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Managing Natural Disasters: Flood Mitigation and Earthquake Response

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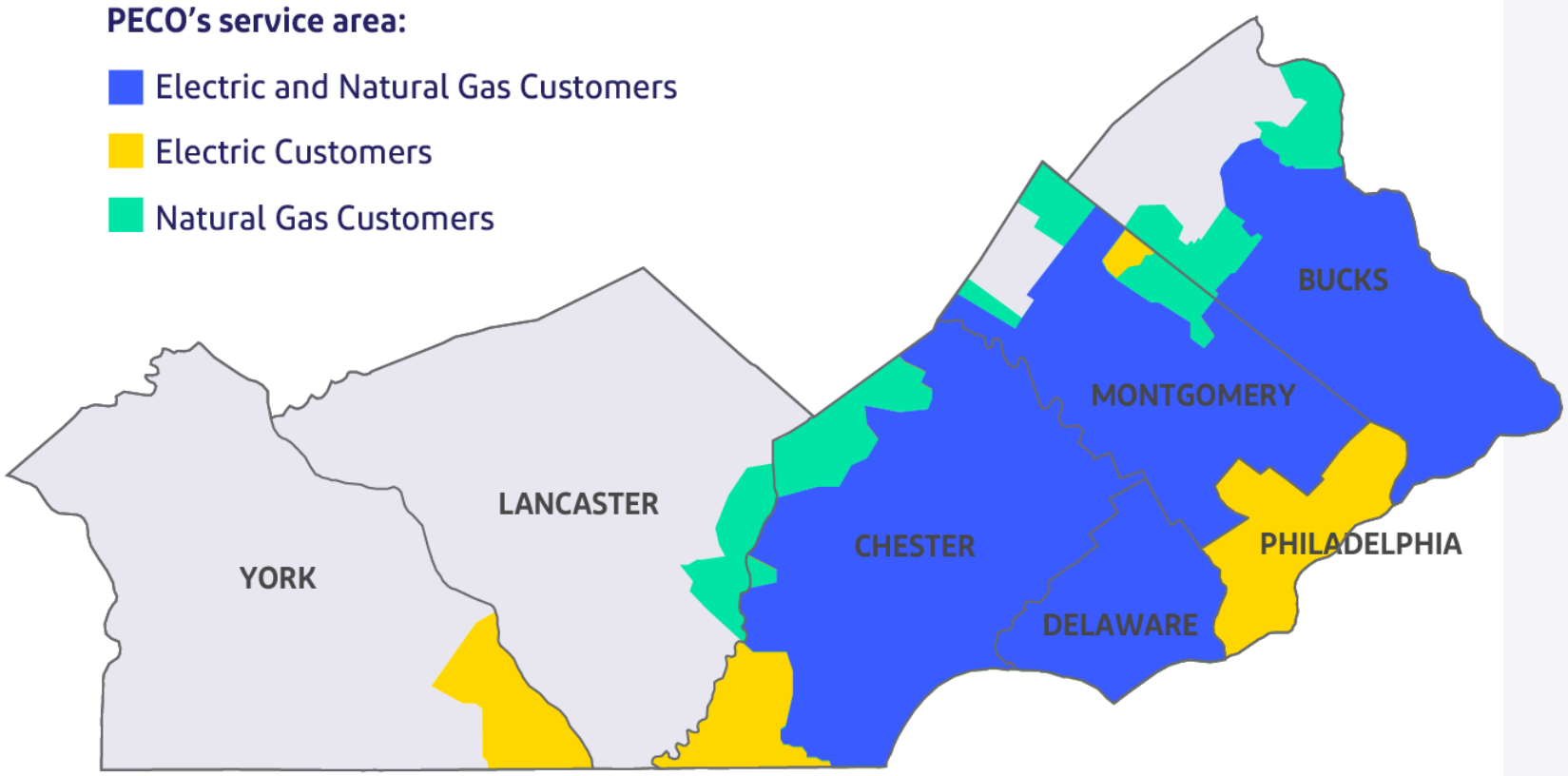
Who We Are



22,659
distribution miles

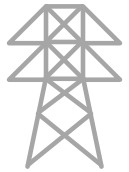
1.7 million
electric customers

553,000
natural gas customers

10%
commercial/industrial

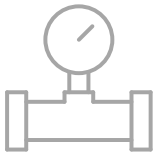
90%
residential

At a Glance



1,050
Transmission Line Miles

22,659
Distribution Miles



13,805
Miles Gas Mains and Services

8,984 MW
All-Time Peak Load

3,000
Employees

$597 million
Diverse Spend in 2023

22,000 hours
of Volunteer Service Logged by PECO Employees in 2023

$8.7 million
Invested in Regional Nonprofit Partners in 2023

Flood Risk Background (From EU)

Problem Statement

Following a ComEd Substation event in the early 2010's, it was identified that the Exelon utilities did not have a consistent way of managing substation risk

- Note: Each OpCo did have risk management protocols, but it was not possible to accurately compare the number of “high risk” substations between the OpCos

Output of Efforts

EU coordinated the development of common substation flooding risk requirements (2015)

- Representatives from T&S Engineering participated from BGE, ComEd and PECO to agree on standards of excellence for all Exelon utilities, including any future utilities

Key Highlights of EU procedure

- Procedure AM-EU-9121 “EU Substation Flooding Risk Requirements” covers:
  - Standardized criteria for risk classification
  - Approved methods for changing risk classification
  - Risk acceptance protocols
  - Response plan requirements
  - Record keeping requirements
  - Reporting Requirements

Flood Risk Background (Continued)

Key Highlights Continued

- Risk criteria is based on flood potential (floodway vs 100 yr flood plain vs 500 yr flood plain) vs criticality of the substation (Security Tier 1-4)
- Engineering is responsible for determining the most cost effective way to reduce flood potential at a specific site to manage the risk ranking of that substation
  - Ex: Raise equipment, build walls, relocate, etc.
- Operating companies may elect to accept the risk of any substation
  - High-risk substations shall require VP level sign-off with written justification
  - Re-reviews with VPs shall be conducted on an annual basis
- Engineering shall manage the inventory of flood risk rankings
  - Flood potential shall be refreshed on a 6 yr basis
- All OpCos shall have general response processes to address substations within the flood plains including processes to:
  - Forecast flood conditions
  - Monitor flood conditions using the NOAA website
  - Patrol substations during flood likely conditions
  - Shed load at impacted substations, if necessary

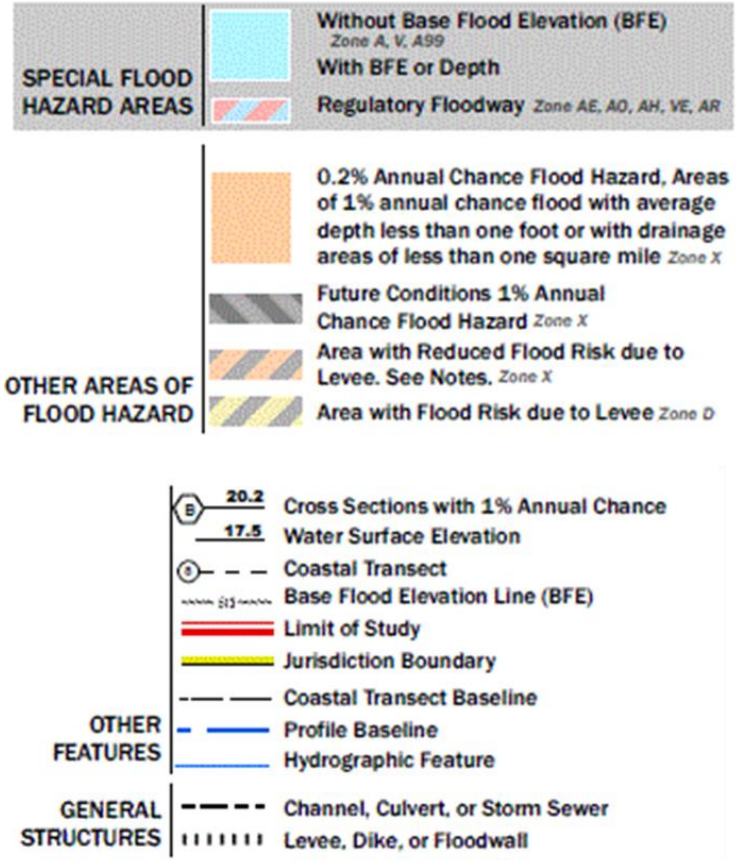
PECO Substation Floodplain Analysis: Identifying Risk

PECO Substations Within Floodplains

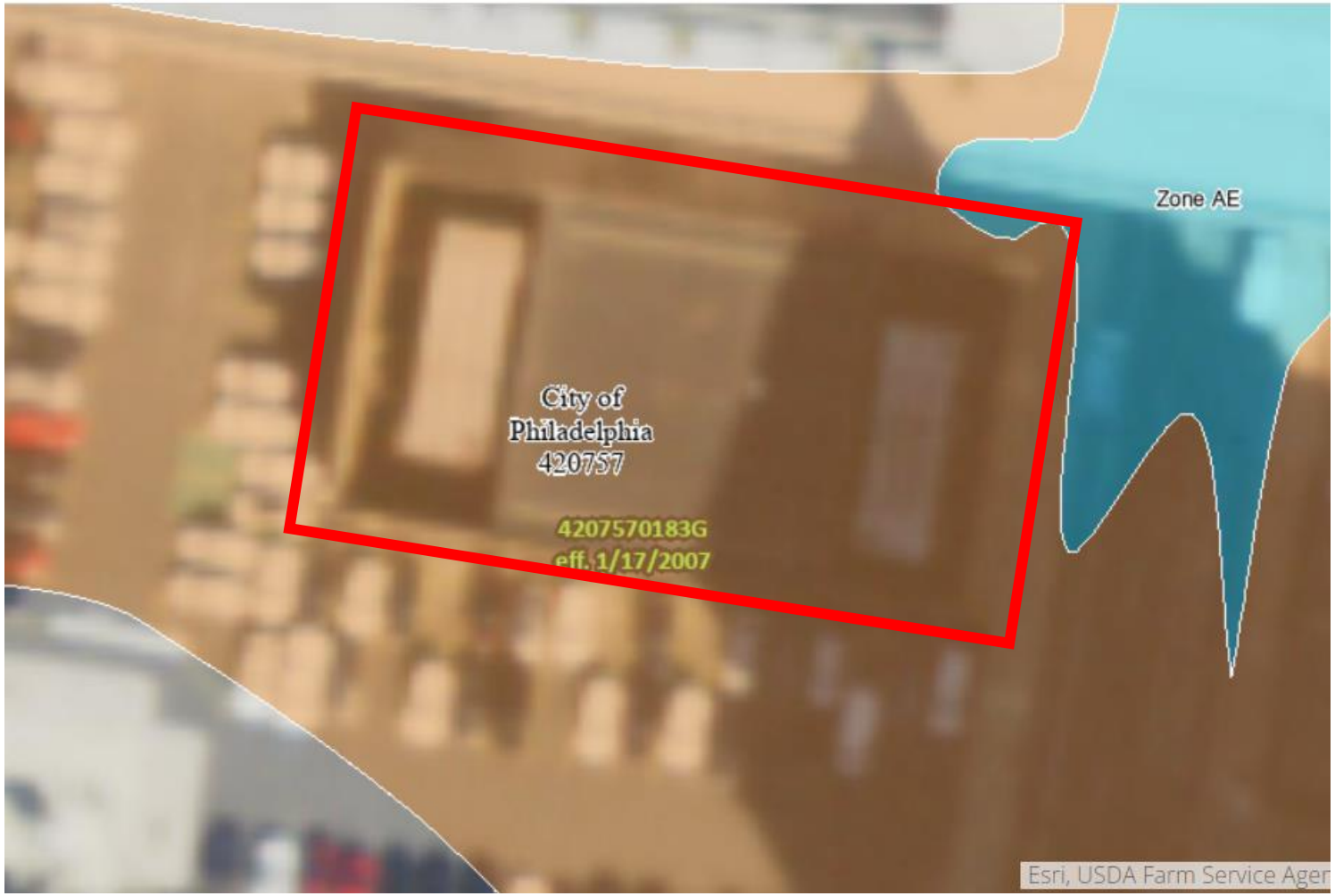
- T&S Engineering has analyzed FEMA's latest Flood Insurance Rate Maps (FIRM's) to identify all substations located within a floodplain
- Floodplain Definitions (From FEMA):
  - **Floodway :** the channel of a river or other watercourse plus any adjacent land areas that must be kept free of encroachment in order to discharge the base flood without substantial increases in flood heights
  - **100-Year Floodplain** : An area inundated by a 1% annual chance of flooding
  - **500-Year Floodplain** : An area inundated by a 0.2% annual chance of flooding

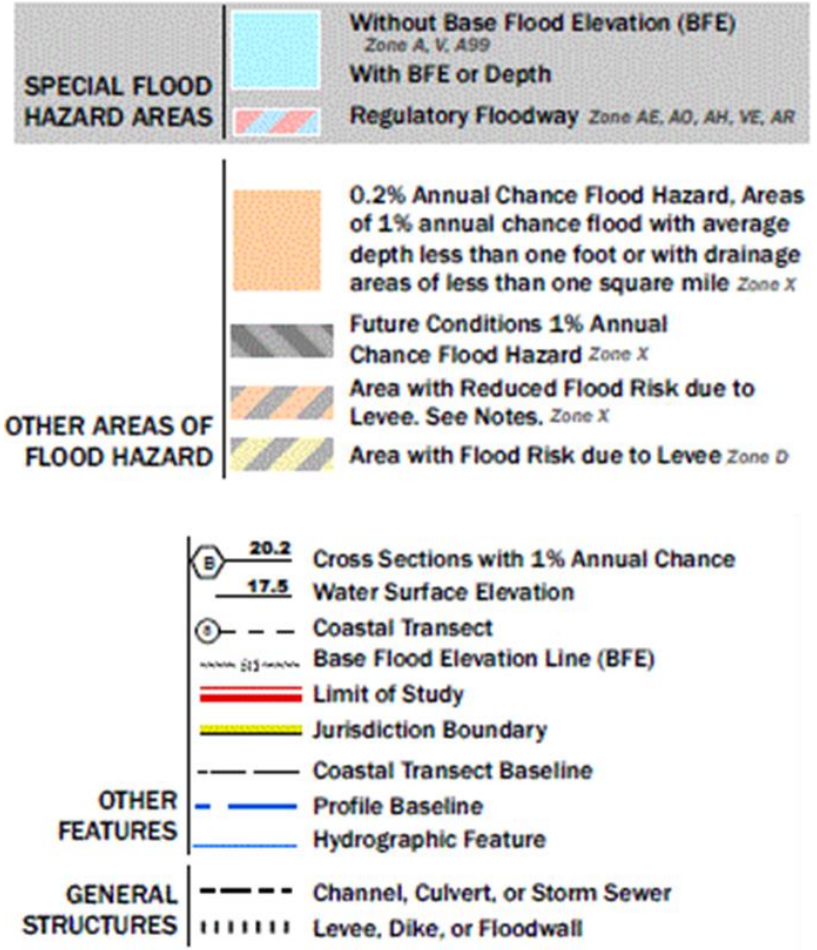
Substation Flooding Risk Assessment Matrix				
Possibility of Flooding	Criticality of Asset			
	Tier 4	Tier 3	Tier 2	Tier 1
Within Floodway	Medium	High	High	High
Likely (Within 100 yr)	Low	Medium	High	High
Possible (Within 500 yr)	Low	Low	Medium	Medium
Unlikely (No Floodplain)	Low	Low	Low	Low

Substation #1- FEMA FIRM



Substation #2 (Enclosed Within Building Walls)





PECO Substation Flooding Risk Procedure

EP – PE – 1068 Rev. 3 – PECO Administrative Procedure – Substation Floodplain Analysis

- PECO T&S Engineering revises the existing procedure to update list of substation per latest analysis
- **Procedure Critical Steps**
  - Weather research by Emergency Response Managers and Shift Manager to notify Technical Lead
  - Technical Lead to review National Weather Service web page for potential flooding areas within PECO substation footprint
  - Technical Lead to review new Substations Within Floodplains spreadsheet which includes risk scores from the new EU Substation Flooding Risk Assessment Matrix and identify which substations could be affected by potential flood conditions

PECO Options For Assessing Substation Flood Risk

DECISION REQUIRED: Per AM-EU-9121 – EU Substation Flooding Risk Requirements, a decision must be made at HIGH RISK substations to accept risk or implement permanent solutions

1. Accept Risk
   - Understand the risks associated with flooding and accept the risk at all substations
     - Weather research by ERM and Shift Manager to notify Technical Lead
     - Technical Lead to review National Weather Service web page for potential flooding areas within PECO substation footprint
     - **Per EP-PE-1068: Technical Lead to review new Substations Within Floodplains spreadsheet which includes risk scores from the new EU Substation Flooding Risk Assessment Matrix and identify which substations could be effected by potential flood conditions**

OR

2. Implement Permanent Flood Prevention Systems
   - Considering cost and operational impact: engineer and implement permanent flood mitigation solutions to prevent flood conditions from damaging any substation equipment
   - Examples
     - Build permanent concrete walls and flood gates around substations/equipment
     - Raise all high risk substation equipment on concrete pads or steel structures
     - Relocate substations out of the flood zone entirely

Substation #3 - Transformer

Floodplain	Risk Score	100-Year Floodplain Elevation (1988)	Foundation Top of Concrete (TOC) Elevation
500 YR	High	16'	*Transformer : 12.9’ (14’)

Engineering Recommendation:

Modify and raise control cabinets 9 [Age 14 years, Condition 0.8]

Cost:

$250K (O&M), currently securing funding within the next five years

*Site elevation for Substation #3 was converted from NAV29 Datum, unaltered elevation in parentheses

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Considerations Post Hurricane Ida

Substation #4- Hurricane Ida Aftermath

Substation #4- 33kV Hurricane Ida Aftermath

Substation #4- 230 kV Yard Hurricane Ida Aftermath

Substation #5- Hurricane Ida Aftermath

Substation #5- Hurricane Ida Aftermath

Flood Prevention: Design Standard Moving Forward

- Current National Design Practice: ASCE 24-14 (2015)
  - “Flood Resistant Design & Construction”
- Future Projects at PECO
  - There is an ever-increasing probability of severe storm conditions which are now categorized as a 100-Year flood event, but in reality are closer to a 50-Year storm event moving forward
  - AM-EU-9121- Procedure requires design to follow latest version of ASCE 24
  - Per ASCE 24-14: Electrical substation minimum design elevation for flood hazard areas shall be at the 100-year elevation plus 2 ft or the 500-year elevation whichever one is higher
  - Recent PECO T&S Greenfield projects have successfully utilized this new practice
- Potential Updates Being Discussed Internally For Current Procedure
  - Adding additional factors for risk classification (previous flood history, nearest waterways)
  - Extending analysis to all risk levels

Substation #6- Hurricane Ida Aftermath

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Earthquake Response

Earthquake Response

- In 2024 PECO experienced a mild earthquake
- Infrequent occurrence in our area
- Previous event initiated development of an Emergency Preparedness (EP) call script
- Current event initiated a cross OpCo review and an update of the EP call script

Earthquake Response

- Emergency Preparedness procedures kicks in
- System Incident Commander holds initial conference call
- Roll Call identifies departments

Roll Call

Operations Assistant:
Safety Officer:
OCC Shift Manager:
TSO ERM:
Planning Section Chief:
Communications Officer :
Gas Lead:
Operations Section Chief:
IT ERM:
Customer Care ERM:
LCS ERM:
External Affairs Mgr.
T&S ERM:
Environmental ERM
BucksMont ERM:
DelChester ERM:
Philadelphia ERM:

Earthquake Response

- Check List outlines main issues to check on / action items
- Check Lists are reviewed on regular basis and can be updated based on lessons learned
- Provides structure and communication path

Call Check List (partial list)

Regulatory:	
☐	Call received from PUC _____ to _____
☐	Call Phila. Manager of Office of Emg Mgmt. (OEM) - External Affairs Mgr.
☐	Call the PUC- SIC, Operations Assistant
☐	Call the PUC- Gas -SIC, Gas PUC Liaison
☐	Call the 911 Centers for any issues - External Affairs Mgr.
Transmission Systems Operation Update - TSO ERM & T&S ERM	
☐	Any there current or expected transmission system concerns?
☐	Any there any issues with Transmission and Substation configuration?
☐	Any there any issues with Generation, and what is the status of Nuclear's off site power supply?
☐	Check Tunnel & East Side Head House
☐	Check Substation Structures at Conowingo, Peach Bottom and Limerick substations
☐	Consider checking other high priority substations for higher magnitude earthquakes
☐	Check Oil Pump Houses for High and Low Pressure Oil Type transmission cables
☐	Patrol Overhead Transmission Lines & Underground Lines that cross waterways
Gas System Status - Gas Lead	
☐	Check Referenced Procedures listed above
☐	Check LNG Plant for alarms, system performance, physical walk down
☐	Check Gate Stations for alarms, system performance, physical walk down
☐	Check Tillman Street for alarms, system performance, physical walk down
☐	Gas Regulatory - Perform a leak survey in accordance with GO-PE-1004
☐	Gas C&M - Consider patrolling the Gas Transmission Lines

Earthquake Response

- Gas Department has multiple procedures they review during events
- Focus on foundations and leaks
- Checks of LNG plant and Gate Stations
- Notification to regulatory agencies

Procedures for Reference:	
GO-PE-P041	PECO DIMP Threat Matrix-Forms
GO-PE-701-4040	Recognizing, Investigating and Reporting Safety Related Conditions at the West Conshohocken LNG Plant
OP-PE-3025	OCC Tiered Response Notifications
EP-EU-3001	Guideline For Executive Notification and Internal Executive Reports Of Significant Events
GO-PE-701-4024	LNG Tank Foundation survey
GO-PE-1004	Gas Leak Surveys
OP-PE-3028	Agency Notifications for Gas Emergencies

Earthquake Response

- T&S focus on critical sites and oil pump houses / oil filled transmission lines
- Focus on structures, foundations and leaks

Transmission Systems Operation Update - TSO ERM & T&S ERM	
	Any there current or expected transmission system concerns?
	Any there any issues with Transmission and Substation configuration?
	Any there any issues with Generation, and what is the status of Nuclear's off site power supply?
	Check Tunnel & East Side Head House
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Questions