



# Phasing Required for Adding CHW Capacity and Replacing Aging Infrastructure for an Urban Campus



University of  
Pittsburgh

June 26, 2019



**IDEA2019**  
The Energy for More Resilient Cities

# AGENDA



## University of Pittsburgh

- ▶ Overview
- ▶ Campus Growth
- ▶ Effects of Growth
- ▶ Solutions

# OVERVIEW



## University of Pittsburgh

### ► Oakland Campus

- Enrollment: 28,000 Students
- 4 Chilled Water Plants
- Installed CHW Tonnage
  - 31,200 TOTAL

	PLANT	TONS
PITT	POSVAR	12,800
	PETERSEN	5,200
UPMC	SCAIFE	3,200
	BST	10,000

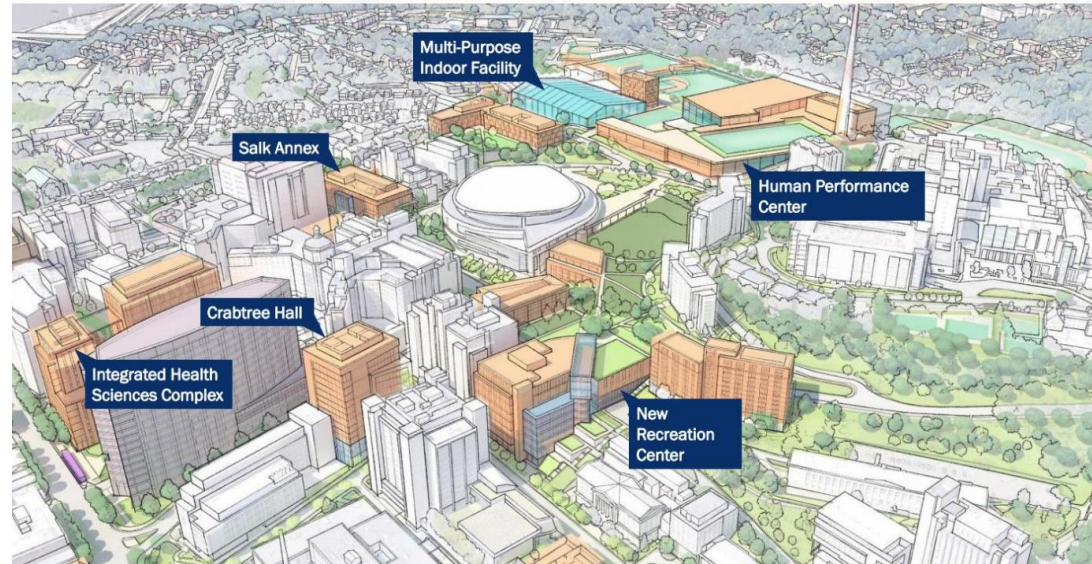
# OVERVIEW



## University of Pittsburgh

### ▶ CHW PROGRAM

- NEW CHILLED WATER PLANT
  - 15,000 TONS
- RENOVATIONS TO EXISTING CHILLED WATER PLANT
  - OPERATIONAL AND EFFICIENCY IMPROVEMNTS
- EXTENSIVE DISTRIBUTION PIPING





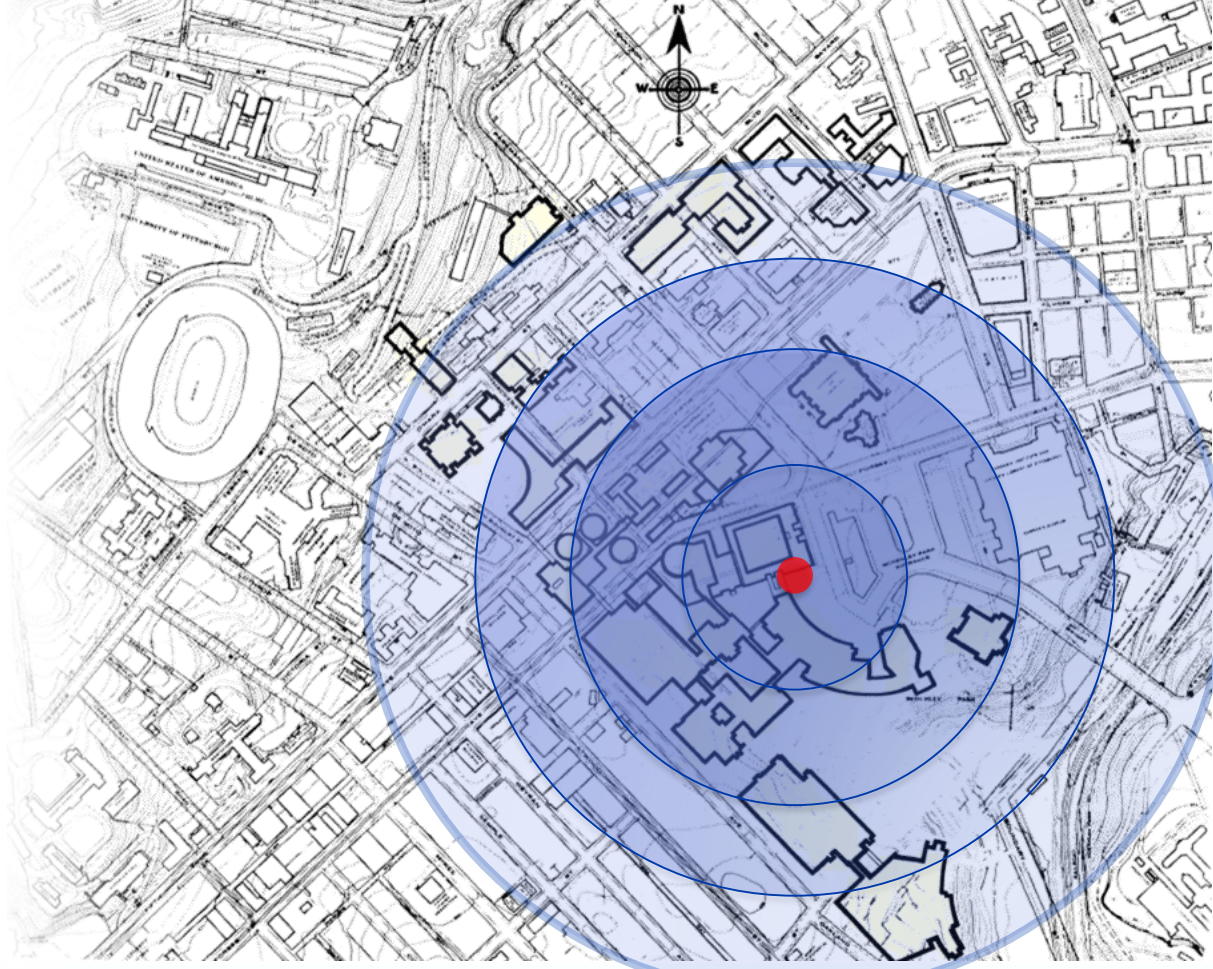
# CAMPUS GROWTH

- ▶ Original Campus CHW Plan
  - CHW Plant designed to be in the center of the loads (1962)



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# CAMPUS GROWTH

## ► Original Campus CHW Plan

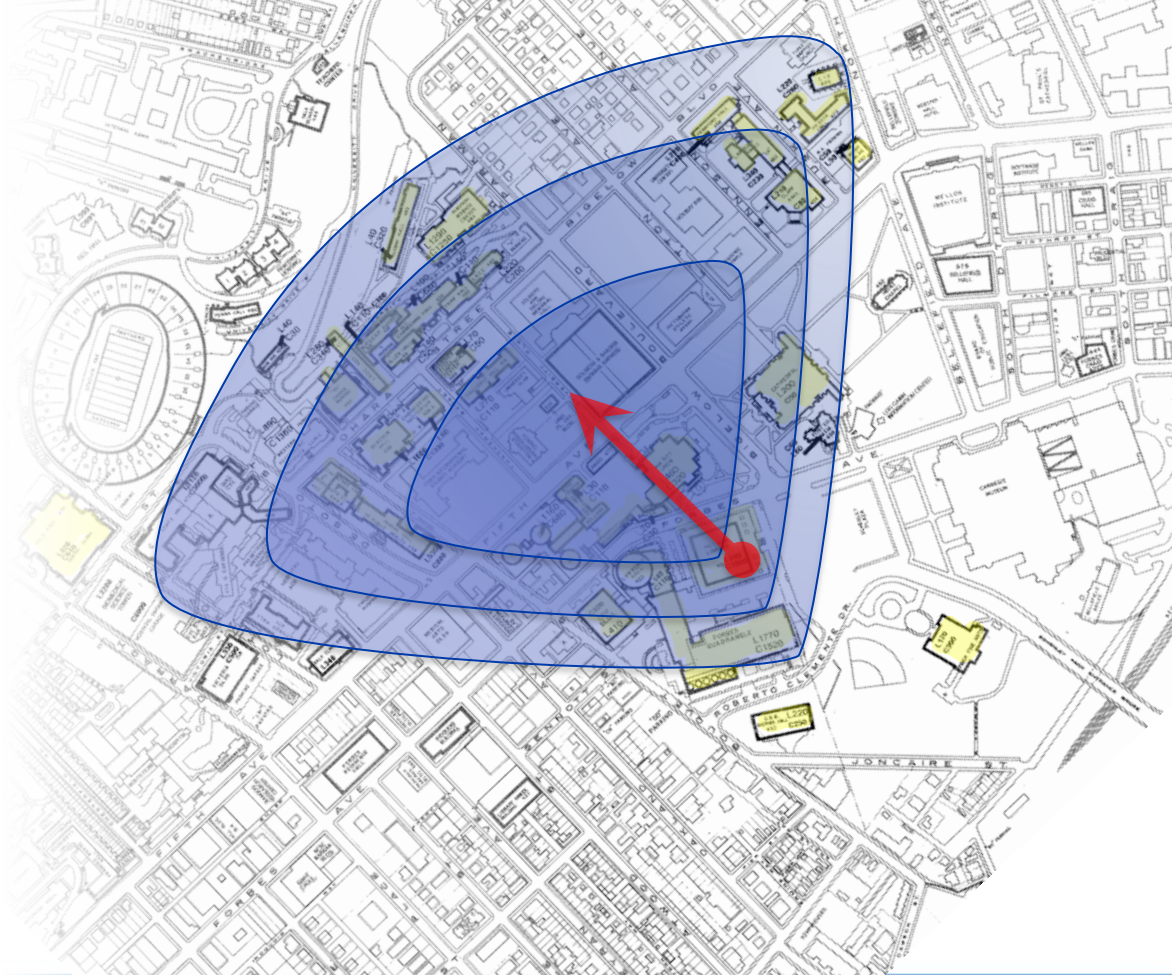
- CHW Plant designed to be in the center of the loads (1962)

## ► 1992 Plan

- CHW density shifted North and East

## ► Now & Future

- More Growth toward the North and East



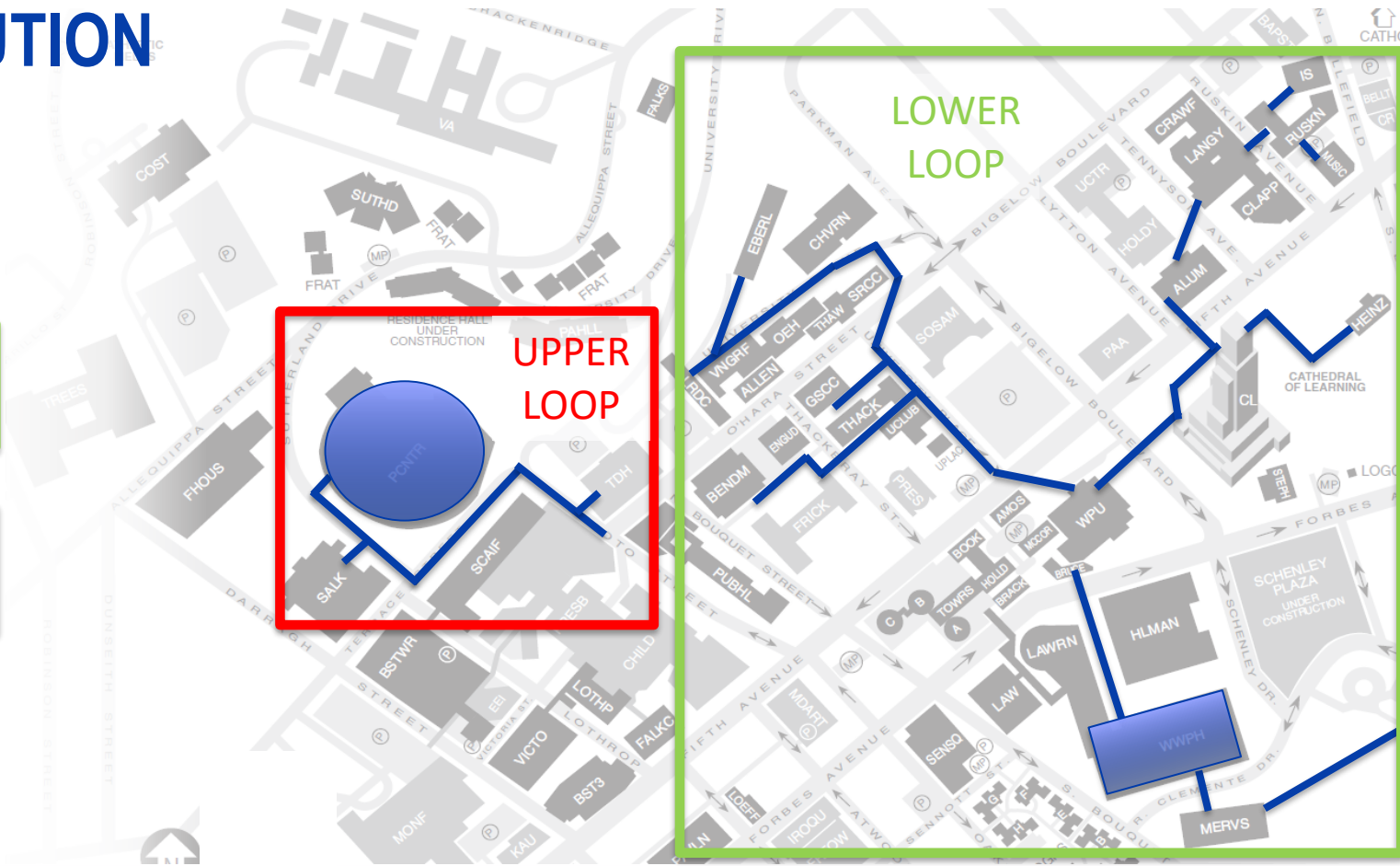




# DISTRIBUTION

## EXISTING

- POSVAR
- PETERSEN

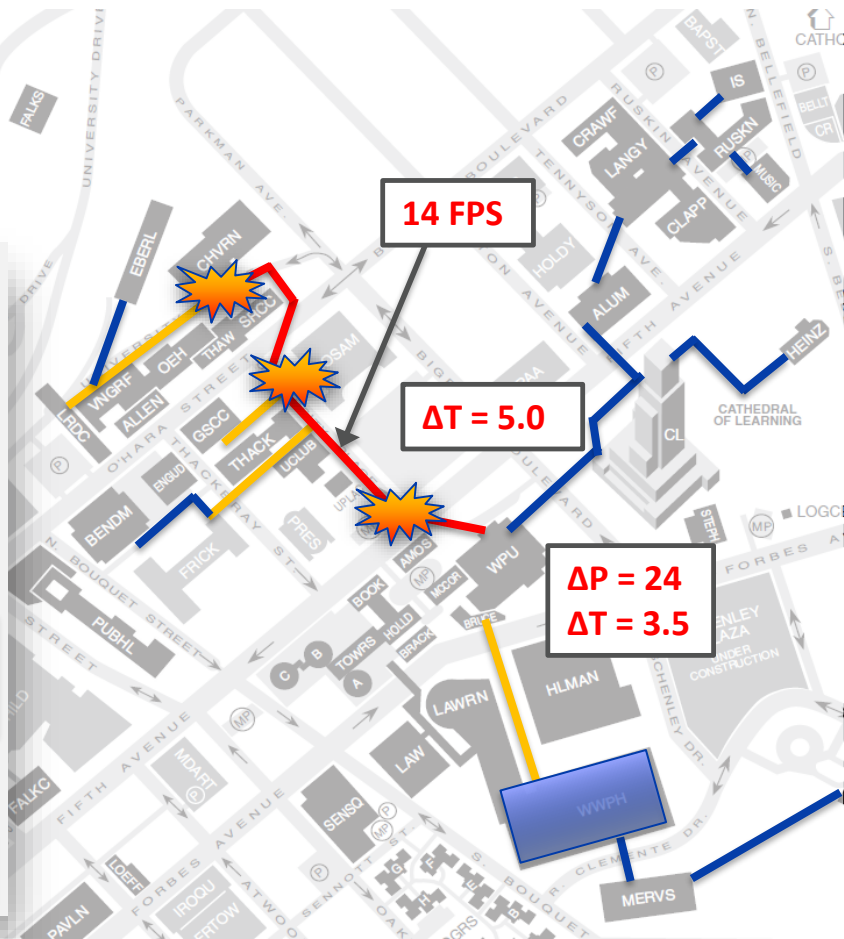
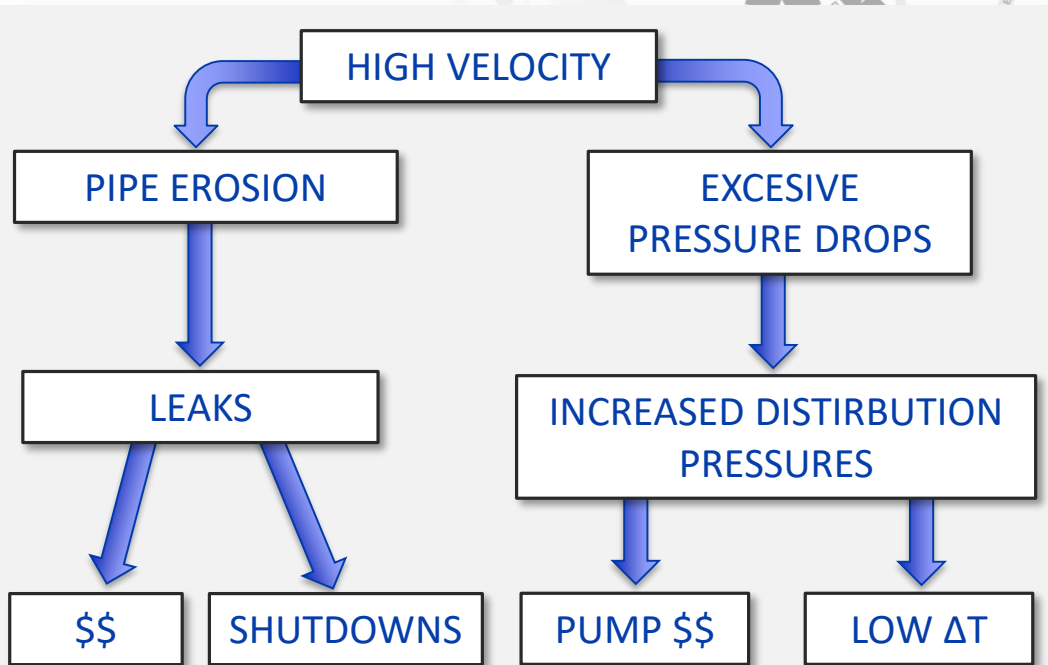


## EXISTING DISTRIBUTION SYSTEM



# EFFECTS

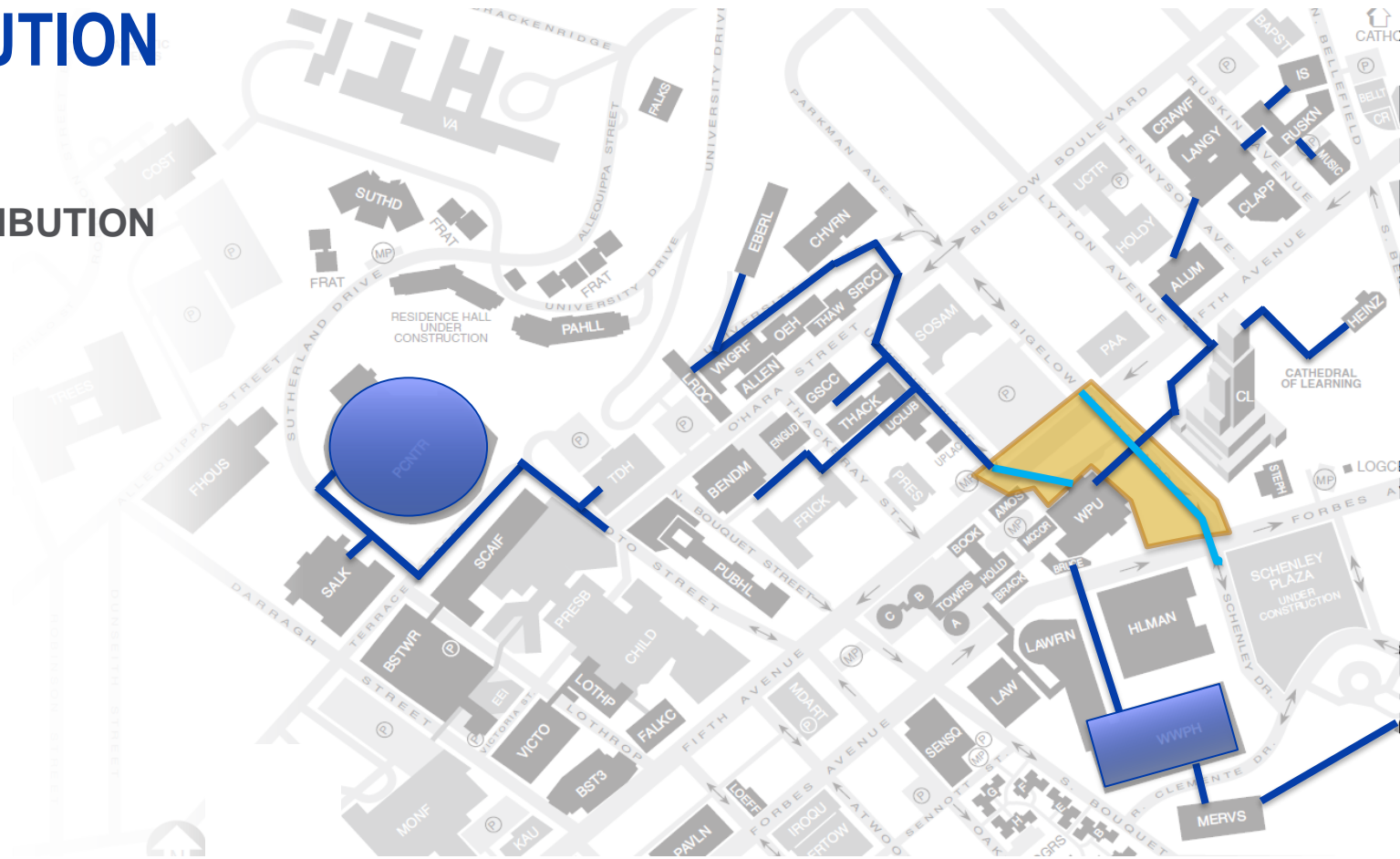
## EXISTING DISTRIBUTION SYSTEM





# DISTRIBUTION

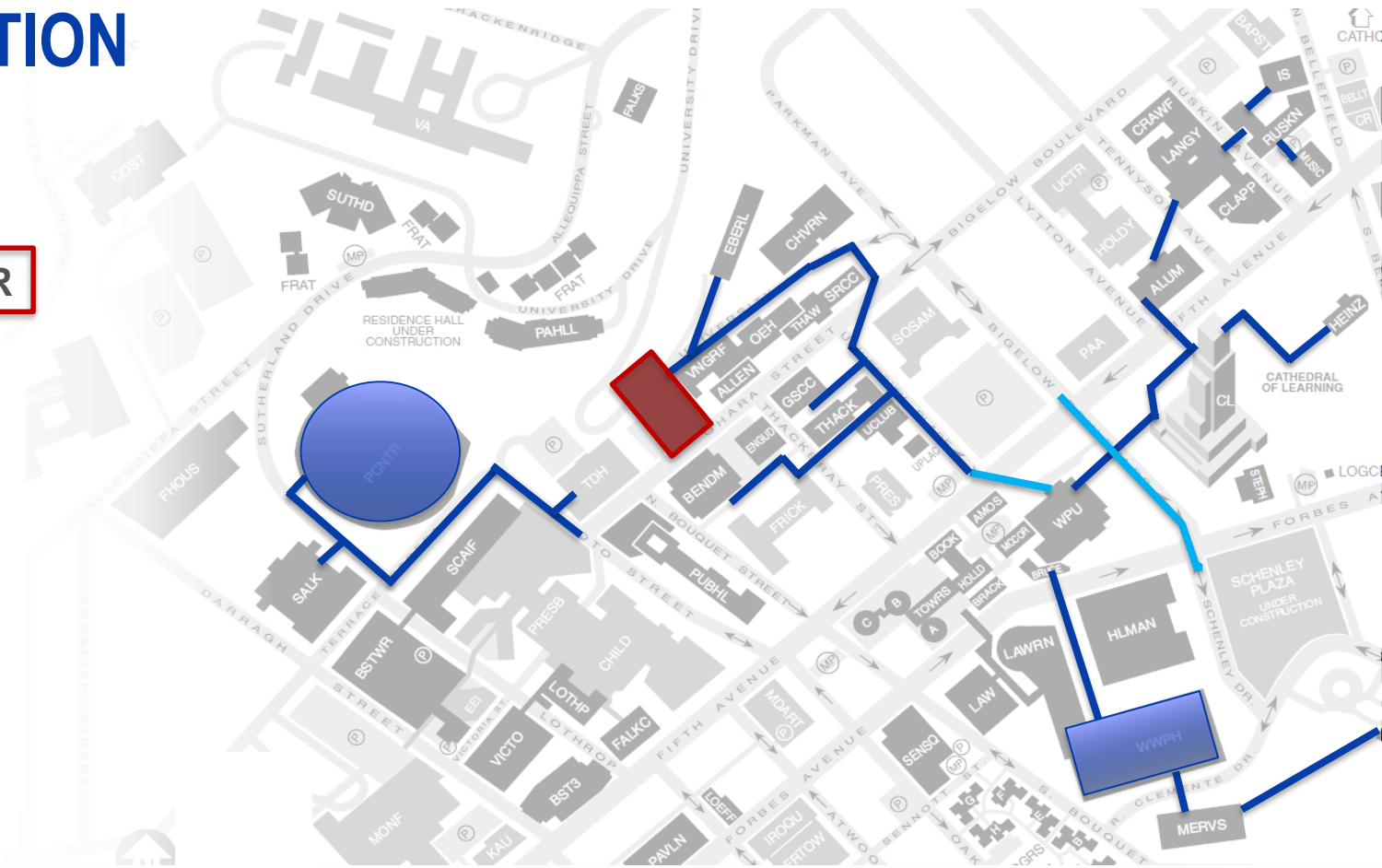
## PHASING DISTRIBUTION PIPING



# DISTRIBUTION

FUTURE

NEW REC CENTER

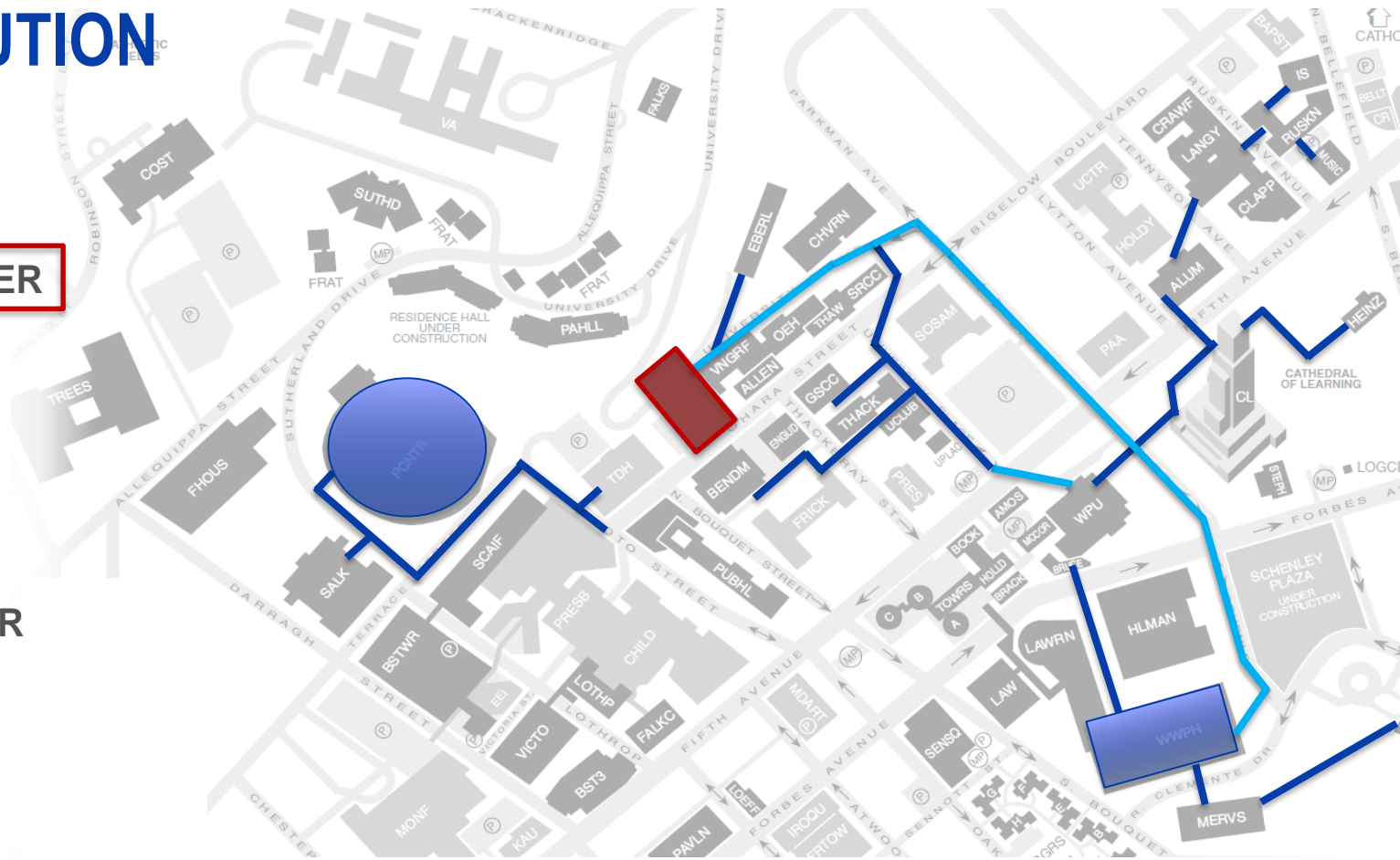


# DISTRIBUTION

## FUTURE

### NEW REC CENTER

- POSVAR
- PETERSEN
- NEW CHILLER PLANT
- UPMC



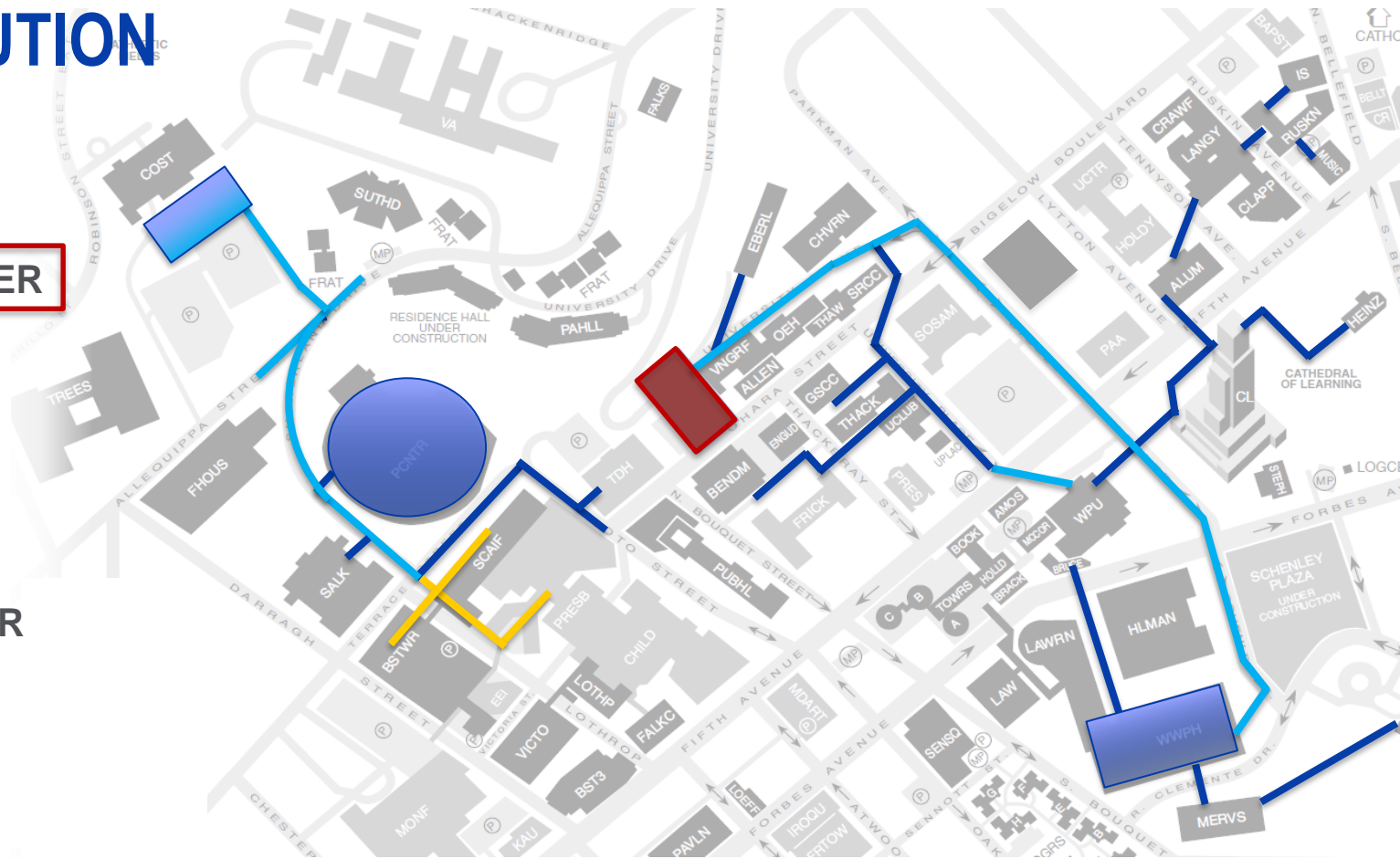


# DISTRIBUTION

## FUTURE

### NEW REC CENTER

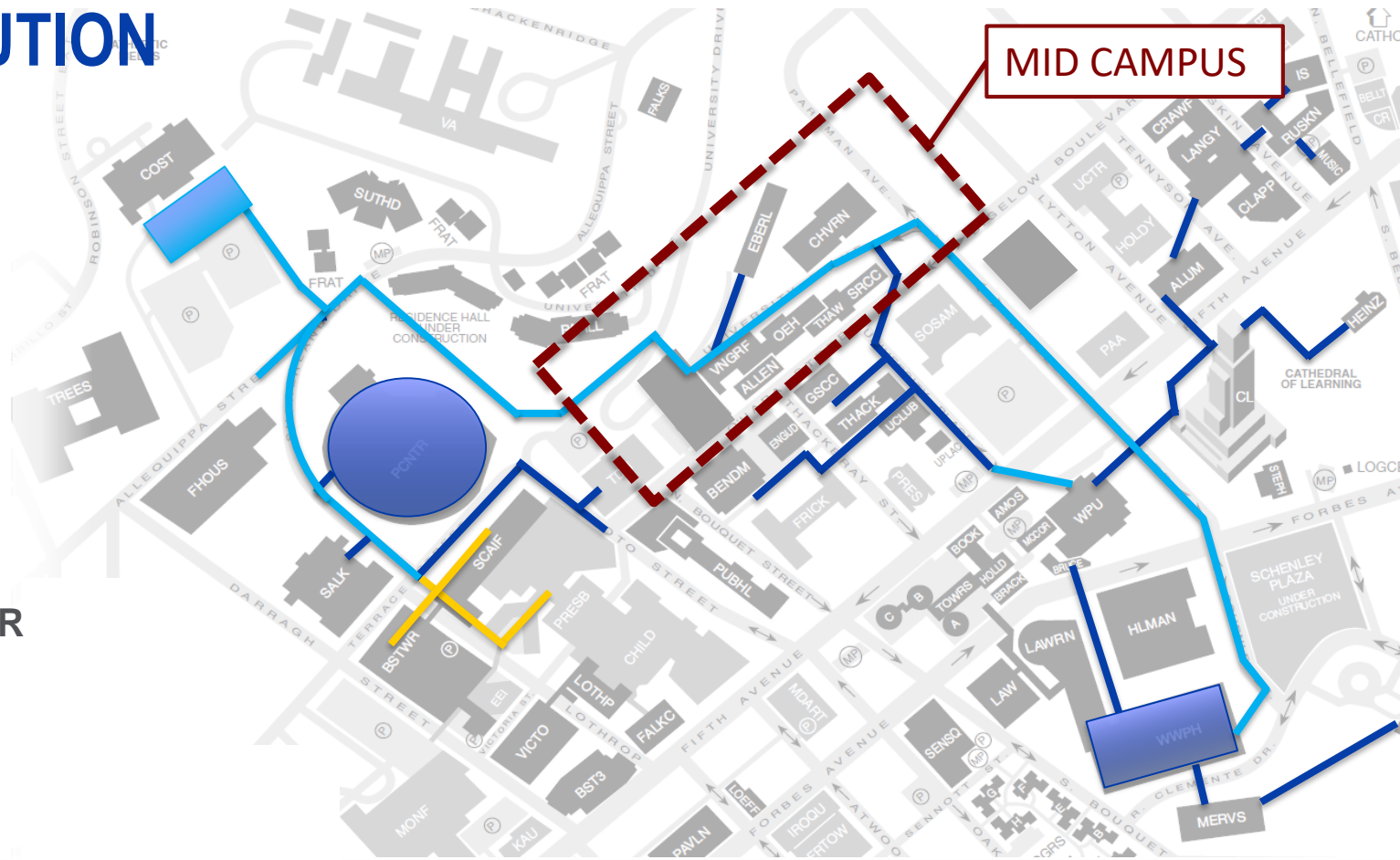
- POSVAR
- PETERSEN
- NEW CHILLER PLANT
- UPMC



# DISTRIBUTION

## FUTURE

- POSVAR
- PETERSEN
- NEW CHILLER PLANT
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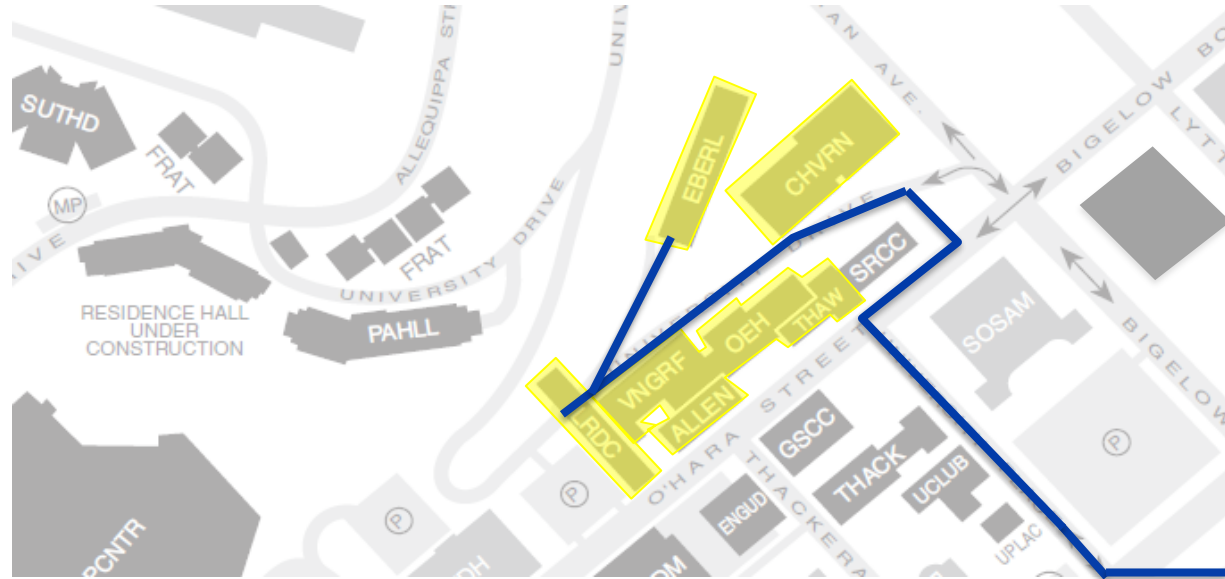


# DISTRIBUTION

- MID CAMPUS

## EXISTING

- ACCESS VIA UNIVERSITY DR.



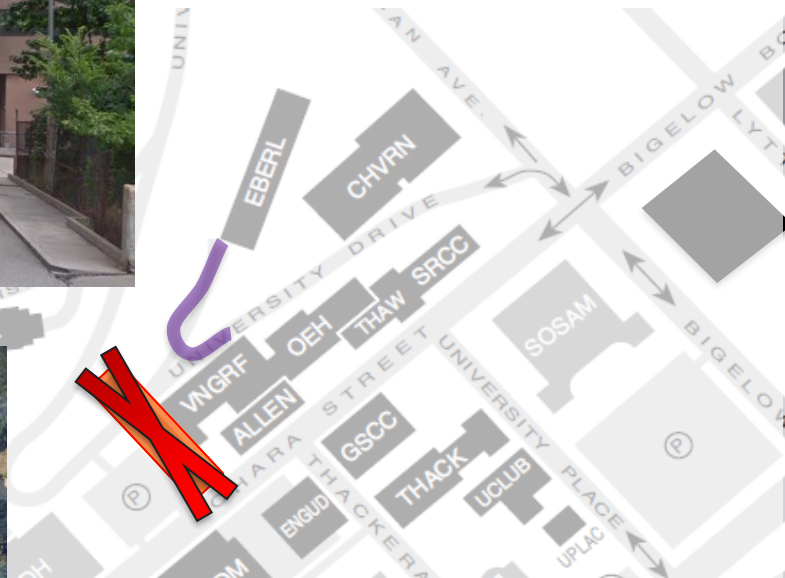
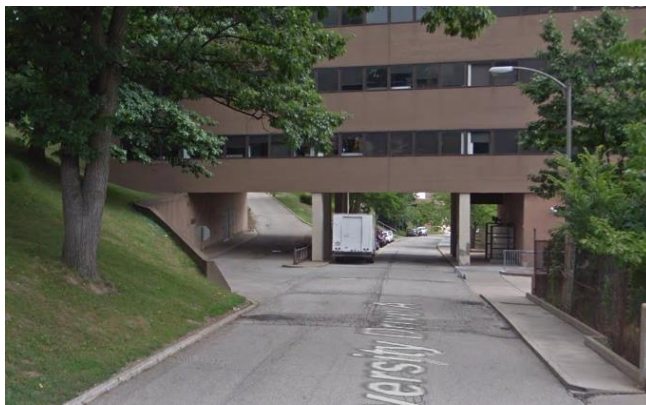


# DISTRIBUTION

- MID CAMPUS

## NEW REC CENTER

- CONSTRUCTION/  
DEMOLITION
- LIMITED  
ACCESS
- NEW ROAD  
DESIGN

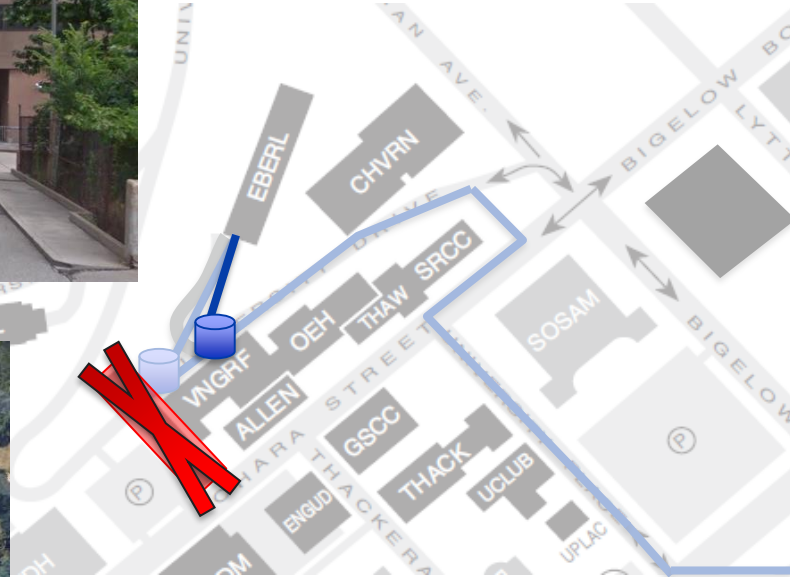
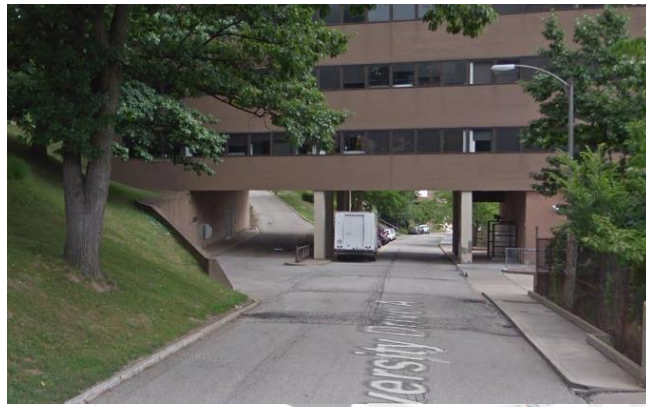


# DISTRIBUTION

- **MID CAMPUS**

## NEW REC CENTER

- **CONSTRUCTION/DEMOLITION**
  - **LIMITED ACCESS**
  - **NEW ROAD DESIGN**
- 
- An aerial photograph showing a parking lot filled with cars, bordered by a road and surrounded by trees and greenery.



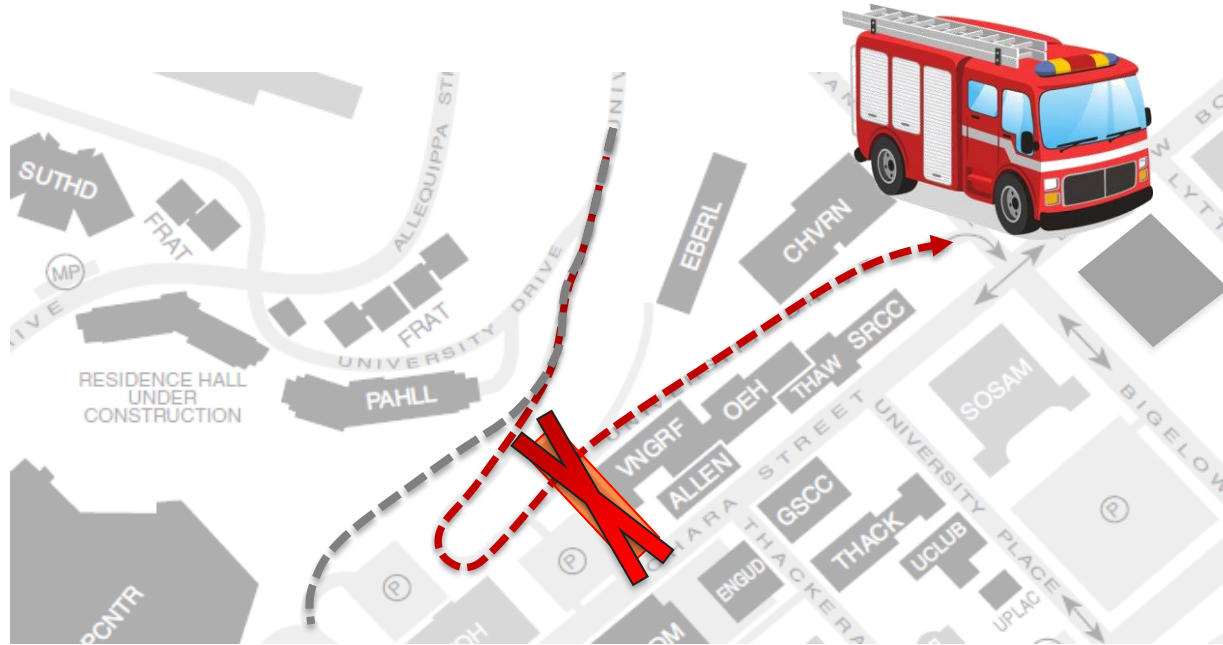
# DISTRIBUTION

- MID CAMPUS

EXISTING

SERVED BY

- POSVAR
- PETERSEN
- NEW CHILLER PLANT
- UPMC



FIRE DEPARTMENT ACCESS



# DISTRIBUTION

- MID CAMPUS

## EXISTING

## SERVED BY

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# DISTRIBUTION

- MID CAMPUS

## NEW REC CENTER

### SERVED BY

- POSVAR
- PETERSEN
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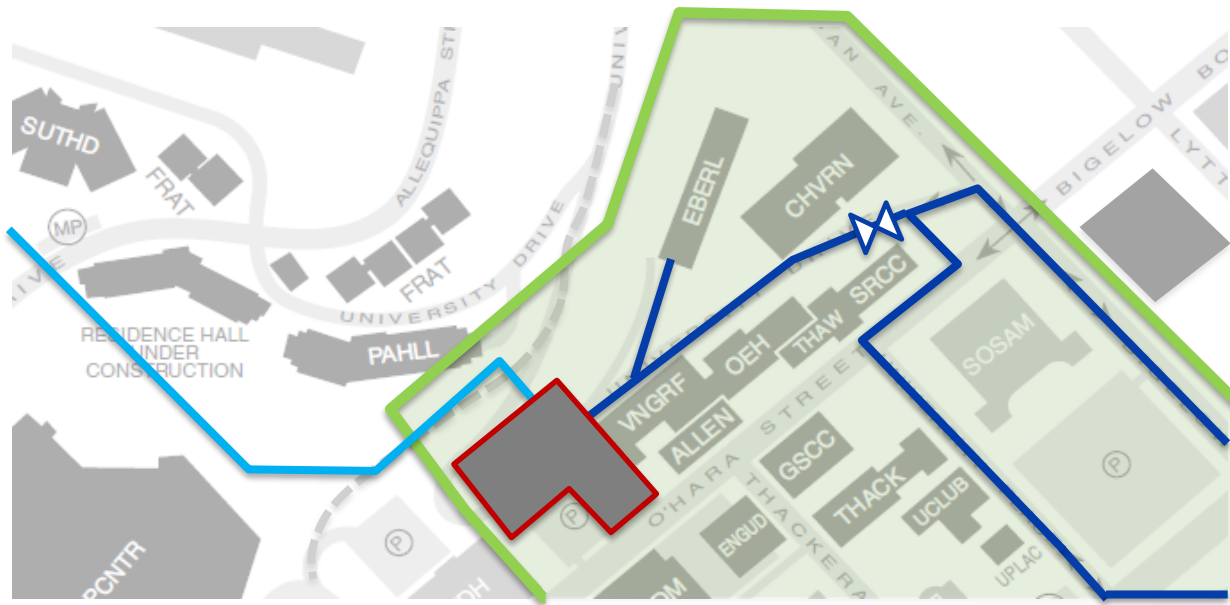
# DISTRIBUTION

- MID CAMPUS

## NEW REC CENTER

### SERVED BY

- POSVAR
- PETERSEN
- NEW CHILLER PLANT
- UPMC



# DISTRIBUTION

- MID CAMPUS

FUTURE

SERVED BY

- POSVAR

- PETERSEN
- NEW CHILLER PLANT
- UPMC





- POSVAR
- PETERSEN
- NEW CHILLER PLANT
- UPMC

**VELOCITY**  
14 FPS → 6 FPS

**PRESSURE DROP**  
28 PSI → 11 PSI

**POSVAR KW/TON**  
1.049 → 0.69

- **VELOCITY IMPROVEMENTS**
- **PRESSURE DROP IMPROVEMENTS**
- **POSVAR CHILLER PLANT MODIFICATIONS**

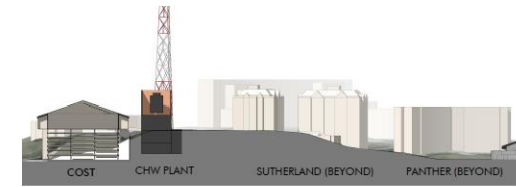
# ADDED CAPACITIES

## ▶ NEW CHILLER PLANT

- 15,000 Tons Total
- 2,500 Ton Chillers
- 5 kV Substation

## ▶ PLANT AVG KW/TON

- 0.557

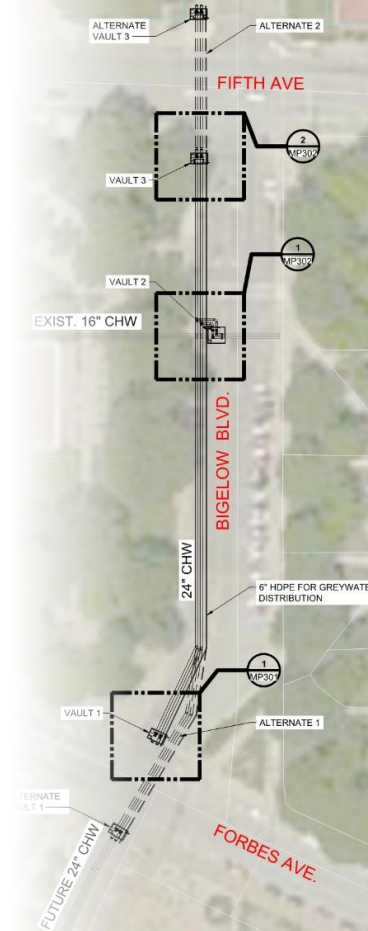
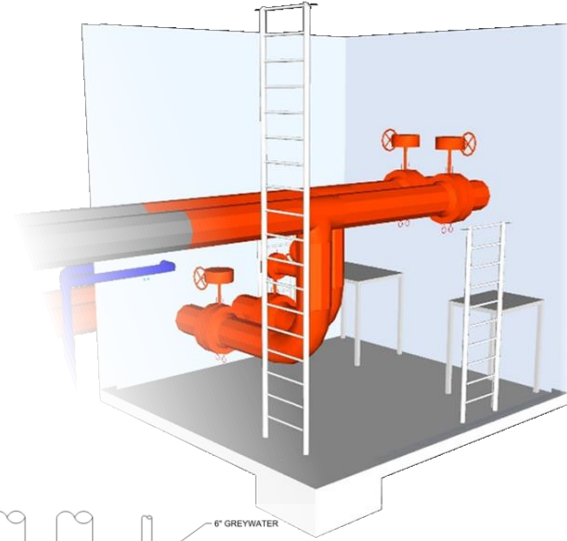
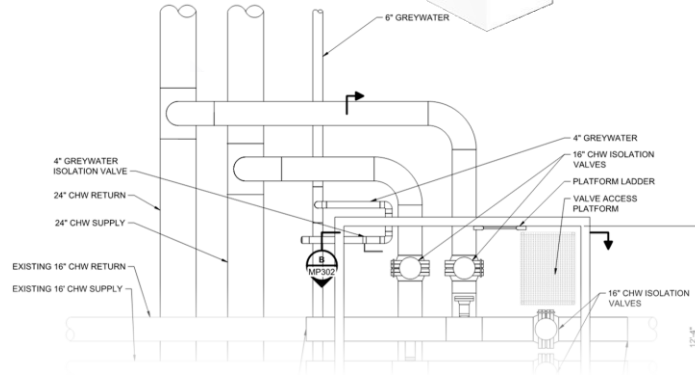


SECTION THRU SITE



# COORDINATION

- ▶ Adjacent Properties
- ▶ Internal Departments
- ▶ Understand Limitations





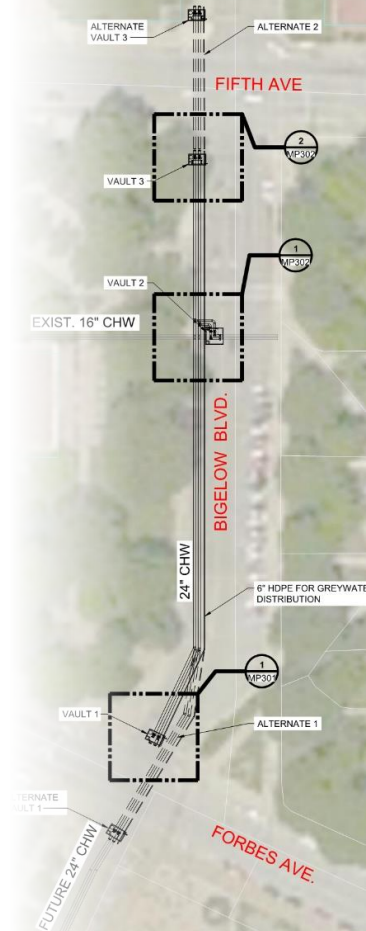
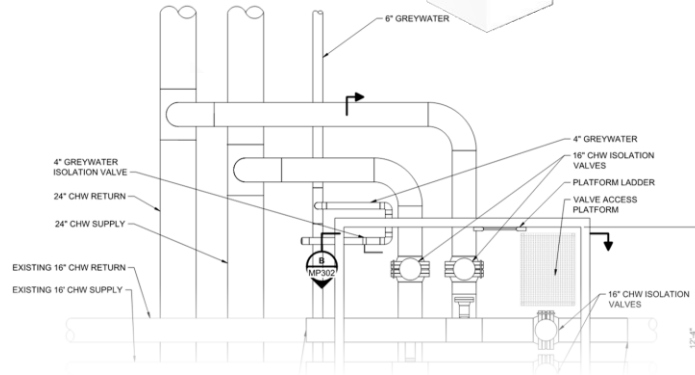
# COORDINATION

## ► Adjacent Properties

- Campus & Health Care
  - UPMC Renovations
  - Capacity Study incorporating both Campuses
  - Share N+1 Equipment
  - Taps for future connection

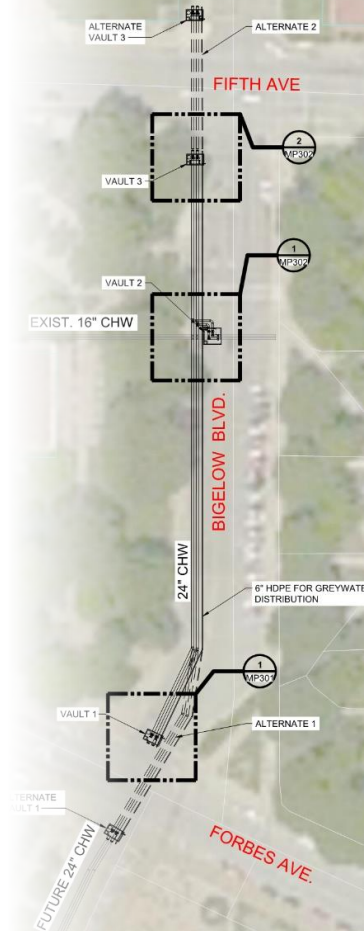
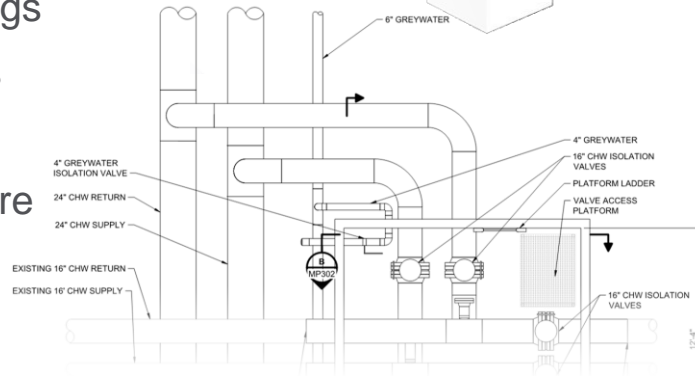
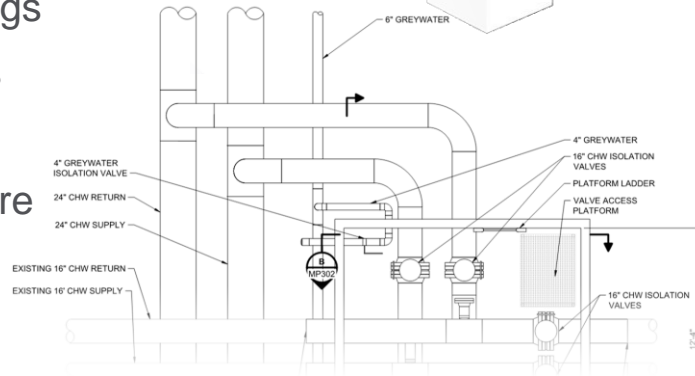
## ► Internal Departments

## ► Understand Limitations



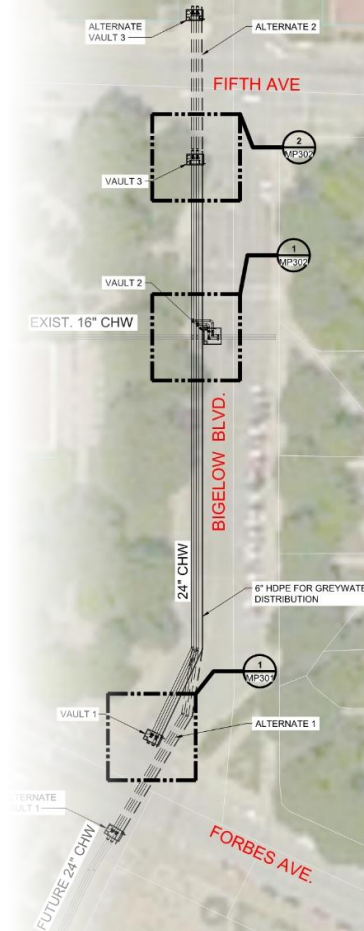
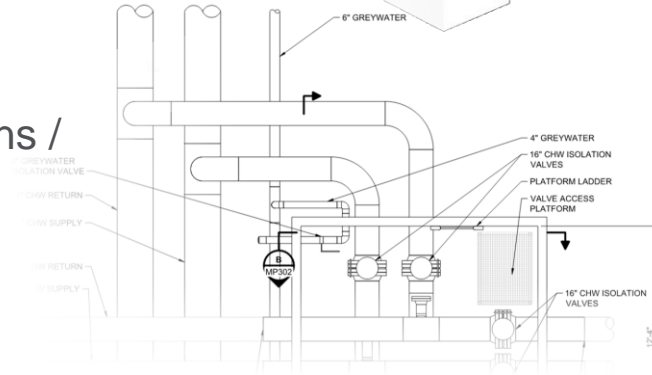
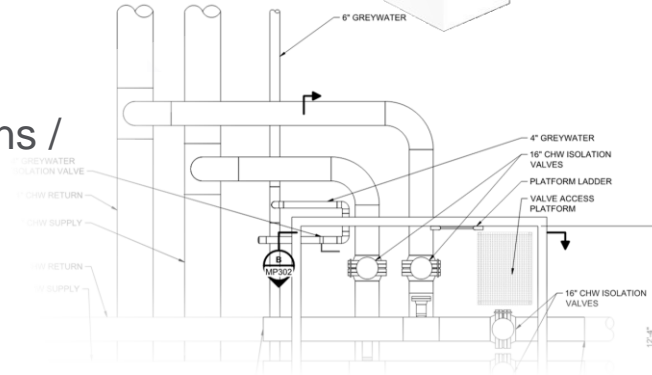
# COORDINATION

- ▶ Adjacent Properties
- ▶ Internal Departments
  - Campus Development
    - New building loads / locations
    - Resurfacing roads
  - Electrical
    - 5kV Distribution for future buildings
    - Redundant feeds for major loads
  - Sustainability
    - Rainwater Collection infrastructure
    - EUI, GHG Goals
- ▶ Understand Limitations



# COORDINATION

- ▶ Adjacent Properties
- ▶ Internal Departments
- ▶ Understand Limitations
  - Allowable / Scheduled Outages:
    - Labs
    - Hospitals
    - Plan for loops for future shutdowns / redundancy
    - Temporary Chiller Connections
  - Fire Department Access



# SUSTAINABILITY

## ► Key Targets from Pitt's **Sustainability Plan**:

- Reduce greenhouse gas (GHG) emissions by 50%
- Produce or procure at least 50% of campus electric energy from renewable sources
- Achieve an **energy use intensity** that is at least 50% below the national average - 120
- Achieve water use intensity that is 50% below the district average

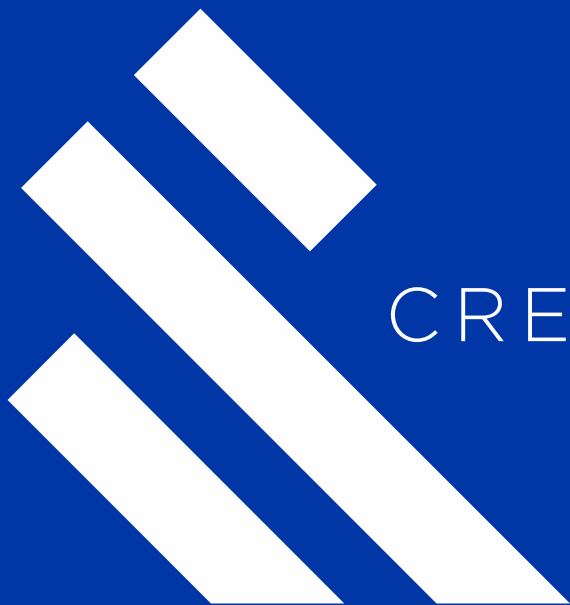
*STEWARDSHIP*

*EXPLORATION*

*COMMUNITY & CULTURE*







CREATE AMAZING.