

N-1 Outages
Transmission Line
Transformer
Static VAr Compensators
Circuit Breaker
Capacitor Bank
Substations (see section 3.7)

3.2 Transmission N-0 Criteria

The N-0 criterion is applied only to minor substations and in some cases, single radial lines supplying minor zone substations (see Section 3.7).

N-0 means that should an element fail or be required out of service for repairs, maintenance or upgrade then supply may be constrained or not met at all until all elements are returned to service.

N-0 criterion:

The system must be capable of meeting the peak load with all elements in service.

Should an element fail or be required out of service for repairs or maintenance then load is not required to be met.

3.3 Substation Planning Criteria

The total capacity of a substation can be limited by any one or more plant items comprising the following main components in a substation:

- *Transmission* line circuits.
- Power transformer circuits.

Horizon Power designs its substations to the Substation N-1 (Firm Capacity) Criterion.

The adequacy of *transmission* line circuits supplying substations are assessed through load flow studies subject to the N-1 criterion.

The adequacy of power transformer circuits are assessed by comparing the forecasted substation peak load with the substation's capacity. The amount of load that can be supplied is limited by primary plant equipment ratings and, the amount of *distribution* transfer capacity (DTC) available.

3.4 Substation N-1 (Firm Capacity) Criterion

The N-1 Criterion is used to define a substation's firm capacity (FC) and is calculated as follows:

- One transformer substation: FC = DTC (1)
- Two transformer substation: FC = NCR1 + DTC (2)
- Three Transformer substation: FC = NCR1 + NCR2 + DTC (3)

Where,

NCR1 = lowest normal cyclic rating (NCR) of the transformers in the substation;

NCR2 = second lowest NCR of the transformers in the substation;

DTC = available *distribution* transfer capacity. DTC shall be included in equations (1), (2) and (3) above only if there is a high degree of confidence in its accuracy.

Inclusion of DTC in the firm capacity of a substation introduces the possibility of overloading on remaining transformer circuits following the outage of one transformer circuit. Two overload scenarios can arise depending on the substation's mode of operation.

3.5 Three Transformer Double LV Busbar Substation (Special Case)

In three transformer substations with double LV busbar arrangements where transformers are not operated in parallel, the DTC cannot be included in the substation's Firm capacity because the third transformer cannot be connected to the LV busbars (i.e. its capacity is not available until at least one of the operational transformers fail).

Transformer load balancing on transformers supplying a double LV busbar arrangement is assumed to be reasonable. It is assumed that as the substation load grows, the load on each of transformer grows in constant proportion with each other until the heaviest loaded transformer is loaded to a limit of 80% of the smallest transformer's NCR.

Hence, the Firm capacity is calculated as follows:

FC' = NCRS1 + NCRS2

where, NCRS1 = smallest[1] normal cyclic rating of the transformers in the substation.

NCRS2 = second smallest NCR of the transformers in the substation.

3.6 Major Zone Substations

A zone substation is considered to be "Major" if it supplies a peak load of 5MVA or more. Major zone substation components are subject to the N-1 criterion with the exceptions outlined in Table 4 Exceptions to the N-1 Criterion - Major Zone Substations. The *transmission* lines that interconnect Major zone substation are also subject to the N-1 criterion.

Table 4: Exceptions to the N-1 Criterion - Major Zone Substations

Exceptions	Substitute	Restoration
Transformers	Supply to be restored by switching.	*Distribution* transfer to be carried out within 2 hours.
Substation HV busbar	Supply may be lost.	Load below substation firm capacity 100% restoration within 2 hours. Load above substation firm capacity 100% of load supplied from unfaulted sections of the busbar to be restored within 2 hours.
Transformer circuits	Supply to be restored by switching.	*Distribution* transfer to be carried out within 2 hours.
Substation indoor LV busbar	Supply from the relevant LV bus section(s) may be lost.	100% restoration within 96 hours (for town substations) from the time when a safe working environment can be restored.

[1] The ratings of the smallest transformers are selected because it is assumed that in an N-1 contingency condition the largest transformer is out-of-service.

Exceptions	Substitute	Restoration
Substation outdoor LV busbar	Supply from the relevant LV bus section(s) may be lost.	100% restoration within 48 hours (for town substations) from the time when a safe working environment can be restored.

3.7 Minor Zone Substations

Minor zone substations are those with peak load of less than 5MVA. Minor zone substation components are subject to the N-0 criterion with the exceptions outlined in Table 5. Exceptions to the N-0 Criterion - Minor Zone Substations. The *transmission* lines that interconnect Minor Zone substations are also subject to the N-0 reliability criteria with the exceptions outlined in Table 5.

Table 5: Exceptions to the N-0 Criterion - Minor Zone Substation

Exceptions	Substitute	Restoration
Transformers	Supply to be restored by switching.	*Distribution* transfer to be carried out within 2 hours. For sites with one transformer standby generation and *distribution* transfer should be used to restore supply.
Transmission lines	Individual justification should be used to provide redundancy or sufficient *distribution* transfer capacity	Standby local generation may be used to provide immediate restoration. In the case of substations supplied by single radial lines, line restoration to be provided within 1 to 2 days depending on the extent of damage.
Substation HV busbar	Supply may be lost	Load below substation firm capacity 100% restoration within 2 hours. Load above substation firm capacity 100% of load supplied from unfaulted sections of the busbar to be restored within 2 hours.
Transformer circuits	Supply from the relevant LV bus section may be lost.	*Distribution* transfer to be carried out within 2 hours.

4. DISTRIBUTION NETWORK UTILISATION AND CONTINGENCY CRITERIA

4.1 Distribution Interconnector N-1 Criteria

A number of Horizon Power systems have dedicated interconnectors between major zone substations or between major zone substations and power stations, which are typically operated at *distribution* voltages of between 11kV and 33kV (for example the 33kV interconnectors between Broome Power Station and Frederick St substation).

All *distribution* interconnectors between major zone substations, and between major zone substations and power stations shall be planned in accordance with the *Transmission* N-1 criterion as outlined in Section 3.1.

4.2 MV Distribution Feeders

This section outlines the criteria for planning *Distribution* MV feeders. This is summarised below:

- Where technically and economically feasible, the *Network Service Provider* must provide normally open interconnections between adjacent *distribution* feeders.
- Application of the N-0 Criteria is provided in Table 6 below:

Table 6: Summary of N-0 Criteria for MV Distribution

Number of Feeder Interconnections	Utilisation	Comments
Radial (No Interconnections)	100%	Contingency plan to be developed to limit outage duration to less than 12 hours
1 feeder interconnection	60%	
2 feeder interconnections	75%	
3 feeder interconnections	85%	

High voltage *distribution* feeders in urban areas shall be planned and designed so that, for a zone substation feeder circuit or exit cable fault, the load of that feeder can be transferred to adjacent feeders by manual *network* reconfiguration.

Where practical, the *network* shall be planned and designed so that, in the event of a failure of a zone substation transformer, all load of that transformer can be transferred to other transformers within the same zone substation and adjacent zone substations.

The radial nature of rural *distribution* feeders normally precludes the application of contingency criteria to these feeders. However, where reasonably achievable, interconnection between feeders shall be provided, and reclosers and sectionalisers shall be installed to minimise the extent of outages.

4.3 LV Distribution Feeders

Horizon Power's Technical Rules Section 2.4.3.1 provides the following guidance in planning LV *distribution* feeders:

"All new low voltage connection points and service mains, and upgrades to existing overhead service mains due to capacity increases, must be underground, even if the service mains are to be connected to an overhead *distribution* line."

4.4 Outage Criteria

The outage criteria, in combination with the reliability criteria, set the reliability performance level at which the system must adhere to.

As per Section 4.2, the deterministic N-0 criterion is applicable to MV *Distribution* systems. N-0 means that should an element fail or be required out of service for repairs, maintenance or upgrade then supply may be constrained or not met at all until all elements are returned to service.