



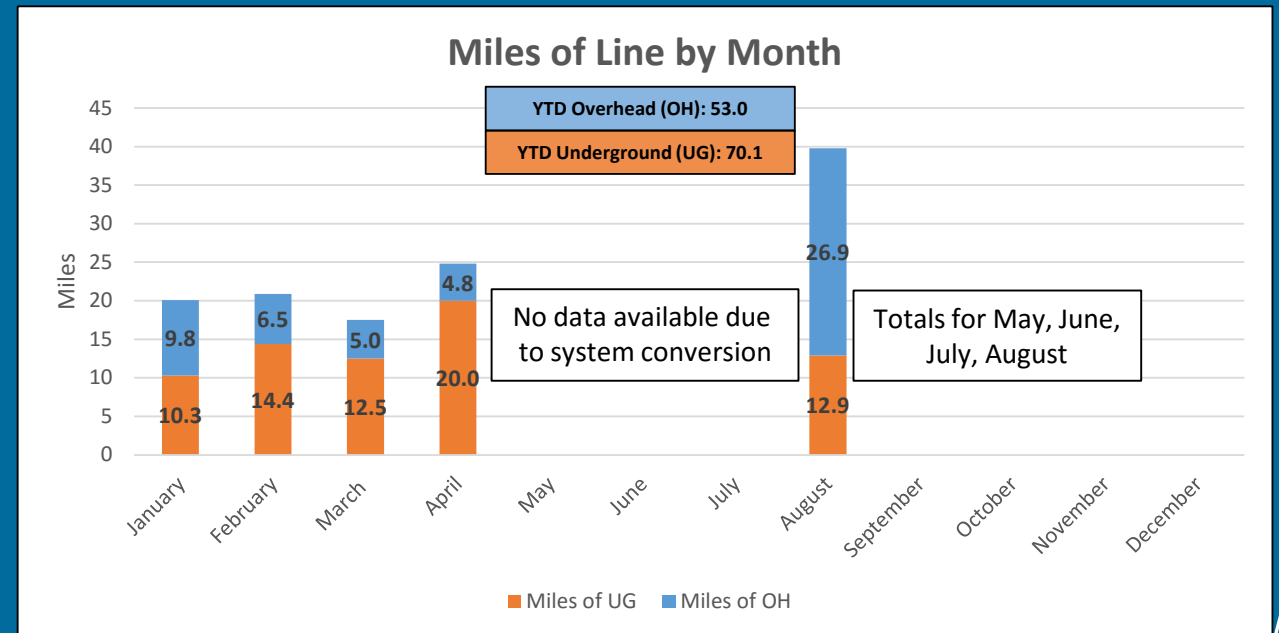
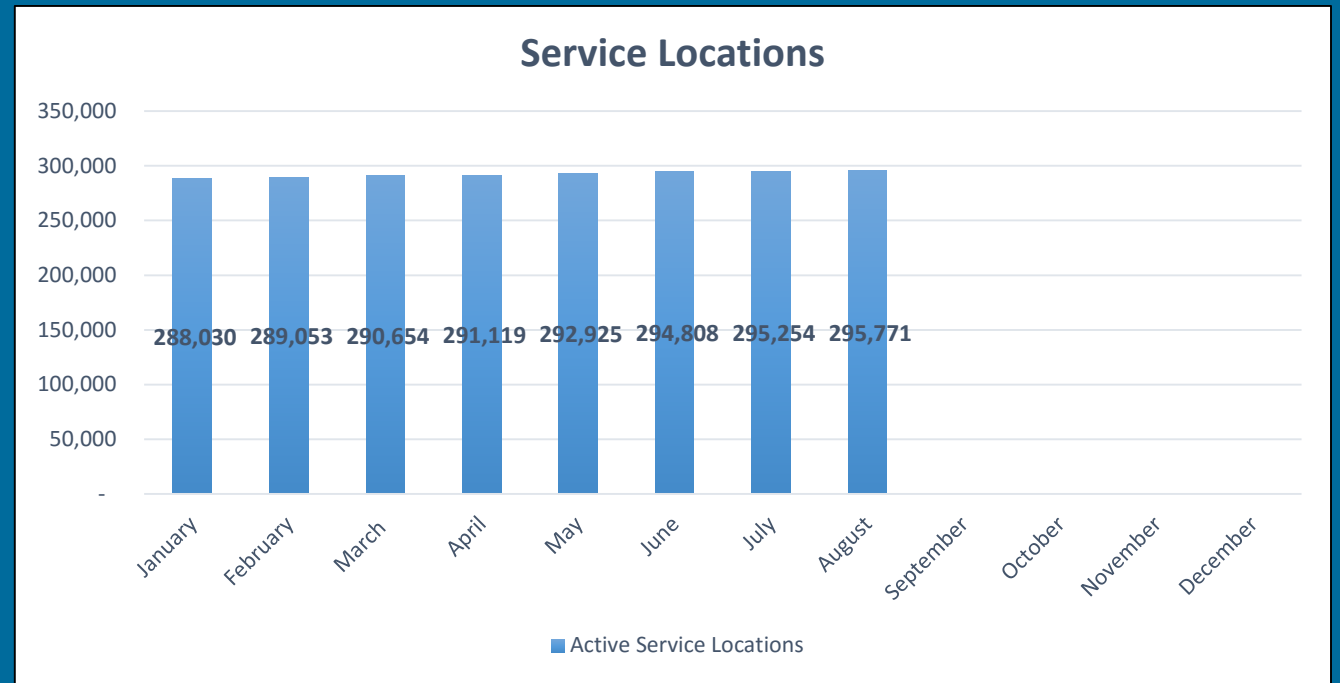
ENGINEERING REPORT

Paul Lochte, VP Engineering (Interim)

September 18, 2017

Engineering

Growth Measures



Engineering Initiatives

- 20 Year Plan – PEC Planning Department in conjunction with Toth Engineering is developing a 20 Year Long Range Plan
- Upgrading Trimble Network Information Systems/Distribution Management Systems (mapping and outage management systems) with database of field collected GPS accurate locations and photos.
- Standards Committee – Members from Engineering, Operations, Finance, Safety and Technical Training met to review material and construction standards.
- 2018 Capital Improvement Plan (CIP) Budget – PEC Planning Department in conjunction with Finance is developing the 2018 CIP Budget
- Rural Utilities Service (RUS) Loan Study – Engineering working with Finance to complete the RUS Loan Project



Engineering Initiatives

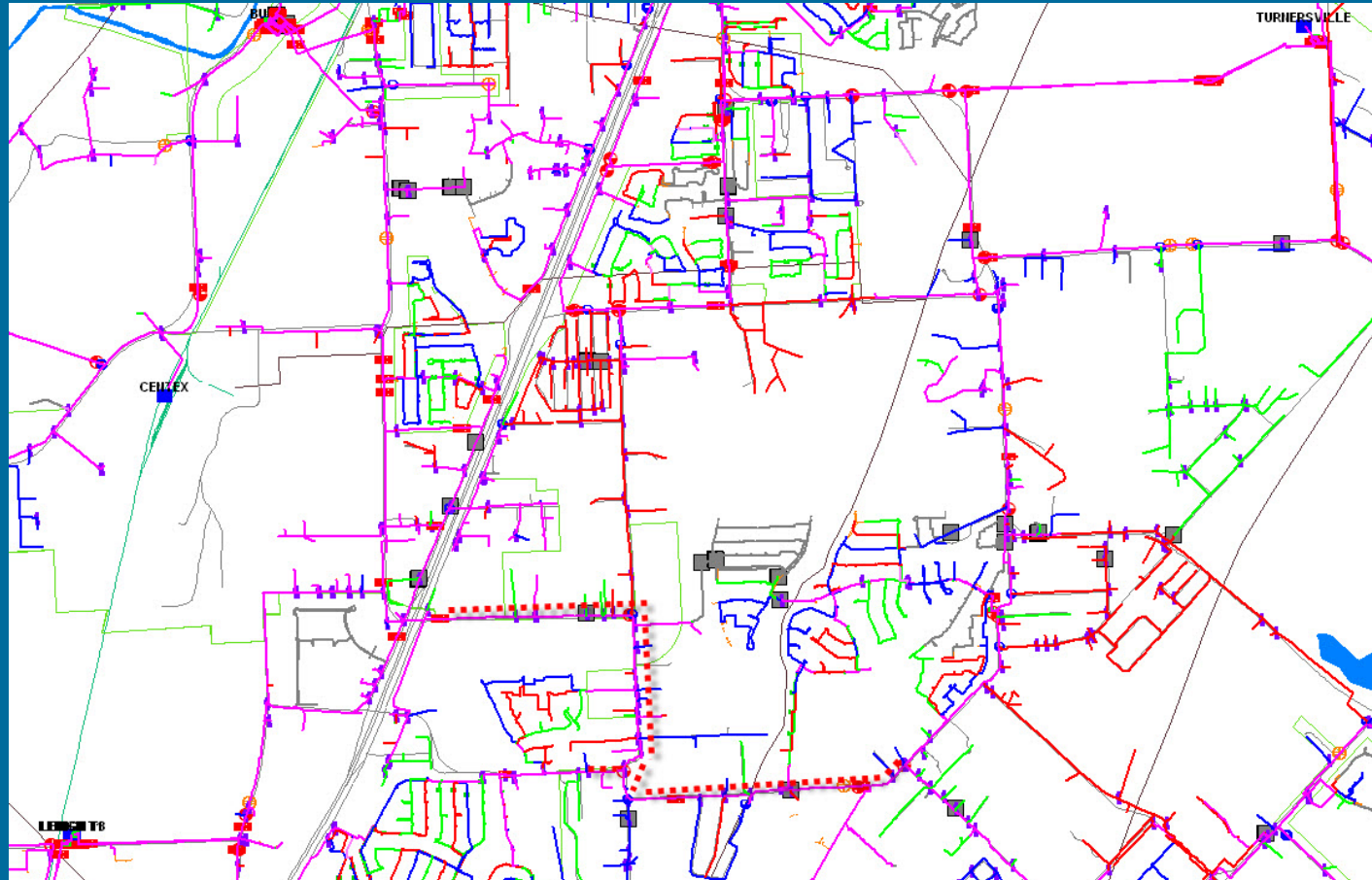
- Cable Seminar (9/13/17) - Techline/Prysmian Cable working with Engineering to conduct a Cable Seminar which will detail underground cable specifications and installation
- Pole Forum (9/26/17) - TEC working with Engineering to conduct a pole forum with different pole manufacturers to demonstrate various pole type options at PEC
- Vegetation Management Request for Proposal (RFP) in progress
- Meter Testing Request for Proposal (RFP) in progress

Engineering Initiatives

- Unmanned Aerial Systems (UAS) Drone Policy has been reviewed and approved
- Automatic Metering Infrastructure (AMI) Request for Proposal (RFP) in progress
- Exploring concept of Regulator Maintenance Shop
- Exploring options for improving Recycling Program

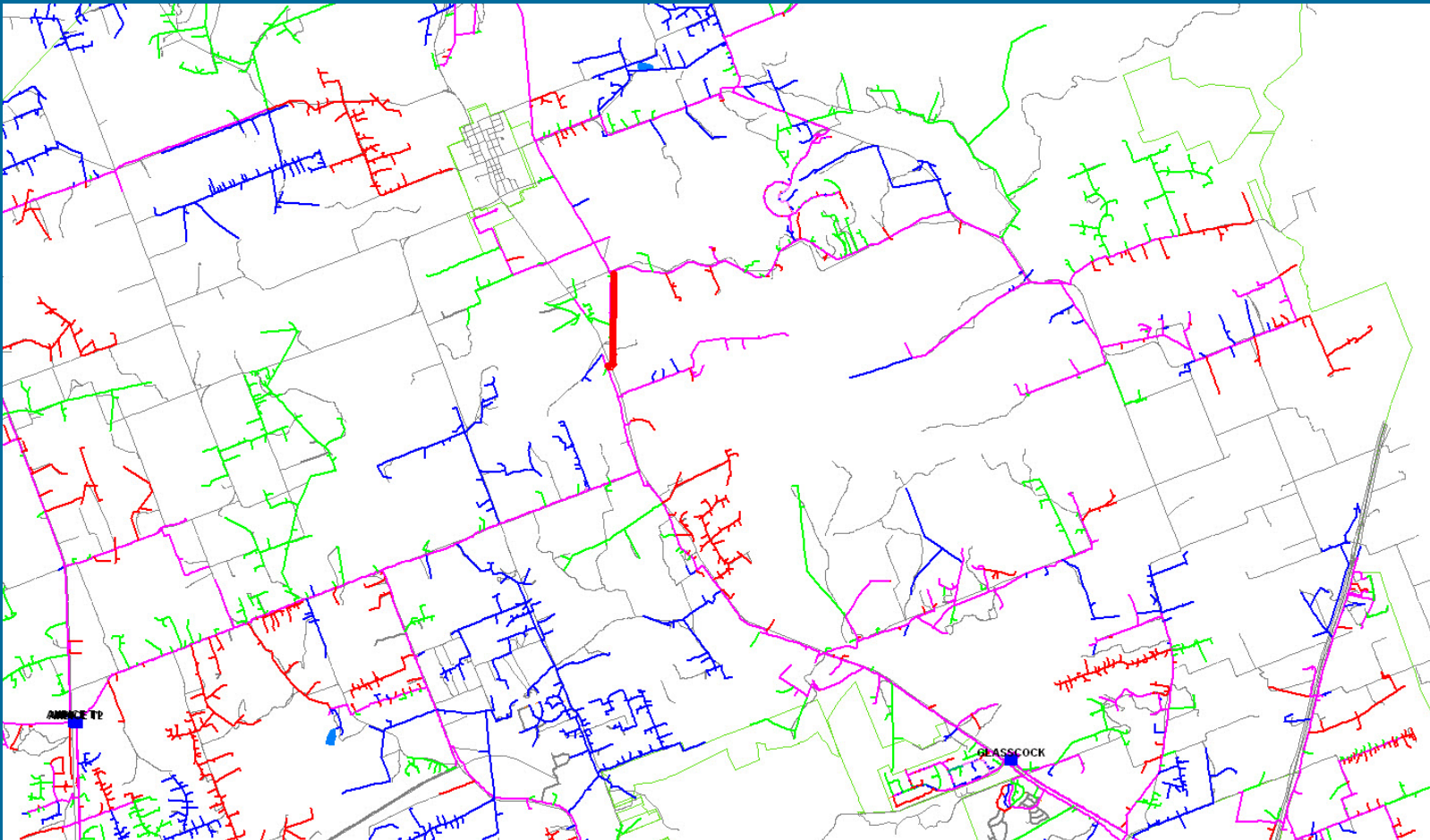
Distribution CIP

TV50 Upgrade to 336 - Engineering design completed for 2 sections and in progress on third section. Currently working with the county on a road widening project involving the third section. Upgrade needed to provide load growth and tie to future substation (Crosswinds).



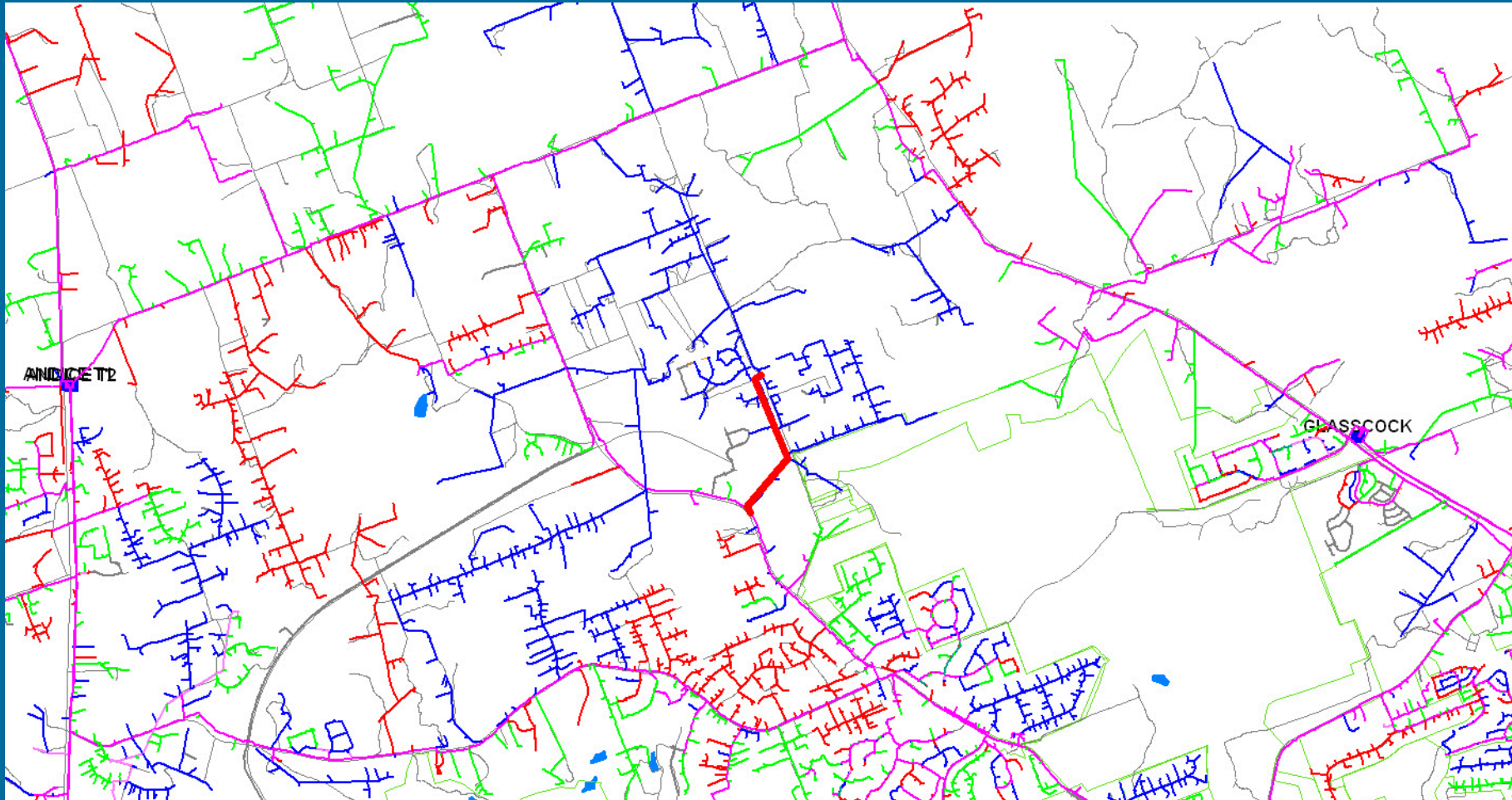
Distribution CIP

- GL40 at CR 223 & Hwy 195 – Developing preliminary design and working to acquire easements. Moving line to roadway for access and reconductoring to 795.



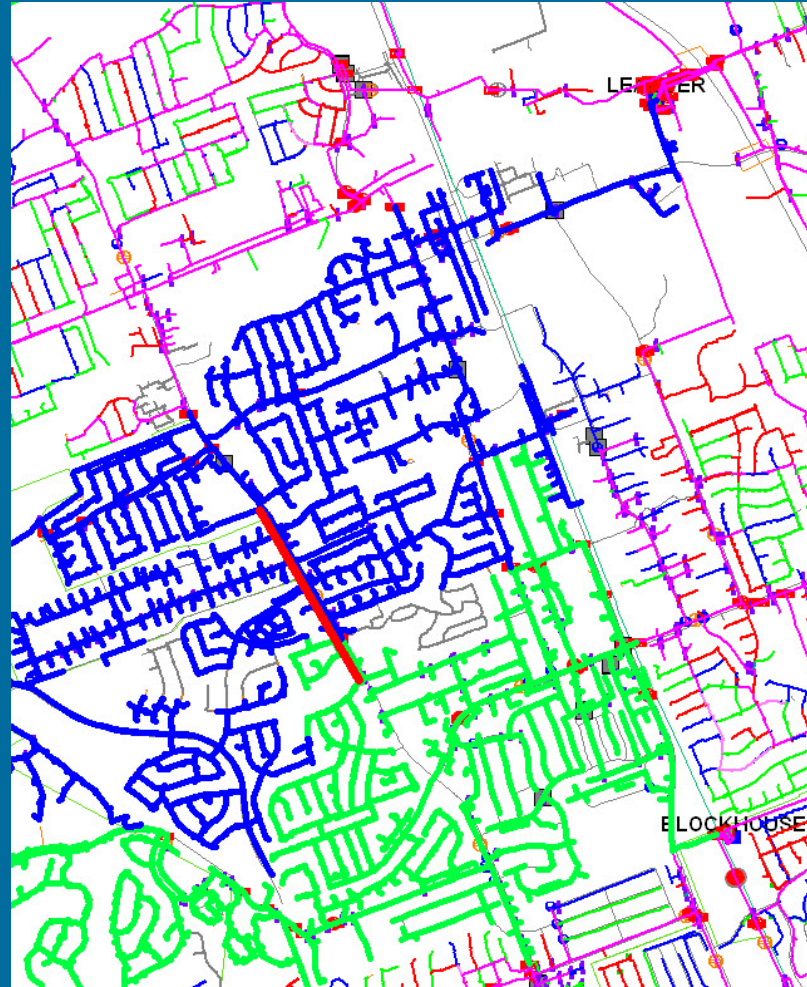
Distribution CIP

- AN120 Windmill Ranch – Upgrade single-phase #4 to three-phase 336 and moving to road for access. Line needed to alleviate high load on single-phase line.



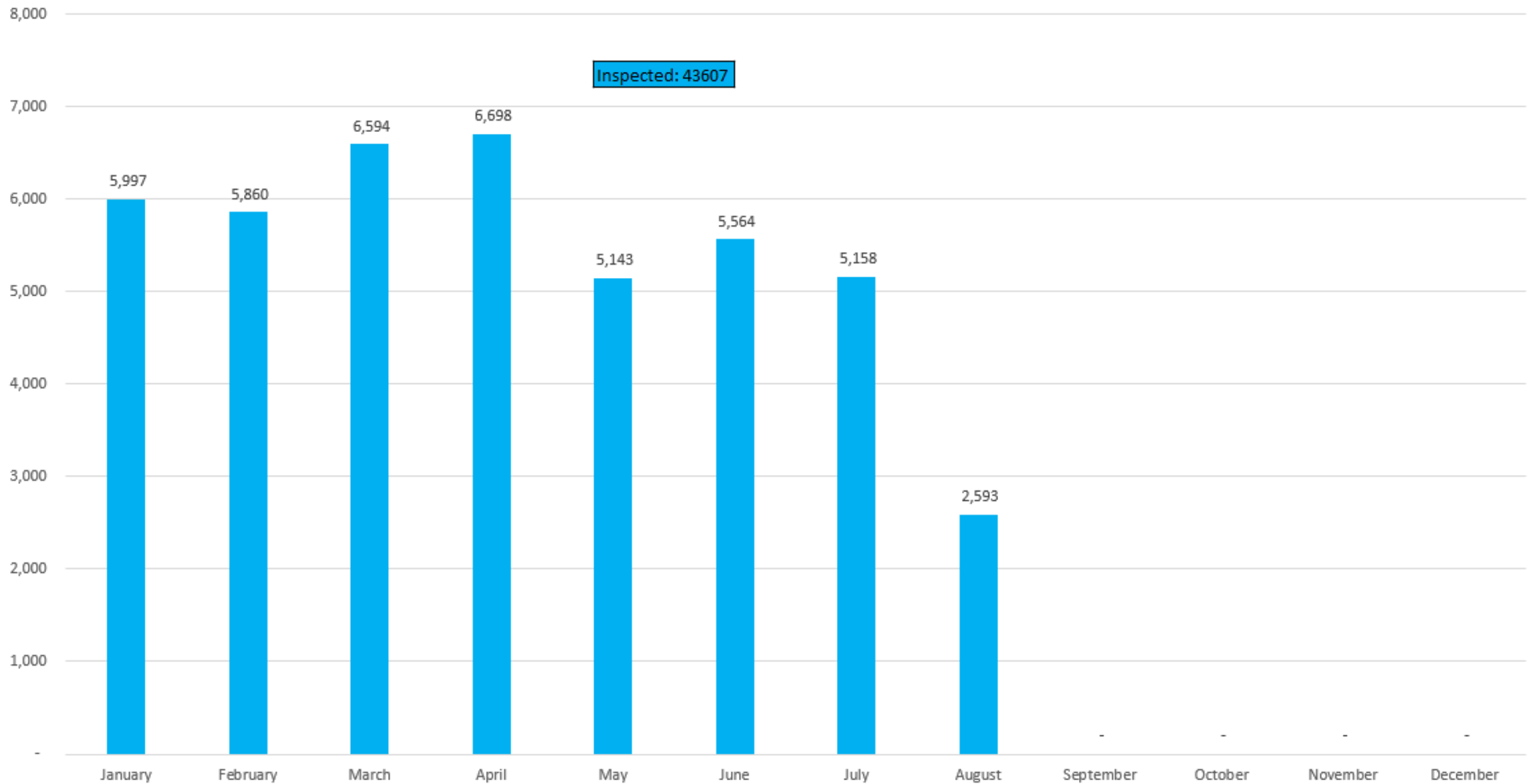
Distribution CIP

- LA30 to BH130 – reconductor 1/0 to 795 on Bagdad Rd. Working with the City of Leander for approval on permitting.



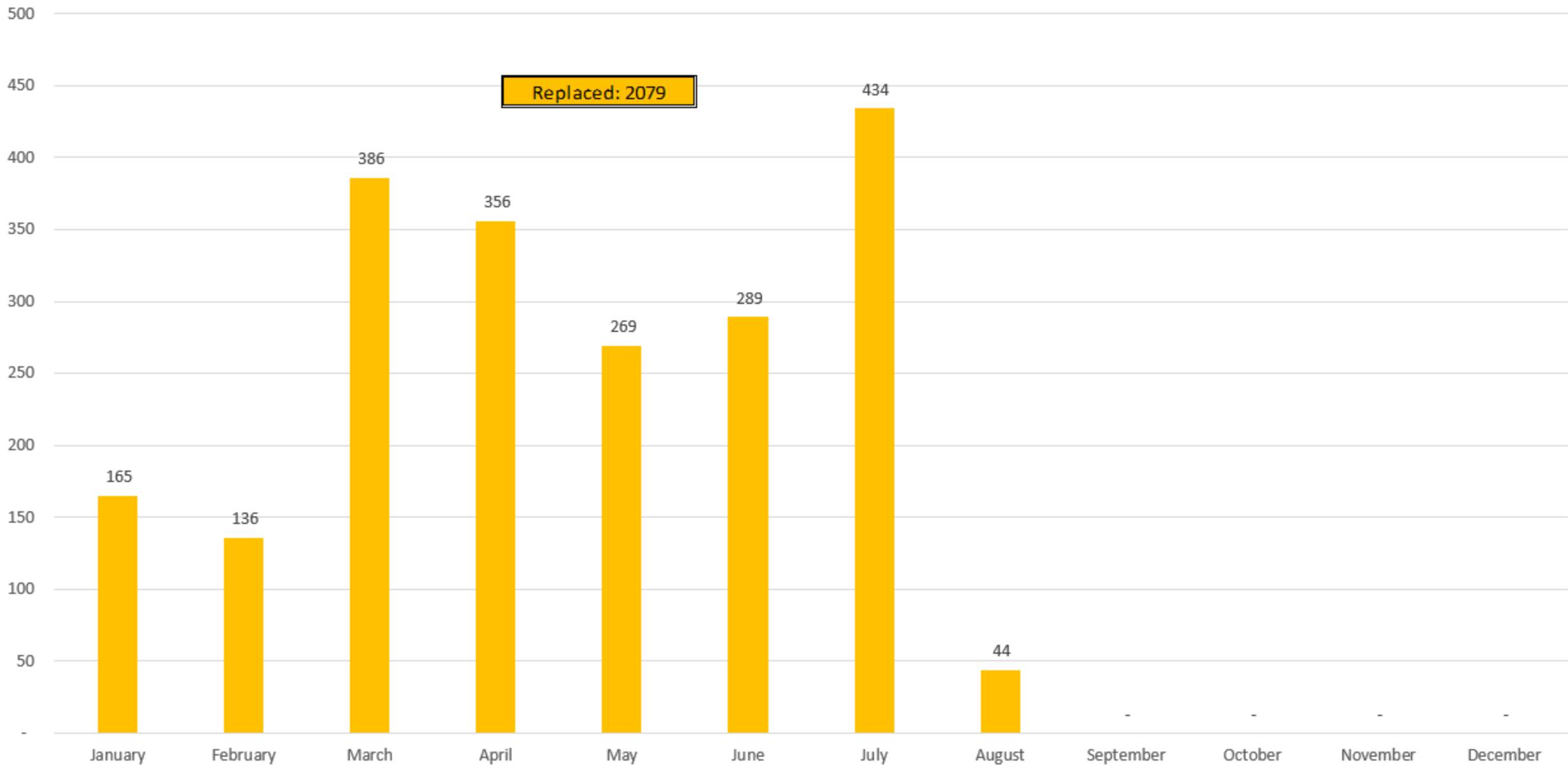
Poles Testing & Treatment Program

Total Inspected per Month



Poles Testing & Treatment Program

Total Replaced per Month



Substation Projects

- **Flatrock T1 Upgrade** – Replace T1 power transformer with spare 22.4MVA unit
 - Construction complete
- **Lakeway T1 Upgrade** – Upgrade T1 power transformer with a new 46.7MVA unit
 - Construction 65%
- **Sherwood Shores T1 & T2 Upgrade** – Upgrade T1 and T2 power transformers with spare 22.4MVA units. LCRA rebuild 138kV bus to a four breaker ring bus
 - Engineering complete
 - Construction begins September 2017
- **Pipeline Substation** - Construct new substation for crude oil pipeline pump station
 - Engineering complete
 - Material and construction bids received
 - Constructing temporary service plan to serve pump station by November 1, 2017 need date



Substation Projects

- **Manchaca T1 & T2 Upgrade** – Upgrade T1 and T2 power transformers with new 46.7MVA units
 - Engineering complete
 - Construction begins September 2017
- **Turnersville T1 Upgrade** – Upgrade T1 power transformer with a new 46.7MVA unit
 - Engineering begins September 2017
- **Seward Junction T1 & T2 Upgrade** – Upgrade T1 and T2 power transformers with new 46.7MVA units
 - Engineering begins October 2017
- **Andice T1 & T2 Upgrade** – Upgrade T1 and T2 power transformers with new 46.7MVA units
 - Engineering begins December 2017

Transmission Projects

- **Certificate of Convenience and Necessity (CCN) T320 Hwy 32 to Wimberley Rebuild and Upgrade Project** – Filing for CCN on the Hwy 32 to Wimberley rebuild and upgrade project. Easement acquisitions, design, and construction will follow upon route selection.
 - CCN Application filed June 2, 2017
 - Hearing scheduled December 18-20, 2017
- **T365 Wirtz to Paleface 138kV Structure Replacements** – Replace approximately seventy 138kV wood H-Frame structures with steel single pole structures. Osmose reject structures.
 - Engineering nearing completion
 - Pole order September 2017
 - Pole delivery January 2018
 - Construction scheduled January – May 2018



Transmission Projects

- **T318 Blanco to Devils Hill Structure Upgrades** – Upgrade approximately thirty 69kV structures with distribution underbuild. Distribution underbuild reconductor project.
 - Engineering begins September 2017
 - Construction scheduled spring/summer 2018

		LOAD STUDY PEC SUBSTATIONS						
			JULY 2017					
SUBSTATION METER POINT	CAPACITY	MONTHLY PEAK (2)				PEAK SINCE LAST TRANSFER		
	MVA	kW	DATE	TIME	AIR TEMP	PEAK kVA	DATE	%FULL LOAD
ANDICE I	22.4F	16,589	07/29/17	16:45	104	22,370	01/07/17	75.57
ANDICE II	22.4F	18,932	07/27/17	19:45	99	21,959	01/07/17	74.19
ANTLER I	46.7F	12,137	07/29/17	17:00	104	15,938	01/07/17	25.87
ANTLER II	46.7F	16,293	07/29/17	17:45	104	20,839	01/07/17	33.83
AVERY I	37.3F	14,527	07/29/17	17:00	104	23,666	08/11/15	48.10
AVERY II	37.3F	22,879	07/29/17	16:45	104	23,134	07/29/17	47.02
AVERY III	46.7F	37,352	07/29/17	17:00	104	38,354	08/12/16	62.26
BALCONES I	37.3F	10,971	07/30/17	16:15	99	12,305	08/12/16	25.01
BALCONES II	37.3F	12,355	07/30/17	16:30	99	12,574	07/30/17	25.56
BALCONES III	46.7F	18,822	07/30/17	18:30	99	19,720	08/12/15	32.01
BALCONES IV	37.3F	24,430	07/29/17	17:00	104	25,522	08/12/16	51.87
BEE CREEK I	22.4F	7,377	07/30/17	16:45	99	12,449	03/03/14	42.06
BEE CREEK II	22.4F	12,576	07/29/17	17:45	104	12,842	07/29/17	43.39
BEE CREEK III	37.3F	27,509	07/29/17	17:45	104	27,790	07/29/17	56.48
BERGHEIM	22.4F	14,269	07/29/17	17:30	104	20,681	01/08/17	69.87
BERTRAM I	22.4F	6,160	07/29/17	18:30	104	9,026	01/07/17	30.49
BERTRAM II	22.4F	10,035	07/29/17	17:30	104	13,571	01/07/17	45.85
BLANCO I	22.4F	8,204	07/30/17	17:15	99	11,589	01/07/17	39.15
BLANCO II	37.3F	10,187	07/29/17	17:15	104	14,980	01/07/17	30.45
BLOCKHOUSE I	37.3F	22,229	07/29/17	17:15	104	29,953	10/12/16	60.88
BLOCKHOUSE II	37.3F	28,920	07/29/17	17:15	104	29,322	07/29/17	59.60
BUCKNER BOYS	22.4F	6,431	07/29/17	17:45	104	7,383	01/07/17	24.94
BUDA I	46.7F	24,917	07/31/17	16:45	97	25,440	07/31/17	41.30
BUDA III	46.7F	13,913	07/30/17	17:15	99	14,470	07/30/17	23.49
BURNET	22.4F	12,996	07/20/17	16:15	100	19,292	01/07/17	65.18
BUTTERCUP I	37.3F	18,054	07/29/17	16:30	104	19,919	08/12/16	40.48
BUTTERCUP II	37.3F	17,485	07/30/17	18:00	99	17,894	08/11/15	36.37
BUTTERCUP III	22.4F	12,110	07/29/17	16:30	104	13,856	08/11/15	46.81
CAMP GARY (LCRA)	10.5F	3,117	07/20/17	16:45	100	4,933	08/07/02	34.74
CANYON IV	46.7F	11,315	07/30/17	17:45	99	12,929	01/07/17	20.99
CEDAR VALLEY I	37.3F	12,694	07/29/17	17:00	104	18,321	03/02/17	37.24
CEDAR VALLEY II	37.3F	24,955	07/29/17	16:30	104	25,421	07/29/17	51.67
CENTEX I	22.4F	10,449	07/10/17	7:45	70	16,309	02/28/08	55.10
CENTEX II	22.4F	11,347	07/05/17	10:15	75	14,529	11/10/15	49.08

LOAD STUDY PEC SUBSTATIONS								
JULY 2017								
SUBSTATION	CAPACITY	MONTHLY PEAK (2)				PEAK SINCE LAST TRANSFER		
METER POINT	MVA	kW	DATE	TIME	AIR	PEAK	DATE	%FULL
					TEMP	kVA		LOAD
COPPERAS COVE I	22.4F	9,637	07/29/17	17:45	104	15,093	01/07/17	50.99
COPPERAS COVE II (3)	22.4F	9,200	07/29/17	16:00	104	14,322	01/07/17	48.39
CRANES MILL I	33.3F	15,974	07/29/17	17:45	104	22,294	01/07/17	50.21
CRANES MILL II	37.3F	11,562	07/29/17	17:45	104	15,784	01/07/17	32.08
DEVIL'S HILL	22.4F	7,927	07/29/17	17:30	104	15,198	08/12/16	51.35
DEVIL'S HILL II	22.4F	8,123	07/30/17	16:15	99	11,951	01/07/17	40.37
DOBYVILLE	22.4F	2,123	07/29/17	17:15	104	3,557	11/17/14	12.02
DRIPPING SPRINGS I	37.3F	20,954	07/29/17	17:30	104	28,097	01/07/17	57.11
DRIPPING SPRINGS II	37.3F	19,455	07/29/17	18:00	104	25,429	01/07/17	51.69
E. BABE SMITH	12.5	4,727	07/29/17	17:30	104	6,951	01/07/17	41.13
ESCARPMENT I	37.3F	17,812	07/29/17	17:15	104	17,923	07/29/17	36.43
ESCARPMENT II	37.3F	18,210	07/29/17	18:00	104	18,532	07/29/17	37.67
FAIRLAND I	22.4F	9,113	07/27/17	13:30	92	10,311	04/11/12	34.83
FAIRLAND II	37.3F	12,586	07/28/17	15:00	101	14,990	01/07/17	30.47
FAIROAKS I	22.4F	13,517	07/30/17	17:00	99	19,241	01/07/17	65.00
FAIROAKS II	37.3F	13,883	07/30/17	17:30	99	16,919	01/07/14	34.39
FISCHER I	22.4F	14,184	07/29/17	18:00	104	18,210	01/07/17	61.52
FISCHER II	37.3F	17,135	07/29/17	18:15	104	21,785	01/07/17	44.28
FLATROCK (6)	10.5F	0				6,571	01/25/14	46.27
FRIENDSHIP I	22.4F	9,590	07/29/17	18:15	104	11,254	07/26/16	38.02
FRIENDSHIP II	22.4F	14,767	07/29/17	17:00	104	16,971	10/05/16	57.33
FRIESS (AEP-TNC)	2.5	1,552	07/29/17	18:30	104	2,215	12/18/16	58.28
GABRIEL T4	22.4F	12,988	07/28/17	18:00	101	17,537	01/07/17	59.25
GLASSCOCK I	33.6F	14,223	07/26/17	16:45	100	16,543	01/06/17	37.26
GLASSCOCK II	33.6F	13,119	07/29/17	17:00	104	13,588	09/13/16	30.60
GOFORTH I	46.7F	26,390	07/30/17	17:00	99	33,567	10/05/16	54.49
GOFORTH II	37.3F	17,211	07/30/17	17:15	99	17,614	07/30/17	35.80
GRANITE MOUNTAIN I	22.4F	11,013	07/21/17	17:45	99	12,460	12/19/16	42.10
GRANITE MOUNTAIN II	22.4F	8,478	07/28/17	14:30	101	13,054	08/11/15	44.10
GRAPHITE MINE	12.5	6,822	07/29/17	17:45	104	9,023	01/07/17	53.39
HENLY	37.3F	7,493	07/29/17	17:30	104	11,132	01/07/17	22.63
HIGHWAY 32	22.4F	10,012	07/29/17	18:15	104	16,165	01/07/14	54.61
HORSESHOE BAY I	22.4F	9,336	07/29/17	21:30	104	14,997	01/07/17	50.67
HORSESHOE BAY II	37.3F	12,046	07/29/17	18:00	104	15,966	01/07/17	32.45
HUNTER	22.4F	14,809	07/29/17	17:15	104	21,627	01/07/14	73.07
JOHNSON CITY I	22.4F	8,408	07/29/17	17:30	104	11,900	01/07/17	40.20
JOHNSON CITY II	22.4F	6,248	07/29/17	17:00	104	8,874	01/07/17	29.98
JUNCTION NEW	10.5F	6,637	07/29/17	18:00	104	10,114	01/07/17	71.23
KENT STREET T1	37.3F	6,940	07/30/17	16:45	99	15,480	08/07/14	31.46
KENT STREET T2	46.7F	15,318	07/29/17	17:15	104	15,521	07/29/17	25.20
KYLE	22.4F	9,301	07/30/17	16:30	99	11,258	05/21/17	38.03

		LOAD STUDY PEC SUBSTATIONS						
			JULY 2017					
SUBSTATION	CAPACITY	MONTHLY PEAK (2)				PEAK SINCE LAST TRANSFER		
METER POINT	MVA	kW	DATE	TIME	AIR	PEAK	DATE	%FULL
					TEMP	kVA		LOAD
LAGO VISTA I	37.3F	21,438	07/29/17	17:45	104	30,964	03/06/15	62.94
LAGO VISTA II	37.3F	12,745	07/29/17	18:00	104	19,475	01/09/10	39.58
LAKEWAY	22.4F	9,974	07/29/17	17:15	104	21,441	01/09/10	72.44
LEANDER II	46.7F	16,147	07/29/17	17:30	104	16,349	08/12/16	26.54
LEANDER III	46.7F	24,210	07/29/17	17:30	104	33,411	08/12/15	54.24
LEANDER IV	37.3F	32,590	07/29/17	17:00	104	33,534	07/29/17	68.16
LEHIGH	37.3F	21,323	07/30/17	17:30	99	24,007	10/17/16	48.79
LEHIGH III	46.7F	15,724	07/20/17	16:00	100	22,224	06/23/17	36.08
MANCHACA I	22.4F	14,414	07/29/17	17:15	104	14,804	07/29/17	50.01
MANCHACA II	22.4F	13,332	07/29/17	17:00	104	13,366	07/29/17	45.16
NAMELESS I	22.4F	12,760	07/29/17	17:15	104	18,648	06/18/16	63.00
NAMELESS II	22.4F	11,557	07/29/17	17:30	104	11,582	07/29/17	39.13
NEW BARKSDALE	12.5	1,442	07/03/17	16:45	96	3,152	06/23/17	18.65
PALEFACE I	37.3F	22,326	07/29/17	17:45	104	26,913	01/07/17	54.70
PALEFACE II	22.4F	9,326	07/29/17	18:00	104	12,198	01/07/17	41.21
PHILLIPS PIPE LINE (LCRA)	10.5F	539	07/30/17	11:15	93	910	03/09/11	6.41
PURGATORY I	37.3F	3,439	07/29/17	17:00	104	4,961	01/07/17	10.08
RIVER OAKS	37.3F	17,119	07/29/17	17:45	104	23,886	01/07/14	80.70
ROCKSPRINGS	14.0	4,005	07/29/17	17:15	104	5,666	12/18/16	29.98
ROHR	22.4F	5,939	07/19/17	14:15	98	9,541	09/25/12	32.23
RUTHERFORD I	37.3F	21,665	07/29/17	18:00	104	21,993	07/29/17	44.70
RUTHERFORD II	46.7F	23,947	07/29/17	17:15	104	24,109	07/29/17	39.14
SATTLER	22.4F	17,316	07/29/17	17:30	104	22,688	01/07/17	76.65
SEGOVIA	10.5F	3,814	07/29/17	17:15	104	6,220	06/23/17	43.80
SEWARD JUNCTION I	22.4F	15,614	07/28/17	17:45	101	18,443	02/02/11	62.31
SEWARD JUNCTION II	22.4F	19,596	07/29/17	17:45	104	20,360	01/07/17	68.78
SHERWOOD SHORES I	10.5F	5,478	07/29/17	18:30	104	7,003	01/07/17	49.31
SHERWOOD SHORES II	10.5F	4,338	07/22/17	18:00	100	5,318	01/07/17	37.45
SPICEWOOD I	37.3F	8,238	07/29/17	16:30	104	11,926	03/03/14	24.24
SPICEWOOD II	37.3F	9,870	07/30/17	15:45	99	13,351	01/07/17	27.14
STARCKE	37.3F	10,818	07/28/17	16:45	101	12,566	08/12/16	25.54
TURNERSVILLE I	22.4F	17,233	07/30/17	16:45	99	17,404	07/30/17	58.80
TURNERSVILLE II	37.3F	18,847	07/30/17	17:00	99	19,163	07/30/17	38.95
WHITESTONE I	37.3F	24,921	07/03/17	18:30	96	30,665	06/23/17	62.33
WHITESTONE II	37.3F	23,837	07/29/17	17:15	104	26,341	08/12/16	53.54
WIMBERLEY I	37.3F	9,276	07/29/17	16:45	104	12,804	01/08/17	26.02
WIMBERLEY II	37.3F	15,659	07/29/17	17:45	104	25,968	01/08/17	52.78
WIRTZ V	22.4F	7,833	07/29/17	17:45	104	9,871	01/07/17	33.35
WIRTZ VI	22.4F	11,373	07/29/17	17:30	104	12,798	01/07/17	43.24

Substation Maintenance

June-August 2017

- Cranes Mill - Replaced 2 interrupters on circuit switcher CS-8585 for T1 due to high resistance
- Installed Mobile #2 at Starcke substation for LCRA upgrade project May 24 - June 20th
- Installed Mobile #1 at Lakeway substation for PEC upgrade project (May 22 – Oct 17th)
- Switched out Marshall Ford – Paleface T-323 line to give contractors at Lakeway clearance to work under line
- Completed commissioning and energized Flatrock substation after a complete upgrade of all equipment. Coordinated with district to switch load back to Flatrock. (Oct 24, 2016 to Aug 18, 2017)
- Buda - Completed commissioning and energized new T3 (June 27th)
- Junction - Replaced the 24 volt DC battery bank at Junction substation (June 8th)
- Rocksprings – Performed internal inspection of T1 substation transformer. Corrected loose connections on tap board causing overheating and gassing issues



Substation Maintenance

June-August 2017

- Sattler – Installed Mobile #2 for PEC project to upgrade 2 line panels, transformer panel, Bus & Breaker Failure panels, and replace the 138KV PT's. Also performed transformer and circuit switcher maintenance (June 22nd – Aug 3rd)
- Friendship – Transferred all load off both power banks to adjacent stations to allow LCRA access to the 138KV operating bus to add expansion joints (June 26th – 27th)
- Coppers Cove – Switched T1 out of service to replace all three 25KV arresters (June 29th)
- Segovia – Replaced the 48 volt DC battery bank at Segovia substation (June 8th)
- Switched out the 138KV Henly – Dripping Springs T-450 line to allow contractor to re-locate under built distribution line (July 12 – July 13th)
- Buda – Repaired SF6 gas leak on CS 5485. Transferred T3 load to T1 (July 17th)
- Devil's Hill – Repaired SF6 gas leak on CB-22920; Replaced SF6 fill valve (July 31st)



Substation Maintenance

June-August 2017

- E. Babe Smith – Bypassed station regulators to allow installation and checkout of SCADA controlled Cooper control for all three regulators. This will allow SCADA control of the substation regulators for 4CP. (Aug 1st)
- Graphite Mine - Bypassed station regulators to allow installation and checkout of SCADA controlled Cooper control for all three regulators. This will allow SCADA control of the substation regulators for 4CP. (Aug 8th)
- Gabriel - Installed Mobile #2 for transformer and circuit switcher maintenance and relay testing (Aug 9 – Aug 17th)
- Junction – Replaced regulators for routine maintenance (Aug 29th)
- Segovia - Replaced regulators for routine maintenance (Aug 30th)
- 25KV breaker maintenance – Performed high voltage compartment inspection and operator maintenance on 5 substation breakers. Replaced tank oil in 3 breakers
- Relay Calibration Check – Performed relay calibration checks on 16 relays



Substation Maintenance

June-August 2017

- Substation Equipment Cycling – Completed equipment cycling of all equipment inside 12 substations. Lago Vista, Leander, Lehigh, Manchaca, River Oaks, Mt. Top, Nameless, Barksdale, Junction, Phillips JC, Purgatory, and Spicewood
- Hot Spot Repair – Repaired 29 hot spots at various substations as identified by infrared thermography surveys





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