

# Underground Chilled Water Project Approach at Syracuse University for Major Expansion

**Syracuse University**

Campus Planning, Design, and Construction

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# Syracuse University

- Founded in 1870 in Syracuse, NY
- 22,500 students
  - 15,250 undergraduate
  - 7,250 graduate and law students
- District Steam Heating Plant Serving SU Campus, SUNY ESF Campus & Three Hospitals
  - 500,000 PPH, Distribution Length +/-6.5 Miles
- District Cooling Plant Serving SU Campus
  - 6,400 Tons of Cooling, Distribution Length +/-2.5 Miles
- Building Gross Areas
  - 9.4M GSF Total Syracuse Properties (w/o parking garages)
  - 7.4M GSF Total Main Campus
  - 3.0M GSF Cooled by Central Chilled Water Plant & Underground Distribution System



# Project Overview

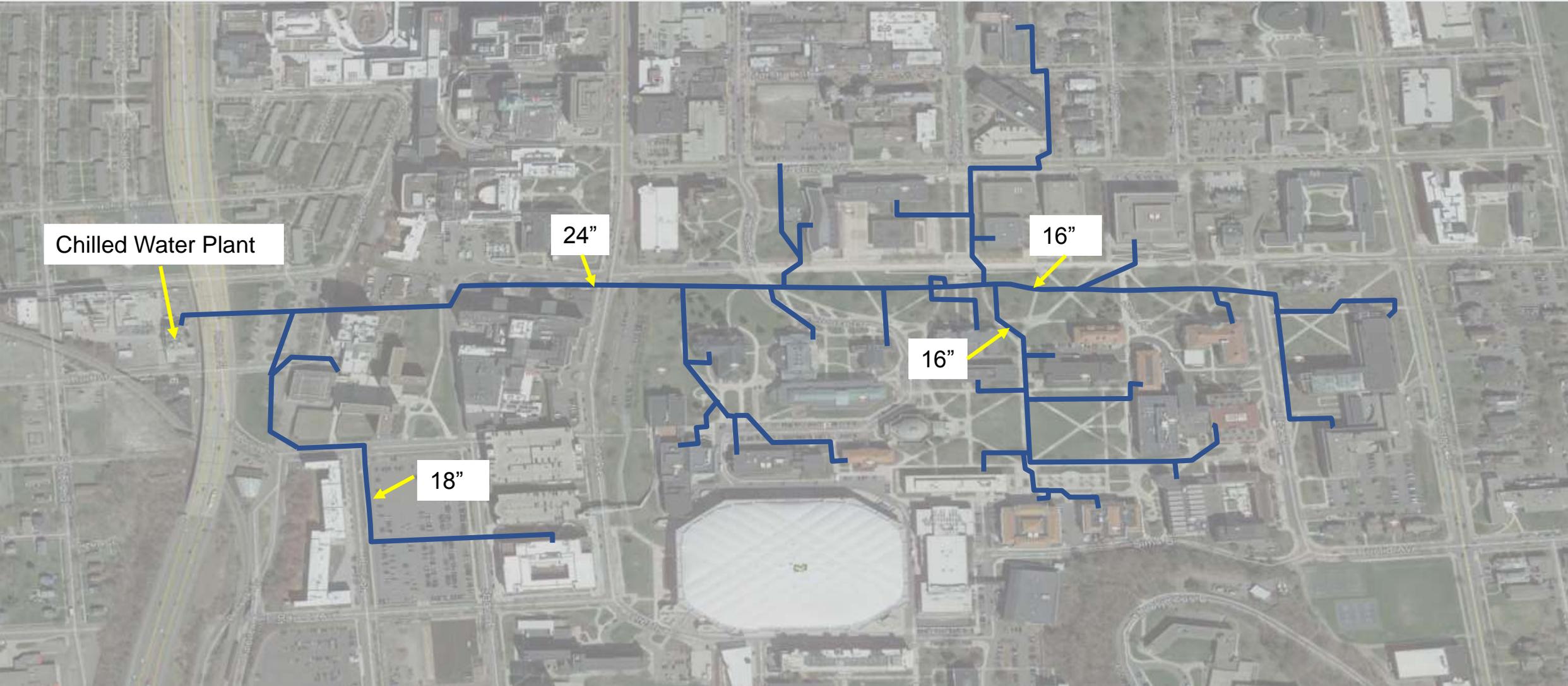
- Master Planning
- Main Campus Chilled Water Upgrade (Selected Project)
- Carrier Dome & Campus Events Coordination
- Project Phasing
- Specific Project Site Requirements
- Contract – Construction Manager Approach
- Utility Mapping, GPS As-Builts & Site Monitoring
- Lessons Learned

# Master Plan – Chilled Water Loads

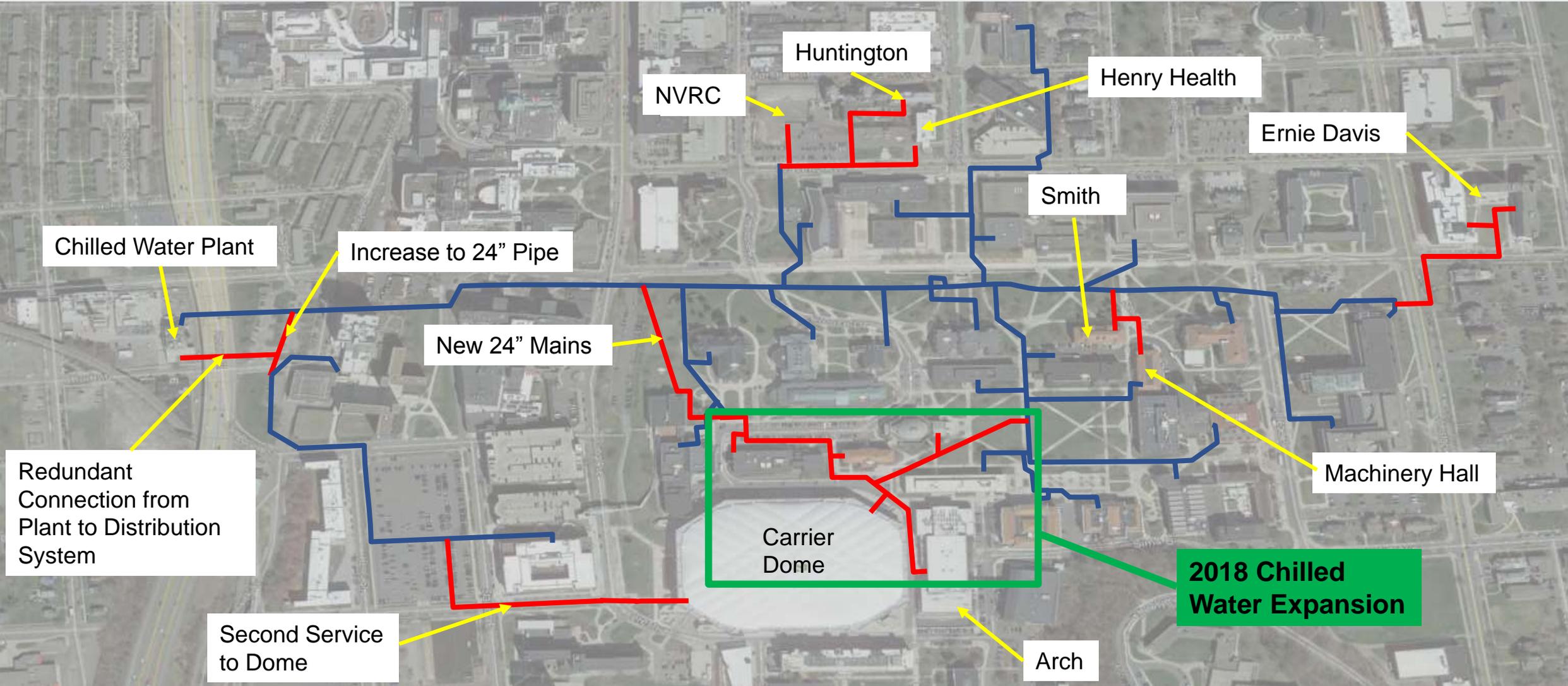
- Current: 4,500 Tons
- Future:
  - Arch = 600 Tons
  - NVRC = 270 Tons
  - Hendricks Chapel = 80 Tons
  - Carrier Dome = 3,000 Tons
  - Smith Hall = 100 Tons
  - Machinery Hall = 150 Tons
  - Henry Health Site = 100 Tons
  - Huntington Hall = 130 Tons
  - Ernie Davis = 300 Tons
  - Total: 4,730 Tons
- Future Campus Total: 9,230 Tons



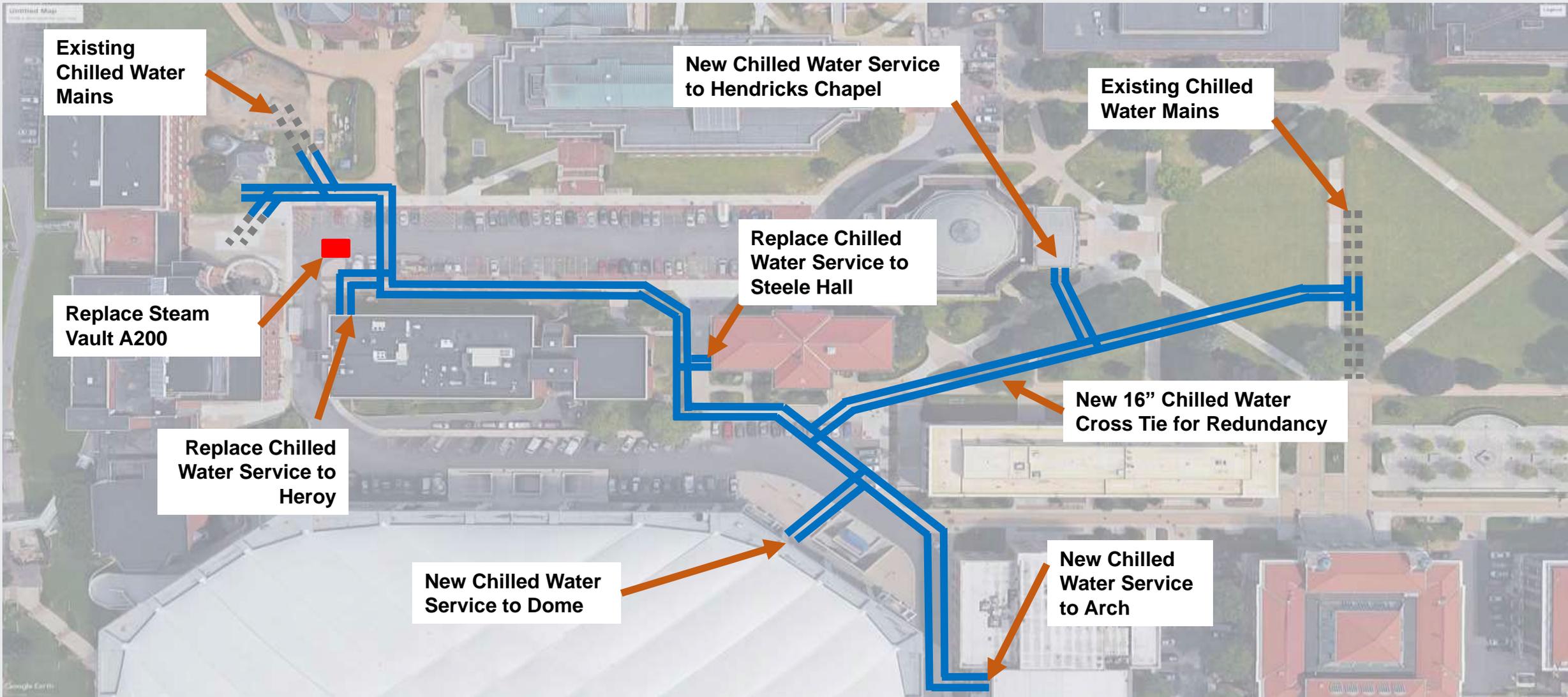
# Existing Underground Chilled Water Distribution System



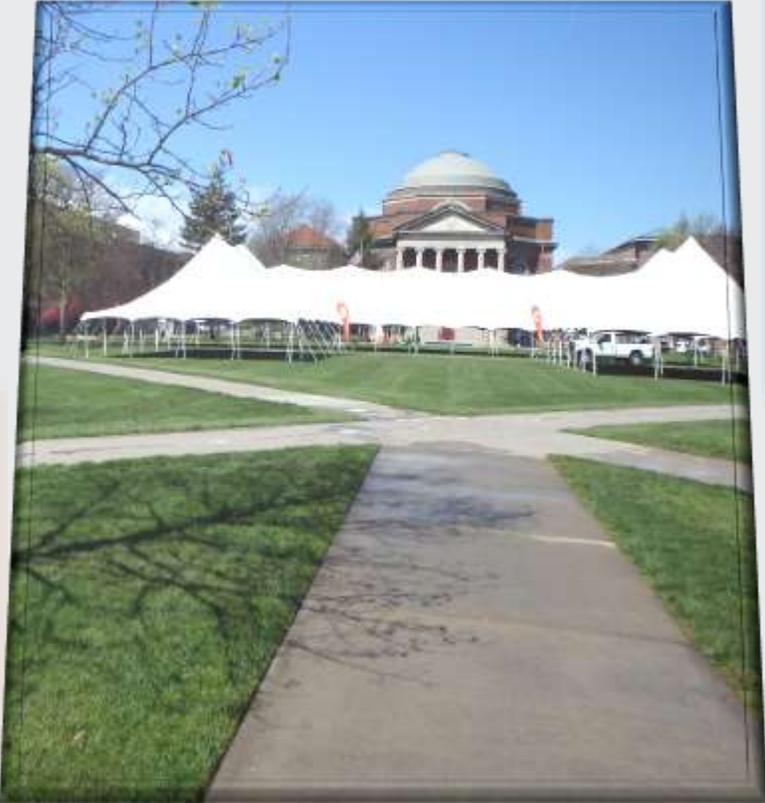
# Chilled Water Distribution Master Plan



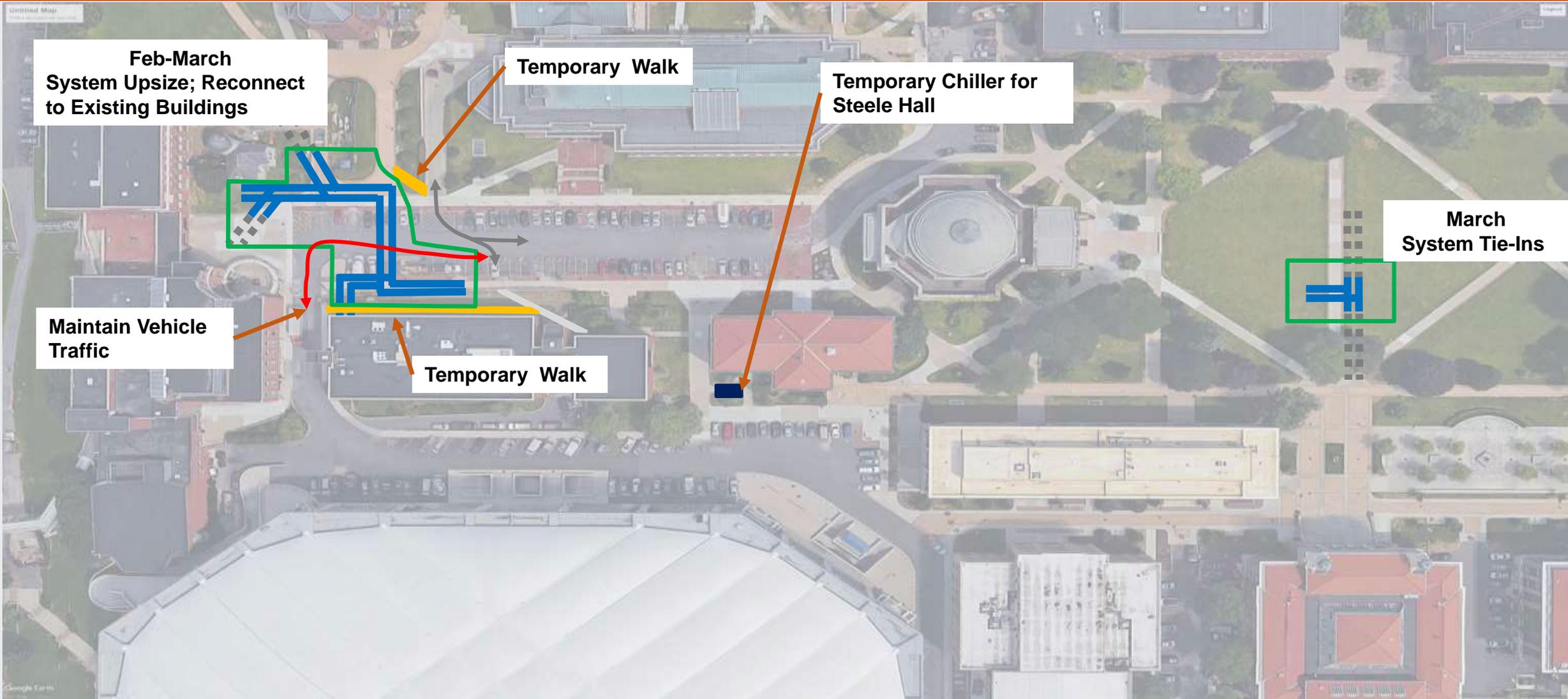
# Main Campus Chilled Water Upgrade Project



# Carrier Dome and Campus Events



# Phase 1 – Winter 2017/2018



# Phase 1 – Chilled Water Work

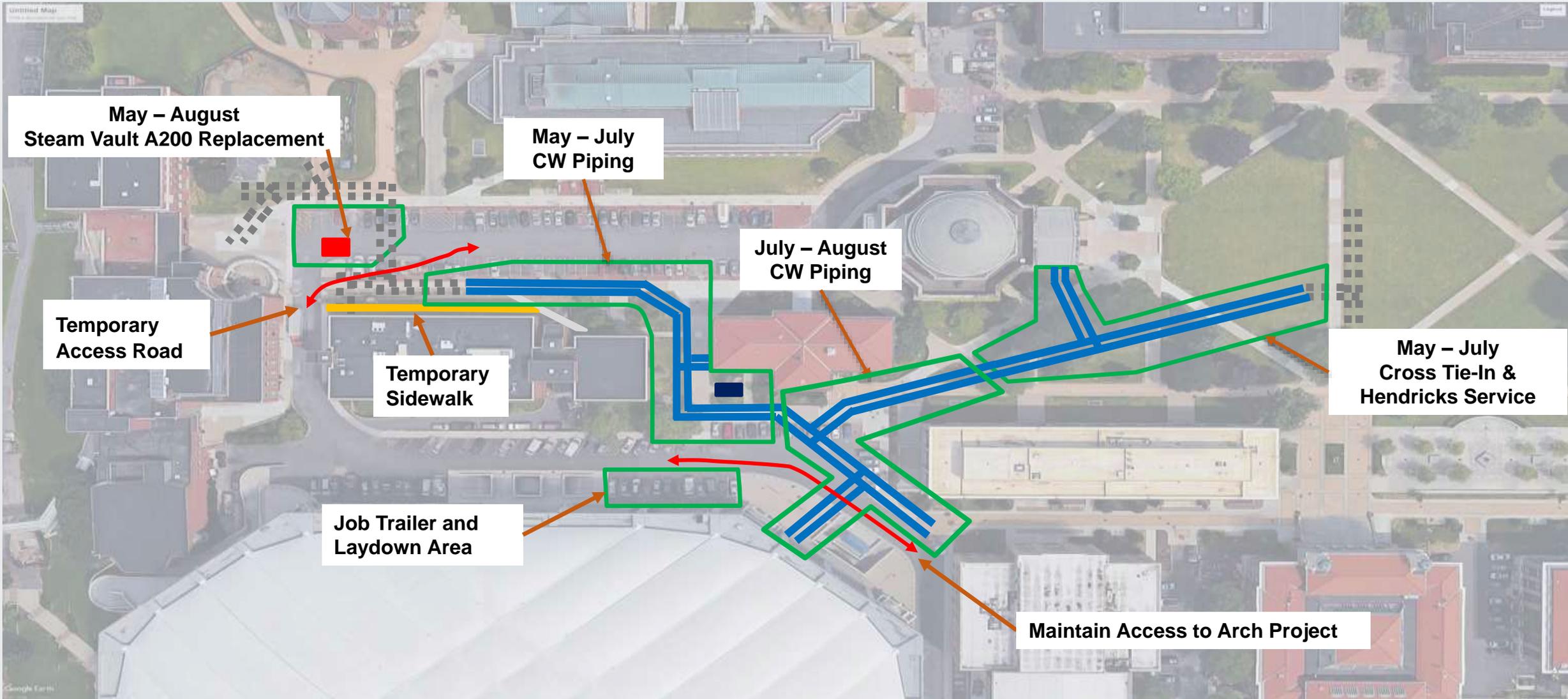
- Temporary Chiller to Steele Hall



- Scope of Work Necessary to Allow Balance of Project to be Completed with Active Distribution System



# Phase 2 – Summer 2018



# Phase 2 – Chilled Water Work

- 1,450 LF of 4”-24” Ch. Water Mains
  - Included four building services



- Use of Speed Shoring System
  - Low Vibration Area



- Ch. Water Entrance to Carrier Dome
  - 24” Core-Drill into Positive Pressure Building
  - Pedestrian Bridge to Accommodate Tours



# Phase 2 – Steam Work

- Steam Bypass

- Heroy & Falk Domestic Hot Water & Reheat Systems



- Selective Demo of Vault

- No Jackhammering



- New Vault Construction



# Phase 2 – Utility/Water Work

- 200 LF of 8” and 10” Water Main Relocations
  - Temporary HDPE Domestic / Fire Water Service

- 450 LF Primary Electric & Communication Ductbanks



# Phase 2 – Snowmelt/Lighting

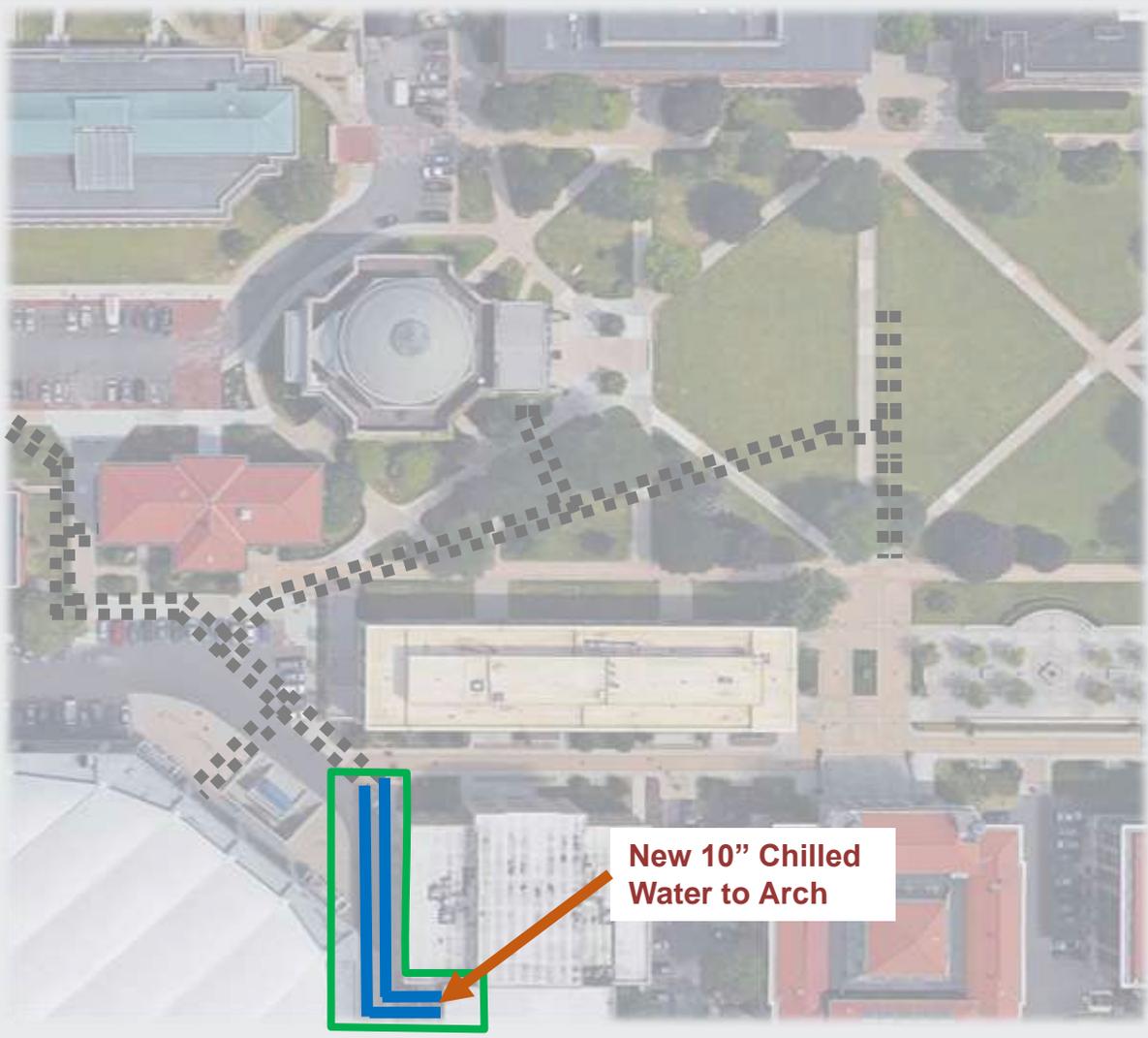
- 4,500 SF Snowmelted Sidewalk  
– Targeted high traffic area



- LED Site Lighting Upgrades for Parking Lot and Pedestrian Walkways

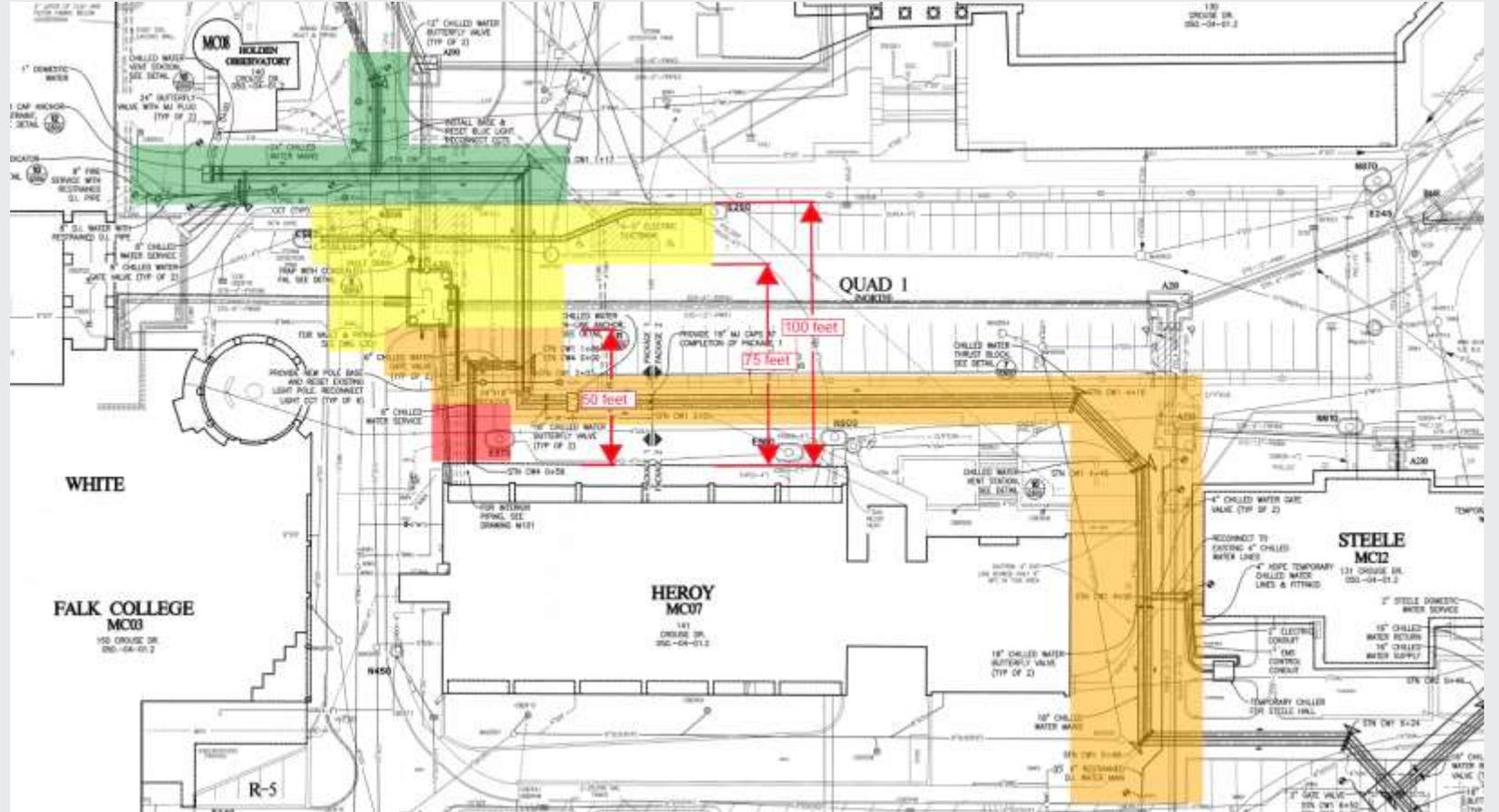


# Phase 3 – Winter/Spring 2019



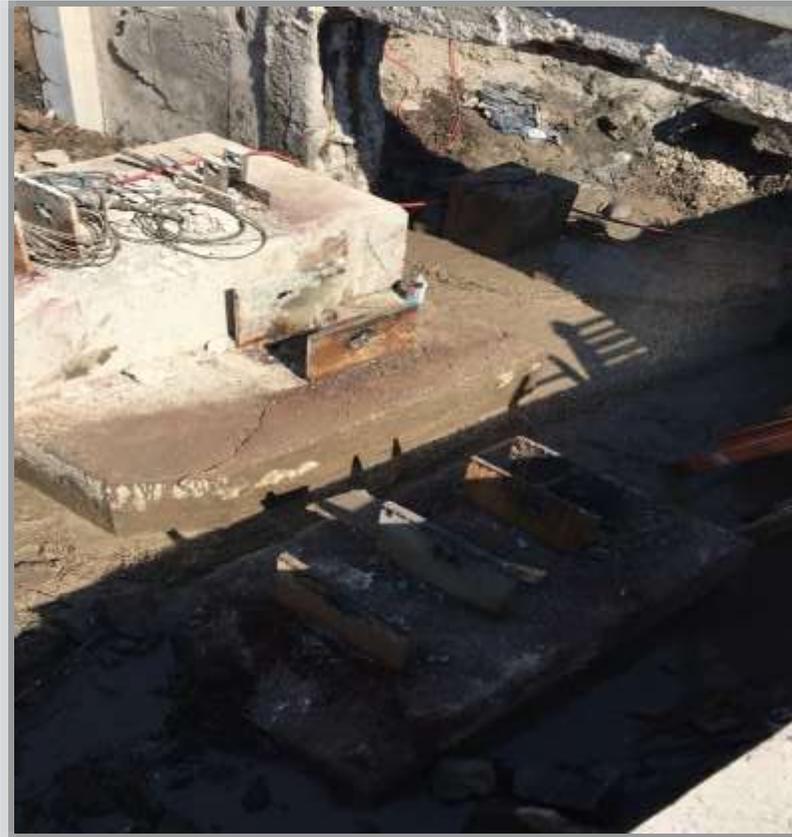
# Specific Project Site Requirements

- Adjacent Building (Heroy) with Active Electron Microscopes, Mass Spectrometers, Electron Microprobes, etc.
- Developed Plan for Contractor – Allowable Equipment / Techniques
- Modified Plan as Construction Progressed



# Specific Project Site Requirements

- Steam Vault Demolition
  - No Jackhammering
  - Track and Wire Sawcutting Only

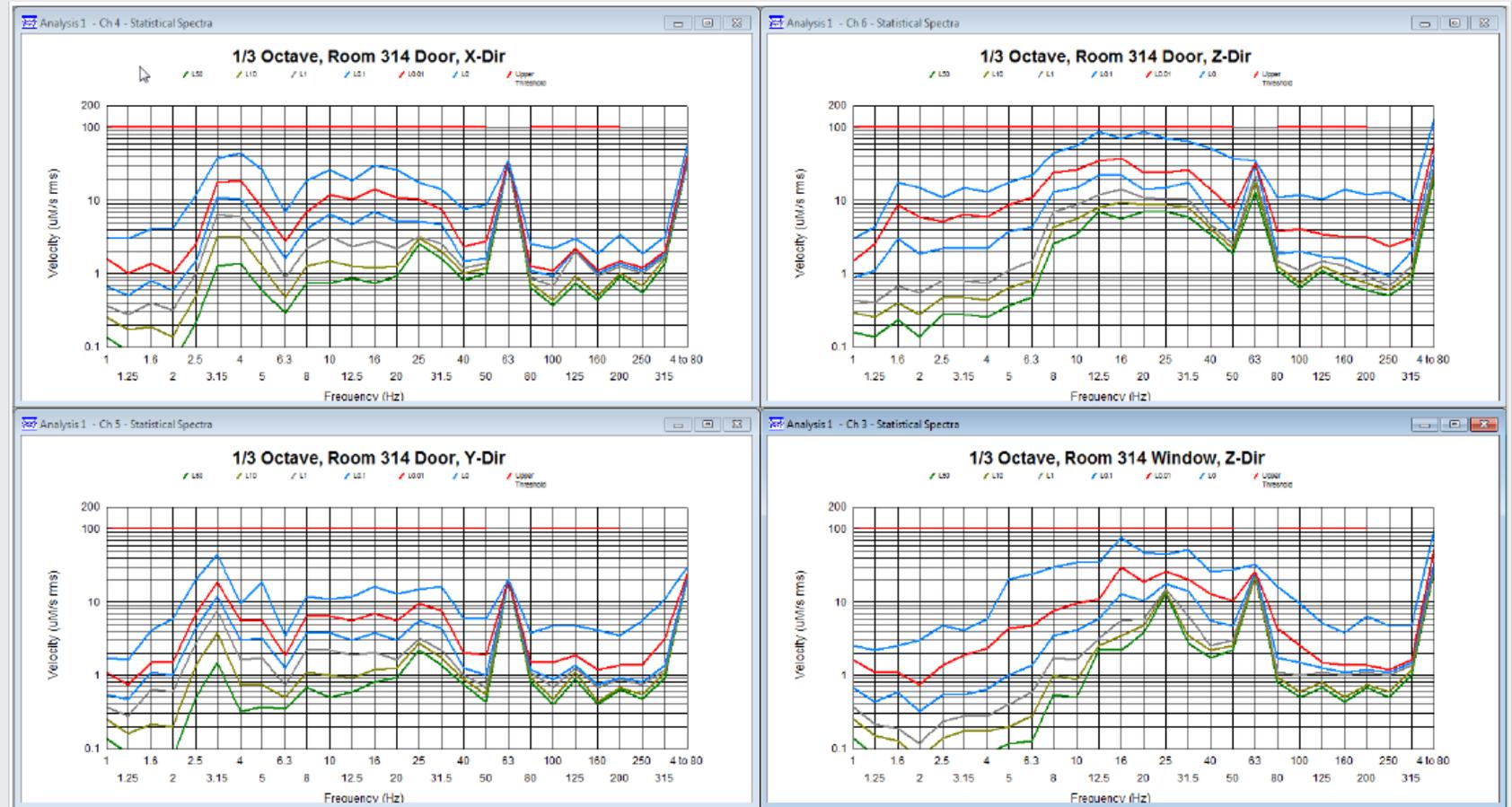


- Backfilling Efforts
  - No plate tampers within 100' of Heroy
  - Utilized #2 stone and jumping-jack



# Specific Project Site Requirements

- Real-Time Vibration Monitoring for Sensitive Lab Equipment
- Sensors (4) Installed in Adjacent Building
- Email / Text Message Alerts
- Reports & Exceedance Logs Every 2 Weeks over 6 Month Period



# Contract – Construction Manager

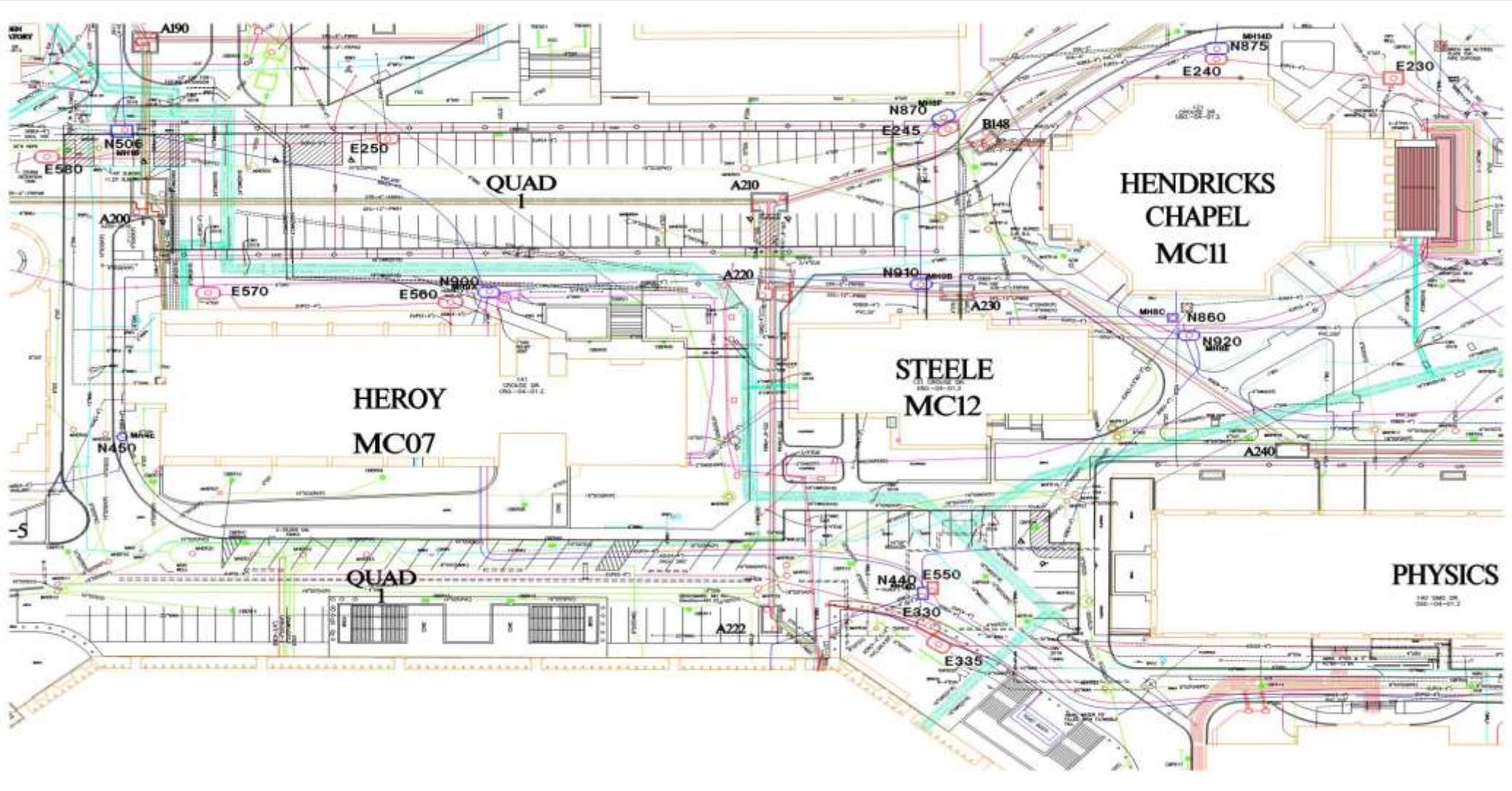
- Construction Manager At Risk (CMAR)
- CM Selection Process
  - Competitive bids for pre-construction phase services
  - CM's submitted rates for self-performing work
  - CM selected based upon pre-construction bid, self-performing costs and experience
  - All subcontracts were competitive bid by multiple firms (Mechanical, Electrical, Plumbing, Insulation, etc)
- AIA Document A133 Agreement
- Multiple Packages To Meet Project Schedule (Each a GMP Amendment)
  - Phase 1: Utility Work Package
  - Phase 2: Utility Work Package
  - Phase 3: Site Landscaping, Snowmelt, & Site Lighting Package
- Total of 7 Funding Sources, Separate Pay Applications for Each with T&M + Fee
- Total Project Cost: +/- \$4.0MM

# Utility Mapping, GPS As-Builts, & Site Monitoring

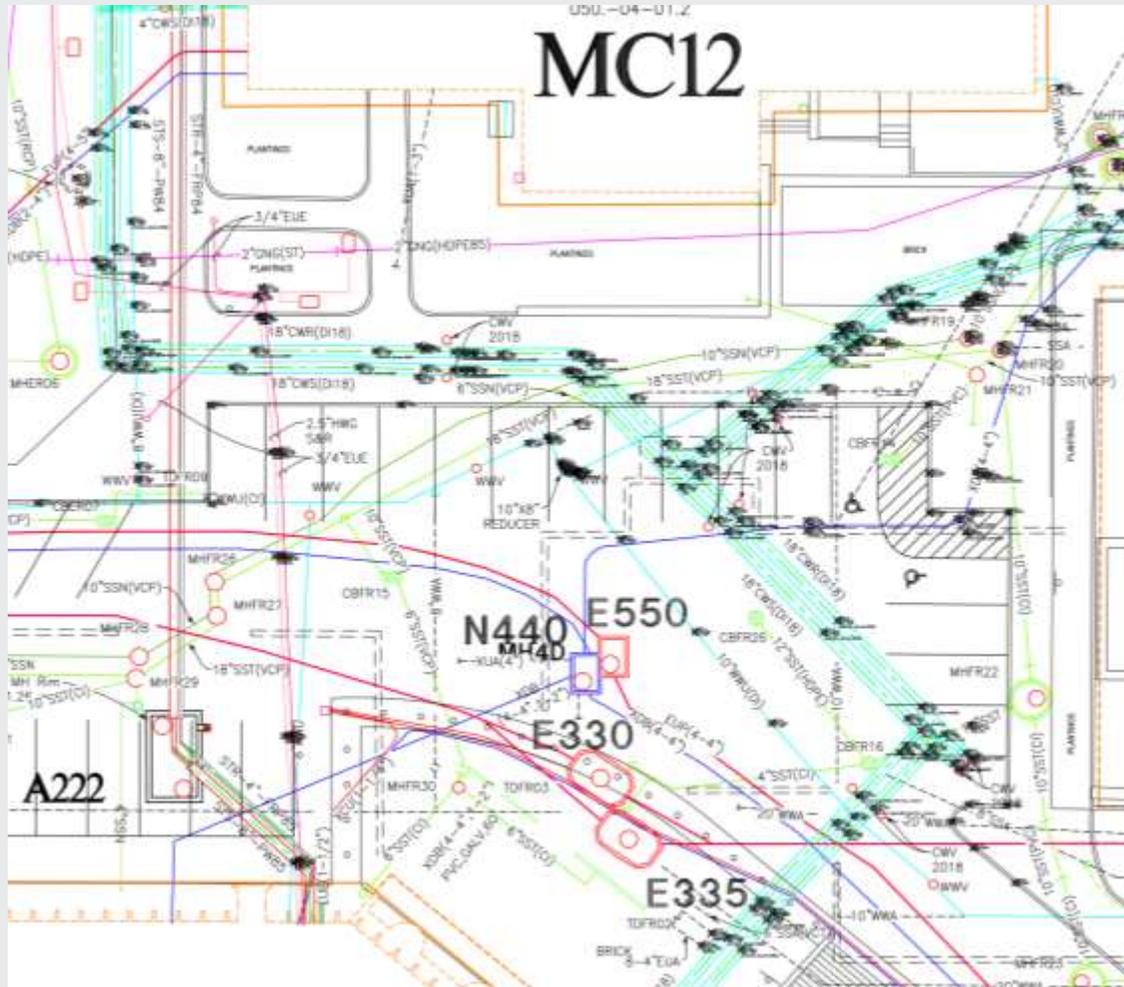
- Current campus site and utility map description
- Leica Equipment
  - Real-Time Kinematic (RTK)
  - CS15 Controller
  - GS14 Receiver
- AutoCad Civil3D & PDF Format
- Student Internship Program
  - State University of New York, ESF Construction Management



# Campus Site & Utility Map



# GPS As-Built Collection



Points of Project: SU-2018 CW Arch-Dome (Coordinate System: NY C NAD83 12A, Units: fts)

Point Id	Code Description	Code Infor...	Attributes	Date/Time	Northing	Easting	Ortho. Hgt.
676	CW Top of Pipe		Install Date=2018/Size=16	08/09/2018 15:14:59	1106869.4386	939960.4183	549.0148
677	CW Top of Pipe		Install Date=2018/Size=16	08/09/2018 15:15:17	1106869.1994	939964.5799	549.1293
678	CW Valve		Valve Type=Butterfly Valve/Install Date=2018/Size=16	08/09/2018 15:16:19	1106859.9573	939956.1119	548.7817
679	CW Valve		Valve Type=Butterfly Valve/Install Date=2018/Size=16	08/09/2018 15:16:46	1106862.1157	939953.8786	548.9004
680	CW Top of Pipe	11.25L	Install Date=2018/Size=16	08/09/2018 15:17:39	1106855.5130	939951.6617	548.8656
681	CW Top of Pipe	11.25L	Install Date=2018/Size=16	08/09/2018 15:17:59	1106857.2683	939949.7470	549.3411
682	CW Top of Pipe		Install Date=2018/Size=10	08/11/2018 12:15:18	1106867.4899	939969.2521	551.4556
683	CW Top of Pipe		Install Date=2018/Size=10	08/11/2018 12:15:55	1106869.3261	939971.3480	551.8274
684	CW Valve	NUT	Valve Type=Gate Valve/Install Date=2018/Size=10	08/11/2018 12:16:31	1106866.3607	939970.3075	553.5587
685	CW Valve	NUT	Valve Type=Gate Valve/Install Date=2018/Size=10	08/11/2018 12:16:59	1106868.1407	939972.3778	553.3254
686	Storm Top Pipe		Size=10	08/11/2018 12:18:15	1106874.0664	939971.9978	559.1610
687	Steam MH Cover	A200	Install Date=2018	08/15/2018 14:22:32	1107104.8541	939567.3522	567.8704
688	Steam Rim	A200		08/15/2018 14:22:53	1107106.3593	939567.2889	567.9318
689	Steam MH Cover	A200	Install Date=2018	08/15/2018 14:23:15	1107094.9384	939555.7682	567.9561
690	Steam Rim	A200		08/15/2018 14:23:37	1107096.4007	939555.6423	567.9433

## Site Plan Users:

- Dig Safe NY – Utility Locating
- Master Planning
- Campus Site Projects
- Share with Local Municipalities



# Lessons Learned

- Vibration and Backfill Methods
- Temporary Chiller Learning Curve – Controls & Melted PVC Pipe
- Communication: Town Hall Meetings & Utility Outages

2012 Utility Outage Summary  
6/15/12, DCM

Date(s)	Duration	System	Building	Edg Zone / Contents	Reason of Outage	Notes
4/13 - 6/15/12	< 10 weeks	Chilled Water	Isaac	Basement	Installation of chilled water piping	Isaac Hall will be served by a temporary chiller for the duration of the outage
5/16/12	< 1 hour	Steam	Denne (North Service)	Sub	Partial isolation of Vault A200	Denne north service to remain active (no interruption to Denne hall access)
5/21 thru August	< 3 months	Steam	Denne (South Service)	Sub	Isolate Vault 020 and isolation bypasses	Outage for duration of summer work. Denne will be fed from north service only
6/18 - 6/22/12	7 days	Steam	Salter, Spennon	Basement, Highrise	Isolation steam bypasses around Vault 020P	Steam shut off 6/18 and will be on 6/22 at 10am. It resumes by 10:15
6/18 - 6/22/12	< 2 days	Steam	Henry, Park, Eggers	Basement	Isolate Vault 020 and isolation bypasses	Steam shutdown to begin at 5:00am Friday 6/18 and be resumed on Sunday 6/22
6/18 - 6/22/12	< 2 days	Steam	Eden, later (ESP Buildings)	Sub, Paden	Remove steam bypasses around Vault 0210, ESP impact	
5/30/12	2 days	Natural Gas	Henry, Park	Basement	Relocate existing natural gas piping east of Henry	Need to coordinate with gas utility. Work completed in Park, emergency generators. Use gas in Park & Henry.
5/31/12	2 days	Domestic Water, Fire Water	Henrietta (Basement & Fire), Steele (Fire Only), Plaster North of Steele	O'Connor	Establish temp water feed to Henrietta to allow installation of fire water between Steele & Henry	
6/1/12 (Saturday)	2 day	Domestic Water, Fire Water	EIT, U/A, Natural Gas, etc. of Connected	Orders, Priority of Security Locks	Install additional isolation valves in Connected Ave	Fire water service to EIT will be maintained (fire water outage to U/A)
6/1 - 6/3/12	< 10 weeks	Irrigation System	Main Quad - Southwest Corner	Control	Installation of chilled water piping across Quad	
< 10 weeks	< 10 weeks	Fire Water	Steele, Hyattsville North of Steele	Basement	Relocate water distribution piping located between Steele and Henry	
6/3/12	< 1 hour	Domestic Water	Isaac	Basement	Isolation temp water feed to Steele to allow relocation of water main between Steele & Henry	Outage from approx 6:00AM - 9:00AM
July 14-17 or June 28-30 (TBD)	2 days	Domestic Water, Fire Water	Relocating w/ DMO, appears to impact Eminent Concrete, Basin Damage Fire and Thaw Concrete	Numerous	Relocate existing fire water main location north	City of Syracuse Water Dept repair
June June (TBD)	< 1 week	Fire Water	Denne South Feed, Hyattsville South of Henry	Sub	Relocate water distribution piping located between Steele and Henry	
June-July (TBD)	2 day	Electrical, Communication	Isaac	Basement, Pentamella	Modify, relocate/communication conduits entrance to building and replace breakers	Communications can be Quad point of sale hardware
Week of 6/12-6/12	< 1 day	Steam	South Garage	Sub	Repair steam in Connected Ave	
June-July (TBD)	2 day	Chilled Water	Isaac	Basement	Switch building from temp chiller back to plant/boiler system	
July (TBD)	TBD (< 1 day)	Domestic Water, Fire Water	Henrietta, Steele	O'Connor, Basement	Remove temporary water feeds	
August (TBD)	< 1 day	Steam	Salter, Spennon	Basement, Highrise, Pentamella, Dining	Remove steam bypasses around Vault 0210	
August (TBD)	< 1 day	Steam	Eden, later (ESP Buildings)	Sub, Paden	Remove steam bypasses around Vault 0210, ESP impact	
August (TBD)	< 1 day	Steam	Henry, Park	Basement	Remove steam bypasses around Vault A200	
August (TBD)	2 days	Steam	Denne (North Service)	Sub	Relocate steam to Vault A300 and restore Denne south service	

Utility Outage Scorecard



# Questions?