

***Generation Interconnection
Feasibility Study Report***

For

***PJM Generation Interconnection Request
Queue Position AC2-055***

Buckskin - Petersburg 69kV

September 2017

Preface

The intent of the feasibility study is to determine a plan, with ballpark cost and construction time estimates, to connect the subject generation to the PJM network at a location specified by the Interconnection Customer. The Interconnection Customer may request the interconnection of generation as a capacity resource or as an energy-only resource. As a requirement for interconnection, the Interconnection Customer may be responsible for the cost of constructing: (1) Direct Connections, which are new facilities and/or facilities upgrades needed to connect the generator to the PJM network, and (2) Network Upgrades, which are facility additions, or upgrades to existing facilities, that are needed to maintain the reliability of the PJM system.

In some instances a generator interconnection may not be responsible for 100% of the identified network upgrade cost because other transmission network uses, e.g. another generation interconnection, may also contribute to the need for the same network reinforcement. The possibility of sharing the reinforcement costs with other projects may be identified in the feasibility study, but the actual allocation will be deferred until the impact study is performed.

The Feasibility Study estimates do not include the feasibility, cost, or time required to obtain property rights and permits for construction of the required facilities. The project developer is responsible for the right of way, real estate, and construction permit issues. For properties currently owned by Transmission Owners, the costs may be included in the study.

General

The Interconnection Customer (IC) proposes to install PJM Project #AC2-055, a 47.5 MW (18.05 MW Capacity) solar generating facility in Highland County, Ohio. The primary point of interconnection is to AEP's Buckskin – Petersburg 69 kV section of the Ross – Highland 69 kV circuit (see Figure 1). The secondary point of interconnection is a direct connection to AEP's Buckskin 69 kV substation (see Figure 2).

The requested in service date is July 1, 2019.

Attachment Facilities

Primary Point of Interconnection (Buckskin - Petersburg 69kV)

To accommodate the interconnection on the Buckskin – Petersburg 69 kV circuit, a new three (3) circuit breaker 69 kV switching station physically configured in a breaker and half bus arrangement but initially operated as a ring-bus will be constructed (see Figure 1). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required. AEP reserves the right to specify the final acceptable configuration considering design practices, future expansion, and compliance requirements.

New Switching Station Work:

- Construct a new three (3) circuit breaker 69 kV switching station physically configured in a breaker and half bus arrangement but initially operated as a ring-bus. Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required (see Figure 1).
- **Estimated Station Cost: \$3,500,000**

Direct Connection Cost Estimate

The total preliminary cost estimate for Direct Connection work is given in the following tables below.

For AEP building Direct Connection cost estimates:

Description	Total Cost
Buckskin – Petersburg 69 kV T-Line Cut In	\$700,000
Total	\$700,000

Table 1

Non-Direct Connection Cost Estimate

The total preliminary cost estimate for Non-Direct Connection work is given in the following table below:

For AEP building Non-Direct Connection cost estimates:

Description	Estimated Cost
69 kV Revenue Metering	\$200,000
Upgrade line protection and controls at the Buckskin 69 kV substation.	\$200,000
Upgrade line protection and controls at the Petersburg 69 kV substation.	\$200,000
Total	\$600,000

Table 2

Secondary Point of Interconnection (Buckskin 69kV substation)

To accommodate the interconnection at the Buckskin 69 kV substation, modify/expand the existing Buckskin 69kV substation requiring the installation of a new 69 kV circuit breaker (see Figure 2). Installation of associated protection and control equipment, 69 kV line risers, SCADA, and 69 kV revenue metering will also be required.

Interconnection Customer Requirements

It is understood that The IC Solar is responsible for all costs associated with this interconnection. The cost of The IC Solar's generating plant and the costs for the line connecting the generating plant to the point of interconnection are not included in this report; these are assumed to be The IC Solar's responsibility.

The Generation Interconnection Agreement does not in or by itself establish a requirement for American Electric Power to provide power for consumption at the developer's facilities. A separate agreement may be reached with the local utility that provides service in the area to ensure that infrastructure is in place to meet this demand and proper metering equipment is installed. It is the responsibility of the developer to contact the local service provider to determine if a local service agreement is required.

Requirement from the PJM Open Access Transmission Tariff:

1. An Interconnection Customer entering the New Services Queue on or after October 1, 2012 with a proposed new Customer Facility that has a Maximum Facility Output equal to or greater than 100 MW shall install and maintain, at its expense, phasor measurement units (PMUs). See Section 8.5.3 of Appendix 2 to the Interconnection Service Agreement as well as section 4.3 of PJM Manual 14D for additional information.

2. The Interconnection Customer may be required to install and/or pay for metering as necessary to properly track real time output of the facility as well as installing metering which shall be used for billing purposes. See Section 8 of Appendix 2 to the Interconnection Service Agreement as well as Section 4 of PJM Manual 14D for additional information.

Revenue Metering and SCADA Requirements

PJM Requirements

The Interconnection Customer will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Sections 24.1 and 24.2.

AEP Requirements

The Interconnection Customer will be required to comply with all AEP Revenue Metering Requirements for Generation Interconnection Customers. The Revenue Metering Requirements may be found within the "Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System" document located at the following link:

<http://www.pjm.com/~media/planning/plan-standards/private-aep/aep-interconnection-requirements.ashx>

Option 1

Network Impacts

The Queue Project AC2-055 was evaluated as a 47.5 MW (Capacity 18.0 MW) injection tapping the Buckskin – Petersburg 69 kV line in the AEP area. Project AC2-055 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-055 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis – 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Option 1	
Contingency Name	Description
8123	CONTINGENCY '8123'
	OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1
	OPEN BRANCH FROM BUS 243453 TO BUS 253248 CKT 1 / 243453 05BEATTY 345 253248 09SCHARL 345 1
	OPEN BRANCH FROM BUS 243453 TO BUS 243469 CKT 3 / 243453 05BEATTY 345 243469 05BEATTY 138 3
	END

Option 1		
Contingency Name	Description	
160_B3	CONTINGENCY '160_B3'	
	OPEN BRANCH FROM BUS 253110 TO BUS 253100 CKT 1	/ 253110 09ADKINS 345 253100 09ATLNTA 345 1
	OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1	/ 253100 09ATLNTA 345 253099 09ATLNTA 69.0 1
	END	
2085_C2_05BEATTY 345-304C	CONTINGENCY '2085_C2_05BEATTY 345-304C'	
	OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1	/ 243453 05BEATTY 345 243454 05BIXBY 345 1
	OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1	/ 243453 05BEATTY 345 253110 09ADKINS 345 1
	END	
5891_B2_TOR607	CONTINGENCY '5891_B2_TOR607'	
	OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1	/ 243019 05HILLSB 138 253111 09MIDDLE 138 1
	OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1	/ 253111 09MIDDLE 138 253057 09OHH 138 1
	END	
6764_B2_TOR5300548	CONTINGENCY '6764_B2_TOR5300548'	
	OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1	/ 246888 05BIERSR 345 242938 05MARQUI 345 1
	END	
6774_C2_05MARQUI 345-D	CONTINGENCY '6774_C2_05MARQUI 345-D'	
	OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1	/ 246888 05BIERSR 345 242938 05MARQUI 345 1
	OPEN BRANCH FROM BUS 242938 TO BUS 253038 CKT 1	/ 242938 05MARQUI 345 253038 09KILLEN 345 1
	END	
6779_C2_05BIERSR 345-D	CONTINGENCY '6779_C2_05BIERSR 345-D'	
	OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1	/ 246888 05BIERSR 345 243454 05BIXBY 345 1
	OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1	/ 246888 05BIERSR 345 246889 05BIERSR 138 1
	END	
6780_C2_05BIERSR 345-C	CONTINGENCY '6780_C2_05BIERSR 345-C'	
	OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1	/ 246888 05BIERSR 345 242938 05MARQUI 345 1
	OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1	/ 246888 05BIERSR 345 246889 05BIERSR 138 1
	END	
6781_B3_05BIERSR 345-1	CONTINGENCY '6781_B3_05BIERSR 345-1'	
	OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1	/ 246888 05BIERSR 345 246889 05BIERSR 138 1
	END	
7353_B2_TOR12737	CONTINGENCY '7353_B2_TOR12737'	
	OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1	/ 243019 05HILLSB 138 249995 08CLINCO 138 1
	OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1	/ 249995 08CLINCO 138 250122 08WARRN1 138 1
	END	
762_B2_TOR8072	CONTINGENCY '762_B2_TOR8072'	
	OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1	/ 243453 05BEATTY 345 253110 09ADKINS 345 1
	END	

Option 1		
Contingency Name	Description	
7954_C1_05MILLBR 138-2_A	CONTINGENCY '7954_C1_05MILLBR 138-2_A' OPEN BRANCH FROM BUS 243042 TO BUS 243088 CKT 1 / 243042 05MILLBR 138 243088 05S POIN 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 931350 CKT 1 / 243042 05MILLBR 138 931350 AC2-049 TAP 138 1 END	
7981_A	CONTINGENCY '7981_A' OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-061 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END	
7981_B	CONTINGENCY '7981_B' OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061 TAP 138 249995 08CLINCO 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END	
8108_C2_05HILLSB 138-D_A	CONTINGENCY '8108_C2_05HILLSB 138-D_A' OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-061 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END	
8109_C2_05HILLSB 138-A_A	CONTINGENCY '8109_C2_05HILLSB 138-A_A' OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB 138 243102 05SINKG8 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049 TAP 138 243102 05SINKG8 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END	
8111_C2_05HILLSB 138-A	CONTINGENCY '8111_C2_05HILLSB 138-A' OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB 138 926100 AC1-089 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-060 TAP 138 1 END	
8126_A	CONTINGENCY '8126_A' OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 246890 CKT 1 / 246889 05BIERSR 138 246890 05HOPETN 138 1 END	

Option 1	
Contingency Name	Description
8126_B	CONTINGENCY '8126_B' OPEN BRANCH FROM BUS 931410 TO BUS 243483 CKT 1 / 931410 AC2-059 TAP 138 243483 05CRCLVS 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 246890 CKT 1 / 246889 05BIERSR 138 246890 05HOPETN 138 1 END
889_B2	CONTINGENCY '889_B2' OPEN BRANCH FROM BUS 253100 TO BUS 253077 CKT 1 / 253100 09ATLNTA 345 253077 09STUART 345 1 END
DAY_L34552-2	CONTINGENCY 'DAY_L34552-2' OPEN LINE FROM BUS 253077 TO BUS 253100 CKT 1 /* 09STUART 345 - 09ATLNTA 345 REMOVE UNIT 2 FROM BUS 253077 /* 09STUART 345 END
OUTAGE_02AB	CONTINGENCY 'OUTAGE_02AB' DISCONNECT BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 END
P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381	CONTINGENCY 'P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381' OPEN BUS 249995 END
P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	CONTINGENCY 'P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381' OPEN BRANCH FROM BUS 249995 TO BUS 931430 CKT 1 END
P2-2..C1 CLINTON COUNTY_A	CONTINGENCY 'P2-2..C1 CLINTON COUNTY_A' OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061 138 249995 08CLINCO 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 OPEN BUS 251803 END

Table 3

Generator Deliverability

(Single or N-1 contingencies for the Capacity portion only of the interconnection)

Option 1														
AC2-055 Generator Deliverability														
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Loading		Rating		MW		FG	
					From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	App.
1	N-1	5891_B2_TOR6 07	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	99.89	100.64	ER	184	1.39	
2	N-1	OUTAGE_02A B	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	99.29	100.04	ER	184	1.39	
3	N-1	6781_B3_05BIE RSR 345-1	AEP - AEP	05LATTAVL8-05BIERSRUN 69 kV line	243608	246893	1	DC	30.38	40.7	ER	50	5.16	

Option 1														
AC2-055 Generator Deliverability														
Contingency		Affected		Bus		Loading		Rating		MW		FG		App.
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	
4	N-1	6764_B2_TOR5 300548	AEP - AEP	05LATTAVL8- 05BIERSRUN 69 kV line	243608	246893	1	DC	20.42	31.21	ER	50	5.4	
5	N-1	5891_B2_TOR6 07	AEP - DEO&K	AC2-061 TAP- 08CLINCO 138 kV line	931430	249995	1	DC	99.89	100.64	ER	184	1.39	
6	N-1	OUTAGE_02A B	AEP - DEO&K	AC2-061 TAP- 08CLINCO 138 kV line	931430	249995	1	DC	99.29	100.04	ER	184	1.39	

Table 4

Multiple Facility Contingency

(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)

AC2-055 Multiple Facility Contingency														
Contingency		Affected		Bus		Loading		Rating		MW		FG		App.
#	Type	Name	Area	Facility Description	From	To	Cir.	PF	Initial	Final	Type	MVA	Con.	
1	DCTL	8123	AEP - AEP	05BCKSKI- 05LATTAVL8 69 kV line	243598	243608	1	DC	33.05	47.51	ER	100	14.46	1
2	LFFB	6774_C2_05MARQUI 345-D	AEP - AEP	05BCKSKI- 05LATTAVL8 69 kV line	243598	243608	1	DC	28.29	42.5	ER	100	14.21	
3	LFFB	6780_C2_05BIERSR 345-C	AEP - AEP	05BCKSKI- 05LATTAVL8 69 kV line	243598	243608	1	DC	30.59	44.17	ER	100	13.59	
4	LFFB	DAY_L34552-2	AEP - AEP	05BCKSKI-AC2- 020 TAP 69 kV line	243598	931130	1	DC	42.22	61.62	ER	72	13.97	2
5	DCTL	8123	AEP - AEP	05LATTAVL8- 05BIERSRUN 69 kV line	243608	246893	1	DC	56.89	85.82	ER	50	14.46	3
6	LFFB	6774_C2_05MARQUI 345-D	AEP - AEP	05LATTAVL8- 05BIERSRUN 69 kV line	243608	246893	1	DC	47.17	75.6	ER	50	14.21	
7	LFFB	6779_C2_05BIERSR 345-D	AEP - AEP	05LATTAVL8- 05BIERSRUN 69 kV line	243608	246893	1	DC	51.98	79.15	ER	50	13.59	
8	LFFB	2085_C2_05BEATTY 345-304C	AEP - AEP	05PETERSB8- 05HIGHLA 69 kV line	243612	243606	1	DC	26.16	59.18	ER	50	19.23	4
9	DCTL	7981_B	AEP - AEP	05HIGHLA- 05NMARSS 138 kV line	246911	247035	1	DC	87.63	88.31	ER	310	4.65	5
10	DCTL	7981_B	AEP - AEP	05NMARSS- 05SEAMAN 138 kV line	247035	243571	1	DC	84.24	84.92	ER	310	4.65	6
11	LFFB	DAY_L34552-2	AEP - DAY	AC2-020 TAP- 09GRNFLD 69 kV line	931130	253030	1	DC	40.51	59.91	ER	72	13.97	7
12	BUS	P2-2..C1 CLINTON COUNTY_A	AEP - AEP	AC2-055 TAP- 05BCKSKI 69 kV line	931380	243598	1	DC	98.19	155.12	ER	50	28.47	
13	LFFB	6780_C2_05BIERSR 345-C	AEP - AEP	AC2-055 TAP- 05BCKSKI 69 kV line	931380	243598	1	DC	59.96	115.89	ER	50	27.96	
14	LFFB	6779_C2_05BIERSR 345-D	AEP - AEP	AC2-055 TAP- 05BCKSKI 69 kV line	931380	243598	1	DC	59.96	115.89	ER	50	27.96	

AC2-055 Multiple Facility Contingency														
#	Type	Contingency	Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
		Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
15	LFFB	2085_C2_05BEATTY 345-304C	AEP - AEP	AC2-055 TAP- 05PETERSB8 69 kV line	931380	243612	1	DC	27.7	66.15	ER	50	19.23	8

Table 5

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

AC2-055 Contribution to Previously Identified Overloads														
#	Type	Contingency	Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
		Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
1	DCTL	7981_B	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	210.9	213.55	ER	185	4.9	9
2	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	210.95	213.6	ER	185	4.9	
3	DCTL	7981_A	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	210.95	213.6	ER	185	4.9	
4	LFFB	8111_C2_05HIL LSB 138-A_A	AEP - DAY	05HILLSB- 09MIDDLE 138 kV line	243019	253111	1	DC	159.57	160.39	ER	185	3.36	10
5	BUS	7954_C1_05MI LLBR 138-2_A	AEP - DAY	05HILLSB- 09MIDDLE 138 kV line	243019	253111	1	DC	147.3	147.91	ER	185	2.51	
6	DCTL	7981_B	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	123.97	124.92	ER	185	3.91	11
7	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	123.97	124.92	ER	185	3.91	
8	DCTL	7981_A	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	123.97	124.92	ER	185	3.91	
9	LFFB	8109_C2_05HIL LSB 138-A_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	234.3	236.98	ER	184	4.93	12
10	BUS	7954_C1_05MI LLBR 138-2_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	189.32	190.31	ER	184	4.02	
11	DCTL	7981_B	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	216.01	218.75	ER	179	4.9	13
12	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	216.01	218.75	ER	179	4.9	
13	DCTL	7981_A	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	216.01	218.75	ER	179	4.9	
14	DCTL	7981_B	AEP - AEP	05ADAMS- 05WARERD 138 kV line	243464	246942	1	DC	153.54	154.59	ER	150	3.51	14
15	LFFB	8109_C2_05HIL LSB 138-A_A	AEP - AEP	05ADAMS- 05WARERD 138 kV line	243464	246942	1	DC	151.25	152.33	ER	150	3.6	
16	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	05ADAMS- 05WARERD 138 kV line	243464	246942	1	DC	153.54	154.59	ER	150	3.51	
17	DCTL	7981_A	AEP - AEP	05ADAMS- 05WARERD 138 kV line	243464	246942	1	DC	153.54	154.59	ER	150	3.51	
18	BUS	7954_C1_05MI LLBR 138-2_A	AEP - AEP	05ADAMS- 05WARERD 138 kV line	243464	246942	1	DC	126.21	127.17	ER	150	3.19	

AC2-055 Contribution to Previously Identified Overloads														
#	Contingency		Affected Area	Facility Description	Bus			PF	Loading		Rating		MW Con.	FG App.
	Type	Name			From	To	Cir.		Initial	Final	Type	MVA		
19	DCTL	7981_B	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	140.09	141.13	ER	150	3.47	15
20	LFFB	8109_C2_05HIL LSB 138-A_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	136.95	138.01	ER	150	3.54	
21	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	140.09	141.13	ER	150	3.47	
22	DCTL	7981_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	140.09	141.13	ER	150	3.47	
23	BUS	7954_C1_05MI LLBR 138-2_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	113.05	113.99	ER	150	3.14	
24	DCTL	7981_B	AEP - DAY	05HIGHLA-09MRTNSV 69 kV line	243606	253043	1	DC	107.29	114.9	ER	71	5.41	16
25	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - DAY	05HIGHLA-09MRTNSV 69 kV line	243606	253043	1	DC	107.29	114.9	ER	71	5.41	
26	DCTL	7981_A	AEP - DAY	05HIGHLA-09MRTNSV 69 kV line	243606	253043	1	DC	107.29	114.9	ER	71	5.41	
27	DCTL	8126_B	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	114.58	117.81	ER	50	3.58	17
28	DCTL	8126_A	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	114.58	117.81	ER	50	3.58	
29	DCTL	7981_B	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	143.34	144.39	ER	150	3.51	18
30	LFFB	8109_C2_05HIL LSB 138-A_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	141.05	142.13	ER	150	3.6	
31	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	143.34	144.39	ER	150	3.51	
32	DCTL	7981_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	143.34	144.39	ER	150	3.51	
33	BUS	7954_C1_05MI LLBR 138-2_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	116.01	116.97	ER	150	3.19	
34	DCTL	7981_B	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	151.59	152.54	ER	185	3.91	19
35	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	151.59	152.54	ER	185	3.91	
36	DCTL	7981_A	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	151.59	152.54	ER	185	3.91	
37	DCTL	7981_B	AEP - AEP	05EMERSS-AC2-062 TAP 138 kV line	247034	931440	1	DC	149.59	150.54	ER	185	3.91	20
38	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	05EMERSS-AC2-062 TAP 138 kV line	247034	931440	1	DC	149.59	150.54	ER	185	3.91	
39	DCTL	7981_A	AEP - AEP	05EMERSS-AC2-062 TAP 138 kV line	247034	931440	1	DC	149.59	150.54	ER	185	3.91	
40	LFFB	8109_C2_05HIL LSB 138-A_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	204.22	206.71	ER	198	4.93	21

AC2-055 Contribution to Previously Identified Overloads														
#	Contingency		Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating Type	MVA	MW Con.	FG App.
	Type	Name			From	To			Initial	Final				
41	BUS	7954_C1_05MI LLBR 138-2_A	DEO&K - DEO&K	08CLINCO- 08WARRN1 138 kV line	249995	250122	1	DC	162.13	163.05	ER	198	4.02	
42	LFFB	8111_C2_05HIL LSB 138-_A	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	157.3	158.12	ER	185	3.36	22
43	BUS	7954_C1_05MI LLBR 138-2_A	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	145.03	145.64	ER	185	2.51	
44	DCTL	7981_B	AEP - AEP	AC1-089 TAP- 05WLDCAT 138 kV line	926100	246946	1	DC	152.67	153.63	ER	185	3.91	23
45	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	AC1-089 TAP- 05WLDCAT 138 kV line	926100	246946	1	DC	152.67	153.63	ER	185	3.91	
46	DCTL	7981_A	AEP - AEP	AC1-089 TAP- 05WLDCAT 138 kV line	926100	246946	1	DC	152.67	153.63	ER	185	3.91	
47	DCTL	7981_B	AEP - AEP	AC2-049 TAP- 05MILLBR 138 kV line	931350	243042	1	DC	234.67	237.4	ER	179	4.9	24
48	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - AEP	AC2-049 TAP- 05MILLBR 138 kV line	931350	243042	1	DC	234.67	237.4	ER	179	4.9	
49	DCTL	7981_A	AEP - AEP	AC2-049 TAP- 05MILLBR 138 kV line	931350	243042	1	DC	234.67	237.4	ER	179	4.9	
50	DCTL	7981_B	AEP - AEP	AC2-055 TAP- 05BCKSKI 69 kV line	931380	243598	1	DC	140.13	197.4	ER	50	28.63	25
51	DCTL	7981_A	AEP - AEP	AC2-055 TAP- 05BCKSKI 69 kV line	931380	243598	1	DC	140.13	197.4	ER	50	28.63	
52	LFFB	8109_C2_05HIL LSB 138-A_A	AEP - DEO&K	AC2-061 TAP- 08CLINCO 138 kV line	931430	249995	1	DC	234.3	236.98	ER	184	4.93	26
53	BUS	7954_C1_05MI LLBR 138-2_A	AEP - DEO&K	AC2-061 TAP- 08CLINCO 138 kV line	931430	249995	1	DC	189.32	190.31	ER	184	4.02	
54	DCTL	7981_B	AEP - LGEE	AC2-062 TAP- 4KENTON 138 kV line	931440	324267	1	DC	148.89	149.84	ER	185	3.91	27
55	LFFB	8108_C2_05HIL LSB 138-D_A	AEP - LGEE	AC2-062 TAP- 4KENTON 138 kV line	931440	324267	1	DC	148.89	149.84	ER	185	3.91	
56	DCTL	7981_A	AEP - LGEE	AC2-062 TAP- 4KENTON 138 kV line	931440	324267	1	DC	148.89	149.84	ER	185	3.91	

Table 6

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

Affected System Analysis & Mitigation

LGEE Impacts:

LGEE Impacts to be determined during later study phases (as applicable).

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

OVEC Impacts to be determined during later study phases (as applicable).

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

AC2-055 Delivery of Energy Portion of Interconnection Request														
Contingency			Affected Area	Facility Description	Bus		Loading			Rating		MW Con.	FG App.	
#	Type	Name			From	To	Cir.	PF	Initial	Final	Type			MVA
1	N-1	7353_B2_TOR12737	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	159.79	160.77	ER	185	4.04	
2	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	151.02	151.64	ER	185	2.54	
3	N-1	7353_B2_TOR12737	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	83.9	84.68	ER	185	3.18	
4	N-1	5891_B2_TOR607	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	185.25	186.14	ER	184	3.65	
5	Non	Non	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	174.71	175.59	NR	159	3.12	

AC2-055 Delivery of Energy Portion of Interconnection Request

#	Type	Contingency	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating		MW Con.	FG App.
		Name			From	To			Initial	Final	Type	MVA		
6	N-1	P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	163.13	164.15	ER	179	4.04	
7	N-1	7353_B2_TOR12737	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	122.71	123.64	ER	150	3.1	
8	N-1	7353_B2_TOR12737	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	110.4	111.32	ER	150	3.06	
9	N-1	6781_B3_05BIERSR 345-1	AEP - AEP	05BCKSKI-05LATTAVL8 69 kV line	243598	243608	1	DC	30.09	43.67	ER	100	13.59	
10	N-1	889_B2	AEP - AEP	05BCKSKI-AC2-020 TAP 69 kV line	243598	931130	1	DC	41.94	61.34	ER	72	13.97	
11	N-1	7353_B2_TOR12737	AEP - DAY	05HIGHLA-09MRTNSV 69 kV line	243606	253043	1	DC	80.16	87.45	ER	71	5.17	
12	N-1	6781_B3_05BIERSR 345-1	AEP - AEP	05LATTAVL8-05BIERSRUN 69 kV line	243608	246893	1	DC	50.98	78.15	ER	50	13.59	
13	N-1	762_B2_TOR8072	AEP - AEP	05PETERSB8-05HIGHLA 69 kV line	243612	243606	1	DC	26.49	59.33	ER	50	19.23	
14	N-1	7353_B2_TOR12737	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	112.51	113.44	ER	150	3.1	
15	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	107.9	108.68	ER	185	3.18	
16	N-1	7353_B2_TOR12737	AEP - AEP	05EMERSS-AC2-062 TAP 138 kV line	247034	931440	1	DC	105.9	106.68	ER	185	3.18	
17	N-1	5891_B2_TOR607	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	158.31	159.14	ER	198	3.65	
18	Non	Non	DAY - DAY	09GRNFLD-09WASHCH 69 kV line	253030	253091	1	DC	14.63	32.09	NR	80	13.99	
19	N-1	160_B3	DAY - DAY	09TEXTAP-09JFFRTP 69 kV line	253081	253163	1	DC	80.02	87.35	ER	96	7.03	
20	N-1	160_B3	DAY - DAY	09WASHCH-09TEXTAP 69 kV line	253091	253081	1	DC	78.39	85.56	ER	98	7.03	
21	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	148.75	149.37	ER	185	2.54	
22	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - AEP	AC1-089 TAP-05WLDCAT 138 kV line	926100	246946	1	DC	109.22	110	ER	185	3.18	
23	N-1	889_B2	AEP - DAY	AC2-020 TAP-09GRNFLD 69 kV line	931130	253030	1	DC	40.24	59.63	ER	72	13.97	
24	N-1	7353_B2_TOR12737	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	180.93	181.95	ER	179	4.04	
25	N-1	6764_B2_TOR5300548	AEP - AEP	AC2-055 TAP-05BCKSKI 69 kV line	931380	243598	1	DC	54.82	111.3	ER	50	28.24	
26	N-1	762_B2_TOR8072	AEP - AEP	AC2-055 TAP-05PETERSB8 69 kV line	931380	243612	1	DC	27.3	65.75	ER	50	19.23	

AC2-055 Delivery of Energy Portion of Interconnection Request														
#	Type	Contingency Name	Affected Area	Facility Description	Bus From	Bus To	Cir.	PF	Loading Initial	Loading Final	Rating Type	Rating MVA	MW Con.	FG App.
27	N-1	5891_B2_TOR607	AEP - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	185.25	186.14	ER	184	3.65	
28	Non	Non	AEP - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	174.64	175.53	NR	159	3.12	
29	N-1	7353_B2_TOR12737	AEP - LGEE	AC2-062 TAP-4KENTON 138 kV line	931440	324267	1	DC	104.82	105.59	ER	185	3.18	

Table 7

New System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05HIGHLA-05NMARSS 138 kV line	Rebuild/reconductor 3.10 miles of the ACSR 636 26/7 conductor section 2. Note: This facility is not overloaded by the AC2-055 project as is shown in table 5 above but the AC2 Queue overloads this facility and the AC2-055 project contributes to the overload.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$4,700,000
#2	05NMARSS-05SEAMAN 138 kV line	Rebuild/reconductor 13.20 miles of the ACSR 636 26/7 conductor section 1. Note: This facility is not overloaded by the AC2-055 project as is shown in table 5 above but the AC2 Queue overloads this facility and the AC2-055 project contributes to the overload.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$19,800,000
#3	AC2-061 TAP-08CLINCO 138 kV line	Rebuild/reconductor 5.0 miles of the ACSR 477 26/7 conductor section 1. Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$7,525,000
Total New Network Upgrades				\$32,025,000

Table 8

The System Reinforcements listed below is not part of the Bulk Electric System (BES), but was identified by AEP and will be required for the interconnection of AC2-055.

#	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05BCKSKI-05LATTAVL8 69 kV line	Rebuild/reconductor 12.0 miles of the ACSR 556.5 18/1 conductor section 1. Note: This facility is not overloaded by the	An approximate construction time would be 24 to 36 months after signing an interconnection	\$14,400,000

#	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
		AC2-055 project as is shown in table 5 above but the AC2 Queue overloads this facility and the AC2-055 project contributes to the overload.	agreement.	
#2	05BCKSKI-AC2-020 TAP 69 kV line	Non AEP conductor is the limiting this line. This is an AEP- Dayton Power & Light tie line therefore; PJM is going to have to coordinate this upgrade with DP&L. Note: This facility is not overloaded by the AC2-055 project as is shown in table 5 above but the AC2 Queue overloads this facility and the AC2-055 project contributes to the overload.	To be provided by DP&L	To be provided by DP&L
#3	05LATTAVL8- 05BIERSRUN 69 kV line	Rebuild/reconductor 12.3 miles of the ACSR 211.6 6/1 Penguin (4/0) conductor section 1. Conduct an engineering study will to determine if the Relay Compliance Trip limits settings can be adjusted. Note: This facility is not overloaded by the AC2-055 project as is shown in table 5 above but the AC2 Queue overloads this facility and the AC2-055 project contributes to the overload.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$14,800,000
#4	05HIGHLA- 05PETERSB8 69 kV line	10.0 miles of ACSR 336.4 30/7 conductor section 1 will need to be rebuilt/reconductored.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement	\$12,000,000
#5	05PETERSB8-AC2-055 69 kV line	16.4 miles of ACSR 211.6.4 6/1 conductor section 1 will need to be rebuilt/reconductored.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement	\$7,680,000
#6	AC2-020 TAP- 09GRNFLD 69 kV line	Non AEP conductor is the limiting this line. This is an AEP- Dayton Power & Light tie line therefore; PJM is going to have to coordinate this upgrade with DP&L.	To be provided by DP&L	To be provided by DP&L
			Total Network Upgrades	\$48,880,000

Table 9

Previous System Reinforcements

(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05HILLSB-05SINKG8 138 kV line	Rebuild/Reconductor 4.36 miles of ACSR 477 26/7 conductor section 1. An engineering study will need to be conducted to determine if the Relay Compliance Trip limits settings can be adjusted to mitigate the overload. Replace the Sinking Springs jumpers. Replace the Sinking Spring Switch (1200A) Rebuild/Reconductor 8.93 miles of ACSR 477 26/7 conductor section 2.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$20,500,000
#2	05HILLSB-09MIDDLE 138 kV line	22.3 miles of the ACSR 477 26/7 conductor section 1 will need to be rebuilt/reconducted. An engineering study will need to be conducted to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted to mitigate the overload.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement	\$33,450,000
#3	05HILLSB-AC1-089 TAP 138 kV line	Rebuild/reconductor 8.0 miles of the ACSR 477 26/7 conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$12,000,000
#4	05HILLSB-AC2-061 TAP 138 kV line	Rebuild/reconductor 5.0 miles of the ACSR 477 26/7 conductor section 1. Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$7,500,000
#5	05SINKG8-AC2-049 TAP 138 kV line	Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Millbrook Park can be adjusted. Rebuild/reconductor 20.37 miles of the ACSR 477 26/7 conductor section 3. Replace the Millbrook Park line riser. Replace the Millbrook Park Bus and Risers. Replace the Millbrook Park Trap Riser. Replace the Sinking Spring switch (1200A).	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$31,800,000

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
		A Sag Study will be required on the 20.37 mile ACSR 477 26/7 conduction section 2. A Sag Study will be required on the 20.37 mile ACSR 477 26/7 conduction section 1. Conduct an engineering study will to determine if the Thermal limit settings at Millbrook Park can be adjusted.		
#6	05ADAMS-05WARERD 138 kV line	Rebuild/reconductor 20.50 miles of the ACSR 336.4 30/7 conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$30,780,000
#7	05SEAMAN-05ADAMS 138 kV line	Rebuild/reconductor 20.50 miles of the ACSR 336.4 30/7 conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$12,000,000
#8	05WARERD-05WAVERL 138 kV line	Rebuild/reconductor 3.12 miles of the ACSR 336.4 30/7 conductor section 1. Rebuild/reconductor 4.37 miles of the ACSR 336.4 30/7 conductor section 2.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$11,240,000
#9	05WLDCAT-05EMERSS 138 kV line	Rebuild/reconductor 1.3 miles of the ACSR 477 26/7 conductor section 1. Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Hillsboro can be adjusted.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$2,025,000
#10	05EMERSS-AC2-062 TAP 138 kV line	Rebuild/reconductor 6.4 miles of the ACSR 477 26/7 conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$9,600,000
#11	AC1-089 TAP-05WLDCAT 138 kV line	Rebuild/reconductor 10.0 miles of the ACSR 477 26/7 conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$15,000,000
#12	05AC2-049 Tap-05MILLBR 138 kV line	An engineering study will need to be conducted to determine if the Relay Compliance Trip limit settings can be adjusted at Millbrook Park to mitigate the overload. 8.50 miles of ACSR 477 26/7 conductor section 3 will need to be rebuilt/reconducted. Replace the Millbrook Park line risers Replace the Millbrook Park bus and risers Replace the Millbrook Park trap riser	An approximate construction time would be 24 to 36 months after signing an interconnection agreement	\$59,100,000

Violation #	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
		Replace the Sinking Spring switch (1200A) 20.4 miles of ACSR 477 26/7 conductor section 2 will need to be rebuilt/reconductored. 9.8 miles of ACSR 477 26/7 conductor section 1 will need to be rebuilt/reconductored. An engineering study will need to be conducted to determine if the Relay Thermal limits settings can be adjusted at Millbrook Park to mitigate the overload. Replace the Hillsboro Wavetrap (2000A)		
#13	AC2-062 TAP-4KENTON 138 kV line	Rebuild/reconductor 18.0 miles of the ACSR 477 26/7 conductor section 1. Replace the Emerald SS Jumpers	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$27,050,000
Total Previous Network Upgrades				\$272,045,000

Table 10

The System Reinforcements listed below is not part of the Bulk Electric System (BES), but was identified by AEP and will be required for the interconnection of AC2-055.

#	Overloaded Facility	Upgrade Description	Schedule	Estimated Cost
#1	05HIGHLA-09MRTNSV 69 kV line	Conduct an engineering study will to determine if the Thermal limit settings at Highland can be adjusted. Replace the Highland switch (1200A). Conduct an engineering study will to determine if the Relay Compliance Trip limits settings at Highland can be adjusted.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$1,425,000
#2	05BIERSRUN-05SLATE 69 kV line	Rebuild/reconductor 5.0 miles of the ACSR 211.6 6/1 Penguin (4/0) conductor section 1.	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$6,000,000
#3	AC2-055 TAP-05BCKSKI 69 kV line	Rebuild/reconductor 8.57 miles of the ACSR 211.6 6/1 Penguin (4/0) conductor section 1. Replace the Petersburg Switch (600A)	An approximate construction time would be 24 to 36 months after signing an interconnection agreement.	\$10,500,000
Total Network Upgrades				\$17,925,000

Table 11**Schedule**

It is anticipated that the time between receipt of executed agreements and Commercial Operation may range from 12 to 18 months if no line work is required. If line work is required, construction time would be between 24 to 36 months after signing an interconnection agreement.

Note: The time provided between anticipated normal completion of System Impact, Facilities Studies, subsequent execution of ISA and ICSA documents, and the proposed In-Service Date is shorter than usual and may be difficult to achieve.

Conclusion

Based upon the results of this Feasibility Study, the construction of the 47.5 MW (18.05 MW Capacity) the IC's solar generating facility (PJM Project #AC2-055) will require the following additional interconnection charges. This plan of service will interconnect the proposed generating facility in a manner that will provide operational reliability and flexibility to both the AEP system and the IC's solar generating facility.

Cost Breakdown for Primary Point of Interconnection (Buckskin – Petersburg 69 kV)		
Attachment Cost	New 69 kV Switching Station	\$3,500,000
Direct Connection Cost Estimate	Buckskin - Petersburg 69 kV T-Line Cut In	\$700,000
Non-Direct Connection Cost Estimate	69 kV Revenue Metering	\$200,000
	Upgrade line protection and controls at the Biers Run 69 kV substation.	\$200,000
	Upgrade line protection and controls at the Circleville 69 kV substation.	\$200,000
	New System Reinforcements <i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the addition of this project generation)</i>	\$32,025,000
	Previous System Reinforcements <i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)</i>	\$272,045,000
	New System Reinforcements – Not part of BES <i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, initially caused by the</i>	\$48,880,000

Cost Breakdown for Primary Point of Interconnection (Buckskin – Petersburg 69 kV)		
	<i>addition of this project generation)</i>	
	Previous System Reinforcements-Not part of BES <i>(Upgrades required to mitigate reliability criteria violations, i.e. Network Impacts, identified for earlier generation or transmission interconnection projects in the PJM Queue)</i>	\$17,925,000
	Total Estimated Cost for Project AC2-055	\$375,675,000

Table 12

The estimates are preliminary in nature, as they were determined without the benefit of detailed engineering studies. Final estimates will require an on-site review and coordination to determine final construction requirements.

Option 2

Network Impacts

The Queue Project AC2-055 was evaluated as a 47.5 MW (Capacity 18.0 MW) injection at the Buckskin 69 kV substation in the AEP area. Project AC2-055 was evaluated for compliance with applicable reliability planning criteria (PJM, NERC, NERC Regional Reliability Councils, and Transmission Owners). Project AC2-055 was studied with a commercial probability of 53%. Potential network impacts were as follows:

Summer Peak Analysis - 2020

Contingency Descriptions

The following contingencies resulted in overloads:

Option 2	
Contingency Name	Description
8123	CONTINGENCY '8123' OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 253248 CKT 1 / 243453 05BEATTY 345 253248 09SCHARL 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 243469 CKT 3 / 243453 05BEATTY 345 243469 05BEATTY 138 3 END
160_B3	CONTINGENCY '160_B3' OPEN BRANCH FROM BUS 253110 TO BUS 253100 CKT 1 / 253110 09ADKINS 345 253100 09ATLNTA 345 1 OPEN BRANCH FROM BUS 253100 TO BUS 253099 CKT 1 / 253100 09ATLNTA 345 253099 09ATLNTA 69.0 1 END
2085_C2_05BEATTY 345-304C	CONTINGENCY '2085_C2_05BEATTY 345-304C' OPEN BRANCH FROM BUS 243453 TO BUS 243454 CKT 1 / 243453 05BEATTY 345 243454 05BIXBY 345 1 OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1 END
5891_B2_TOR607	CONTINGENCY '5891_B2_TOR607' OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB 138 253111 09MIDDLE 138 1 OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111 09MIDDLE 138 253057 09OHH 138 1 END

Option 2	
Contingency Name	Description
6764_B2_TOR5300548	CONTINGENCY '6764_B2_TOR5300548' OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1 / 246888 05BIERSR 345 242938 05MARQUI 345 1 END
6774_C2_05MARQUI 345-D	CONTINGENCY '6774_C2_05MARQUI 345-D' OPEN BRANCH FROM BUS 246888 TO BUS 242938 CKT 1 / 246888 05BIERSR 345 242938 05MARQUI 345 1 OPEN BRANCH FROM BUS 242938 TO BUS 253038 CKT 1 / 242938 05MARQUI 345 253038 09KILLEN 345 1 END
6779_C2_05BIERSR 345-D	CONTINGENCY '6779_C2_05BIERSR 345-D' OPEN BRANCH FROM BUS 246888 TO BUS 243454 CKT 1 / 246888 05BIERSR 345 243454 05BIXBY 345 1 OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1 / 246888 05BIERSR 345 246889 05BIERSR 138 1 END
6781_B3_05BIERSR 345-1	CONTINGENCY '6781_B3_05BIERSR 345-1' OPEN BRANCH FROM BUS 246888 TO BUS 246889 CKT 1 / 246888 05BIERSR 345 246889 05BIERSR 138 1 END
6786_B2_A	CONTINGENCY '6786_B2_A' OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1 END
6786_B2_B	CONTINGENCY '6786_B2_B' OPEN BRANCH FROM BUS 931410 TO BUS 246890 CKT 1 / 931410 AC2-059 TAP 138 246890 05HOPETN 138 1 END
7353_B2_TOR12737	CONTINGENCY '7353_B2_TOR12737' OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 243019 05HILLSB 138 249995 08CLINCO 138 1 OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995 08CLINCO 138 250122 08WARRN1 138 1 END
762_B2_TOR8072	CONTINGENCY '762_B2_TOR8072' OPEN BRANCH FROM BUS 243453 TO BUS 253110 CKT 1 / 243453 05BEATTY 345 253110 09ADKINS 345 1 END
7954_C1_05MILLBR 138-2_A	CONTINGENCY '7954_C1_05MILLBR 138-2_A' OPEN BRANCH FROM BUS 243042 TO BUS 243088 CKT 1 / 243042 05MILLBR 138 243088 05S POIN 138 1 OPEN BRANCH FROM BUS 243042 TO BUS 931350 CKT 1 / 243042 05MILLBR 138 931350 AC2-049 TAP 138 1 END

Option 2		
Contingency Name	Description	
7981_A	CONTINGENCY '7981_A'	
	OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 TAP 138 1	/ 243019 05HILLSB 138 931430 AC2-061
	OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 138 1	/ 243019 05HILLSB 138 253111 09MIDDLE
	OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 138 1	/ 249995 08CLINCO 138 250122 08WARRN1
	OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 1	/ 253111 09MIDDLE 138 253057 09OHH 138
	END	
7981_B	CONTINGENCY '7981_B'	
	OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 08CLINCO 138 1	/ 931430 AC2-061 TAP 138 249995
	OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 138 1	/ 243019 05HILLSB 138 253111 09MIDDLE
	OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 138 1	/ 249995 08CLINCO 138 250122 08WARRN1
	OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 1	/ 253111 09MIDDLE 138 253057 09OHH 138
	END	
8108_C2_05HILLSB 138-D_A	CONTINGENCY '8108_C2_05HILLSB 138-D_A'	
	OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 TAP 138 1	/ 243019 05HILLSB 138 931430 AC2-061
	OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 138 1	/ 243019 05HILLSB 138 253111 09MIDDLE
	OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 138 1	/ 249995 08CLINCO 138 250122 08WARRN1
	OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 1	/ 253111 09MIDDLE 138 253057 09OHH 138
	END	
8109_C2_05HILLSB 138-A_A	CONTINGENCY '8109_C2_05HILLSB 138-A_A'	
	OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 138 1	/ 243019 05HILLSB 138 243102 05SINKG8
	OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 138 1	/ 243019 05HILLSB 138 253111 09MIDDLE
	OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 05SINKG8 138 1	/ 931350 AC2-049 TAP 138 243102
	OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 1	/ 253111 09MIDDLE 138 253057 09OHH 138
	END	
8110_C2_05HILLSB 138-B_A	CONTINGENCY '8110_C2_05HILLSB 138-B_A'	
	OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 138 1	/ 243019 05HILLSB 138 243102 05SINKG8
	OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1	/ 243019 05HILLSB 138 926100 AC1-089

Option 2	
Contingency Name	Description
	TAP 138 1 OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049 TAP 138 243102 05SINKG8 138 1 END
8111_C2_05HILLSB 138-_A	CONTINGENCY '8111_C2_05HILLSB 138-_A' OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB 138 926100 AC1-089 TAP 138 1 OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB 138 931430 AC2-060 TAP 138 1 END
8124_C2_05BIERSR 138-F_A	CONTINGENCY '8124_C2_05BIERSR 138-F_A' OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 246893 CKT 1 / 246889 05BIERSR 138 246893 05BIERSRUN 69.0 1 END
8126_A	CONTINGENCY '8126_A' OPEN BRANCH FROM BUS 246889 TO BUS 243483 CKT 1 / 246889 05BIERSR 138 243483 05CRCLVS 138 1 OPEN BRANCH FROM BUS 246889 TO BUS 931410 CKT 1 / 246889 05BIERSR 138 931410 AC2-059 TAP 138 1 END
8126_B	CONTINGENCY '8126_B' OPEN BRANCH FROM BUS 246889 TO BUS 243483 CKT 1 / 246889 05BIERSR 138 243483 05CRCLVS 138 1 OPEN BRANCH FROM BUS 931410 TO BUS 246890 CKT 1 / 931410 AC2-059 TAP 138 246890 05HOPETN 138 1 END
889_B2	CONTINGENCY '889_B2' OPEN BRANCH FROM BUS 253100 TO BUS 253077 CKT 1 / 253100 09ATLNNTA 345 253077 09STUART 345 1 END
DAY_L34552-2	CONTINGENCY 'DAY_L34552-2' OPEN LINE FROM BUS 253077 TO BUS 253100 CKT 1 /* 09STUART 345 - 09ATLNNTA 345 REMOVE UNIT 2 FROM BUS 253077 /* 09STUART 345 END
P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381	CONTINGENCY 'P1-#.B2 WARREN-CLINTONCO-HILLSBORO 2381' OPEN BUS 249995 END
P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	CONTINGENCY 'P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381' OPEN BRANCH FROM BUS 249995 TO BUS 931430 CKT 1 END

Table 9**Generator Deliverability***(Single or N-1 contingencies for the Capacity portion only of the interconnection)*

Option 2 AC2-055 Generator Deliverability														
#	Type	Contingency Name	Affected Area	Facility Description	Bus			PF	Loading		Rating	MW	FG	
					From	To	Cir.		Initial	Final	Type	MVA	Con.	App.
1	N-1	5891_B2_TOR607	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	99.91	100.52	ER	184	1.12	
2	N-1	6781_B3_05BIERS R 345-1	AEP - AEP	05LATTAVL8-05BIERSRUN 69 kV line	243608	246893	1	DC	30.81	42.55	ER	50	5.87	
3	N-1	6764_B2_TOR5300 548	AEP - AEP	05LATTAVL8-05BIERSRUN 69 kV line	243608	246893	1	DC	20.87	33.14	ER	50	6.13	
4	N-1	6786_B2_B	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	77.45	80.43	ER	50	1.49	
5	N-1	6786_B2_A	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	77.45	80.43	ER	50	1.49	
6	N-1	5891_B2_TOR607	AEP - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	99.91	100.52	ER	184	1.12	

Table 10**Multiple Facility Contingency***(Double Circuit Tower Line, Fault with a Stuck Breaker, and Bus Fault contingencies for the full energy output)*

AC2-055 Multiple Facility Contingency														
#	Type	Contingency Name	Affected Area	Facility Description	Bus			PF	Loading		Rating	MW	FG	
					From	To	Cir.		Initial	Final	Type	MVA	Con.	App.
1	DCTL	8123	AEP - AEP	05BCKSKI-05LATTAVL8 69 kV line	243598	243608	1	DC	33.86	50.28	ER	100	16.43	1
2	LFFB	6774_C2_05MARQ UI 345-D	AEP - AEP	05BCKSKI-05LATTAVL8 69 kV line	243598	243608	1	DC	29.1	45.26	ER	100	16.15	
3	LFFB	6779_C2_05BIERS R 345-D	AEP - AEP	05BCKSKI-05LATTAVL8 69 kV line	243598	243608	1	DC	31.37	46.82	ER	100	15.45	
4	LFFB	2085_C2_05BEATT Y 345-304C	AEP - AEP	05BCKSKI-05PETERSB8 69 kV line	243598	243612	1	DC	29.29	59.87	ER	50	15.29	2
5	LFFB	DAY_L34552-2	AEP - DAY	05BCKSKI-AC2-087 TAP 69 kV line	243598	931650	1	DC	38.26	60.41	ER	72	15.94	3
6	DCTL	8123	AEP - AEP	05LATTAVL8-05BIERSRUN 69 kV line	243608	246893	1	DC	58.52	91.37	ER	50	16.43	4
7	LFFB	6774_C2_05MARQ UI 345-D	AEP - AEP	05LATTAVL8-05BIERSRUN 69 kV line	243608	246893	1	DC	48.81	81.12	ER	50	16.15	
8	LFFB	6779_C2_05BIERS R 345-D	AEP - AEP	05LATTAVL8-05BIERSRUN 69 kV line	243608	246893	1	DC	53.54	84.45	ER	50	15.45	
9	LFFB	2085_C2_05BEATT Y 345-304C	AEP - AEP	05PETERSB8-05HIGHLA 69 kV line	243612	243606	1	DC	27.5	53.71	ER	50	15.29	5
10	LFFB	8124_C2_05BIERS R 138-F_A	AEP - AEP	05SLATE-05ADENA 69 kV line	243617	243839	1	DC	27.26	35.38	ER	100	12.16	6
11	LFFB	8124_C2_05BIERS R 138-F_A	AEP - AEP	05ADENA-05ROSS 69 kV line	243839	243615	1	DC	53.58	61.35	ER	73	12.16	7

AC2-055 Multiple Facility Contingency														
Contingency			Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
#	Type	Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
12	LFFB	8124_C2_05BIERS R 138-F_A	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	38.42	57.97	ER	50	12.16	8
13	DCTL	7981_B	AEP - AEP	05HIGHLA-05NMARSS 138 kV line	246911	247035	1	DC	87.66	88.19	ER	310	3.67	9
14	LFFB	DAY_L34552-2	DAY - DAY	09GRNFLD-09WASHCH 69 kV line	253030	253091	1	DC	19.95	36.22	ER	98	15.94	10
15	LFFB	DAY_L34552-2	DAY - DAY	AC2-087 TAP-09GRNFLD 69 kV line	931650	253030	1	DC	38.26	60.41	ER	72	15.94	11

Table 11

Contribution to Previously Identified Overloads

(This project contributes to the following contingency overloads, i.e. "Network Impacts", identified for earlier generation or transmission interconnection projects in the PJM Queue)

AC2-055 Contribution to Previously Identified Overloads														
Contingency			Affected Area	Facility Description	Bus				Loading		Rating		MW Con.	FG App.
#	Type	Name			From	To	Cir.	PF	Initial	Final	Type	MVA		
1	DCTL	7981_B	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	210.95	211.92	ER	185	3.98	12
2	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	211	211.97	ER	185	3.98	
3	DCTL	7981_A	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	211	211.97	ER	185	3.98	
4	LFFB	8111_C2_05HILLSB 138-_A	AEP - DAY	05HILLSB-09MIDDLE 138 kV line	243019	253111	1	DC	159.61	160.27	ER	185	2.69	13
5	DCTL	7981_B	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	124.01	124.78	ER	185	3.17	14
6	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	124.01	124.78	ER	185	3.17	
7	DCTL	7981_A	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	124.01	124.78	ER	185	3.17	
8	LFFB	8109_C2_05HILLSB 138-A_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	234.36	235.33	ER	184	3.99	15
9	BUS	7954_C1_05MILLBR 138-2_A	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	189.37	190.16	ER	184	3.27	
10	DCTL	7981_B	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	216.06	217.06	ER	179	3.98	16
11	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	216.06	217.06	ER	179	3.98	
12	DCTL	7981_A	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	216.06	217.06	ER	179	3.98	
13	DCTL	7981_B	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	153.58	154.4	ER	150	2.75	17
14	LFFB	8109_C2_05HILLSB 138-A_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	151.29	152.14	ER	150	2.83	
15	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	153.58	154.4	ER	150	2.75	
16	DCTL	7981_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	153.58	154.4	ER	150	2.75	
17	BUS	7954_C1_05MILLBR 138-2_A	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	126.7	127.45	ER	150	2.49	

AC2-055 Contribution to Previously Identified Overloads														
Contingency			Affected Area	Facility Description	Bus		Cir.	PF	Loading		Rating		MW Con.	FG App.
#	Type	Name			From	To			Initial	Final	Type	MVA		
18	DCTL	7981_B	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	140.13	140.95	ER	150	2.73	18
19	LFFB	8109_C2_05HILLSB 138-A_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	136.99	137.82	ER	150	2.79	
20	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	140.13	140.95	ER	150	2.73	
21	DCTL	7981_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	140.13	140.95	ER	150	2.73	
22	BUS	7954_C1_05MILLBR 138-2_A	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	113.53	114.27	ER	150	2.46	
23	DCTL	7981_B	AEP - DAY	05HIGHLA-09MRTNSV 69 kV line	243606	253043	1	DC	107.35	110	ER	71	4.18	19
24	LFFB	8108_C2_05HILLSB 138-D_A	AEP - DAY	05HIGHLA-09MRTNSV 69 kV line	243606	253043	1	DC	107.49	110.14	ER	71	4.18	
25	DCTL	7981_A	AEP - DAY	05HIGHLA-09MRTNSV 69 kV line	243606	253043	1	DC	107.49	110.14	ER	71	4.18	
26	DCTL	8126_B	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	114.59	118.29	ER	50	4.11	
27	DCTL	8126_A	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	114.59	118.29	ER	50	4.11	
28	DCTL	7981_B	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	143.38	144.2	ER	150	2.75	20
29	LFFB	8109_C2_05HILLSB 138-A_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	141.09	141.94	ER	150	2.83	
30	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	143.38	144.2	ER	150	2.75	
31	DCTL	7981_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	143.38	144.2	ER	150	2.75	
32	BUS	7954_C1_05MILLBR 138-2_A	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	116.5	117.25	ER	150	2.49	
33	DCTL	7981_B	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	151.63	152.41	ER	185	3.17	21
34	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	151.63	152.41	ER	185	3.17	
35	DCTL	7981_A	AEP - AEP	05WLDCAT-05EMERSS 138 kV line	246946	247034	1	DC	151.63	152.41	ER	185	3.17	
36	DCTL	7981_B	AEP - LGEE	05EMERSS-4KENTON 138 kV line	247034	324267	1	DC	150.34	151.11	ER	185	3.17	22
37	LFFB	8108_C2_05HILLSB 138-D_A	AEP - LGEE	05EMERSS-4KENTON 138 kV line	247034	324267	1	DC	150.34	151.11	ER	185	3.17	
38	DCTL	7981_A	AEP - LGEE	05EMERSS-4KENTON 138 kV line	247034	324267	1	DC	150.34	151.11	ER	185	3.17	
39	LFFB	8109_C2_05HILLSB 138-A_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV	249995	250122	1	DC	204.27	205.18	ER	198	3.99	23

AC2-055 Contribution to Previously Identified Overloads														
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Type	Rating MVA	MW Con.	FG App.
				line	From	To			Initial	Final				
40	BUS	7954_C1_05MILLBR 138-2_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	162.17	162.92	ER	198	3.27	
41	LFFB	8110_C2_05HILLSB 138-B_A	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	161.33	162.29	ER	198	4.23	
42	LFFB	8111_C2_05HILLSB 138-_A	DAY - DAY	09MIDDLE-09OHH 138 kV line	253111	253057	1	DC	157.34	157.99	ER	185	2.69	24
43	DCTL	7981_B	AEP - AEP	AC1-089 TAP-05WLDCAT 138 kV line	926100	246946	1	DC	152.72	153.49	ER	185	3.17	25
44	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	AC1-089 TAP-05WLDCAT 138 kV line	926100	246946	1	DC	152.72	153.49	ER	185	3.17	
45	DCTL	7981_A	AEP - AEP	AC1-089 TAP-05WLDCAT 138 kV line	926100	246946	1	DC	152.72	153.49	ER	185	3.17	
46	DCTL	7981_B	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	234.71	235.72	ER	179	3.98	26
47	LFFB	8108_C2_05HILLSB 138-D_A	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	234.71	235.72	ER	179	3.98	
48	DCTL	7981_A	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	234.71	235.72	ER	179	3.98	
49	LFFB	8109_C2_05HILLSB 138-A_A	AEP - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	234.36	235.33	ER	184	3.99	27
50	BUS	7954_C1_05MILLBR 138-2_A	AEP - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	189.31	190.11	ER	184	3.27	

Table 12

Steady-State Voltage Requirements

(Results of the steady-state voltage studies should be inserted here)

None

Short Circuit

(Summary of impacted circuit breakers)

New circuit breakers found to be over-duty:

None

Affected System Analysis & Mitigation

LGEE Impacts:

LGEE Impacts to be determined during later study phases (as applicable).

MISO Impacts:

MISO Impacts to be determined during later study phases (as applicable).

Duke, Progress & TVA Impacts:

Duke Carolina, Progress, & TVA Impacts to be determined during later study phases (as applicable).

OVEC Impacts:

OVEC Impacts to be determined during later study phases (as applicable).

Delivery of Energy Portion of Interconnection Request

PJM also studied the delivery of the energy portion of this interconnection request. Any problems identified below are likely to result in operational restrictions to the project under study. The developer can proceed with network upgrades to eliminate the operational restriction at their discretion by submitting a Merchant Transmission Interconnection request.

Only the most severely overloaded conditions are listed. There is no guarantee of full delivery of energy for this project by fixing only the conditions listed in this section. With a Transmission Interconnection Request, a subsequent analysis will be performed, which will study all overload conditions associated with the overloaded element(s) identified.

AC2-055 Delivery of Energy Portion of Interconnection Request														
Contingency			Affected Area	Facility Description	Bus		Loading			Rating		MW Con.	FG App.	
#	Type	Name			From	To	Cir.	PF	Initial	Final	Type			MVA
1	N-1	7353_B2_TOR12737	AEP - AEP	05HILLSB-05SINKG8 138 kV line	243019	243102	1	DC	159.82	160.62	ER	185	3.29	
2	N-1	7353_B2_TOR12737	AEP - AEP	05HILLSB-AC1-089 TAP 138 kV line	243019	926100	1	DC	84.61	85.24	ER	185	2.59	
3	N-1	5891_B2_TOR607	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	185.29	186.01	ER	184	2.94	
4	Non	Non	AEP - DEO&K	05HILLSB-AC2-061 TAP 138 kV line	243019	931430	1	DC	175.18	175.89	NR	159	2.53	
5	N-1	7353_B2_TOR12737	AEP - AEP	05SINKG8-AC2-049 TAP 138 kV line	243102	931350	1	DC	163.17	164	ER	179	3.29	
6	N-1	P1-#.B2 WARREN- CLINTONCO- HILLSBORO 2381	AEP - AEP	05ADAMS-05WARERD 138 kV line	243464	246942	1	DC	123.18	123.91	ER	150	2.42	
7	N-1	7353_B2_TOR12737	AEP - AEP	05SEAMAN-05ADAMS 138 kV line	243571	243464	1	DC	110.87	111.59	ER	150	2.4	
8	N-1	6781_B3_05BIERSR 345-1	AEP - AEP	05BCKSKI- 05LATTAVL8 69 kV line	243598	243608	1	DC	30.87	46.32	ER	100	15.45	
9	N-1	762_B2_TOR8072	AEP - AEP	05BCKSKI- 05PETERSB8 69 kV line	243598	243612	1	DC	28.89	59.47	ER	50	15.29	
10	N-1	889_B2	AEP - DAY	05BCKSKI-AC2-087 TAP 69 kV line	243598	931650	1	DC	37.98	60.13	ER	72	15.94	
11	N-1	6781_B3_05BIERSR 345-1	AEP - AEP	05LATTAVL8- 05BIERSRUN 69 kV line	243608	246893	1	DC	52.54	83.45	ER	50	15.45	

AC2-055 Delivery of Energy Portion of Interconnection Request														
#	Type	Contingency Name	Affected Area	Facility Description	Bus		Cir.	PF	Loading		Type	MVA	MW Con.	FG App.
					From	To			Initial	Final				
12	N-1	762_B2_TOR8072	AEP - AEP	05PETERSB8-05HIGHLA 69 kV line	243612	243606	1	DC	27.82	53.89	ER	50	15.29	
13	N-1	6786_B2_B	AEP - AEP	05BIERSRUN-05SLATE 69 kV line	246893	243617	1	DC	80.2	83.73	ER	50	3.92	
14	N-1	P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	05WARERD-05WAVERL 138 kV line	246942	243585	1	DC	112.98	113.71	ER	150	2.42	
15	N-1	7353_B2_TOR12737	AEP - AEP	05WLDCA-05EMERSS 138 kV line	246946	247034	1	DC	107.94	108.57	ER	185	2.59	
16	N-1	P2-1..LOE BRKR OPEN AT HILLSBORO AEP 2381	AEP - LGEE	05EMERSS-4KENTON 138 kV line	247034	324267	1	DC	106.64	107.27	ER	185	2.59	
17	N-1	5891_B2_TOR607	DEO&K - DEO&K	08CLINCO-08WARRN1 138 kV line	249995	250122	1	DC	158.3	158.97	ER	198	2.94	
18	Non	Non	DAY - DAY	09GRNFLD-09WASHCH 69 kV line	253030	253091	1	DC	12.61	32.54	NR	80	15.97	
19	N-1	889_B2	DAY - DAY	09GRNFLD-09WASHCH 69 kV line	253030	253091	1	DC	19.74	36.01	ER	98	15.94	
20	N-1	160_B3	DAY - DAY	09TEXTAP-09JFFRTP 69 kV line	253081	253163	1	DC	79.22	87.47	ER	96	7.92	
21	N-1	160_B3	DAY - DAY	09WASHCH-09TEXTAP 69 kV line	253091	253081	1	DC	77.6	85.69	ER	98	7.92	
22	N-1	P1-#..B2 WARREN-CLINTONCO-HILLSBORO 2381	AEP - AEP	AC1-089 TAP-05WLDCA 138 kV line	926100	246946	1	DC	109.26	109.89	ER	185	2.59	
23	N-1	7353_B2_TOR12737	AEP - AEP	AC2-049 TAP-05MILLBR 138 kV line	931350	243042	1	DC	180.97	181.8	ER	179	3.29	
24	N-1	5891_B2_TOR607	AEP - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	185.29	186.01	ER	184	2.94	
25	Non	Non	AEP - DEO&K	AC2-061 TAP-08CLINCO 138 kV line	931430	249995	1	DC	175.11	175.83	NR	159	2.53	
26	N-1	889_B2	DAY - DAY	AC2-087 TAP-09GRNFLD 69 kV line	931650	253030	1	DC	37.98	60.13	ER	72	15.94	

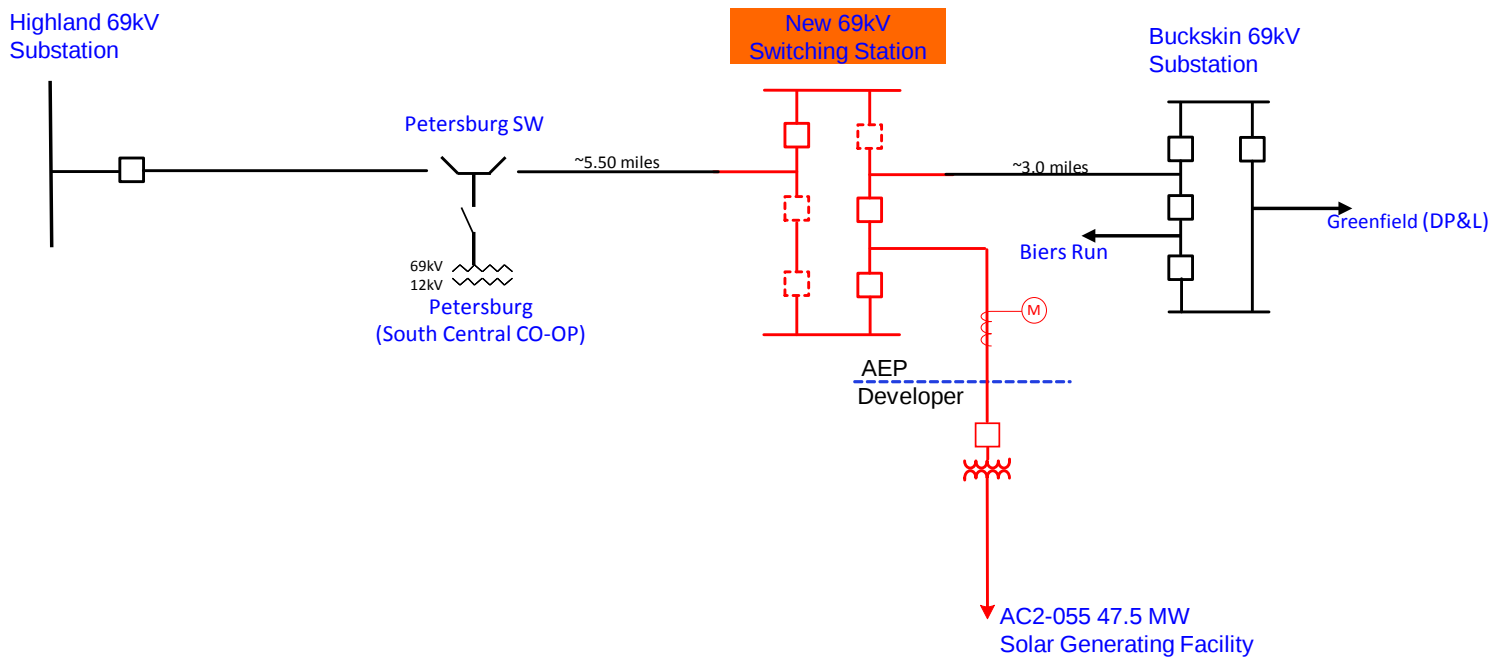
Table 13

Figure 1: Primary Point of Interconnection (Buckskin – Petersburg 69 kV)

Single Line Diagram

**AC2-055 Primary Point of Interconnection
Line Tap/New 69 kV Switching Station**

Remote stations not
completely shown



Legend

- Existing
- To be Constructed for AC2-055

Figure 2: Secondary Point of Interconnection (Buckskin 69kV Substation)
Single Line Diagram

AC2-055 Secondary Point of Interconnection

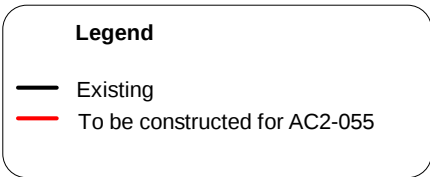
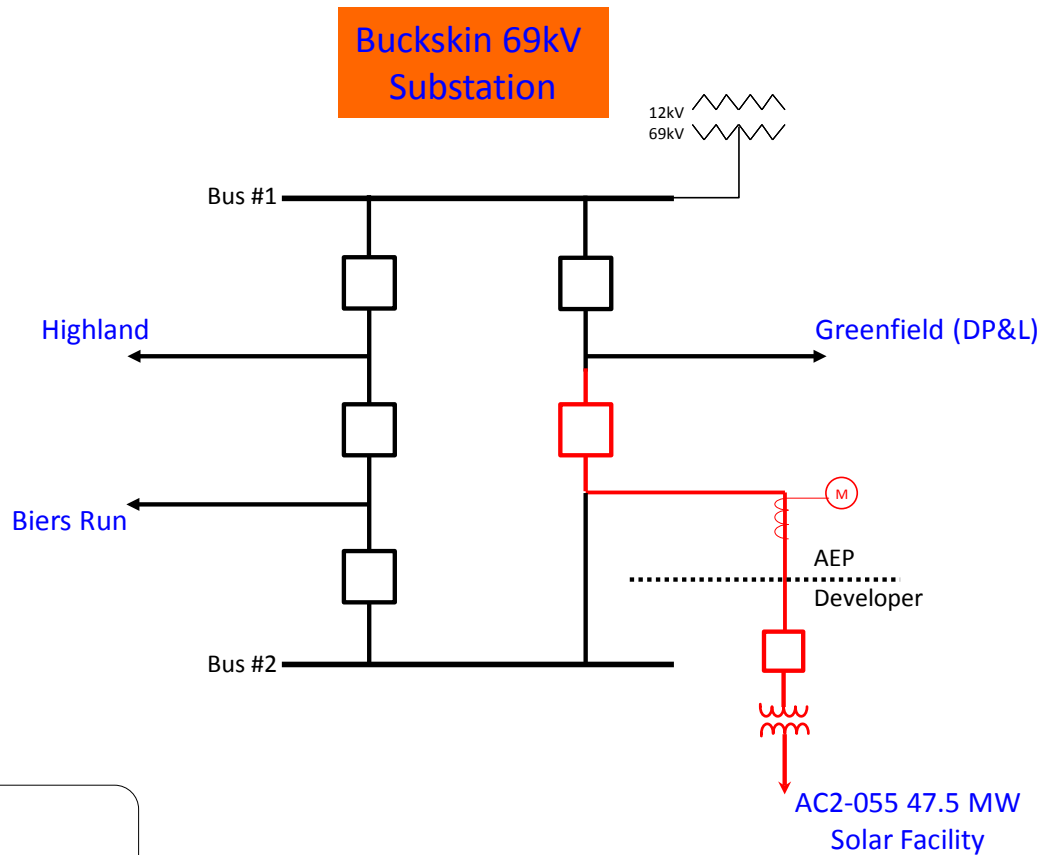


Figure 3: Primary Point of Interconnection (Buckskin – Petersburg 69 kV)

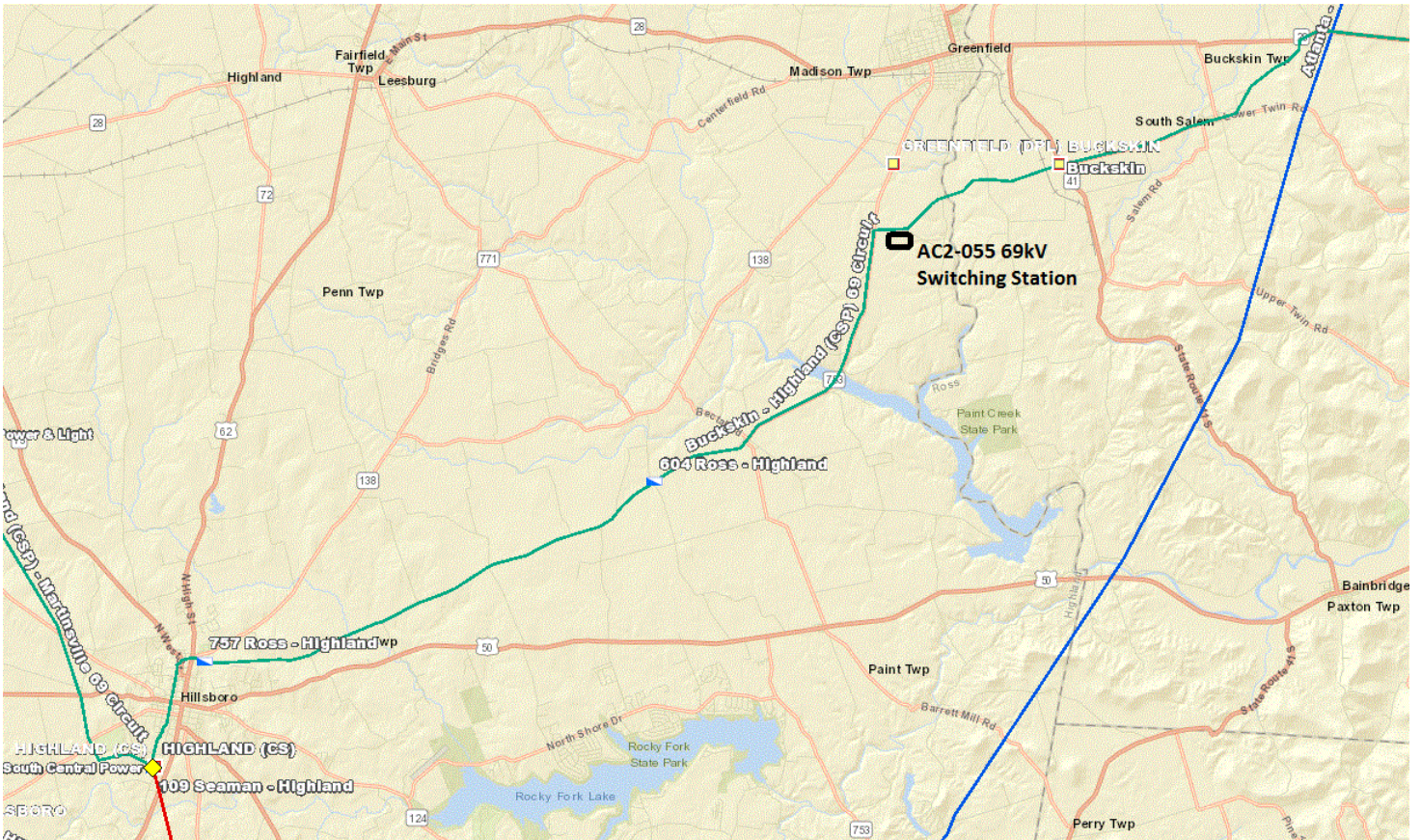
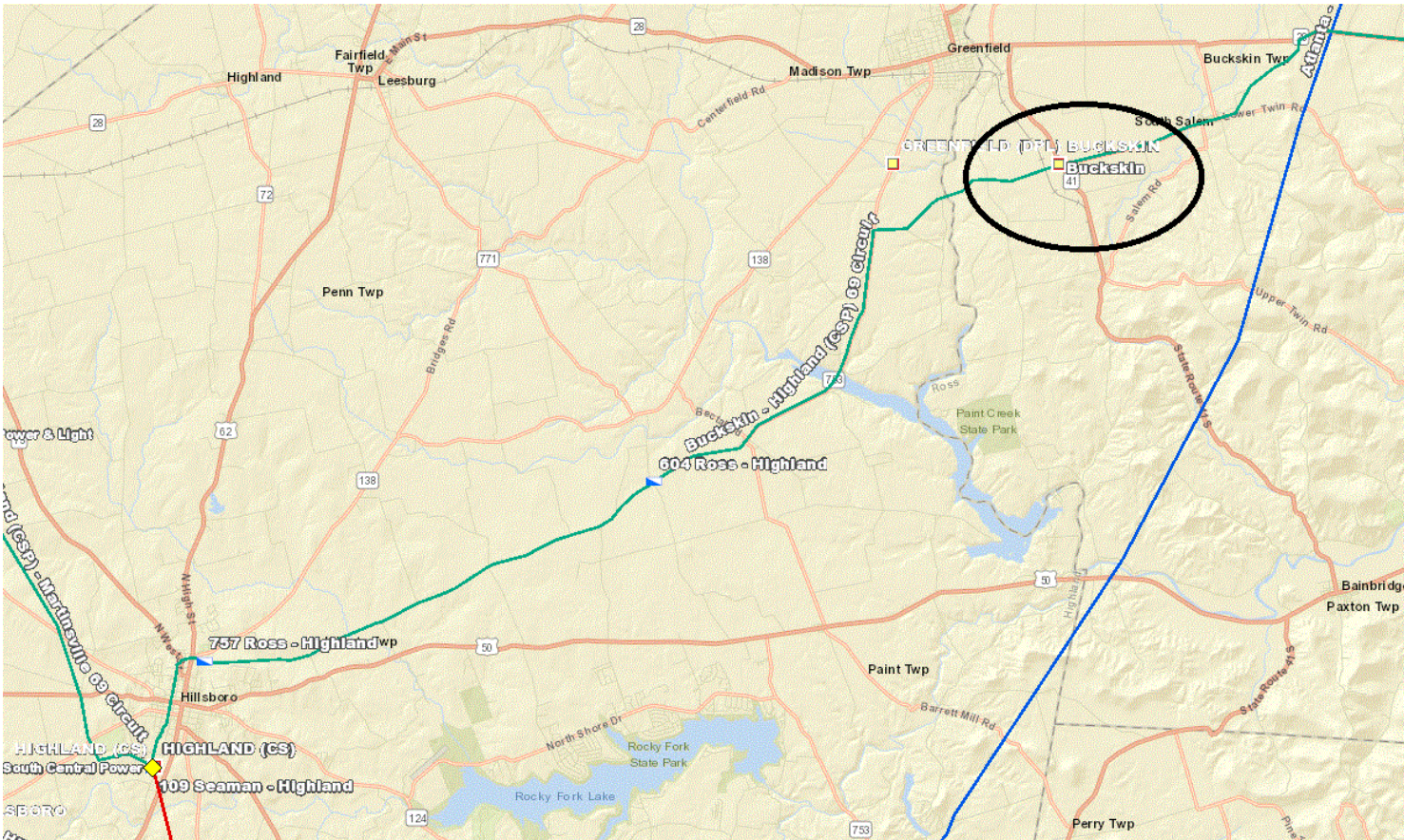


Figure 4: Secondary Point of Interconnection (Buckskin 69 kV)



Appendices for Primary POI

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(AEP - AEP) The 05HIGHLA-05NMARSS 138 kV line (from bus 246911 to bus 247035 ckt 1) loads from 87.63% to 88.31% (**DC power flow**) of its emergency rating (310 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 4.65 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.73
931121	AC2-019 C	0.77
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.54
931132	AC2-020 E OP	1.42
931192	AC2-027 E	2.02
931221	AC2-031 C	14.63
931222	AC2-031 E	7.2
931281	AC2-042 C	45.72
931282	AC2-042 E	30.48
931351	AC2-049 C	2.96
931352	AC2-049 E	1.97
931381	AC2-055 C OP	1.77
931382	AC2-055 E OP	2.88
931421	AC2-060 C	4.94
931422	AC2-060 E	2.78
931431	AC2-061 C	12.68
931432	AC2-061 E	12.86
931441	AC2-062 C OP	4.07
931442	AC2-062 E OP	1.82
931451	AC2-064 C	6.95
931452	AC2-064 E	4.63
931651	AC2-087 C OP	3.66
931652	AC2-087 E OP	2.9
247592	W4-036	0.93
926061	AC1-085 C	33.18
926062	AC1-085 E	54.14

<i>926101</i>	<i>AC1-089 C</i>	<i>11.16</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>18.22</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>14.69</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>7.14</i>

Appendix 2

(AEP - AEP) The 05NMARSS-05SEAMAN 138 kV line (from bus 247035 to bus 243571 ckt 1) loads from 84.24% to 84.92% (**DC power flow**) of its emergency rating (310 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 4.65 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.73
931121	AC2-019 C	0.77
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.54
931132	AC2-020 E OP	1.42
931192	AC2-027 E	2.02
931221	AC2-031 C	14.63
931222	AC2-031 E	7.2
931281	AC2-042 C	45.72
931282	AC2-042 E	30.48
931351	AC2-049 C	2.96
931352	AC2-049 E	1.97
931381	AC2-055 C OP	1.77
931382	AC2-055 E OP	2.88
931421	AC2-060 C	4.94
931422	AC2-060 E	2.78
931431	AC2-061 C	12.68
931432	AC2-061 E	12.86
931441	AC2-062 C OP	4.07
931442	AC2-062 E OP	1.82
931451	AC2-064 C	6.95
931452	AC2-064 E	4.63
931651	AC2-087 C OP	3.66
931652	AC2-087 E OP	2.9
247592	W4-036	0.93
926061	AC1-085 C	33.18
926062	AC1-085 E	54.14

<i>926101</i>	<i>AC1-089 C</i>	<i>11.16</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>18.22</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>14.69</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>7.14</i>

Appendix 3

(AEP - AEP) The 05HILLSB-05SINKG8 138 kV line (from bus 243019 to bus 243102 ckt 1) loads from 210.9% to 213.55% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 4.9 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.55
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931381	AC2-055 C OP	1.86
931382	AC2-055 E OP	3.04
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.62
931442	AC2-062 E OP	2.96
931651	AC2-087 C OP	3.97
931652	AC2-087 E OP	3.15
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4
926061	AC1-085 C	53.03
926062	AC1-085 E	86.52

<i>926101</i>	<i>AC1-089 C</i>	<i>17.87</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>29.16</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>23.48</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 4

(AEP - DAY) The 05HILLSB-09MIDDLE 138 kV line (from bus 243019 to bus 253111 ckt 1) loads from 159.57% to 160.39% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111_C2_05HILLSB 138-_A'. This project contributes approximately 3.36 MW to the thermal violation.

CONTINGENCY '8111_C2_05HILLSB 138-_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB
138 931430 AC2-060 TAP 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.54
931122	AC2-019 E	0.88
931131	AC2-020 C OP	0.39
931132	AC2-020 E OP	1.02
931192	AC2-027 E	1.42
931221	AC2-031 C	16.99
931222	AC2-031 E	8.37
931281	AC2-042 C	53.11
931282	AC2-042 E	35.41
931351	AC2-049 C	3.7
931352	AC2-049 E	2.47
931381	AC2-055 C OP	1.28
931382	AC2-055 E OP	2.08
931421	AC2-060 C	3.62
931422	AC2-060 E	2.04
931451	AC2-064 C	8.69
931452	AC2-064 E	5.8
931651	AC2-087 C OP	2.68
931652	AC2-087 E OP	2.13
247592	W4-036	0.68
924371	AB2-085 C OP	6.32
924372	AB2-085 E OP	2.97
924541	AB2-103 C OP	3.81
924542	AB2-103 E OP	1.79
926061	AC1-085 C	38.55
926062	AC1-085 E	62.9
926631	AC1-144 C	17.07
926632	AC1-144 E	8.29

Appendix 5

(AEP - AEP) The 05HILLSB-AC1-089 TAP 138 kV line (from bus 243019 to bus 926100 ckt 1) loads from 123.97% to 124.92% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.91 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.46
931132	AC2-020 E OP	1.22
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.49
931382	AC2-055 E OP	2.42
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.16
931652	AC2-087 E OP	2.51
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.
926061	AC1-085 C	43.08

<i>926062</i>	<i>AC1-085 E</i>	<i>70.28</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>19.07</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>9.27</i>

Appendix 6

(AEP - DEO&K) The 05HILLSB-AC2-061 TAP 138 kV line (from bus 243019 to bus 931430 ckt 1) loads from 234.3% to 236.98% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 4.93 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.54
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.87
931382	AC2-055 E OP	3.06
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931441	AC2-062 C OP	6.6
931442	AC2-062 E OP	2.95
931651	AC2-087 C OP	3.98
931652	AC2-087 E OP	3.16
247592	W4-036	1.01
916272	Z1-080 E	2.18
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2
926062	AC1-085 E	88.44
926101	AC1-089 C	18.22

926102	AC1-089 E	29.73
926631	AC1-144 C	24.
926632	AC1-144 E	11.66

Appendix 7

(AEP - AEP) The 05SINKG8-AC2-049 TAP 138 kV line (from bus 243102 to bus 931350 ckt 1) loads from 216.01% to 218.75% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 4.9 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.55
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931381	AC2-055 C OP	1.86
931382	AC2-055 E OP	3.04
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.62
931442	AC2-062 E OP	2.96
931651	AC2-087 C OP	3.97
931652	AC2-087 E OP	3.15
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4
926061	AC1-085 C	53.03
926062	AC1-085 E	86.52

<i>926101</i>	<i>AC1-089 C</i>	<i>17.87</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>29.16</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>23.48</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 8

(AEP - AEP) The 05ADAMS-05WARERD 138 kV line (from bus 243464 to bus 246942 ckt 1) loads from 153.54% to 154.59% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.51 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.34
931121	AC2-019 C	0.59
931122	AC2-019 E	0.96
931131	AC2-020 C OP	0.41
931132	AC2-020 E OP	1.07
931192	AC2-027 E	1.55
931221	AC2-031 C	11.2
931222	AC2-031 E	5.51
931281	AC2-042 C	34.99
931282	AC2-042 E	23.33
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.33
931382	AC2-055 E OP	2.18
931421	AC2-060 C	3.7
931422	AC2-060 E	2.08
931431	AC2-061 C	9.71
931432	AC2-061 E	9.84
931441	AC2-062 C OP	3.21
931442	AC2-062 E OP	1.44
931451	AC2-064 C	5.11
931452	AC2-064 E	3.41
931651	AC2-087 C OP	2.74
931652	AC2-087 E OP	2.18
247592	W4-036	0.69
924371	AB2-085 C OP	27.11
924372	AB2-085 E OP	12.76

924541	<i>AB2-103 C OP</i>	<i>10.95</i>
924542	<i>AB2-103 E OP</i>	<i>5.15</i>
926061	<i>AC1-085 C</i>	<i>25.4</i>
926062	<i>AC1-085 E</i>	<i>41.44</i>
926101	<i>AC1-089 C</i>	<i>8.57</i>
926102	<i>AC1-089 E</i>	<i>13.99</i>
926631	<i>AC1-144 C</i>	<i>11.25</i>
926632	<i>AC1-144 E</i>	<i>5.46</i>

Appendix 9

(AEP - AEP) The 05SEAMAN-05ADAMS 138 kV line (from bus 243571 to bus 243464 ckt 1) loads from 140.09% to 141.13% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.47 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.31
931121	AC2-019 C	0.58
931122	AC2-019 E	0.95
931131	AC2-020 C OP	0.4
931132	AC2-020 E OP	1.06
931192	AC2-027 E	1.53
931221	AC2-031 C	11.02
931222	AC2-031 E	5.43
931281	AC2-042 C	34.44
931282	AC2-042 E	22.96
931351	AC2-049 C	2.17
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.32
931382	AC2-055 E OP	2.15
931421	AC2-060 C	3.67
931422	AC2-060 E	2.07
931431	AC2-061 C	9.56
931432	AC2-061 E	9.69
931441	AC2-062 C OP	3.13
931442	AC2-062 E OP	1.4
931451	AC2-064 C	5.1
931452	AC2-064 E	3.4
931651	AC2-087 C OP	2.72
931652	AC2-087 E OP	2.16
247592	W4-036	0.69
924541	AB2-103 C OP	10.77
924542	AB2-103 E OP	5.07

926061	AC1-085 C	25.
926062	AC1-085 E	40.79
926101	AC1-089 C	8.43
926102	AC1-089 E	13.75
926631	AC1-144 C	11.07
926632	AC1-144 E	5.38

Appendix 10

(AEP - AEP) The 05WARERD-05WAVERL 138 kV line (from bus 246942 to bus 243585 ckt 1) loads from 143.34% to 144.39% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.51 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.34
931121	AC2-019 C	0.59
931122	AC2-019 E	0.96
931131	AC2-020 C OP	0.41
931132	AC2-020 E OP	1.07
931192	AC2-027 E	1.55
931221	AC2-031 C	11.2
931222	AC2-031 E	5.51
931281	AC2-042 C	34.99
931282	AC2-042 E	23.33
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.33
931382	AC2-055 E OP	2.18
931421	AC2-060 C	3.7
931422	AC2-060 E	2.08
931431	AC2-061 C	9.71
931432	AC2-061 E	9.84
931441	AC2-062 C OP	3.21
931442	AC2-062 E OP	1.44
931451	AC2-064 C	5.11
931452	AC2-064 E	3.41
931651	AC2-087 C OP	2.74
931652	AC2-087 E OP	2.18
247592	W4-036	0.69
924371	AB2-085 C OP	27.11
924372	AB2-085 E OP	12.76

924541	<i>AB2-103 C OP</i>	<i>10.95</i>
924542	<i>AB2-103 E OP</i>	<i>5.15</i>
926061	<i>AC1-085 C</i>	<i>25.4</i>
926062	<i>AC1-085 E</i>	<i>41.44</i>
926101	<i>AC1-089 C</i>	<i>8.57</i>
926102	<i>AC1-089 E</i>	<i>13.99</i>
926631	<i>AC1-144 C</i>	<i>11.25</i>
926632	<i>AC1-144 E</i>	<i>5.46</i>

Appendix 11

(AEP - AEP) The 05WLDCAT-05EMERSS 138 kV line (from bus 246946 to bus 247034 ckt 1) loads from 151.59% to 152.54% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.91 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	4.3
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.46
931132	AC2-020 E OP	1.22
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.49
931382	AC2-055 E OP	2.42
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.16
931652	AC2-087 E OP	2.51
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.

926061	AC1-085 C	43.08
926062	AC1-085 E	70.28
926101	AC1-089 C	20.33
926102	AC1-089 E	33.17
926631	AC1-144 C	19.07
926632	AC1-144 E	9.27

Appendix 12

(AEP - AEP) The 05EMERSS-AC2-062 TAP 138 kV line (from bus 247034 to bus 931440 ckt 1) loads from 149.59% to 150.54% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.91 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	4.3
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.46
931132	AC2-020 E OP	1.22
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.49
931382	AC2-055 E OP	2.42
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.16
931652	AC2-087 E OP	2.51
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.

926061	AC1-085 C	43.08
926062	AC1-085 E	70.28
926101	AC1-089 C	20.33
926102	AC1-089 E	33.17
926631	AC1-144 C	19.07
926632	AC1-144 E	9.27

Appendix 13

(DEO&K - DEO&K) The 08CLINCO-08WARRN1 138 kV line (from bus 249995 to bus 250122 ckt 1) loads from 204.22% to 206.71% (**DC power flow**) of its emergency rating (198 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 4.93 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.54
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.87
931382	AC2-055 E OP	3.06
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931431	AC2-061 C	28.84
931432	AC2-061 E	29.24
931441	AC2-062 C OP	6.6
931442	AC2-062 E OP	2.95
931651	AC2-087 C OP	3.98
931652	AC2-087 E OP	3.16
247592	W4-036	1.01
916272	Z1-080 E	3.82
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2

926062	AC1-085 E	88.44
926101	AC1-089 C	18.22
926102	AC1-089 E	29.73
926631	AC1-144 C	24.
926632	AC1-144 E	11.66

Appendix 14

(DAY - DAY) The 09MIDDLE-09OHH 138 kV line (from bus 253111 to bus 253057 ckt 1) loads from 157.3% to 158.12% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111_C2_05HILLSB 138-_A'. This project contributes approximately 3.36 MW to the thermal violation.

CONTINGENCY '8111_C2_05HILLSB 138-_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB
138 931430 AC2-060 TAP 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.54
931122	AC2-019 E	0.88
931131	AC2-020 C OP	0.39
931132	AC2-020 E OP	1.02
931192	AC2-027 E	1.42
931221	AC2-031 C	16.99
931222	AC2-031 E	8.37
931281	AC2-042 C	53.11
931282	AC2-042 E	35.41
931351	AC2-049 C	3.7
931352	AC2-049 E	2.47
931381	AC2-055 C OP	1.28
931382	AC2-055 E OP	2.08
931421	AC2-060 C	3.62
931422	AC2-060 E	2.04
931451	AC2-064 C	8.69
931452	AC2-064 E	5.8
931651	AC2-087 C OP	2.68
931652	AC2-087 E OP	2.13
247592	W4-036	0.68
924371	AB2-085 C OP	6.32
924372	AB2-085 E OP	2.97
924541	AB2-103 C OP	3.81
924542	AB2-103 E OP	1.79
926061	AC1-085 C	38.55
926062	AC1-085 E	62.9
926631	AC1-144 C	17.07
926632	AC1-144 E	8.29

Appendix 15

(AEP - AEP) The AC1-089 TAP-05WLDCAT 138 kV line (from bus 926100 to bus 246946 ckt 1) loads from 152.67% to 153.63% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.91 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.46
931132	AC2-020 E OP	1.22
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.49
931382	AC2-055 E OP	2.42
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.16
931652	AC2-087 E OP	2.51
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25
924542	AB2-103 E OP	2.
926061	AC1-085 C	43.08

926062	AC1-085 E	70.28
926101	AC1-089 C	20.33
926102	AC1-089 E	33.17
926631	AC1-144 C	19.07
926632	AC1-144 E	9.27

Appendix 16

(AEP - AEP) The AC2-049 TAP-05MILLBR 138 kV line (from bus 931350 to bus 243042 ckt 1) loads from 234.67% to 237.4% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 4.9 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.55
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931351	AC2-049 C	20.15
931352	AC2-049 E	13.43
931381	AC2-055 C OP	1.86
931382	AC2-055 E OP	3.04
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.62
931442	AC2-062 E OP	2.96
931451	AC2-064 C	47.29
931452	AC2-064 E	31.53
931651	AC2-087 C OP	3.97
931652	AC2-087 E OP	3.15
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87

924541	<i>AB2-103 C OP</i>	<i>5.1</i>
924542	<i>AB2-103 E OP</i>	<i>2.4</i>
926061	<i>AC1-085 C</i>	<i>53.03</i>
926062	<i>AC1-085 E</i>	<i>86.52</i>
926101	<i>AC1-089 C</i>	<i>17.87</i>
926102	<i>AC1-089 E</i>	<i>29.16</i>
926631	<i>AC1-144 C</i>	<i>23.48</i>
926632	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 17

(DEO&K - DEO&K) The AC2-061 TAP-08CLINCO 138 kV line (from bus 931430 to bus 249995 ckt 1) loads from 234.3% to 236.98% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 4.93 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.54
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.87
931382	AC2-055 E OP	3.06
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931431	AC2-061 C	28.84
931432	AC2-061 E	29.24
931441	AC2-062 C OP	6.6
931442	AC2-062 E OP	2.95
931651	AC2-087 C OP	3.98
931652	AC2-087 E OP	3.16
247592	W4-036	1.01
916272	Z1-080 E	2.18
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2

926062	AC1-085 E	88.44
926101	AC1-089 C	18.22
926102	AC1-089 E	29.73
926631	AC1-144 C	24.
926632	AC1-144 E	11.66

Appendix 18

(AEP - LGEE) The AC2-062 TAP-4KENTON 138 kV line (from bus 931440 to bus 324267 ckt 1) loads from 148.89% to 149.84% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.91 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	4.3
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.46
931132	AC2-020 E OP	1.22
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.49
931382	AC2-055 E OP	2.42
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	24.55
931442	AC2-062 E OP	10.98
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.16
931652	AC2-087 E OP	2.51
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31

924541	<i>AB2-103 C OP</i>	4.25
924542	<i>AB2-103 E OP</i>	2.
926061	<i>AC1-085 C</i>	43.08
926062	<i>AC1-085 E</i>	70.28
926101	<i>AC1-089 C</i>	20.33
926102	<i>AC1-089 E</i>	33.17
926631	<i>AC1-144 C</i>	19.07
926632	<i>AC1-144 E</i>	9.27

Appendices for Secondary POI

The following appendices contain additional information about each flowgate presented in the body of the report. For each appendix, a description of the flowgate and its contingency was included for convenience. However, the intent of the appendix section is to provide more information on which projects/generators have contributions to the flowgate in question. Although this information is not used "as is" for cost allocation purposes, it can be used to gage other generators impact.

It should be noted the generator contributions presented in the appendices sections are full contributions, whereas in the body of the report, those contributions take into consideration the commercial probability of each project.

Appendix 1

(AEP - AEP) The 05HIGHLA-05NMARSS 138 kV line (from bus 246911 to bus 247035 ckt 1) loads from 87.66% to 88.19% (**DC power flow**) of its emergency rating (310 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.67 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.73
931121	AC2-019 C	0.77
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.59
931132	AC2-020 E OP	1.54
931192	AC2-027 E	2.02
931221	AC2-031 C	14.63
931222	AC2-031 E	7.2
931281	AC2-042 C	45.72
931282	AC2-042 E	30.48
931351	AC2-049 C	2.96
931352	AC2-049 E	1.97
931381	AC2-055 C OP	1.39
931382	AC2-055 E OP	2.27
931421	AC2-060 C	4.94
931422	AC2-060 E	2.78
931431	AC2-061 C	12.68
931432	AC2-061 E	12.86
931451	AC2-064 C	6.95
931452	AC2-064 E	4.63
931651	AC2-087 C OP	3.62
931652	AC2-087 E OP	2.87
247592	W4-036	0.93
926061	AC1-085 C	33.18
926062	AC1-085 E	54.14
926101	AC1-089 C	11.16
926102	AC1-089 E	18.22

926631	AC1-144 C	14.69
926632	AC1-144 E	7.14

Appendix 2

(AEP - AEP) The 05HILLSB-05SINKG8 138 kV line (from bus 243019 to bus 243102 ckt 1) loads from 210.95% to 211.92% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.98 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931381	AC2-055 C OP	1.51
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.
931442	AC2-062 E OP	2.68
931651	AC2-087 C OP	3.93
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4
926061	AC1-085 C	53.03
926062	AC1-085 E	86.52

<i>926101</i>	<i>AC1-089 C</i>	<i>17.87</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>29.16</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>23.48</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 3

(AEP - DAY) The 05HILLSB-09MIDDLE 138 kV line (from bus 243019 to bus 253111 ckt 1) loads from 159.61% to 160.27% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111_C2_05HILLSB 138-_A'. This project contributes approximately 2.69 MW to the thermal violation.

CONTINGENCY '8111_C2_05HILLSB 138-_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB
138 931430 AC2-060 TAP 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.54
931122	AC2-019 E	0.88
931131	AC2-020 C OP	0.43
931132	AC2-020 E OP	1.13
931192	AC2-027 E	1.42
931221	AC2-031 C	16.99
931222	AC2-031 E	8.37
931281	AC2-042 C	53.11
931282	AC2-042 E	35.41
931351	AC2-049 C	3.7
931352	AC2-049 E	2.47
931381	AC2-055 C OP	1.02
931382	AC2-055 E OP	1.66
931421	AC2-060 C	3.62
931422	AC2-060 E	2.04
931441	AC2-062 C OP	4.46
931442	AC2-062 E OP	2.
931451	AC2-064 C	8.69
931452	AC2-064 E	5.8
931651	AC2-087 C OP	2.65
931652	AC2-087 E OP	2.1
247592	W4-036	0.68
924371	AB2-085 C OP	6.32
924372	AB2-085 E OP	2.97
924541	AB2-103 C OP	3.81
924542	AB2-103 E OP	1.79
926061	AC1-085 C	38.55
926062	AC1-085 E	62.9
926631	AC1-144 C	17.07
926632	AC1-144 E	8.29

Appendix 4

(AEP - AEP) The 05HILLSB-AC1-089 TAP 138 kV line (from bus 243019 to bus 926100 ckt 1) loads from 124.01% to 124.78% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.17 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.51
931132	AC2-020 E OP	1.33
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.2
931382	AC2-055 E OP	1.96
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	4.94
931442	AC2-062 E OP	2.21
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.12
931652	AC2-087 E OP	2.48
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25

924542	<i>AB2-103 E OP</i>	2.
926061	<i>AC1-085 C</i>	43.08
926062	<i>AC1-085 E</i>	70.28
926631	<i>AC1-144 C</i>	19.07
926632	<i>AC1-144 E</i>	9.27

Appendix 5

(AEP - DEO&K) The 05HILLSB-AC2-061 TAP 138 kV line (from bus 243019 to bus 931430 ckt 1) loads from 234.36% to 235.33% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 3.99 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.52
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931441	AC2-062 C OP	6.21
931442	AC2-062 E OP	2.78
931651	AC2-087 C OP	3.94
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
916272	Z1-080 E	2.18
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2
926062	AC1-085 E	88.44
926101	AC1-089 C	18.22

926102	AC1-089 E	29.73
926631	AC1-144 C	24.
926632	AC1-144 E	11.66

Appendix 6

(AEP - AEP) The 05SINKG8-AC2-049 TAP 138 kV line (from bus 243102 to bus 931350 ckt 1) loads from 216.06% to 217.06% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.98 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931381	AC2-055 C OP	1.51
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.
931442	AC2-062 E OP	2.68
931651	AC2-087 C OP	3.93
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87
924541	AB2-103 C OP	5.1
924542	AB2-103 E OP	2.4
926061	AC1-085 C	53.03
926062	AC1-085 E	86.52

<i>926101</i>	<i>AC1-089 C</i>	<i>17.87</i>
<i>926102</i>	<i>AC1-089 E</i>	<i>29.16</i>
<i>926631</i>	<i>AC1-144 C</i>	<i>23.48</i>
<i>926632</i>	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 7

(AEP - AEP) The 05ADAMS-05WARERD 138 kV line (from bus 243464 to bus 246942 ckt 1) loads from 153.58% to 154.4% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 2.75 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.34
931121	AC2-019 C	0.59
931122	AC2-019 E	0.96
931131	AC2-020 C OP	0.44
931132	AC2-020 E OP	1.16
931192	AC2-027 E	1.55
931221	AC2-031 C	11.2
931222	AC2-031 E	5.51
931281	AC2-042 C	34.99
931282	AC2-042 E	23.33
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.04
931382	AC2-055 E OP	1.7
931421	AC2-060 C	3.7
931422	AC2-060 E	2.08
931431	AC2-061 C	9.71
931432	AC2-061 E	9.84
931441	AC2-062 C OP	14.53
931442	AC2-062 E OP	6.5
931451	AC2-064 C	5.11
931452	AC2-064 E	3.41
931651	AC2-087 C OP	2.71
931652	AC2-087 E OP	2.15
247592	W4-036	0.69
924371	AB2-085 C OP	27.11
924372	AB2-085 E OP	12.76

924541	<i>AB2-103 C OP</i>	<i>10.95</i>
924542	<i>AB2-103 E OP</i>	<i>5.15</i>
926061	<i>AC1-085 C</i>	<i>25.4</i>
926062	<i>AC1-085 E</i>	<i>41.44</i>
926101	<i>AC1-089 C</i>	<i>8.57</i>
926102	<i>AC1-089 E</i>	<i>13.99</i>
926631	<i>AC1-144 C</i>	<i>11.25</i>
926632	<i>AC1-144 E</i>	<i>5.46</i>

Appendix 8

(AEP - AEP) The 05SEAMAN-05ADAMS 138 kV line (from bus 243571 to bus 243464 ckt 1) loads from 140.13% to 140.95% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 2.73 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.31
931121	AC2-019 C	0.58
931122	AC2-019 E	0.95
931131	AC2-020 C OP	0.44
931132	AC2-020 E OP	1.15
931192	AC2-027 E	1.53
931221	AC2-031 C	11.02
931222	AC2-031 E	5.43
931281	AC2-042 C	34.44
931282	AC2-042 E	22.96
931351	AC2-049 C	2.17
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.04
931382	AC2-055 E OP	1.69
931421	AC2-060 C	3.67
931422	AC2-060 E	2.07
931431	AC2-061 C	9.56
931432	AC2-061 E	9.69
931441	AC2-062 C OP	5.12
931442	AC2-062 E OP	2.29
931451	AC2-064 C	5.1
931452	AC2-064 E	3.4
931651	AC2-087 C OP	2.69
931652	AC2-087 E OP	2.14
247592	W4-036	0.69
924541	AB2-103 C OP	10.77
924542	AB2-103 E OP	5.07

926061	AC1-085 C	25.
926062	AC1-085 E	40.79
926101	AC1-089 C	8.43
926102	AC1-089 E	13.75
926631	AC1-144 C	11.07
926632	AC1-144 E	5.38

Appendix 9

(AEP - AEP) The 05WARERD-05WAVERL 138 kV line (from bus 246942 to bus 243585 ckt 1) loads from 143.38% to 144.2% (**DC power flow**) of its emergency rating (150 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 2.75 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	1.34
931121	AC2-019 C	0.59
931122	AC2-019 E	0.96
931131	AC2-020 C OP	0.44
931132	AC2-020 E OP	1.16
931192	AC2-027 E	1.55
931221	AC2-031 C	11.2
931222	AC2-031 E	5.51
931281	AC2-042 C	34.99
931282	AC2-042 E	23.33
931351	AC2-049 C	2.18
931352	AC2-049 E	1.45
931381	AC2-055 C OP	1.04
931382	AC2-055 E OP	1.7
931421	AC2-060 C	3.7
931422	AC2-060 E	2.08
931431	AC2-061 C	9.71
931432	AC2-061 E	9.84
931441	AC2-062 C OP	14.53
931442	AC2-062 E OP	6.5
931451	AC2-064 C	5.11
931452	AC2-064 E	3.41
931651	AC2-087 C OP	2.71
931652	AC2-087 E OP	2.15
247592	W4-036	0.69
924371	AB2-085 C OP	27.11
924372	AB2-085 E OP	12.76

924541	<i>AB2-103 C OP</i>	<i>10.95</i>
924542	<i>AB2-103 E OP</i>	<i>5.15</i>
926061	<i>AC1-085 C</i>	<i>25.4</i>
926062	<i>AC1-085 E</i>	<i>41.44</i>
926101	<i>AC1-089 C</i>	<i>8.57</i>
926102	<i>AC1-089 E</i>	<i>13.99</i>
926631	<i>AC1-144 C</i>	<i>11.25</i>
926632	<i>AC1-144 E</i>	<i>5.46</i>

Appendix 10

(AEP - AEP) The 05WLDCAT-05EMERSS 138 kV line (from bus 246946 to bus 247034 ckt 1) loads from 151.63% to 152.41% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.17 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	4.3
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.51
931132	AC2-020 E OP	1.33
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.2
931382	AC2-055 E OP	1.96
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	4.94
931442	AC2-062 E OP	2.21
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.12
931652	AC2-087 E OP	2.48
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31

924541	<i>AB2-103 C OP</i>	4.25
924542	<i>AB2-103 E OP</i>	2.
926061	<i>AC1-085 C</i>	43.08
926062	<i>AC1-085 E</i>	70.28
926101	<i>AC1-089 C</i>	20.33
926102	<i>AC1-089 E</i>	33.17
926631	<i>AC1-144 C</i>	19.07
926632	<i>AC1-144 E</i>	9.27

Appendix 11

(AEP - LGEE) The 05EMERSS-4KENTON 138 kV line (from bus 247034 to bus 324267 ckt 1) loads from 150.34% to 151.11% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.17 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	4.3
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.51
931132	AC2-020 E OP	1.33
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.2
931382	AC2-055 E OP	1.96
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	4.94
931442	AC2-062 E OP	2.21
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.12
931652	AC2-087 E OP	2.48
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31

924541	<i>AB2-103 C OP</i>	4.25
924542	<i>AB2-103 E OP</i>	2.
926061	<i>AC1-085 C</i>	43.08
926062	<i>AC1-085 E</i>	70.28
926101	<i>AC1-089 C</i>	20.33
926102	<i>AC1-089 E</i>	33.17
926631	<i>AC1-144 C</i>	19.07
926632	<i>AC1-144 E</i>	9.27

Appendix 12

(DEO&K - DEO&K) The 08CLINCO-08WARRN1 138 kV line (from bus 249995 to bus 250122 ckt 1) loads from 204.27% to 205.18% (**DC power flow**) of its emergency rating (198 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 3.99 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.52
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931431	AC2-061 C	28.84
931432	AC2-061 E	29.24
931441	AC2-062 C OP	6.21
931442	AC2-062 E OP	2.78
931651	AC2-087 C OP	3.94
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
916272	Z1-080 E	3.82
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2

926062	AC1-085 E	88.44
926101	AC1-089 C	18.22
926102	AC1-089 E	29.73
926631	AC1-144 C	24.
926632	AC1-144 E	11.66

Appendix 13

(DAY - DAY) The 09MIDDLE-09OHH 138 kV line (from bus 253111 to bus 253057 ckt 1) loads from 157.34% to 157.99% (**DC power flow**) of its emergency rating (185 MVA) for the line fault with failed breaker contingency outage of '8111_C2_05HILLSB 138-_A'. This project contributes approximately 2.69 MW to the thermal violation.

CONTINGENCY '8111_C2_05HILLSB 138-_A'

OPEN BRANCH FROM BUS 243019 TO BUS 926100 CKT 1 / 243019 05HILLSB
138 926100 AC1-089 TAP 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 931430 CKT 1 / 243019 05HILLSB
138 931430 AC2-060 TAP 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.54
931122	AC2-019 E	0.88
931131	AC2-020 C OP	0.43
931132	AC2-020 E OP	1.13
931192	AC2-027 E	1.42
931221	AC2-031 C	16.99
931222	AC2-031 E	8.37
931281	AC2-042 C	53.11
931282	AC2-042 E	35.41
931351	AC2-049 C	3.7
931352	AC2-049 E	2.47
931381	AC2-055 C OP	1.02
931382	AC2-055 E OP	1.66
931421	AC2-060 C	3.62
931422	AC2-060 E	2.04
931441	AC2-062 C OP	4.46
931442	AC2-062 E OP	2.
931451	AC2-064 C	8.69
931452	AC2-064 E	5.8
931651	AC2-087 C OP	2.65
931652	AC2-087 E OP	2.1
247592	W4-036	0.68
924371	AB2-085 C OP	6.32
924372	AB2-085 E OP	2.97
924541	AB2-103 C OP	3.81
924542	AB2-103 E OP	1.79
926061	AC1-085 C	38.55
926062	AC1-085 E	62.9
926631	AC1-144 C	17.07
926632	AC1-144 E	8.29

Appendix 14

(AEP - AEP) The AC1-089 TAP-05WLDCAT 138 kV line (from bus 926100 to bus 246946 ckt 1) loads from 152.72% to 153.49% (**DC power flow**) of its emergency rating (185 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.17 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931121	AC2-019 C	0.61
931122	AC2-019 E	1.
931131	AC2-020 C OP	0.51
931132	AC2-020 E OP	1.33
931192	AC2-027 E	1.62
931221	AC2-031 C	18.99
931222	AC2-031 E	9.35
931281	AC2-042 C	59.34
931282	AC2-042 E	39.56
931351	AC2-049 C	4.11
931352	AC2-049 E	2.74
931381	AC2-055 C OP	1.2
931382	AC2-055 E OP	1.96
931421	AC2-060 C	4.27
931422	AC2-060 E	2.4
931431	AC2-061 C	16.47
931432	AC2-061 E	16.69
931441	AC2-062 C OP	4.94
931442	AC2-062 E OP	2.21
931451	AC2-064 C	9.64
931452	AC2-064 E	6.43
931651	AC2-087 C OP	3.12
931652	AC2-087 E OP	2.48
247592	W4-036	0.8
924371	AB2-085 C OP	7.03
924372	AB2-085 E OP	3.31
924541	AB2-103 C OP	4.25

924542	<i>AB2-103 E OP</i>	2.
926061	<i>AC1-085 C</i>	43.08
926062	<i>AC1-085 E</i>	70.28
926101	<i>AC1-089 C</i>	20.33
926102	<i>AC1-089 E</i>	33.17
926631	<i>AC1-144 C</i>	19.07
926632	<i>AC1-144 E</i>	9.27

Appendix 15

(AEP - AEP) The AC2-049 TAP-05MILLBR 138 kV line (from bus 931350 to bus 243042 ckt 1) loads from 234.71% to 235.72% (**DC power flow**) of its emergency rating (179 MVA) for the tower line contingency outage of '7981_B'. This project contributes approximately 3.98 MW to the thermal violation.

CONTINGENCY '7981_B'

OPEN BRANCH FROM BUS 931430 TO BUS 249995 CKT 1 / 931430 AC2-061
TAP 138 249995 08CLINCO 138 1
OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1
OPEN BRANCH FROM BUS 249995 TO BUS 250122 CKT 1 / 249995
08CLINCO 138 250122 08WARRN1 138 1
OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1
END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.78
931121	AC2-019 C	0.76
931122	AC2-019 E	1.25
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.01
931221	AC2-031 C	23.37
931222	AC2-031 E	11.51
931281	AC2-042 C	73.05
931282	AC2-042 E	48.7
931351	AC2-049 C	20.15
931352	AC2-049 E	13.43
931381	AC2-055 C OP	1.51
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.36
931422	AC2-060 E	3.02
931431	AC2-061 C	20.27
931432	AC2-061 E	20.55
931441	AC2-062 C OP	6.
931442	AC2-062 E OP	2.68
931451	AC2-064 C	47.29
931452	AC2-064 E	31.53
931651	AC2-087 C OP	3.93
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
924371	AB2-085 C OP	8.23
924372	AB2-085 E OP	3.87

924541	<i>AB2-103 C OP</i>	<i>5.1</i>
924542	<i>AB2-103 E OP</i>	<i>2.4</i>
926061	<i>AC1-085 C</i>	<i>53.03</i>
926062	<i>AC1-085 E</i>	<i>86.52</i>
926101	<i>AC1-089 C</i>	<i>17.87</i>
926102	<i>AC1-089 E</i>	<i>29.16</i>
926631	<i>AC1-144 C</i>	<i>23.48</i>
926632	<i>AC1-144 E</i>	<i>11.41</i>

Appendix 16

(DEO&K - DEO&K) The AC2-061 TAP-08CLINCO 138 kV line (from bus 931430 to bus 249995 ckt 1) loads from 234.36% to 235.33% (**DC power flow**) of its emergency rating (184 MVA) for the line fault with failed breaker contingency outage of '8109_C2_05HILLSB 138-A_A'. This project contributes approximately 3.99 MW to the thermal violation.

CONTINGENCY '8109_C2_05HILLSB 138-A_A'

OPEN BRANCH FROM BUS 243019 TO BUS 243102 CKT 1 / 243019 05HILLSB
138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 243019 TO BUS 253111 CKT 1 / 243019 05HILLSB
138 253111 09MIDDLE 138 1

OPEN BRANCH FROM BUS 931350 TO BUS 243102 CKT 1 / 931350 AC2-049
TAP 138 243102 05SINKG8 138 1

OPEN BRANCH FROM BUS 253111 TO BUS 253057 CKT 1 / 253111
09MIDDLE 138 253057 09OHH 138 1

END

<i>Bus Number</i>	<i>Bus Name</i>	<i>Full Contribution</i>
931022	AC2-008 E	2.83
931121	AC2-019 C	0.77
931122	AC2-019 E	1.26
931131	AC2-020 C OP	0.64
931132	AC2-020 E OP	1.68
931192	AC2-027 E	2.04
931221	AC2-031 C	23.89
931222	AC2-031 E	11.77
931281	AC2-042 C	74.67
931282	AC2-042 E	49.78
931381	AC2-055 C OP	1.52
931382	AC2-055 E OP	2.47
931421	AC2-060 C	5.37
931422	AC2-060 E	3.02
931431	AC2-061 C	28.84
931432	AC2-061 E	29.24
931441	AC2-062 C OP	6.21
931442	AC2-062 E OP	2.78
931651	AC2-087 C OP	3.94
931652	AC2-087 E OP	3.12
247592	W4-036	1.01
916272	Z1-080 E	2.18
924371	AB2-085 C OP	8.72
924372	AB2-085 E OP	4.1
924541	AB2-103 C OP	5.31
924542	AB2-103 E OP	2.5
926061	AC1-085 C	54.2

926062	AC1-085 E	88.44
926101	AC1-089 C	18.22
926102	AC1-089 E	29.73
926631	AC1-144 C	24.
926632	AC1-144 E	11.66