North Carolina Transmission Planning Collaborative

Report on the NCTPC 2020 Offshore Wind Study

June 7, 2021
FINAL REPORT

2020 – 2030 NCTPC Offshore Wind Study
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I. Executive Summary

The 2020-2030 Collaborative Transmission Plan (the "2020 Collaborative Transmission Plan" or the "2020 Plan") was published in January 2021. This addendum documents the offshore wind study performed in response to a Local Public Policy Request.

The Southeastern Wind Coalition (SEWC) requested a study of the feasibility and costs of injecting up to 5000 MW of offshore wind power at up to 3 sites in eastern DEP, or possibly connecting to and wheeling offshore wind power from Dominion Virginia Power (Dominion, DVP). The power from the offshore wind plants would be delivered 40% to DEP and 60% to DEC. Rather than studying pre-determined MW levels, SEWC requested that NCTPC find the MW breakpoints at which transmission upgrades would be needed.

The offshore wind study started with the 2030 summer peak base case prepared for the 2020 NCTPC studies. The planned 2640 MW Dominion offshore wind plant was then added to the Dominion Fentress 500kV bus, dispatched against existing Dominion generation. No other generation from the DEC, DEP, or PJM generator interconnection queues was added. These generator interconnection queues contain thousands of MW of possible generation that may or may not actually interconnect and which could significantly affect the flows on the DEC, DEP, and Dominion transmission systems in unknown ways. The results of this study could change significantly depending on which and how much generation in those queues moves forward to interconnection.

The focus of this offshore wind study was to estimate the amount of generation that could be injected at various locations in eastern part DEP, within a reasonable distance from the Atlantic coast, and transmitted to DEP and DEC customers. The initial screening list of injection points included 29 major transmission substations and switching stations in eastern DEP as well as two stations in Dominion. Later in the process, another possible future DEP station, Sutton North, was added to the list. Linear transfer capability analysis was performed for each injection station, sending the injected power 60% to DEC and 40% to DEP. Basic transmission upgrades and their costs were estimated for transmission limits encountered. Transfer analysis and transmission upgrade estimation were repeated for each site until costs per injected MW escalated beyond reasonable levels. This screening analysis of 32 sites is described in Section II, with details shown in Appendix A.

Based on the results of screening the 32 sites, the three preferred sites chosen for analysis at higher levels of offshore wind power injection were:

- New Bern 230kV
- Greenville 230kV
- Sutton North 230kV

The first two are existing DEP stations and the last, Sutton North, is a proposed future DEP 230kV switching station.

Based on system knowledge and the 2012 offshore wind study results, and the goal to inject 1000s of MW of offshore wind power at each site, 500kV transmission lines were added to connect each of the three preferred sites to the existing DEP 500kV transmission system further inland. These upgrades are necessary to carry significant power from the coast, where DEP has only moderate amounts of customer load, to DEP's major load center in the Raleigh, NC area.

The results of this study showed that 100s of MW of offshore wind generation can be injected at numerous substations in eastern DEP with moderate upgrades, up to around 1000 MW or so at some sites, again with moderate upgrades (less than $100M). Table 1 summarizes the best cost per Watt found at the 32 sites screened. Network upgrade costs as well as cost estimates for interconnection lines from the beach landing to the DEP substation are included in Total Cost. Costs of undersea cables to bring power from the offshore wind farm site to the beach landing are not included.

Note that the results for the two Dominion buses (Fentress 500 kV and Landstown 230 kV) do not include any possible required upgrades in the Dominion system nor any wheeling fees[1]. Recent PJM interconnection studies have found significant transmission overloads for generation sites in southeastern Dominion.

[1] PJM wheeling fees were $63,045/(MW-year) as of 10/31/2020. For the approximately 2300 MW injection level shown in Table 1 for Dominion buses, PJM wheeling fees would total $2.9 billion over 20 years. This wheeling rate is subject to change.

Table 1. Best Cost per Watt Found at 32 Sites Screened

Point of Interconnection	MW Injection	Total Cost ($M)	Total Cost ($/W)
Fentress 500 (DVP)	2307	$ 100	$ 0.04[2]
Landstown 230 (DVP)	2257	$ 65	$ 0.03[3]
Cumberland 500	1700	$ 380	$ 0.22
Cumberland 230	1461	$ 375	$ 0.26
Wake 230	1458	$ 464	$ 0.32
New Bern 230	1449	$ 181	$ 0.12
Wommack 230	1432	$ 259	$ 0.18
Wake 500	1417	$ 460	$ 0.32
Lee 230	1151	$ 360	$ 0.31
Greenville 230	1106	$ 425	$ 0.38
Jacksonville 230	1049	$ 118	$ 0.11
Delco 230	1036	$ 183	$ 0.18
Castle Hayne 230	994	$ 34	$ 0.03
Grants Creek 230	966	$ 79	$ 0.08
Florence 230	911	$ 400	$ 0.44
Marion 230	876	$ 288	$ 0.33
Havelock 230	859	$ 20	$ 0.02
Clinton 230	853	$ 321	$ 0.38
Kinston Dupont 230	851	$ 154	$ 0.18
Weatherspoon 230	788	$ 302	$ 0.38
Whiteville 230	770	$ 175	$ 0.23
Sutton North 230	833	$ 117	$ 0.14

[2] PJM network upgrades and wheeling fees not included.

[3] PJM network upgrades and wheeling fees not included.

Point of Interconnection	MW Injection	Total Cost ($M)	Total Cost ($/W)
Kingstree 230	667	$ 225	$ 0.34
Mt. Olive 230	637	$ 312	$ 0.49
Sumter 230	558	$ 375	$ 0.67
Morehead Wildwood 230	550	$ 27	$ 0.05
Wallace 230	548	$ 160	$ 0.29
Aurora 230	544	$ 230	$ 0.42
Folkstone 230	518	$ 7	$ 0.01
Latta 230	425	$ 265	$ 0.62
Brunswick 1 230	387	$ 26	$ 0.07
Brunswick 2 230	277	$ 30	$ 0.11

Injecting 2000 to 3000 MW or more at any location in DEP will require larger transmission investments at the 500kV voltage level, costing approximately $900M to $2.0B depending on location and MW injection level. For the three sites studied at higher MW injection levels, Table 2 shows the selected injection levels found with and without construction of 500kV lines.

Injecting 5000 MW at a single site was not found to be feasible, but equivalent total injection at multiple sites might be. However, simultaneous injections at multiple sites were not analyzed in this study.

This study estimated transmission infrastructure needed only in the Duke Energy regions. The Greenville site in particular would require an Affected System Study by PJM that could result in significant additional upgrade costs.

Table 2. Selected Injection Levels at Preferred Sites

Point of Interconnection	MW Injection	Total Cost ($M)	Total Cost ($/W)
Without 500 kV Additions			
New Bern 230 *kV*	1449	$ 181	$ 0.12
Greenville 230 *kV*	1106	$ 425	$ 0.38
Sutton North 230 *kV*	1217	$ 355	$ 0.29
Build New Bern - Wommack - Wake 500 kV lines			
New Bern 500 *kV*	3252	$ 1,177	$ 0.36
Build Greenville - Wommack - Wake 500 kV lines			
Greenville 230 *kV*	3587	$ 2,010	$ 0.56
Build Sutton North - Cumberland 500 kV line			
Sutton North 500 *kV*	2272	$ 917	$ 0.40

II. 2020 Offshore Wind Study Scope and Methodology

This offshore wind study was requested by the Southeastern Wind Coalition (SEWC) as a Local Public Policy study request. NCTPC had previously performed an offshore wind study in 2012. The 2012 study focused on the transmission infrastructure needed to accommodate preset levels of MW injection to the grid from offshore wind generation. SEWC asked for an update to that study with a focus on finding natural breakpoints where transmission upgrades would be needed, instead of preset MW test levels. Offshore wind injections up to 5000 MW were requested.

II.A. Generator Interconnections and Base Case

Any study by NCTPC for potential new generation connected to the Duke Energy transmission system is subject to limitations in accuracy and applicability. The official processes to connect generation to the Duke Energy systems in North and South Carolina are the FERC Large Generator Interconnection Procedures (LGIP) and Small Generator Interconnection Procedures (SGIP) and the North and South Carolina state interconnection procedures. Those procedures prioritize generator interconnections on a first come, first served basis, and those interconnection queues are currently backlogged with dozens of requests. Similarly, the PJM generator interconnection process, which covers Dominion territory in northeastern NC and Virginia, also has a large, backlogged queue. Any offshore wind developer wanting to connect their project to the Duke Energy grid would need to enter the appropriate interconnection queue behind those generators already in the queue.

NCTPC studies do not attempt to replicate the official generation interconnection procedures. The official generator interconnection queues have many requests that may or may not move forward to interconnection and operation. Historically, 50% or fewer requests complete the process to

operation. It is not possible to accurately predict which generators in the queues will go forward to completion.

As per the normal NCTPC modeling process, the 2030 Summer peak model only included generators that are operational or have fully executed interconnection agreements. This offshore wind study started with that 2030 summer model and made one prospective generator addition – the 2640 MW offshore wind interconnection request at Dominion's Fentress 500kV substation. This addition was made due to the project's relevance to the study at hand and its public announcement by Dominion. Other generation in the Dominion Virginia Balancing Authority Area was scaled down to compensate.

DEP TRM[4] cases were also created from the above offshore wind base case. However, those cases ended up being less limiting than the main offshore wind base case for the most part. DEP TRM cases result in reduced DEP generation and DEP additional imports, whereas the purpose of the offshore wind study is to add offshore wind generation to the DEP area and export 60% of it to DEC, thus netting lower flows in the TRM cases versus the base case.

II.B. Injection Capability Calculation via Transfer Capability Analysis

The method to test injection of offshore wind power at various stations in eastern DEP in this study was using linear transfer capability analysis with the TARA software from PowerGEM. One at a time, power was ramped up at each of the 32 injection sites, keeping track of transmission limits found. As power was increased at each injection site, an equivalent amount of generation was decreased in DEC (60%) and DEP (40%) using participation

[4] Transmission Reliability Margin – more fully described in the NCTPC 2020 Annual Planning Report

factors provided by each company. This method is called First Contingency Incremental Transfer Capability (FCITC).

For each transmission limit found, a rough upgrade was determined based on the transmission owner's knowledge of the limiting element. For example, transmission lines that were limited by low line conductor clearances were assumed to be upgraded by raising the clearance of the line. Lines that were limited by the line conductor already at maximum clearance were assumed to be reconductored to a larger conductor. Limiting transmission transformers were upgraded to a larger size. Assumed standard upgrade costs are provided in Appendix B.

For each injection site, limiting lines and transformers were upgraded and the total cumulative upgrade cost at each site was recorded. Analysis and upgrades at a given site continued until cost per MW rose too high, using engineering judgement.

Full detailed MW injection capabilities and costs are provided in Appendix A. The results are for non-simultaneous injection at one site at a time. Injection of offshore wind generation at multiple sites was not studied. The results shown are indicative only and official interconnection and network upgrade costs would be determined in the official interconnection process.

For the two sites in Dominion, Fentress 500kV and Landstown 230kV, the injected power was sent to DEC (60%) and DEP (40%), same as with the DEP sites. Potential overloads and upgrade costs in Dominion/PJM were not included in the analysis, nor were PJM wheeling fees to transport the power across the Dominion/PJM system to Duke Energy.

This study included only power flow analysis, and only DEC and DEP transmission flows were monitored. Stability and short circuit analysis were not included and would be a significant requirement for an official system impact study for offshore wind generation, possibly incurring additional transmission upgrade costs.

II.C. Three Sites Analyzed at Higher Injection Levels

1. Three Sites Selected

Based on the results of screening the 32 sites for MW injection levels and costs, three sites were selected for further analysis and injection of higher MW levels. The first site that stood out for high MW capability at relatively lower cost was DEP's New Bern 230kV Substation. The initial screening results showed injection capability at New Bern 230kV of well over 1000 MW for well under $0.20 per Watt. New Bern benefits from already having five 230kV lines, two of which head in the direction of the DEP Raleigh load center. In addition, DEP has a partial right-of-way (ROW) available from New Bern 230kV to Wommack 230kV and a full 500kV ROW from Wommack 230kV to Wake 500kV.

None of the other sites stood out for both high MW and low cost, but the other two sites were selected for geographic diversity. Greenville 230kV was selected for its high initial MW screening levels, although the cost is also high per Watt injected. Another caveat with Greenville 230kV is that it borders the PJM/Dominion area, and there may be additional significant upgrades required in the PJM/Dominion area that were not determined in this study.

For diversity, a site in the more south-eastern part of DEP was desired. Sites very close to the coast, such as Brunswick or Castle Hayne, are not ideal due to known constraints in getting more power out of those areas. However, DEP has been aware of a possible new 230kV switching station site north of the Sutton Plant where three 230kV transmission lines share a ROW. This potential future Sutton North 230kV Switching Station was chosen as the third site. This site was added to the initial screening analysis as a 32nd site for screening to put it on the same basis as the original 31 sites.

2. 500kV Transmission Infrastructure

Because the study scope was looking for injection levels in the 1000s of MW, and since the three selected sites had already been screened with basic upgrades of existing 230kV and 115kV lines, this additional analysis of the three selected sites started with building a 500kV transmission path from each site to the existing DEP 500kV transmission system.

As mentioned, New Bern 230kV already has potential ROW to Wommack and on to Wake 500kV, so two new 500kV lines were specified for New Bern: New Bern – Wommack 500kV and Wommack – Wake 500kV. See Figure 1. New Bern and Wommack started with a single 500/230kV transformer rated 1000/1120 MVA like other existing DEP transformers. It was quickly determined that New Bern would need two such transformers, and they could be upsized to 1500/1680 MVA like some transformers utilized by DEC to achieve even higher levels of MW injection.

Due to the existing 500kV ROW from Wommack to Wake, the Greenville site 500kV path was built as a Greenville-Wommack 500kV line and then the same Wommack-Wake 500kV line as the New Bern option. See Figure 2.

The Sutton North site was studied with two different 500kV options because neither route stood out as obviously superior. One path was a 500kV line from Sutton North to Wommack, and then build the Wommack-Wake 500kV line. See Figure 3. While this does take advantage of the existing Wommack-Wake 500kV ROW, it is a long distance from Sutton North to Wommack. The other option analyzed for Sutton North was a 500kV line built directly from Sutton North to the existing Cumberland 500kV Substation. See Figure 4. This is a shorter total 500kV line length, but all new ROW would have to be acquired, and prior generation studies have shown low injection limits at Cumberland.

For each of the three sites, once a 500kV bus was added, generation could be interconnected at either 230kV or 500kV buses. Each of these was separately analyzed.

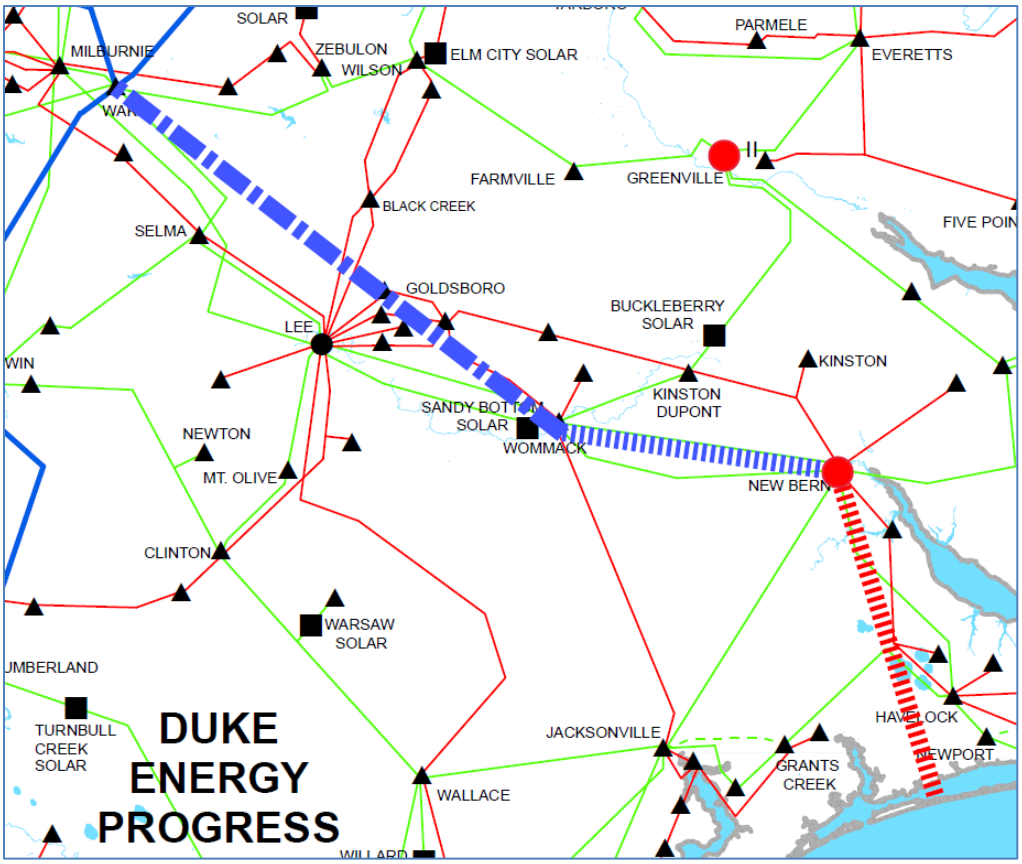

Figure 1. New Bern – Wommack – Wake 500kV Path

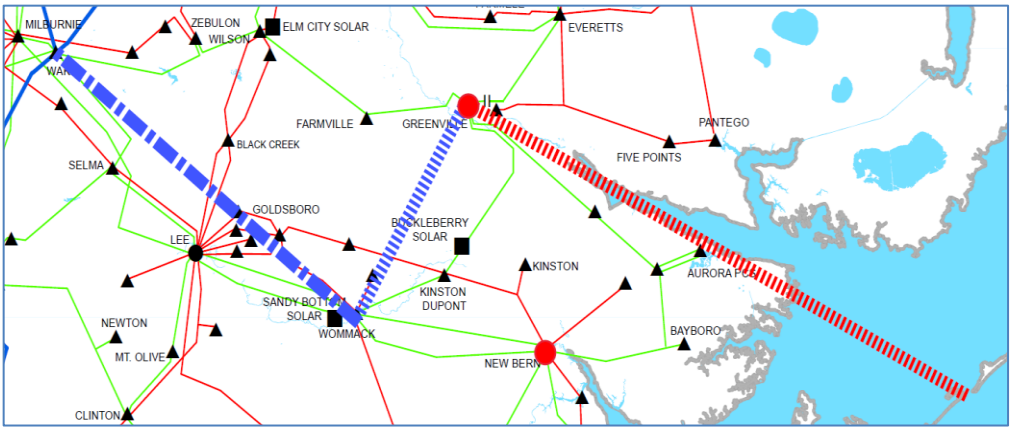

Figure 2. Greenville – Wommack – Wake 500kV Path

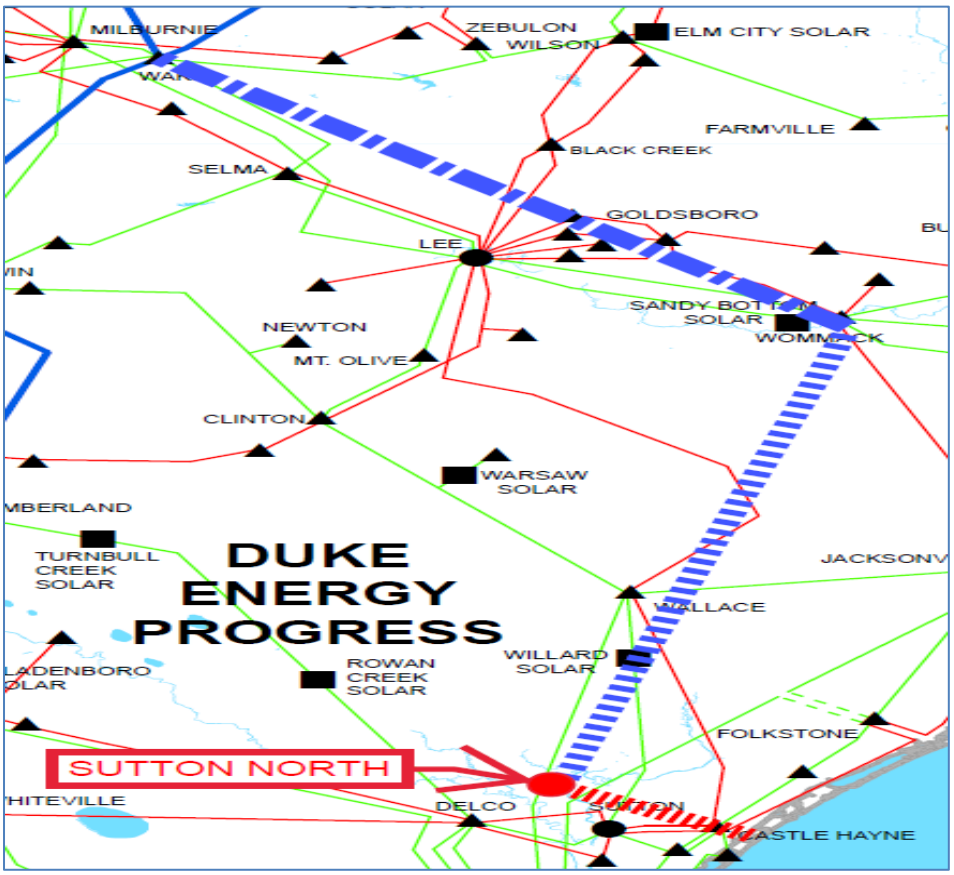

Figure 3. Sutton North – Wommack – Wake 500kV Path

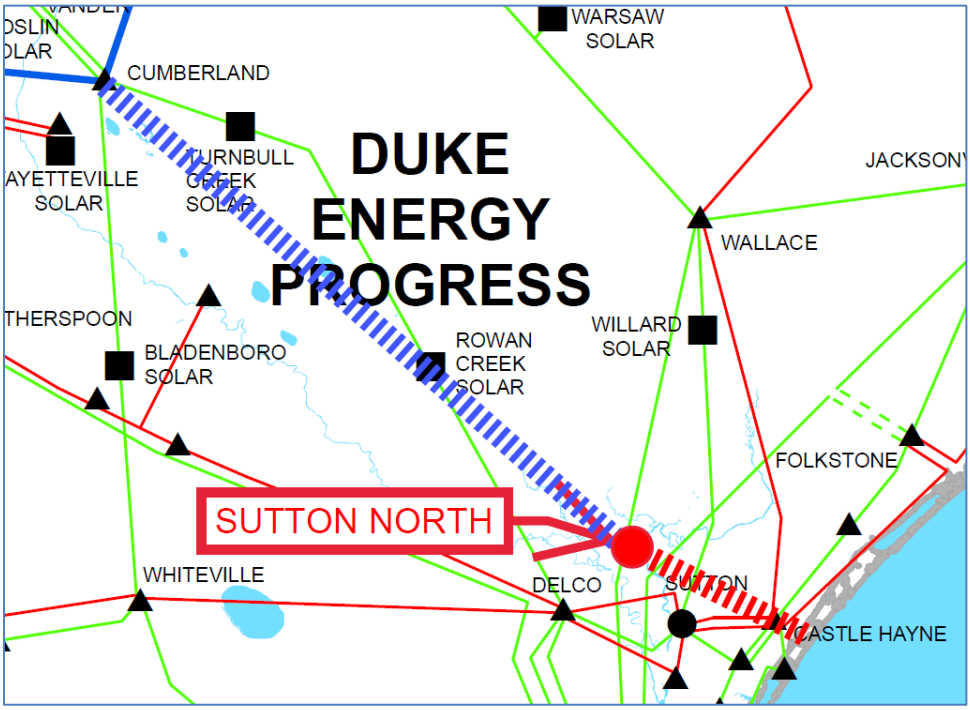

Figure 4. Sutton North – Cumberland 500kV Path

3. Results for Three Selected Sites at Higher Injection Levels

Appendix A.2 gives the full analysis results for the three selected sites with 500kV line build-out, and a summary was provided in the Executive Summary. New Bern and Greenville injection levels were able to reach well over 3000 MW each, but the costs per Watt were much higher than with the initial screening at lower MW levels. Costs were also high at Sutton North but limited to lower MW levels before costs began escalating even higher.

At New Bern, costs of achieving over 3000 MW of offshore wind generation injection are in the $0.40 per Watt range. Greenville was more expensive at $0.60 per Watt and higher for over 3000 MW of offshore wind injection. As mentioned before, the Greenville site may also have some significant unknown costs in PJM/Dominion. Sutton North was able to achieve costs of a little over $0.40 per Watt with the 500kV line to Cumberland, but only up to around 2500 MW. The Sutton North route to Wommack and Wake was also limited to a similar MW level, but this route cost more at around $0.60 per Watt.

As a reminder, this study does not include generation from the DEC, DEP, or PJM generator interconnection queues, and the results of this study could change significantly depending on what generation moves to construction and operation before any proposed offshore wind generation. Results are non-simultaneous and do not include consideration of stability and short-circuit levels.

Appendix A
Detailed Results

Yellow Highlight: Selected lower-cost injection levels at each site
Green Highlight: Three sites selected for investigation of higher injection levels
Gray Highlight: Existing transmission projects

An incremental cost per Watt of "#DIV/0!" in the tables below is not an error. In a few cases an upgrade did not increase injection capability at all (0 MW increase) because the following limit was at the same MW injection level.

Appendix A.1 – Results for 32 Injection Sites without 500kV Additions

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element	Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6AURORASST							Interconnection	46	Interconnection from the Beach	n/a	n/a	$ 230
6AURORASST	544	544	$ 230	$ 0.42	$ 230	$ 0.42	304454 AURORA SS TT 230 304449 EDWARDS TAP 230 1	0.96	Raise to 212F	594	594	$ 2
6AURORASST	548	4	$ 2	$ 0.48	$ 232	$ 0.42	304454 AURORA SS TT 230 304434 BAYBORO TAP 230 1	10.74	Raise to 212F	594	594	$ 21
6AURORASST	558	10	$ 21	$ 2.15	$ 253	$ 0.45	304449 EDWARDS TAP 230 304473 PA-WASHINTON 230 1	19.03	Raise to 212F	594	594	$ 38
6AURORASST	576	18	$ 38	$ 2.11	$ 291	$ 0.51	304445 CHOCOWINITY 230 304451 GREENVILE TT 230 1	18.57	Raise to 212F	482	482	$ 37
6AURORASST	577	1	$ 37	$ 37.14	$ 329	$ 0.57	304434 BAYBORO TAP 230 305142 E16-FAIRFELD 230 1	8.53	Raise to 212F	594	594	$ 17
6AURORASST	589	12	$ 17	$ 1.42	$ 346	$ 0.59	305142 E16-FAIRFELD 230 304463 NEW BERN WES 230 1	7.46	Raise to 212F	594	594	$ 15
6AURORASST	601	12	$ 15	$ 1.24	$ 361	$ 0.60	304463 NEW BERN WES 230 304465 NEWBERN230TT 230 1	1.02	Raise to 212F	594	594	$ 2
6AURORASST	605	4	$ 2	$ 0.51	$ 363	$ 0.60	304473 PA-WASHINTON 230 304445 CHOCOWINITY 230 1	0.04	Raise to 212F	594	594	$ 0
6AURORASST	619	14	$ 0	$ 0.01	$ 363	$ 0.59	304445 CHOCOWINITY 230 304451 GREENVILE TT 230 1	18.57	Reconductor to 6-1590 ACSR	1195	1195	$ 74
6BRUN1230T							Interconnection	5	Interconnection from the Beach	n/a	n/a	$ 25
6BRUN1230T	255	255	$ 25	$ 0.10	$ 25	$ 0.10	304022 BRUN1 230 TT 230 304610 SPRT &PA TAP 230 1	0.09	Reconductor to 6-1590 ACSR	1195	1195	$ 0
6BRUN1230T	368	113	$ 0	$ 0.00	$ 25	$ 0.07	304022 BRUN1 230 TT 230 305009 E1-DAWSCREEK 230 1	12.9	Station/relay upgrades	846	846	$ 1
6BRUN1230T	387	19	$ 1	$ 0.05	$ 26	$ 0.07	304610 SPRT &PA TAP 230 305010 E1-BOLIVIA 230 1	13.16	9th line	-	-	$ 100
6BRUN2230T							Interconnection	5	Interconnection from the Beach	n/a	n/a	$ 25
6BRUN2230T	159	159	$ 25	$ 0.16	$ 25	$ 0.16	304020 BRUN2 230 TT 230 305005 E1-SOUTHPORT 230 1	2.34	Raise to 212F	594	594	$ 5
6BRUN2230T	277	118	$ 5	$ 0.04	$ 30	$ 0.11	304020 BRUN2 230 TT 230 304621 TOWN CRK TT 230 1	14.67	Raise to 212F	846	846	$ 29
6BRUN2230T	308	31	$ 29	$ 0.95	$ 59	$ 0.19	304621 TOWN CRK TT 230 304615 BARNCRK E TT 230 2	1.42	9th line - Brunswick - Sutton North	-	-	$ 100
6CASTLEH230T							Interconnection	9	Interconnection from the Beach	n/a	n/a	$ 45
6CASTLEH230T							304551 CASTLH115ETT 115 304532 VISTA 115 1	15.96	Existing Project	297	297	$ -
6CASTLEH230T							304532 VISTA 115 305063 E9-HUGHBATTS 115 1	1.88	Existing Project	297	297	$ -
6CASTLEH230T	534	534	$ -	$ -	$ -	$ -	304550 CASTLEH230TT 230 304564 SCOTT TAP 230 1	6.18	Double Breaker Wallace 230	-	-	$ 5
6CASTLEH230T	547	13	$ 5	$ 0.38	$ 5	$ 0.01	304550 CASTLEH230TT 230 304545 CASTLH115WTT 115 1	-	Replace with 336 MVA	336	427	$ 4
6CASTLEH230T	752	205	$ 4	$ 0.02	$ 9	$ 0.01	304550 CASTLEH230TT 230 304564 SCOTT TAP 230 1	6.18	Reconductor to 6-1590 ACSR	1195	1195	$ 25
6CASTLEH230T	994	242	$ 25	$ 0.10	$ 34	$ 0.03	304545 CASTLH115WTT 115 304533 INDUSTR TAP 115 1	2.55	Reconductor to 3-1590 ACSR	311	311	$ 10
6CASTLEH230T	1048	54	$ 10	$ 0.19	$ 44	$ 0.04	304533 INDUSTR TAP 115 304513 BURGAW SUB 115 1	14.31	Raise to 212F	131	131	$ 29
6CLINTON230T							Interconnection	60	Interconnection from the Beach	n/a	n/a	$ 300
6CLINTON230T	758	758	$ 300	$ 0.40	$ 300	$ 0.40	304205 CLINTON230TT 230 304255 CLINTON115TT 115 1	-	Add 2nd bank (336 MVA)	336	427	$ 7
6CLINTON230T	717	-41	$ 7	$ (0.17)	$ 307	$ 0.43	304255 CLINTON115TT 115 305131 E15-HARGROVE 115 1	3.97	Raise to 212F	164	164	$ 8
6CLINTON230T	768	51	$ 8	$ 0.16	$ 315	$ 0.41	305131 E15-HARGROVE 115 304266 FAISNHWYIND 115 1	2.92	Raise to 212F	164	164	$ 6
6CLINTON230T	815	47	$ 6	$ 0.12	$ 321	$ 0.39	304278 MT OLV115 TT 115 304237 MT OLIVE TAP 115 1	0.09	Reconductor to 3-1590 ACSR	311	311	$ 0

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element						Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6CLINTON230T	853	38	$ 0	$ 0.01	$ 321	$ 0.38	304266 FAISNHWYIND	115	304278 MT OLV115 TT	115	1		6.38	Raise to 212F	164	164	$ 13
6CLINTON230T	936	83	$ 13	$ 0.15	$ 334	$ 0.36	304237 MT OLIVE TAP	115	304270 MT OLV WEST	115	1		1.35	Raise to 212F	164	164	$ 3
6CLINTON230T	946	10	$ 3	$ 0.27	$ 337	$ 0.36	304255 CLINTON115TT	115	305131 E15-HARGROVE	115	1		3.97	Reconductor to 3-1590 ACSR	311	311	$ 16
6CUMBLND230T							Interconnection						72	Interconnection from the Beach	n/a	n/a	$ 360
6CUMBLND230T	1018	1018	$ 360	$ 0.35	$ 360	$ 0.35	304390 CUMBLND230TT	230	304387 FAY 230 TT	230	2		13.73	Add 2nd 500/230kV bank	1120	1120	$ 15
6CUMBLND230T	1461	443	$ 15	$ 0.03	$ 375	$ 0.26	304389 FAYEAST230TT	230	304305 LINDEN SUB	230	1		12.2	Reconductor to 6-1590 ACSR	1195	1195	$ 49
6CUMBLND230T	1461	0	$ 49	#DIV/0!	$ 424	$ 0.29	304305 LINDEN SUB	230	304196 ERWIN230 TT	230	1		10.95	Reconductor to 6-1590 ACSR	1195	1195	$ 44
6CUMBLND230T	1729	268	$ 44	$ 0.16	$ 468	$ 0.27	304390 CUMBLND230TT	230	304387 FAY 230 TT	230	2		13.74	Reconductor to 6-1590 ACSR	1195	1195	$ 55
6DELCO230T							Interconnection						30	Interconnection from the Beach	n/a	n/a	$ 150
6DELCO230T	486	486	$ 150	$ 0.31	$ 150	$ 0.31	304582 DELCO230 TT	230	304587 DELCO115W TT	115	1		-	Replace with 336 MVA	336	427	$ 4
6DELCO230T	728	242	$ 4	$ 0.02	$ 154	$ 0.21	304039 SUTTON230 TT	230	304554 WILM N&O TAP	230	1		5.38	Reconductor to 6-1590 ACSR	1195	1195	$ 22
6DELCO230T	843	115	$ 22	$ 0.19	$ 176	$ 0.21	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		3.57	Raise to 212F	594	594	$ 7
6DELCO230T	1036	193	$ 7	$ 0.04	$ 183	$ 0.18	304039 SUTTON230 TT	230	304520 WILM INVISTA	230	1		1.79	Raise to 212F	594	594	$ 4
6DELCO230T	1049	13	$ 4	$ 0.28	$ 186	$ 0.18	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1		4.39	Raise to 212F	594	594	$ 9
6DELCO230T	1125	76	$ 9	$ 0.12	$ 195	$ 0.17	304520 WILM INVISTA	230	304534 WILM PRAX	230	1		0.39	Raise to 212F	594	594	$ 1
6DELCO230T	1150	25	$ 1	$ 0.03	$ 196	$ 0.17	304516 WILM BASF	230	305470 WILARDSOLTAP	230	1		20.22	Raise to 212F	594	594	$ 40
6DELCO230T	1223	73	$ 40	$ 0.55	$ 236	$ 0.19	304554 WILM N&O TAP	230	304552 WILM EAST	230	1		2.72	Reconductor to 6-1590 ACSR	1195	1195	$ 11
6FLOSUB230T							Interconnection						64	Interconnection from the Beach	n/a	n/a	$ 320
6FLOSUB230T	553	553	$ 320	$ 0.58	$ 320	$ 0.58	306416 WATEREE	100	306375 GT FALL1	100	1		20	Reconductor to 954 ACSR	232	260	$ 80
6FLOSUB230T	911	358	$ 80	$ 0.22	$ 400	$ 0.44	304662 FLO SUB230TT	230	304663 LATTA SS TT	230	1		23.59	Reconductor to 6-1590 ACSR	1195	1195	$ 94
6FLOSUB230T	1199	288	$ 94	$ 0.33	$ 494	$ 0.41	304662 FLO SUB230TT	230	304707 FLOSUB115ETT	115	2		-	Replace with 448 MVA	448	560	$ 4
6FOLKSTN230T							Interconnection						10	Interconnection from the Beach	n/a	n/a	$ 50
6FOLKSTN230T							304543 FOLKSTN115TT	115	305061 E9-DAWSON	115	1		8.77	Existing Project	221	221	$ -
6FOLKSTN230T	328	328	$ -	$ -	$ -	$ -	304542 FOLKSTN230TT	230	304543 FOLKSTN115TT	115	1		-	Add 2nd bank (336 MVA)	336	427	$ 7
6FOLKSTN230T	518	190	$ 7	$ 0.04	$ 7	$ 0.01	304543 FOLKSTN115TT	115	305061 E9-DAWSON	115	1		8.77	Reconductor to 3-1590 ACSR	340	340	$ 35
6FOLKSTN230T	577	59	$ 35	$ 0.59	$ 42	$ 0.07	305061 E9-DAWSON	115	305073 E9-SOUTHWEST	115	1		18.5	Reconductor to 3-1590 ACSR	340	340	$ 74
6GREENVIL230							Interconnection						85	Interconnection from the Beach	n/a	n/a	$ 425
6GREENVIL230	1106	1106	$ 425	$ 0.38	$ 425	$ 0.38	304451 GREENVILE TT	230	314574 6EVERETS	230	1		22.21	Reconductor to 6-1590 ACSR	1195	1195	$ 89
6GREENVIL230	1184	78	$ 89	$ 1.14	$ 514	$ 0.43	304451 GREENVILE TT	230	304452 GREENVILE W	230	1		4.1	Reconductor to 6-1590 ACSR	1195	1195	$ 16
6GREENVIL230	1224	40	$ 16	$ 0.41	$ 530	$ 0.43	304452 GREENVILE W	230	304229 PA-FARMVILLE	230	1		9.61	Reconductor to 6-1590 ACSR	1195	1195	$ 38
6GREENVIL230	1283	59	$ 38	$ 0.65	$ 569	$ 0.44	304229 PA-FARMVILLE	230	304228 WILSON230 TT	230	1		20.28	Reconductor to 6-1590 ACSR	1195	1195	$ 81
6GREENVIL230	1465	182	$ 81	$ 0.45	$ 650	$ 0.44	304451 GREENVILE TT	230	304445 CHOCOWINITY	230	1		18.61	Reconductor to 6-1590 ACSR	1195	1195	$ 74
6GREENVIL230	1601	136	$ 74	$ 0.55	$ 724	$ 0.45	304473 PA-WASHINTON	230	304449 EDWARDS TAP	230	1		19.03	Raise to 212F	594	594	$ 38
6GREENVIL230	1628	27	$ 38	$ 1.41	$ 762	$ 0.47	304449 EDWARDS TAP	230	304454 AURORA SS TT	230	1		0.96	Raise to 212F	594	594	$ 2
6GREENVIL230	1784	156	$ 2	$ 0.01	$ 764	$ 0.43	304445 CHOCOWINITY	230	304473 PA-WASHINTON	230	1		0.04	Reconductor to 6-1590 ACSR	1195	1195	$ 0
6GREENVIL230	1825	41	$ 0	$ 0.00	$ 764	$ 0.42	304454 AURORA SS TT	230	304434 BAYBORO TAP	230	1		10.74	Raise to 212F	594	594	$ 21
6GREENVIL230	1902	77	$ 21	$ 0.28	$ 786	$ 0.41	304434 BAYBORO TAP	230	305142 E16-FAIRFELD	230	1		8.53	Raise to 212F	594	594	$ 17

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element					Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6GREENVIL230	1933	31	$ 17	$ 0.55	$ 803	$ 0.42	305142 E16-FAIRFELD	230	304463 NEW BERN WES	230	1	7.46	Raise to 212F	594	594	$ 15
6GREENVIL230	1948	15	$ 15	$ 0.99	$ 818	$ 0.42	304449 EDWARDS TAP	230	304454 AURORA SS TT	230	1	0.96	Reconductor to 6-1590 ACSR	1195	1195	$ 4
6GRNTSCK230T							Interconnection					14	Interconnection from the Beach	n/a	n/a	$ 70
6GRNTSCK230T	746	746	$ 70	$ 0.09	$ 70	$ 0.09	304518 GRNTSCK230TT	230	304527 SWANSBORO	230	1	4.73	Double Breaker New Bern 230	-	-	$ 4
6GRNTSCK230T	758	12	$ 4	$ 0.33	$ 74	$ 0.10	304518 GRNTSCK230TT	230	305078 E9-PINEY GR2	230	1	1	Double Breaker Grants Cr 230	-	-	$ 5
6GRNTSCK230T	966	208	$ 5	$ 0.02	$ 79	$ 0.08	304527 SWANSBORO	230	305018 E2-MAYSVILLE	230	1	3.73	Reconductor to 6-1590 ACSR	1195	1195	$ 15
6GRNTSCK230T	1055	89	$ 15	$ 0.17	$ 94	$ 0.09	305077 E9-RAMSEY RD	230	305076 E9-HORACE	230	1	13.14	Reconductor to 6-1590 ACSR	1195	1195	$ 53
6HAVELOK230T							Interconnection					4	Interconnection from the Beach	n/a	n/a	$ 20
6HAVELOK230T	859	859	$ 20	$ 0.02	$ 20	$ 0.02	304484 HAVELOK230TT	230	304465 NEWBERN230TT	230	1	23.47	Raise to 212F	594	594	$ 47
6HAVELOK230T	1001	142	$ 47	$ 0.33	$ 67	$ 0.07	304484 HAVELOK230TT	230	304465 NEWBERN230TT	230	1	23.47	Reconductor to 6-1590 ACSR	1195	1195	$ 94
6JACKSON230T							Interconnection					20	Interconnection from the Beach	n/a	n/a	$ 100
6JACKSON230T	897	897	$ 100	$ 0.11	$ 100	$ 0.11	304518 GRNTSCK230TT	230	304527 SWANSBORO	230	1	4.73	Double Breaker New Bern 230	-	-	$ 4
6JACKSON230T	929	32	$ 4	$ 0.13	$ 104	$ 0.11	304471 CC WD EN TAP	230	304465 NEWBERN230TT	230	1	2.12	Reconductor to 6-1590 ACSR	1195	1195	$ 8
6JACKSON230T	979	50	$ 8	$ 0.17	$ 112	$ 0.11	304524 JACKSON230TT	230	305077 E9-RAMSEY RD	230	1	1.26	Reconductor to 6-1590 ACSR	1195	1195	$ 5
6JACKSON230T	1049	70	$ 5	$ 0.07	$ 118	$ 0.11	305077 E9-RAMSEY RD	230	305076 E9-HORACE	230	1	13.14	Reconductor to 6-1590 ACSR	1195	1195	$ 53
6JACKSON230T	1050	1	$ 53	$ 52.56	$ 170	$ 0.16	304525 JACKSN115ETT	115	305065 E9-GUMBRNCH	115	1	4.69	Raise to 212F	221	221	$ 9
6JACKSON230T	1068	18	$ 9	$ 0.52	$ 179	$ 0.17	305076 E9-HORACE	230	304528 RHEMS	230	1	7.64	Reconductor to 6-1590 ACSR	1195	1195	$ 31
6KINDUP230TT							Interconnection					30	Interconnection from the Beach	n/a	n/a	$ 150
6KINDUP230TT	722	722	$ 150	$ 0.21	$ 150	$ 0.21	304475 WEYER TAP	115	304466 NEWBER115NTT	115	1	6.08	Double Breaker New Bern 230	-	-	$ 4
6KINDUP230TT	851	129	$ 4	$ 0.03	$ 154	$ 0.18	304475 WEYER TAP	115	304466 NEWBER115NTT	115	1	6.08	Raise to 212F	202	202	$ 12
6KINDUP230TT	858	7	$ 12	$ 1.74	$ 166	$ 0.19	304480 KINSDUP115TT	115	304477 VOA TAP	115	1	10.94	Raise to 212F	202	202	$ 22
6KINDUP230TT	878	20	$ 22	$ 1.09	$ 188	$ 0.21	304477 VOA TAP	115	304475 WEYER TAP	115	1	12.53	Raise to 212F	202	202	$ 25
6KINDUP230TT	1055	177	$ 25	$ 0.14	$ 213	$ 0.20	304474 KINSDUP230TT	230	304480 KINSDUP115TT	115	1	-	Uprate	336	427	$ 1
6KINDUP230TT	1103	48	$ 1	$ 0.02	$ 214	$ 0.19	304480 KINSDUP115TT	115	304481 PA-AYDEN	115	1	1.27	Raise to 212F	202	202	$ 3
6KINDUP230TT	1202	99	$ 3	$ 0.03	$ 217	$ 0.18	304481 PA-AYDEN	115	304459 GRIFTON	115	1	0.01	Raise to 212F	202	202	$ 0
6KINGSTR230T							Interconnection					45	Interconnection from the Beach	n/a	n/a	$ 225
6KINGSTR230T	667	667	$ 225	$ 0.34	$ 225	$ 0.34	304675 LAKE CITY	230	304674 OLANTA	230	1	8.08	Raise to 212F	542	542	$ 16
6KINGSTR230T	681	14	$ 16	$ 1.15	$ 241	$ 0.35	304674 OLANTA	230	304671 FLOR SARDIS	230	1	7.45	Raise to 212F	542	542	$ 15
6KINGSTR230T	687	6	$ 15	$ 2.48	$ 256	$ 0.37	304677 KINGSTR230TT	230	304676 KINGSTREE N	230	1	5.71	Raise to 212F	594	594	$ 11
6KINGSTR230T	704	17	$ 11	$ 0.67	$ 267	$ 0.38	304671 FLOR SARDIS	230	304673 FLOR EBENEZR	230	1	9.38	Raise to 212F	542	542	$ 19
6KINGSTR230T	705	1	$ 19	$ 18.76	$ 286	$ 0.41	304675 LAKE CITY	230	304674 OLANTA	230	1	8.08	Reconductor to 6-1590 ACSR	1195	1195	$ 32
6KINGSTR230T	709	4	$ 32	$ 8.08	$ 319	$ 0.45	304676 KINGSTREE N	230	304675 LAKE CITY	230	1	11.08	Raise to 212F	594	594	$ 22
6KINGSTR230T	711	2	$ 22	$ 11.08	$ 341	$ 0.48	304678 KINGSTR115TT	115	304679 KINGTREE SUB	115	1	0.15	Reconductor to 3-1590 ACSR	340	340	$ 1
6LANDSTN							Interconnection					8	Interconnection from the Beach	n/a	n/a	$ 40
6LANDSTN	1342	1342	$ 40	$ 0.03	$ 40	$ 0.03	314554 3BTLEBRO	115	304223 ROCKYMT115TT	115	1	8.5	Reconductor to 3-795 ACSS	314	314	$ 25
6LANDSTN	2257	915	$ 25	$ 0.03	$ 65	$ 0.03	314574 6EVERETS	230	304451 GREENVILE TT	230	1	22.21	Reconductor to 6-1590 ACSR	1195	1195	$ 89

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element					Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6LANDSTN	3109	852	$ 89	$ 0.10	$ 154	$ 0.05	306540 6MCGUIRE	230	306443 6MARSHAL	230	1&2	-	Rebuild in plan	-	-	$ -
6LATTASST							Interconnection					53	Interconnection from the Beach	n/a	n/a	$ 265
6LATTASST	425	425	$ 265	$ 0.62	$ 265	$ 0.62	304632 MARION115 TT	115	304653 DILLON TAP	115	1	14.6	Reconductor to 3-1590 ACSR	311	311	$ 58
6LATTASST	618	193	$ 58	$ 0.30	$ 323	$ 0.52	304663 LATTA SS TT	230	304682 DILLONMP TAP	230	1	4.43	Raise to 212F	542	542	$ 9
6LATTASST	663	45	$ 9	$ 0.20	$ 332	$ 0.50	304682 DILLONMP TAP	230	304046 WSPOON230 TT	230	1	27.96	Raise to 212F	542	542	$ 56
6LEESUB230T							Interconnection					70	Interconnection from the Beach	n/a	n/a	$ 350
6LEESUB230T	1103	1103	$ 350	$ 0.32	$ 350	$ 0.32	304251 LEESUB230 TT	230	304261 LEESUB115STT	115	2	-	Replace with 448 MVA	448	560	$ 5
6LEESUB230T	1103	0	$ 5	#DIV/0!	$ 355	$ 0.32	304251 LEESUB230 TT	230	304261 LEESUB115STT	115	1	-	Replace with 448 MVA	448	560	$ 5
6LEESUB230T	1151	48	$ 5	$ 0.10	$ 360	$ 0.31	304251 LEESUB230 TT	230	304179 WILSON MILLS	230	1	20.36	Reconductor to 6-1590 ACSR	1195	1195	$ 81
6LEESUB230T	1245	94	$ 81	$ 0.87	$ 441	$ 0.35	304251 LEESUB230 TT	230	304192 SELMA 230 TT	230	1	0.04	Reconductor to 6-1590 ACSR + ancillary	1195	1195	$ 2
6MARION230T							Interconnection					46	Interconnection from the Beach	n/a	n/a	$ 230
6MARION230T	391	391	$ 230	$ 0.59	$ 230	$ 0.59	304632 MARION115 TT	115	304653 DILLON TAP	115	1	14.6	Reconductor to 3-1590 ACSR	311	311	$ 58
6MARION230T	876	485	$ 58	$ 0.12	$ 288	$ 0.33	304631 MARION230 TT	230	304632 MARION115 TT	115	1	-	Replace with 336 MVA	336	427	$ 4
6MARION230T	907	31	$ 4	$ 0.13	$ 292	$ 0.32	304631 MARION230 TT	230	304632 MARION115 TT	115	2	-	Replace with 336 MVA	336	427	$ 4
6MARION230T	930	23	$ 4	$ 0.17	$ 296	$ 0.32	304653 DILLON TAP	115	304447 FAIRMONT TAP	115	1	13.7	Reconductor to 3-1590 ACSR	311	311	$ 55
6MORHDWW230T							Interconnection					4	Interconnection from the Beach	n/a	n/a	$ 20
6MORHDWW230T	336	336	$ 20	$ 0.06	$ 20	$ 0.06	304497 MORHDWW230TT	230	304498 MORHDWW115TT	115	1	-	Add 2nd bank (336 MVA)	336	427	$ 7
6MORHDWW230T	527	191	$ 7	$ 0.04	$ 27	$ 0.05	304498 MORHDWW115TT	115	304496 MORWW 115/24	115	1	0.04	Reconductor to 3-1590 ACSR	340	340	$ 0
6MORHDWW230T	550	23	$ 0	$ 0.01	$ 27	$ 0.05	304496 MORWW 115/24	115	305019 E2-NEWPORT	115	1	3.22	Reconductor to 3-1590 ACSR	340	340	$ 13
6MTOLV230T							Interconnection					62	Interconnection from the Beach	n/a	n/a	$ 310
6MTOLV230T	224	224	$ 310	$ 1.38	$ 310	$ 1.38	304279 MT OLV230 TT	230	304278 MT OLV115 TT	115	1	-	Double Breaker Mt. Olive 230	-	-	$ 2
6MTOLV230T	637	413	$ 2	$ 0.00	$ 312	$ 0.49	304279 MT OLV230 TT	230	304278 MT OLV115 TT	115	1	-	Replace with 336 MVA	336	427	$ 4
6NEWBERN230T							Interconnection					34	Interconnection from the Beach	n/a	n/a	$ 170
6NEWBERN230T	825	825	$ 170	$ 0.21	$ 170	$ 0.21	304465 NEWBERN230TT	230	304466 NEWBER115NTT	115	1	-	Replace with 336 MVA	336	427	$ 4
6NEWBERN230T	941	116	$ 4	$ 0.03	$ 174	$ 0.18	304465 NEWBERN230TT	230	304489 NEWBER115STT	115	2	-	Replace with 336 MVA	336	427	$ 4
6NEWBERN230T	1104	163	$ 4	$ 0.02	$ 178	$ 0.16	304489 NEWBER115STT	115	304466 NEWBER115NTT	115	Z1	-	Replace bus tie breaker	598	598	$ 1
6NEWBERN230T	1404	300	$ 1	$ 0.00	$ 179	$ 0.13	304465 NEWBERN230TT	230	304463 NEW BERN WES	230	1	1.02	Raise to 212F	594	594	$ 2
6NEWBERN230T	1449	45	$ 2	$ 0.05	$ 181	$ 0.12	304463 NEW BERN WES	230	305142 E16-FAIRFELD	230	1	7.46	Raise to 212F	594	594	$ 15
6NEWBERN230T	1496	47	$ 15	$ 0.32	$ 196	$ 0.13	304475 WEYER TAP	115	304477 VOA TAP	115	1	12.53	Raise to 212F	202	202	$ 25
6NEWBERN230T	1515	19	$ 25	$ 1.32	$ 221	$ 0.15	304477 VOA TAP	115	304480 KINSDUP115TT	115	1	10.94	Raise to 212F	202	202	$ 22
6NEWBERN230T	1773	258	$ 22	$ 0.08	$ 243	$ 0.14	304471 CC WD EN TAP	230	304528 RHEMS	230	1	5.62	Reconductor to 6-1590 ACSR	1195	1195	$ 22
6SUMTER230T							Interconnection					75	Interconnection from the Beach	n/a	n/a	$ 375
6SUMTER230T	558	558	$ 375	$ 0.67	$ 375	$ 0.67	306416 WATEREE	100	306375 GT FALL1	100	1	20	Reconductor to 954 ACSR	232	260	$ 80
6SUMTER230T	584	26	$ 80	$ 3.08	$ 455	$ 0.78	304700 SUMTER230 TT	230	304728 ELLIOTT TAP	230	1	20.41	Raise to 212F	542	542	$ 41
6SUMTER230T	608	24	$ 41	$ 1.70	$ 496	$ 0.82	304728 ELLIOTT TAP	230	304018 ROB2 230 TT	230	1	20.75	Raise to 212F	542	542	$ 42

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element	Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6SUMTER230T	748	140	$ 42	$ 0.30	$ 537	$ 0.72	304700 SUMTER230 TT 230 304728 ELLIOTT TAP 230 1	20.41	Reconductor to 6-1590 ACSR	1195	1195	$ 82
6SUTNORTH230							Interconnection	17	Interconnection from the Beach	n/a	n/a	$ 85
6SUTNORTH230	0	0	$ 85		$ 85		Build Sutton North 230kV SS	-	Build Switching Station	-	-	$ 25
6SUTNORTH230	695	695	$ 25	$ 0.04	$ 110	$ 0.16	305880 CROOKDSOLTAP 230 304515 WALLACE230TT 230 1	3.55	Raise to 212F	594	594	$ 7
6SUTNORTH230	833	138	$ 7	$ 0.05	$ 117	$ 0.14	304039 SUTTON230 TT 230 304554 WILM N&O TAP 230 1	5.45	Reconductor to 6-1590 ACSR	1195	1195	$ 22
6SUTNORTH230	852	19	$ 22	$ 1.15	$ 139	$ 0.16	305470 WILARDSOLTAP 230 305880 CROOKDSOLTAP 230 1	4.39	Raise to 212F	594	594	$ 9
6SUTNORTH230	927	75	$ 9	$ 0.12	$ 148	$ 0.16	305995 6SUTNORTH230 230 305470 WILARDSOLTAP 230 1	19	Raise to 212F	594	594	$ 38
6SUTNORTH230	1024	97	$ 38	$ 0.39	$ 186	$ 0.18	305995 6SUTNORTH230 230 304515 WALLACE230TT 230 1	27.5	Raise to 212F	594	594	$ 55
6SUTNORTH230	1136	112	$ 55	$ 0.49	$ 241	$ 0.21	305995 6SUTNORTH230 230 304515 WALLACE230TT 230 1	27.5	Reconductor to 6-1590 ACSR	1195	1195	$ 110
6SUTNORTH230	1171	35	$ 110	$ 3.14	$ 351	$ 0.30	304582 DELCO230 TT 230 304587 DELCO115W TT 115 1	-	Replace with 336 MVA	336	427	$ 4
6SUTNORTH230	1217	46	$ 4	$ 0.09	$ 355	$ 0.29	304554 WILM N&O TAP 230 304552 WILM EAST 230 1	2.72	Reconductor to 6-1590 ACSR	1195	1195	$ 11
6SUTNORTH230	1225	8	$ 11	$ 1.36	$ 366	$ 0.30	305880 CROOKDSOLTAP 230 304515 WALLACE230TT 230 1	3.55	Reconductor to 6-1590 ACSR	1195	1195	$ 14
6WAKE230TT							Interconnection	90	Interconnection from the Beach	n/a	n/a	$ 450
6WAKE230TT	786	786	$ 450	$ 0.57	$ 450	$ 0.57	304156 ROL/SQD TAP 230 304276 KNIGHT HODG 230 1	4.83	Raise to 212F	1084	1084	$ 10
6WAKE230TT	849	63	$ 10	$ 0.15	$ 460	$ 0.54	304276 KNIGHT HODG 230 304162 MILBUR230 TT 230 1	2.19	Raise to 212F	1084	1084	$ 4
6WAKE230TT	1458	609	$ 4	$ 0.01	$ 464	$ 0.32	304190 WAKE 230 TT 230 304156 ROL/SQD TAP 230 1	0.17	New line	-	-	$ 100
6WALLACE230T							Interconnection	32	Interconnection from the Beach	n/a	n/a	$ 160
6WALLACE230T	548	548	$ 160	$ 0.29	$ 160	$ 0.29	304515 WALLACE230TT 230 305075 E9-W ONSLOW 230 1	19.7	Double Breaker Wallace 230	-	-	$ 5
6WALLACE230T	567	19	$ 5	$ 0.26	$ 165	$ 0.29	304515 WALLACE230TT 230 305075 E9-W ONSLOW 230 1	19.7	Raise to 212F	594	594	$ 39
6WALLACE230T	584	17	$ 39	$ 2.32	$ 204	$ 0.35	305075 E9-W ONSLOW 230 304521 CATHERN LAKE 230 1	7.69	Raise to 212F	594	594	$ 15
6WALLACE230T	618	34	$ 15	$ 0.45	$ 220	$ 0.36	304521 CATHERN LAKE 230 304524 JACKSON230TT 230 1	3.42	Raise to 212F	594	594	$ 7
6WALLACE230T	658	40	$ 7	$ 0.17	$ 227	$ 0.34	304515 WALLACE230TT 230 305075 E9-W ONSLOW 230 1	19.7	Reconductor to 6-1590 ACSR	1195	1195	$ 79
6WALLACE230T	675	17	$ 79	$ 4.64	$ 305	$ 0.45	305075 E9-W ONSLOW 230 304521 CATHERN LAKE 230 1	7.69	Reconductor to 6-1590 ACSR	1195	1195	$ 31
6WALLACE230T	691	16	$ 31	$ 1.92	$ 336	$ 0.49	304515 WALLACE230TT 230 304517 WALLACE115TT 115 1	-	Replace with 336 MVA	336	427	$ 4
6WHITEVL230T							Interconnection	34	Interconnection from the Beach	n/a	n/a	$ 170
6WHITEVL230T	663	663	$ 170	$ 0.26	$ 170	$ 0.26	304020 BRUN2 230 TT 230 305005 E1-SOUTHPORT 230 1	2.34	Raise to 212F	594	594	$ 5
6WHITEVL230T	770	107	$ 5	$ 0.04	$ 175	$ 0.23	304580 WHITEVIL TAP 115 305003 E1-HALLSBORO 115 1	5.42	Reconductor to 3-1590 ACSR	340	340	$ 22
6WHITEVL230T	796	26	$ 22	$ 0.83	$ 196	$ 0.25	305003 E1-HALLSBORO 115 304575 LAKE WACCA 115 1	4.28	Reconductor to 3-1590 ACSR	340	340	$ 17
6WHITEVL230T	818	22	$ 17	$ 0.78	$ 213	$ 0.26	305330 BLADENSOLTAP 230 305034 E4-POWELL 230 1	1.73	Raise to 212F	594	594	$ 3
6WHITEVL230T	850	32	$ 3	$ 0.11	$ 217	$ 0.26	304600 WHITEVL230TT 230 305330 BLADENSOLTAP 230 1	15.91	Raise to 212F	594	594	$ 32
6WHITEVL230T	871	21	$ 32	$ 1.52	$ 249	$ 0.29	304575 LAKE WACCA 115 304587 DELCO115W TT 115 1	16.86	Reconductor to 3-1590 ACSR	340	340	$ 67
6WHITEVL230T	929	58	$ 67	$ 1.16	$ 316	$ 0.34	305034 E4-POWELL 230 305035 E4-TARHELL 230 1	12.91	Raise to 212F	542	542	$ 26
6WOMMACK230T							Interconnection	51	Interconnection from the Beach	n/a	n/a	$ 255
6WOMMACK230T	883	883	$ 255	$ 0.29	$ 255	$ 0.29	304500 WOMMACK230TT 230 304510 WOMACKW115TT 115 2	-	Replace with 336 MVA	336	427	$ 4
6WOMMACK230T	1432	549	$ 4	$ 0.01	$ 259	$ 0.18	304500 WOMMACK230TT 230 304507 WOMACKE115TT 115 1	-	Replace with 336 MVA	336	427	$ 4
6WOMMACK230T	1432	0	$ 4	#DIV/0!	$ 263	$ 0.18	304030 LEESEP115WTT 115 305162 E17-ROSEWOOD 115 1	4.29	Reconductor to 3-1590 ACSR	311	311	$ 17
6WOMMACK230T	1471	39	$ 17	$ 0.44	$ 280	$ 0.19	304500 WOMMACK230TT 230 304506 DOVER 230 1	8.65	Raise to 212F	594	594	$ 17

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element					Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6WOMMACK230T	1519	48	$ 17	$ 0.36	$ 297	$ 0.20	304506 DOVER	230	304465 NEWBERN230TT	230	1	23.38	Raise to 212F	594	594	$ 47
6WSPOON230T							Interconnection					58	Interconnection from the Beach	n/a	n/a	$ 290
6WSPOON230T	311	311	$ 290	$ 0.93	$ 290	$ 0.93	304046 WSPOON230 TT	230	304047 WSPOON115 TT	115	1	-	Replace with 336 MVA and 1.5 breaker	336	427	$ 8
6WSPOON230T	498	187	$ 8	$ 0.04	$ 298	$ 0.60	304046 WSPOON230 TT	230	304047 WSPOON115 TT	115	2	-	Replace with 336 MVA and 1.5 breaker	336	427	$ 4
6WSPOON230T	788	290	$ 4	$ 0.01	$ 302	$ 0.38	305410 ROSLINSOLTAP	115	304403 HOPEMILLCHUR	115	1	3.07	Reconductor to 3-1590 ACSR	311	311	$ 13
8CUMBLND500T							Interconnection					72	Interconnection from the Beach	n/a	n/a	$ 360
8CUMBLND500T	1016	1016	$ 360	$ 0.35	$ 360	$ 0.35	304391 CUMBLND500TT	500	998843 CUMBERLAND1	230	1	-	Add 2nd 500/230kV bank	1120	1120	$ 15
8CUMBLND500T	1440	424	$ 15	$ 0.04	$ 375	$ 0.26	304391 CUMBLND500TT	500	998842 CUMBERLAND2	230	2	-	Get emergency ratings	1120	1400	$ 5
8CUMBLND500T	1700	260	$ 5	$ 0.02	$ 380	$ 0.22	304378 RICHMON230TT	230	304348 ROCKHAM230TT	230	1	-	New line	-	-	-
8FENTRES							Interconnection					15	Interconnection from the Beach	n/a	n/a	$ 75
8FENTRES	1383	1383	$ 75	$ 0.05	$ 75	$ 0.05	314554 3BTLEBRO	115	304223 ROCKYMT115TT	115	1	8.5	Reconductor to 3-795 ACSS	314	314	$ 25
8FENTRES	2307	924	$ 25	$ 0.03	$ 100	$ 0.04	314574 6EVERETS	230	304451 GREENVILE TT	230	1	22.21	Reconductor to 6-1590 ACSR	1195	1195	$ 89
8FENTRES	2813	506	$ 89	$ 0.18	$ 189	$ 0.07	306540 6MCGUIRE	230	306443 6MARSHAL	230	1&2	-	Planned upgrade	-	-	-
8WAKE500TT							Interconnection					90	Interconnection from the Beach	n/a	n/a	$ 450
8WAKE500TT	1310	1310	$ 450	$ 0.34	$ 450	$ 0.34	304156 ROL/SQD TAP	230	304276 KNIGHT HODG	230	1	4.83	Raise to 212F	1084	1084	$ 10
8WAKE500TT	1417	107	$ 10	$ 0.09	$ 460	$ 0.32	304276 KNIGHT HODG	230	304162 MILBUR230 TT	230	1	2.19	Raise to 212F	1084	1084	$ 4
8WAKE500TT	1451	34	$ 4	$ 0.13	$ 464	$ 0.32	304183 WAKE 500 TT	500	998846 WAKE2	230	2	-	Double Breaker Wake 500 ???	-	-	$ 20
8WAKE500TT	1454	3	$ 20	$ 6.67	$ 484	$ 0.33	304183 WAKE 500 TT	500	998847 WAKE1	230	1	-	Double Breaker Wake 500 ???	-	-	$ -

Appendix A.2 – Results for Three Selected Injection Sites with 500kV Transmission Additions

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element	Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6GREENVIL230	0						Interconnection	85	Interconnection from the Beach	-	-	$ 850
6GREENVIL230	1106	1106	$ 850	$ 0.77	$ 850	$ 0.77	304451 GREENVILE TT 230 314574 6EVERETS 230 1	22.21	Build Grnvl-Wom-Wake 500kV	-	-	$ 845
6GREENVIL230	1773	667	$ 845	$ 1.27	$ 1,695	$ 0.96	304451 GREENVILE TT 230 314574 6EVERETS 230 1	22.21	Add 2nd 500/230kV bank	1125	1125	$ 15
6GREENVIL230	1940	167	$ 15	$ 0.09	$ 1,710	$ 0.88	304451 GREENVILE TT 230 314574 6EVERETS 230 1	22.21	Reconductor to 6-1590 ACSR	1195	1195	$ 89
6GREENVIL230	2034	93	$ 89	$ 0.95	$ 1,799	$ 0.88	304451 GREENVILE TT 230 304452 GREENVILE W 230 1	4.1	Reconductor to 6-1590 ACSR	1195	1195	$ 16
6GREENVIL230	2135	102	$ 16	$ 0.16	$ 1,815	$ 0.85	304452 GREENVILE W 230 304229 PA-FARMVILLE 230 1	9.61	Reconductor to 6-1590 ACSR	1195	1195	$ 38
6GREENVIL230	2284	149	$ 38	$ 0.26	$ 1,854	$ 0.81	304229 PA-FARMVILLE 230 304228 WILSON230 TT 230 1	20.28	Reconductor to 6-1590 ACSR	1195	1195	$ 81
6GREENVIL230	2916	631	$ 81	$ 0.13	$ 1,935	$ 0.66	304451 GREENVILE TT 230 304445 CHOCOWINITY 230 1	18.61	Reconductor to 6-1590 ACSR	1195	1195	$ 74
6GREENVIL230	3074	158	$ 74	$ 0.47	$ 2,009	$ 0.65	306540 6MCGUIRE 230 306443 6MARSHAL 230 2	13.8	Reconductor already planned	-	-	$ 0
6GREENVIL230	3227	153	$ 0	$ 0.00	$ 2,009	$ 0.62	304445 CHOCOWINITY 230 304473 PA-WASHINTON 230 1	0.04	Reconductor to 6-1590 ACSR	1195	1195	$ 0.2
6GREENVIL230	3587	360	$ 0	$ 0.00	$ 2,010	$ 0.56	304480 KINSDUP115TT 115 304481 PA-AYDEN 115 1	1.27	Raise to 212F	201.6	201.6	$ 2.5
6GREENVIL230	3590	3	$ 3	$ 0.91	$ 2,012	$ 0.56	304473 PA-WASHINTON 230 304449 EDWARDS TAP 230 1	19.03	Raise to 212F	594	594	$ 38
6GREENVIL230	3605	15	$ 38	$ 2.54	$ 2,050	$ 0.57	304156 ROL/SQD TAP 230 304276 KNIGHT HODG 230 1	4.83	Raise to 212F	1084	1084	$ 10
8GREENVIL500	0						Interconnection	85	Interconnection from the Beach	-	-	$ 850
8GREENVIL500	1106	1106	$ 850	$ 0.77	$ 850	$ 0.77	304451 GREENVILE TT 230 314574 6EVERETS 230 1	22.21	Build Grnvl-Wom-Wake 500kV	-	-	$ 845
8GREENVIL500	1687	581	$ 845	$ 1.45	$ 1,695	$ 1.00	305997 8GREENVIL500 500 998836 GREENVILLE1 230 1	-	Add 2nd 500/230kV bank	1125	1125	$ 15
8GREENVIL500	2163	476	$ 15	$ 0.03	$ 1,710	$ 0.79	304451 GREENVILE TT 230 314574 6EVERETS 230 1	22.21	Reconductor to 6-1590 ACSR	1195	1195	$ 89
8GREENVIL500	2189	26	$ 89	$ 3.42	$ 1,799	$ 0.82	304451 GREENVILE TT 230 304452 GREENVILE W 230 1	4.1	Reconductor to 6-1590 ACSR	1195	1195	$ 16
8GREENVIL500	2286	97	$ 16	$ 0.17	$ 1,815	$ 0.79	304452 GREENVILE W 230 304229 PA-FARMVILLE 230 1	9.61	Reconductor to 6-1590 ACSR	1195	1195	$ 38
8GREENVIL500	2428	142	$ 38	$ 0.27	$ 1,854	$ 0.76	304229 PA-FARMVILLE 230 304228 WILSON230 TT 230 1	20.28	Reconductor to 6-1590 ACSR	1195	1195	$ 81
8GREENVIL500	2916	488	$ 81	$ 0.17	$ 1,935	$ 0.66	304451 GREENVILE TT 230 304445 CHOCOWINITY 230 1	18.61	Reconductor to 6-1590 ACSR	1195	1195	$ 74
8GREENVIL500	3070	155	$ 74	$ 0.48	$ 2,009	$ 0.65	306540 6MCGUIRE 230 306443 6MARSHAL 230 2	13.8	Reconductor already planned	-	-	$ 0
8GREENVIL500	3227	157	$ 0	$ 0.00	$ 2,009	$ 0.62	304445 CHOCOWINITY 230 304473 PA-WASHINTON 230 1	0.04	Reconductor to 6-1590 ACSR	1195	1195	$ 0.2
8GREENVIL500	3374	147	$ 0	$ 0.00	$ 2,010	$ 0.60	305997 8GREENVIL500 500 998836 GREENVILLE1 230 1	-	Larger transformers???	2000	2000	$ 10
8GREENVIL500	3419	45	$ 10	$ 0.22	$ 2,020	$ 0.59	304156 ROL/SQD TAP 230 304276 KNIGHT HODG 230 1	4.83	Raise to 212F	1084	1084	$ 10
8GREENVIL500	3576	157	$ 10	$ 0.06	$ 2,029	$ 0.57	304276 KNIGHT HODG 230 304162 MILBUR230 TT 230 1	2.19	Raise to 212F	1084	1084	$ 4
6NEWBERN230T	0						Interconnection	34	Interconnection from the Beach	n/a	n/a	$ 340
6NEWBERN230T	825	825	$ 340	$ 0.41	$ 340	$ 0.41	304465 NEWBERN230TT 230 304466 NEWBER115NTT 115 1	115	Build NewBern-Wom-Wake 500kV	-	-	$ 570
6NEWBERN230T	1006	181	$ 570	$ 3.15	$ 910	$ 0.90	304465 NEWBERN230TT 230 304466 NEWBER115NTT 115 1	-	Replace with 336 MVA	336	504	$ 4
6NEWBERN230T	1404	398	$ 4	$ 0.01	$ 914	$ 0.65	304465 NEWBERN230TT 230 304489 NEWBER115STT 115 2	-	Replace with 336 MVA	336	504	$ 4
6NEWBERN230T	1650	246	$ 4	$ 0.02	$ 918	$ 0.56	304489 NEWBER115STT 115 304466 NEWBER115NTT 115 Z1	-	Replace bus tie breaker	598	598	$ 1
6NEWBERN230T	2137	486	$ 1	$ 0.00	$ 919	$ 0.43	304465 NEWBERN230TT 230 304463 NEW BERN WES 230 1	1.02	Raise to 212F	594	594	$ 2
6NEWBERN230T	~~2198~~	~~61~~	~~$ 2~~	~~$ 0.03~~	~~$ 921~~	~~$ 0.42~~	~~304475 WEYER TAP 115 304477 VOA TAP 115 1~~	12.53	Add 2nd 500/230kV bank	1125	1125	$ 15

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element						Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6NEWBERN230T	2324	127	$ 15	$ 0.12	$ 936	$ 0.40	304475 WEYER TAP	115	304477 VOA TAP	115	1		12.53	Raise to 212F	202	202	$ 25
6NEWBERN230T	2372	48	$ 25	$ 0.52	$ 961	$ 0.41	304465 NEWBERN230TT	230	304506 DOVER	230	1		23.38	Raise to 212F	594	594	$ 47
6NEWBERN230T	2386	14	$ 47	$ 3.34	$ 1,008	$ 0.42	304477 VOA TAP	115	304480 KINSDUP115TT	115	1		10.94	Raise to 212F	202	202	$ 22
6NEWBERN230T	2393	7	$ 22	$ 3.13	$ 1,030	$ 0.43	304506 DOVER	230	304500 WOMMACK230TT	230	1		8.65	Raise to 212F	594	594	$ 17
6NEWBERN230T	2396	3	$ 17	$ 5.77	$ 1,047	$ 0.44	304463 NEW BERN WES	230	305142 E16-FAIRFELD	230	1		7.46	Raise to 212F	594	594	$ 15
6NEWBERN230T	2485	89	$ 15	$ 0.17	$ 1,062	$ 0.43	304466 NEWBER115NTT	115	304475 WEYER TAP	115	1		6.08	Raise to 212F	221	221	$ 12
6NEWBERN230T	2520	35	$ 12	$ 0.35	$ 1,074	$ 0.43	305142 E16-FAIRFELD	230	304434 BAYBORO TAP	230	1		8.53	Raise to 212F	594	594	$ 17
6NEWBERN230T	2631	111	$ 17	$ 0.15	$ 1,091	$ 0.41	304465 NEWBERN230TT	230	304484 HAVELOK230TT	230	1		23.47	Double Breaker New Bern 230	-	-	$ 4
6NEWBERN230T	2814	183	$ 4	$ 0.02	$ 1,095	$ 0.39	304465 NEWBERN230TT	230	304506 DOVER	230	1		23.38	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 47
6NEWBERN230T	2819	5	$ 47	$ 9.35	$ 1,142	$ 0.41	304434 BAYBORO TAP	230	304454 AURORA SS TT	230	1		10.74	Raise to 212F	594	594	$ 21
6NEWBERN230T	2835	16	$ 21	$ 1.34	$ 1,163	$ 0.41	304506 DOVER	230	304500 WOMMACK230TT	230	1		8.65	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 17
6NEWBERN230T	3031	196	$ 17	$ 0.09	$ 1,181	$ 0.39	306540 6MCGUIRE	230	306443 6MARSHAL	230	2		13.8	Reconductor already planned	-	-	$ 0
6NEWBERN230T	3101	70	$ 0	$ 0.00	$ 1,181	$ 0.38	304465 NEWBERN230TT	230	304484 HAVELOK230TT	230	1		23.47	Raise to 212F	594	594	$ 47
6NEWBERN230T	3252	151	$ 47	$ 0.31	$ 1,228	$ 0.38	304465 NEWBERN230TT	230	304500 WOMMACK230TT	230	1		33.87	Reconductor to 6-1590 ACSR	1195	1195	$ 135
6NEWBERN230T	3282	30	$ 135	$ 4.52	$ 1,363	$ 0.42	304465 NEWBERN230TT	230	304463 NEW BERN WES	230	1		1.02	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 2
8NEWBERN500	0						Interconnection						34	Interconnection from the Beach	n/a	n/a	$ 340
8NEWBERN500	825	825	$ 340	$ 0.41	$ 340	$ 0.41	304465 NEWBERN230TT	230	304466 NEWBER115NTT	115	1		115	Build NewBern-Wom-Wake 500kV	-	-	$ 570
8NEWBERN500	1687	862	$ 570	$ 0.66	$ 910	$ 0.54	305998 8NEWBERN500	500	998835 NEWBERN1	230	1		-	Add 2nd 500/230kV bank	1125	1687	$ 15
8NEWBERN500	1459	-228	$ 15	$ (0.07)	$ 925	$ 0.63	304465 NEWBERN230TT	230	304466 NEWBER115NTT	115	1		-	Replace with 336 MVA	336	504	$ 4
8NEWBERN500	2065	606	$ 4	$ 0.01	$ 929	$ 0.45	304465 NEWBERN230TT	230	304489 NEWBER115STT	115	2		-	Replace with 336 MVA	336	504	$ 4
8NEWBERN500	2372	307	$ 4	$ 0.01	$ 933	$ 0.39	304465 NEWBERN230TT	230	304506 DOVER	230	1		23.38	Raise to 212F	594	594	$ 47
8NEWBERN500	2393	21	$ 47	$ 2.23	$ 980	$ 0.41	304506 DOVER	230	304500 WOMMACK230TT	230	1		8.65	Raise to 212F	594	594	$ 17
8NEWBERN500	2413	20	$ 17	$ 0.87	$ 997	$ 0.41	304465 NEWBERN230TT	230	304463 NEW BERN WES	230	1		1.02	Raise to 212F	594	594	$ 2
8NEWBERN500	2434	21	$ 2	$ 0.10	$ 999	$ 0.41	304475 WEYER TAP	115	304477 VOA TAP	115	1		12.53	Raise to 212F	202	202	$ 25
8NEWBERN500	2440	6	$ 25	$ 4.18	$ 1,024	$ 0.42	304489 NEWBER115STT	115	304466 NEWBER115NTT	115	Z1		-	Replace bus tie breaker	598	598	$ 1
8NEWBERN500	2476	36	$ 1	$ 0.03	$ 1,025	$ 0.41	304477 VOA TAP	115	304480 KINSDUP115TT	115	1		10.94	Raise to 212F	202	202	$ 22
8NEWBERN500	2511	35	$ 22	$ 0.63	$ 1,047	$ 0.42	304463 NEW BERN WES	230	305142 E16-FAIRFELD	230	1		7.46	Raise to 212F	594	594	$ 15
8NEWBERN500	2545	34	$ 15	$ 0.44	$ 1,062	$ 0.42	304466 NEWBER115NTT	115	304475 WEYER TAP	115	1		6.08	Raise to 212F	221	221	$ 12
8NEWBERN500	2599	54	$ 12	$ 0.23	$ 1,074	$ 0.41	305142 E16-FAIRFELD	230	304434 BAYBORO TAP	230	1		8.53	Raise to 212F	594	594	$ 17
8NEWBERN500	2814	215	$ 17	$ 0.08	$ 1,091	$ 0.39	304465 NEWBERN230TT	230	304506 DOVER	230	1		23.38	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 47
8NEWBERN500	2819	5	$ 47	$ 9.35	$ 1,138	$ 0.40	304434 BAYBORO TAP	230	304454 AURORA SS TT	230	1		10.74	Raise to 212F	594	594	$ 21
8NEWBERN500	2835	16	$ 21	$ 1.34	$ 1,159	$ 0.41	304506 DOVER	230	304500 WOMMACK230TT	230	1		8.65	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 17
8NEWBERN500	3039	204	$ 17	$ 0.08	$ 1,177	$ 0.39	306540 6MCGUIRE	230	306443 6MARSHAL	230	2		13.8	Reconductor already planned	-	-	$ 0
8NEWBERN500	3252	213	$ 0	$ 0.00	$ 1,177	$ 0.36	304465 NEWBERN230TT	230	304500 WOMMACK230TT	230	1		33.87	Reconductor to 6-1590 ACSR	1195	1195	$ 135
8NEWBERN500	3282	30	$ 135	$ 4.52	$ 1,312	$ 0.40	304465 NEWBERN230TT	230	304463 NEW BERN WES	230	1		1.02	Reconductor to 6-1590 ACSR	1195	1195	$ 4
8NEWBERN500	3311	29	$ 4	$ 0.14	$ 1,316	$ 0.40	304454 AURORA SS TT	230	304449 EDWARDS TAP	230	1		0.96	Raise to 212F	594	594	$ 2
8NEWBERN500	3374	63	$ 2	$ 0.03	$ 1,318	$ 0.39	305998 8NEWBERN500	500	998833 NEWBERN2	230	2		-	Larger transformers???	2000	2000	$ 10
8NEWBERN500	3390	16	$ 10	$ 0.63	$ 1,328	$ 0.39	304449 EDWARDS TAP	230	304473 PA-WASHINTON	230	1		19.03	Raise to 212F	594	594	$ 38
8NEWBERN500	3403	13	$ 38	$ 2.93	$ 1,366	$ 0.40	304251 LEESUB230 TT	230	304192 SELMA 230 TT	230	1		16.78	Ancillary equipment	940	940	$ 1
8NEWBERN500	3445	42	$ 1	$ 0.01	$ 1,367	$ 0.40	304465 NEWBERN230TT	230	304484 HAVELOK230TT	230	1		23.47	Raise to 212F	594	594	$ 47

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element						Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
8NEWBERN500	3467	22	$ 47	$ 2.13	$ 1,414	$ 0.41	304378 RICHMON230TT	230	304348 ROCKHAM230TT	230	1		5.96	Raise to 212F	1084	1084	$ 12
8NEWBERN500	3468	1	$ 12	$ 11.92	$ 1,426	$ 0.41	305142 E16-FAIRFELD	230	304434 BAYBORO TAP	230	1		8.53	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 17
8NEWBERN500	3541	73	$ 17	$ 0.23	$ 1,443	$ 0.41	304156 ROL/SQD TAP	230	304276 KNIGHT HODG	230	1		4.83	Raise to 212F	1084	1084	$ 10
8NEWBERN500	3555	14	$ 10	$ 0.69	$ 1,452	$ 0.41	304445 CHOCOWINITY	230	304451 GREENVILE TT	230	1		18.57	Raise to 212F	482	482	$ 37
6SUTNORTH230-Cumb	0						Interconnection						17	Interconnection from the Beach	n/a	n/a	$ 170
6SUTNORTH230-Cumb	695	695	$ 170	$ 0.24	$ 170	$ 0.24	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		-	Build SuttNorth-Cumberland 500kV	-	-	$ 660
6SUTNORTH230-Cumb	1147	452	$ 660	$ 1.46	$ 830	$ 0.72	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		-	Add 2nd 500/230kV bank	1125	1687	$ 15
6SUTNORTH230-Cumb	1256	109	$ 15	$ 0.14	$ 845	$ 0.67	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		3.57	Raise to 212F	594	594	$ 7
6SUTNORTH230-Cumb	1530	274	$ 7	$ 0.03	$ 852	$ 0.56	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1		4.39	Raise to 212F	594	594	$ 9
6SUTNORTH230-Cumb	1663	133	$ 9	$ 0.07	$ 861	$ 0.52	305995 6SUTNORTH230	230	305470 WILARDSOLTAP	230	1		19	Raise to 212F	594	594	$ 38
6SUTNORTH230-Cumb	1961	298	$ 38	$ 0.13	$ 899	$ 0.46	305995 6SUTNORTH230	230	304515 WALLACE230TT	230	1		27.5	Raise to 212F	594	594	$ 55
6SUTNORTH230-Cumb	2005	44	$ 55	$ 1.25	$ 954	$ 0.48	304378 RICHMON230TT	230	304348 ROCKHAM230TT	230	1		5.96	Raise to 212F	1084	1084	$ 12
6SUTNORTH230-Cumb	2113	108	$ 12	$ 0.11	$ 966	$ 0.46	305995 6SUTNORTH230	230	304354 ROCKY POINT	230	1		8.2	Reconductor to 6-1590 ACSR	1195	1195	$ 33
6SUTNORTH230-Cumb	2131	18	$ 33	$ 1.82	$ 999	$ 0.47	305995 6SUTNORTH230	230	304516 WILM BASF	230	1		1.22	Raise to 212F	594	594	$ 2
6SUTNORTH230-Cumb	2146	15	$ 2	$ 0.16	$ 1,001	$ 0.47	304039 SUTTON230 TT	230	304554 WILM N&O TAP	230	1		5.38	Reconductor to 6-1590 ACSR	1195	1195	$ 22
6SUTNORTH230-Cumb	2179	33	$ 22	$ 0.65	$ 1,023	$ 0.47	305995 6SUTNORTH230	230	304515 WALLACE230TT	230	1		27.5	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 55
6SUTNORTH230-Cumb	2190	11	$ 55	$ 5.00	$ 1,078	$ 0.49	304520 WILM INVISTA	230	304039 SUTTON230 TT	230	1		1.79	Raise to 212F	594	594	$ 4
6SUTNORTH230-Cumb	2190	0	$ 4	#DIV/0!	$ 1,081	$ 0.49	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		3.57	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 7
6SUTNORTH230-Cumb	2258	68	$ 7	$ 0.11	$ 1,088	$ 0.48	304354 ROCKY POINT	230	305069 E9-MEADOW	230	1		34.95	Reconductor to 6-1590 ACSR	1195	1195	$ 140
6SUTNORTH230-Cumb	2272	14	$ 140	$ 9.99	$ 1,228	$ 0.54	304503 WARSAW TAP	230	304205 CLINTON230TT	230	1		12.6	Reconductor to 6-1590 ACSR	1195	1195	$ 50
6SUTNORTH230-Cumb	2322	50	$ 50	$ 1.01	$ 1,279	$ 0.55	305032 E4-BLIND BRG	230	304503 WARSAW TAP	230	1		12.67	Reconductor to 6-1590 ACSR	1195	1195	$ 51
6SUTNORTH230-Cumb	2410	88	$ 51	$ 0.58	$ 1,329	$ 0.55	305069 E9-MEADOW	230	304524 JACKSON230TT	230	1		4.78	Reconductor to 6-1590 ACSR	1195	1195	$ 19
6SUTNORTH230-Cumb	2413	3	$ 19	$ 6.37	$ 1,348	$ 0.56	304516 WILM BASF	230	304534 WILM PRAX	230	1		1.99	Raise to 212F	594	594	$ 4
6SUTNORTH230-Cumb	2437	24	$ 4	$ 0.17	$ 1,352	$ 0.55	304534 WILM PRAX	230	304520 WILM INVISTA	230	1		0.39	Raise to 212F	594	594	$ 1
6SUTNORTH230-Cumb	2453	16	$ 1	$ 0.05	$ 1,353	$ 0.55	304020 BRUN2 230 TT	230	305004 E1-PROSPECT	230	1		19.31	Raise to 212F	594	594	$ 39
6SUTNORTH230-Cumb	2462	9	$ 39	$ 4.29	$ 1,392	$ 0.57	304582 DELCO230 TT	230	304587 DELCO115W TT	115	1		-	Replace with 336 MVA	336	427	$ 4
6SUTNORTH230-Cumb	2464	2	$ 4	$ 2.00	$ 1,396	$ 0.57	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1		4.39	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 9
6SUTNORTH230-Cumb	2512	48	$ 9	$ 0.18	$ 1,404	$ 0.56	305995 6SUTNORTH230	230	304516 WILM BASF	230	1		1.22	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 2
6SUTNORTH230-Cumb	2512	0	$ 2	#DIV/0!	$ 1,407	$ 0.56	304516 WILM BASF	230	304534 WILM PRAX	230	1		1.99	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 4
6SUTNORTH230-Cumb	2514	2	$ 4	$ 1.99	$ 1,411	$ 0.56	304515 WALLACE230TT	230	305031 E4-BEVERAGE	230	1		6.54	Reconductor to 6-1590 ACSR	1195	1195	$ 26
6SUTNORTH230-Cumb	2536	22	$ 26	$ 1.19	$ 1,437	$ 0.57	304534 WILM PRAX	230	304520 WILM INVISTA	230	1		0.39	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 1
6SUTNORTH230-Cumb	2536	0	$ 1	#DIV/0!	$ 1,438	$ 0.57	304378 RICHMON230TT	230	304348 ROCKHAM230TT	230	1		5.96	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 12
8SUTNORTH500-Cumb	0						Interconnection						17	Interconnection from the Beach	n/a	n/a	$ 170
8SUTNORTH500-Cumb	695	695	$ 170	$ 0.24	$ 170	$ 0.24	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		-	Build SuttNorth-Cumberland 500kV	-	-	$ 660
8SUTNORTH500-Cumb	1687	992	$ 660	$ 0.67	$ 830	$ 0.49	305996 8SUTNORTH500	500	998836 SUTTONNORTH1	230	1		-	Add 2nd 500/230kV bank	1125	1687	$ 15
8SUTNORTH500-Cumb	1624	-63	$ 15	$ (0.24)	$ 845	$ 0.52	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		3.57	Raise to 212F	594	594	$ 7
8SUTNORTH500-Cumb	1890	266	$ 7	$ 0.03	$ 852	$ 0.45	304378 RICHMON230TT	230	304348 ROCKHAM230TT	230	1		5.96	Raise to 212F	1084	1084	$ 12
8SUTNORTH500-Cumb	1930	40	$ 12	$ 0.30	$ 864	$ 0.45	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1		4.39	Raise to 212F	594	594	$ 9

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element						Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
8SUTNORTH500-Cumb	2045	115	$ 9	$ 0.08	$ 873	$ 0.43	305995 6SUTNORTH230	230	305470 WILARDSOLTAP	230	1		19	Raise to 212F	594	594	$ 38
8SUTNORTH500-Cumb	2131	86	$ 38	$ 0.44	$ 911	$ 0.43	305995 6SUTNORTH230	230	304516 WILM BASF	230	1		1.22	Raise to 212F	594	594	$ 2
8SUTNORTH500-Cumb	2190	59	$ 2	$ 0.04	$ 913	$ 0.42	304520 WILM INVISTA	230	304039 SUTTON230 TT	230	1		1.79	Raise to 212F	594	594	$ 4
8SUTNORTH500-Cumb	2272	82	$ 4	$ 0.04	$ 917	$ 0.40	304503 WARSAW TAP	230	304205 CLINTON230TT	230	1		12.6	Reconductor to 6-1590 ACSR	1195	1195	$ 50
8SUTNORTH500-Cumb	2322	50	$ 50	$ 1.01	$ 967	$ 0.42	305032 E4-BLIND BRG	230	304503 WARSAW TAP	230	1		12.67	Reconductor to 6-1590 ACSR	1195	1195	$ 51
8SUTNORTH500-Cumb	2391	69	$ 51	$ 0.73	$ 1,018	$ 0.43	304378 RICHMON230TT	230	304348 ROCKHAM230TT	230	1		5.96	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 12
8SUTNORTH500-Cumb	2413	22	$ 12	$ 0.54	$ 1,030	$ 0.43	304516 WILM BASF	230	304534 WILM PRAX	230	1		1.99	Raise to 212F	594	594	$ 4
8SUTNORTH500-Cumb	2437	24	$ 4	$ 0.17	$ 1,034	$ 0.42	304534 WILM PRAX	230	304520 WILM INVISTA	230	1		0.39	Raise to 212F	594	594	$ 1
8SUTNORTH500-Cumb	2453	16	$ 1	$ 0.05	$ 1,035	$ 0.42	304020 BRUN2 230 TT	230	305004 E1-PROSPECT	230	1		19.31	Raise to 212F	594	594	$ 39
8SUTNORTH500-Cumb	2498	45	$ 39	$ 0.86	$ 1,073	$ 0.43	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		3.57	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 7
8SUTNORTH500-Cumb	2513	15	$ 7	$ 0.48	$ 1,080	$ 0.43	304515 WALLACE230TT	230	305031 E4-BEVERAGE	230	1		6.54	Reconductor to 6-1590 ACSR	1195	1195	$ 26
8SUTNORTH500-Cumb	2516	3	$ 26	$ 8.72	$ 1,107	$ 0.44	305995 6SUTNORTH230	230	304516 WILM BASF	230	1		1.22	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 2
8SUTNORTH500-Cumb	2516	0	$ 2	#DIV/0!	$ 1,109	$ 0.44	304516 WILM BASF	230	304534 WILM PRAX	230	1		1.99	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 4
8SUTNORTH500-Cumb	2527	11	$ 4	$ 0.36	$ 1,113	$ 0.44	305530 TRNBLSOLTAP	230	304390 CUMBLND230TT	230	1		9.56	Ancillary equipment	512	512	$ 0
8SUTNORTH500-Cumb	2535	8	$ 0	$ 0.03	$ 1,113	$ 0.44	304039 SUTTON230 TT	230	304554 WILM N&O TAP	230	1		5.38	Reconductor to 6-1590 ACSR	1195	1195	$ 22
8SUTNORTH500-Cumb	2540	5	$ 22	$ 4.30	$ 1,135	$ 0.45	304534 WILM PRAX	230	304520 WILM INVISTA	230	1		0.39	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 1
8SUTNORTH500-Cumb	2575	35	$ 1	$ 0.02	$ 1,135	$ 0.44	304520 WILM INVISTA	230	304039 SUTTON230 TT	230	1		1.79	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 4
8SUTNORTH500-Cumb	2597	22	$ 4	$ 0.16	$ 1,139	$ 0.44	305995 6SUTNORTH230	230	304515 WALLACE230TT	230	1		27.5	Raise to 212F	594	594	$ 55
8SUTNORTH500-Cumb	2633	36	$ 55	$ 1.53	$ 1,194	$ 0.45	305995 6SUTNORTH230	230	304354 ROCKY POINT	230	1		8.2	Reconductor to 6-1590 ACSR	1195	1195	$ 33
8SUTNORTH500-Cumb	2692	59	$ 33	$ 0.56	$ 1,227	$ 0.46	304020 BRUN2 230 TT	230	305004 E1-PROSPECT	230	1		19.31	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 39
8SUTNORTH500-Cumb	2731	39	$ 39	$ 0.99	$ 1,265	$ 0.46	305530 TRNBLSOLTAP	230	304390 CUMBLND230TT	230	1		9.56	Raise to 212F	542	542	$ 19
8SUTNORTH500-Cumb	2732	1	$ 19	$ 19.12	$ 1,285	$ 0.47	304505 ROSE HILL	230	305032 E4-BLIND BRG	230	1		4.58	Reconductor to 6-1590 ACSR	1195	1195	$ 18
8SUTNORTH500-Cumb	2735	3	$ 18	$ 6.11	$ 1,303	$ 0.48	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1		4.39	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 9
8SUTNORTH500-Cumb	2753	18	$ 9	$ 0.49	$ 1,312	$ 0.48	304354 ROCKY POINT	230	305069 E9-MEADOW	230	1		34.95	Reconductor to 6-1590 ACSR	1195	1195	$ 140
8SUTNORTH500-Cumb	2816	63	$ 140	$ 2.22	$ 1,451	$ 0.52	305995 6SUTNORTH230	230	304515 WALLACE230TT	230	1		27.5	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 55
8SUTNORTH500-Cumb	2850	34	$ 55	$ 1.62	$ 1,506	$ 0.53	306540 6MCGUIRE	230	306443 6MARSHAL	230	2		13.8	Reconductor already planned	-	-	$ 0
6SUTNORTH230-Wom	0						Interconnection						17	Interconnection from the Beach	n/a	n/a	$ 170
6SUTNORTH230-Wom	695	695	$ 170	$ 0.24	$ 170	$ 0.24	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		-	Build SuttNorth-Wom-Wake 500kV	-	-	$ 1,110
6SUTNORTH230-Wom	1545	850	$ 1,110	$ 1.31	$ 1,280	$ 0.83	305996 8SUTNORTH500	500	998836 SUTTONNORTH1	230	1		-	Add 2nd 500/230kV bank	1125	1687	$ 15
6SUTNORTH230-Wom	1689	144	$ 15	$ 0.10	$ 1,295	$ 0.77	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1		3.57	Raise to 212F	594	594	$ 7
6SUTNORTH230-Wom	1923	234	$ 7	$ 0.03	$ 1,302	$ 0.68	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1		4.39	Raise to 212F	594	594	$ 9
6SUTNORTH230-Wom	2037	114	$ 9	$ 0.08	$ 1,311	$ 0.64	305995 6SUTNORTH230	230	305470 WILARDSOLTAP	230	1		19	Raise to 212F	594	594	$ 38
6SUTNORTH230-Wom	2140	103	$ 38	$ 0.37	$ 1,349	$ 0.63	305995 6SUTNORTH230	230	304516 WILM BASF	230	1		1.22	Raise to 212F	594	594	$ 2
6SUTNORTH230-Wom	2200	60	$ 2	$ 0.04	$ 1,351	$ 0.61	304520 WILM INVISTA	230	304039 SUTTON230 TT	230	1		1.79	Raise to 212F	594	594	$ 4
6SUTNORTH230-Wom	2273	73	$ 4	$ 0.05	$ 1,355	$ 0.60	304503 WARSAW TAP	230	304205 CLINTON230TT	230	1		12.6	Reconductor to 6-1590 ACSR	1195	1195	$ 50
6SUTNORTH230-Wom	2280	7	$ 50	$ 7.20	$ 1,405	$ 0.62	304582 DELCO230 TT	230	304587 DELCO115W TT	115	1		-	Replace with 336 MVA	336	427	$ 4
6SUTNORTH230-Wom	2325	45	$ 4	$ 0.09	$ 1,409	$ 0.61	305032 E4-BLIND BRG	230	304503 WARSAW TAP	230	1		12.67	Reconductor to 6-1590 ACSR	1195	1195	$ 51
6SUTNORTH230-Wom	2349	24	$ 51	$ 2.11	$ 1,460	$ 0.62	305995 6SUTNORTH230	230	304515 WALLACE230TT	230	1		27.5	Raise to 212F	594	594	$ 55
6SUTNORTH230-Wom	2421	72	$ 55	$ 0.76	$ 1,515	$ 0.63	304516 WILM BASF	230	304534 WILM PRAX	230	1		1.99	Raise to 212F	594	594	$ 4
6SUTNORTH230-Wom	2445	24	$ 4	$ 0.17	$ 1,519	$ 0.62	304534 WILM PRAX	230	304520 WILM INVISTA	230	1		0.39	Raise to 212F	594	594	$ 1

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element					Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
6SUTNORTH230-Wom	2486	41	$ 1	$ 0.02	$ 1,520	$ 0.61	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1	3.57	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 7
6SUTNORTH230-Wom	2492	6	$ 7	$ 1.19	$ 1,527	$ 0.61	304020 BRUN2 230 TT	230	305004 E1-PROSPECT	230	1	19.31	Raise to 212F	594	594	$ 39
6SUTNORTH230-Wom	2518	26	$ 39	$ 1.49	$ 1,566	$ 0.62	304515 WALLACE230TT	230	305031 E4-BEVERAGE	230	1	6.54	Reconductor to 6-1590 ACSR	1195	1195	$ 26
6SUTNORTH230-Wom	2525	7	$ 26	$ 3.74	$ 1,592	$ 0.63	305995 6SUTNORTH230	230	304516 WILM BASF	230	1	1.22	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 2
6SUTNORTH230-Wom	2549	24	$ 2	$ 0.10	$ 1,594	$ 0.63	304039 SUTTON230 TT	230	304554 WILM N&O TAP	230	1	5.38	Reconductor to 6-1590 ACSR	1195	1195	$ 22
6SUTNORTH230-Wom	2575	26	$ 22	$ 0.83	$ 1,616	$ 0.63	305530 TRNBLSOLTAP	230	304390 CUMBLND230TT	230	1	9.56	Raise to 212F	512	512	$ 19
6SUTNORTH230-Wom	2585	10	$ 19	$ 1.91	$ 1,635	$ 0.63	304520 WILM INVISTA	230	304039 SUTTON230 TT	230	1	1.79	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 4
6SUTNORTH230-Wom	2596	11	$ 4	$ 0.33	$ 1,638	$ 0.63	305995 6SUTNORTH230	230	304354 ROCKY POINT	230	1	8.2	Reconductor to 6-1590 ACSR	1195	1195	$ 33
6SUTNORTH230-Wom	2709	113	$ 33	$ 0.29	$ 1,671	$ 0.62	304354 ROCKY POINT	230	305069 E9-MEADOW	230	1	34.95	Reconductor to 6-1590 ACSR	1195	1195	$ 140
6SUTNORTH230-Wom	2720	11	$ 140	$ 12.71	$ 1,811	$ 0.67	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1	4.39	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 9
6SUTNORTH230-Wom	2731	11	$ 9	$ 0.80	$ 1,820	$ 0.67	304587 DELCO115W TT	115	304575 LAKE WACCA	115	1	16.86	Reconductor to 3-1590 ACSR	340	340	$ 67
6SUTNORTH230-Wom	2739	8	$ 67	$ 8.43	$ 1,887	$ 0.69	304505 ROSE HILL	230	305032 E4-BLIND BRG	230	1	4.58	Reconductor to 6-1590 ACSR	1195	1195	$ 18
6SUTNORTH230-Wom	2822	83	$ 18	$ 0.22	$ 1,906	$ 0.68	305069 E9-MEADOW	230	304524 JACKSON230TT	230	1	4.78	Reconductor to 6-1590 ACSR	1195	1195	$ 19
6SUTNORTH230-Wom	2824	2	$ 19	$ 9.56	$ 1,925	$ 0.68	304525 JACKSN115ETT	115	305065 E9-GUMBRNCH	115	1	4.69	Reconductor to 3-1590 ACSR	340	340	$ 19
8SUTNORTH500-Wom	0						Interconnection					17	Interconnection from the Beach	n/a	n/a	$ 170
8SUTNORTH500-Wom	695	695	$ 170	$ 0.24	$ 170	$ 0.24	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1	-	Build SuttNorth-Wom-Wake 500kV	-	-	$ 1,110
8SUTNORTH500-Wom	1687	992	$ 1,110	$ 1.12	$ 1,280	$ 0.76	305996 8SUTNORTH500	500	998836 SUTTONNORTH1	230	1	-	Add 2nd 500/230kV bank	1125	1687	$ 15
8SUTNORTH500-Wom	1689	2	$ 15	$ 7.50	$ 1,295	$ 0.77	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1	3.57	Raise to 212F	594	594	$ 7
8SUTNORTH500-Wom	1923	234	$ 7	$ 0.03	$ 1,302	$ 0.68	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1	4.39	Raise to 212F	594	594	$ 9
8SUTNORTH500-Wom	2037	114	$ 9	$ 0.08	$ 1,311	$ 0.64	305995 6SUTNORTH230	230	305470 WILARDSOLTAP	230	1	19	Raise to 212F	594	594	$ 38
8SUTNORTH500-Wom	2140	103	$ 38	$ 0.37	$ 1,349	$ 0.63	305995 6SUTNORTH230	230	304516 WILM BASF	230	1	1.22	Raise to 212F	594	594	$ 2
8SUTNORTH500-Wom	2200	60	$ 2	$ 0.04	$ 1,351	$ 0.61	304520 WILM INVISTA	230	304039 SUTTON230 TT	230	1	1.79	Raise to 212F	594	594	$ 4
8SUTNORTH500-Wom	2273	73	$ 4	$ 0.05	$ 1,355	$ 0.60	304503 WARSAW TAP	230	304205 CLINTON230TT	230	1	12.6	Reconductor to 6-1590 ACSR	1195	1195	$ 50
8SUTNORTH500-Wom	2324	51	$ 50	$ 0.99	$ 1,405	$ 0.60	305032 E4-BLIND BRG	230	304503 WARSAW TAP	230	1	12.67	Reconductor to 6-1590 ACSR	1195	1195	$ 51
8SUTNORTH500-Wom	2425	101	$ 51	$ 0.50	$ 1,456	$ 0.60	304516 WILM BASF	230	304534 WILM PRAX	230	1	1.99	Raise to 212F	594	594	$ 4
8SUTNORTH500-Wom	2450	25	$ 4	$ 0.16	$ 1,460	$ 0.60	304534 WILM PRAX	230	304520 WILM INVISTA	230	1	0.39	Raise to 212F	594	594	$ 1
8SUTNORTH500-Wom	2482	32	$ 1	$ 0.02	$ 1,461	$ 0.59	305880 CROOKDSOLTAP	230	304515 WALLACE230TT	230	1	3.57	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 7
8SUTNORTH500-Wom	2483	1	$ 7	$ 7.14	$ 1,468	$ 0.59	304020 BRUN2 230 TT	230	305004 E1-PROSPECT	230	1	19.31	Raise to 212F	594	594	$ 39
8SUTNORTH500-Wom	2517	34	$ 39	$ 1.14	$ 1,507	$ 0.60	304515 WALLACE230TT	230	305031 E4-BEVERAGE	230	1	6.54	Reconductor to 6-1590 ACSR	1195	1195	$ 26
8SUTNORTH500-Wom	2528	11	$ 26	$ 2.38	$ 1,533	$ 0.61	304039 SUTTON230 TT	230	304554 WILM N&O TAP	230	1	5.38	Reconductor to 6-1590 ACSR	1195	1195	$ 22
8SUTNORTH500-Wom	2529	1	$ 22	$ 21.52	$ 1,554	$ 0.61	305995 6SUTNORTH230	230	304516 WILM BASF	230	1	1.22	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 2
8SUTNORTH500-Wom	2529	0	$ 2	#DIV/0!	$ 1,557	$ 0.62	304516 WILM BASF	230	304534 WILM PRAX	230	1	1.99	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 4
8SUTNORTH500-Wom	2554	25	$ 4	$ 0.16	$ 1,561	$ 0.61	304534 WILM PRAX	230	304520 WILM INVISTA	230	1	0.39	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 1
8SUTNORTH500-Wom	2564	10	$ 1	$ 0.08	$ 1,561	$ 0.61	305530 TRNBLSOLTAP	230	304390 CUMBLND230TT	230	1	9.56	Raise to 212F	512	512	$ 19
8SUTNORTH500-Wom	2584	20	$ 19	$ 0.96	$ 1,581	$ 0.61	305995 6SUTNORTH230	230	304515 WALLACE230TT	230	1	27.5	Raise to 212F	594	594	$ 55
8SUTNORTH500-Wom	2589	5	$ 55	$ 11.00	$ 1,636	$ 0.63	304520 WILM INVISTA	230	304039 SUTTON230 TT	230	1	1.79	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 4
8SUTNORTH500-Wom	2593	4	$ 4	$ 0.90	$ 1,639	$ 0.63	305995 6SUTNORTH230	230	304354 ROCKY POINT	230	1	8.2	Reconductor to 6-1590 ACSR	1195	1195	$ 33
8SUTNORTH500-Wom	2706	113	$ 33	$ 0.29	$ 1,672	$ 0.62	304354 ROCKY POINT	230	305069 E9-MEADOW	230	1	34.95	Reconductor to 6-1590 ACSR	1195	1195	$ 140
8SUTNORTH500-Wom	2717	11	$ 140	$ 12.71	$ 1,812	$ 0.67	305470 WILARDSOLTAP	230	305880 CROOKDSOLTAP	230	1	4.39	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 9
8SUTNORTH500-Wom	2729	12	$ 9	$ 0.73	$ 1,821	$ 0.67	304020 BRUN2 230 TT	230	305004 E1-PROSPECT	230	1	19.31	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 39

POI	MW Limit	Increm. MW	Increm Cost ($M)	Increm. Cost ($/W)	Total Cost ($M)	Total Cost ($/W)	Limiting Element	Miles	Upgrade	New Rate A	New Rate B	Increm Cost ($M)
8SUTNORTH500-Wom	2737	8	$ 39	$ 4.83	$ 1,859	$ 0.68	304505 ROSE HILL 230 305032 E4-BLIND BRG 230 1	4.58	Reconductor to 6-1590 ACSR	1195	1195	$ 18
8SUTNORTH500-Wom	2780	43	$ 18	$ 0.43	$ 1,877	$ 0.68	304582 DELCO230 TT 230 304587 DELCO115W TT 115 1	-	Replace with 336 MVA	336	427	$ 4
8SUTNORTH500-Wom	2803	23	$ 4	$ 0.17	$ 1,881	$ 0.67	305995 6SUTNORTH230 230 304515 WALLACE230TT 230 1	27.5	Reconductor to 6-1590 ACSR instead of raise	1195	1195	$ 55
8SUTNORTH500-Wom	2822	19	$ 55	$ 2.89	$ 1,936	$ 0.69	305069 E9-MEADOW 230 304524 JACKSON230TT 230 1	4.78	Reconductor to 6-1590 ACSR	1195	1195	$ 19
8SUTNORTH500-Wom	2824	2	$ 19	$ 9.56	$ 1,956	$ 0.69	304525 JACKSN115ETT 115 305065 E9-GUMBRNCH 115 1	4.69	Reconductor to 3-1590 ACSR	340	340	$ 19

Appendix B
Transmission Upgrade Costs Used in This Study

$M	Description	
$2	per mile to raise clearances	
$4	per mile to reconductor	
$5	per mile for interconnection/green field line	
$10	per mile for 500kV (incl. purchase of ROW)	
$5	per mile for 500kV (ROW already owned)	
$4	to replace 230/115kV transformer	
$7	to install 230/115kV transformer in new position	
$15	to install 500/230kV transformer in new position	
$25	to build Sutton North 230kV	
	Sutton North - Wommack - Wake 500kV	miles
$25	to build Sutton North 230kV	
$35	for Sutton 500kV switchyard	
$35	for Wommack 500kV switchyard	
$690	Sutton-Wommack 500kV line	69
$325	Wommack-Wake 500kV line	65
$1,110		
	Sutton North - Cumberland 500kV	miles
$25	to build Sutton North 230kV	
$35	for Sutton 500kV switchyard	
$600	Sutton-Cumberland 500kV line	60
$660		
	New Bern - Wommack - Wake 500kV	miles
$35	for New Bern 500kV switchyard	
$35	for Wommack 500kV switchyard	
$175	New Bern-Wommack 500kV line	35
$325	Wommack-Wake 500kV line	65
$570		
	Greenville - Wommack - Wake 500kV	miles
$35	for Greenville 500kV switchyard	
$35	for Wommack 500kV switchyard	
$450	Greenville-Wommack 500kV line	45
$325	Wommack-Wake 500kV line	65
$845		

Appendix C
Mileages from Substations to Coastline Used in This Study

POI Station	Miles from Coast
6AURORASST	46
6BRUN1230T	5
6BRUN2230T	5
6CASTLEH230T	9
6CLINTON230T	60
6CUMBLND230T	72
6DELCO230T	30
6FLOSUB230T	64
6FOLKSTN230T	10
6GREENVIL230	85
6GRNTSCK230T	14
6HAVELOK230T	4
6JACKSON230T	20
6KINDUP230TT	30
6KINGSTR230T	45
6LANDSTN	8
6LATTASST	53
6LEESUB230T	70
6MARION230T	46
6MORHDWW230T	4
6MTOLV230T	62
6NEWBERN230T	34
6SUMTER230T	75
6SUTNORTH230	17
6WAKE230TT	90
6WALLACE230T	32
6WHITEVL230T	34
6WOMMACK230T	51
6WSPOON230T	58
8CUMBLND500T	72
8FENTRES	15
8GREENVIL500	85
8NEWBERN500	34
8WAKE500TT	90