

## Chapter 8.0

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### Infrastructure Systems Component

## 8.0 INFRASTRUCTURE SYSTEMS COMPONENT

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### 8.1 Introduction

The Infrastructure Systems Component includes a description of the infrastructure systems that will support the BCH 2013 IMP Amendment Projects. Various Project components will connect to existing City and private utility company systems in the adjacent public streets. Based on initial investigations with the appropriate agencies and utility companies, existing infrastructure systems are available to accept the incremental increase in demand associated with the development and operation of the BCCB and 819 Beacon Street Projects. The following utilities are discussed: wastewater, water, stormwater, natural gas, electricity, and telecommunications. In addition, consideration is given to the sustainable elements of the energy supply provision for the Projects. The proposed Patient and Family Parking Garage Addition will not have any impact related to wastewater, water or stormwater because sewage generation is not anticipated from the addition.

The final design process for the Projects will include required engineering analyses and will adhere to applicable protocols and design standards, ensuring that the proposed buildings are properly supported by, and in turn properly use, the City's infrastructure. Detailed design of the Projects' utility systems will proceed in conjunction with the final design of the Projects and their mechanical systems.

The systems discussed below include those owned or managed by the Boston Water and Sewer Commission (BWSC), private utility companies, and on-site infrastructure systems. There will be close coordination among these entities and with the Projects' engineers and architects during subsequent reviews, and design and construction processes.

All improvements and connections to BWSC infrastructure will be reviewed by BWSC as part of the BWSC site plan review process. This process includes a comprehensive design review of the proposed service connections, assessment of system demands and capacity and establishment of service accounts.

### 8.2 Regulatory Framework

This chapter, in addition to a description of existing and future infrastructure connections, discusses the regulatory framework of utility connection reviews and standards. All connections will be designed and constructed in accordance with city, state, and federal standards.

- ◆ BWSC approvals will be required for all water, sewer, and stormwater systems.
- ◆ Sewer connection self-certification and/or permits will be filed with the Massachusetts Department of Environmental Protection (MassDEP) as required.

- ◆ The Boston Fire Department will review the proposed Projects with respect to fire protection measures such as fire department connections, hydrants, and standpipes.
- ◆ Design of the energy systems (gas and electric) will be coordinated with the respective system owners.
- ◆ New utility connections will be authorized by the Boston Public Works Department through the street opening permit process, as required.
- ◆ Additional information on the regulatory framework for each utility system is included in subsequent sections of this chapter.

A more complete list of state and local permits anticipated in connection with the Projects' infrastructure is included in Chapter 2.

### **8.3 Water Quality and Stormwater Management**

The Projects are expected to result in beneficial changes in both drainage patterns and water quality. Site-by-site descriptions of stormwater management are included in the following sections.

The proposed Project sites are currently mostly impervious to rainfall percolation. The BCCB site is currently 68% impervious. The 819 Beacon Street site is currently 100% impervious. Therefore, construction of the Projects is not expected to produce significant increases in the rate and volume of stormwater runoff. The proposed Patient and Family Parking Garage Addition is not expected to have any impact on stormwater rate, quantity and quality.

In addition, the Proponent is exploring the use of rainwater harvesting tanks, stormwater infiltration systems, as well as vegetated terrace areas as potential stormwater management systems for the Projects. The 819 Beacon Street Project is currently contemplating an approximately 7,000 sf vegetated roof area. The possible implementation of these stormwater management systems will have a positive impact on the quality of the stormwater discharged from the Project sites. When put in place, rooftop vegetation and subsurface stormwater infiltration create an opportunity to replicate the natural water cycle in a dense urban core environment.

Stormwater management controls will be established in compliance with BWSC standards, and the Projects will reduce peak flows, pollutants, or sediments that would potentially impact the Charles River. In conjunction with the site plan and the General Service Application, the Proponent will submit a Stormwater Management Plan to the BWSC. Compliance with the standards for the final site design will be reviewed as part of the BWSC site plan review process. Furthermore, the Proponent intends to coordinate with BWSC regarding existing drainage at the Core Campus.

### **8.3.1**      *MassDEP Stormwater Management Policy Standards*

In March 1997, MassDEP adopted a new Stormwater Management Policy to address non-point source pollution. In 1997, MassDEP published the Massachusetts Stormwater Handbook as guidance on the Stormwater Policy, which was revised in February 2008. The Policy prescribes specific stormwater management standards for redevelopment projects, including urban pollutant removal criteria for projects that may impact environmental resource areas. Compliance is achieved through the implementation of Best Management Practices (BMPs) in the stormwater management design. The Policy is administered locally pursuant to MGL Ch. 131, s. 40.

A brief explanation of each Policy Standard and the system compliance is provided below:

***Standard #1:*** *No new stormwater conveyances (e.g., outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

Compliance: The proposed designs will comply with this Standard. No new untreated stormwater will be directly discharged to, nor will erosion be caused to wetlands or waters of the Commonwealth as a result of stormwater discharges related to the proposed Projects.

The Proponent is exploring rainwater harvesting tanks and/or stormwater infiltration systems and vegetated terrace areas for the BCCB and 819 Beacon Street. For example, the 819 Beacon Street Project is currently contemplating an approximately 7,000 sf vegetated roof area. It is the Proponent's intention to treat runoff whether through the options listed above or mechanical treatment units prior to discharge into the public storm drain system.

***Standard #2:*** *Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.*

Compliance: The proposed Projects will be designed to comply with this Standard. The existing discharge rate will be met or decreased as a result of the improvements associated with the proposed Projects. The quantities shown below are representative of pre-development and maximum post-development discharge rates. The implementation of potential rainwater harvesting tanks, green roofs, and infiltration systems will help achieve these numbers for the proposed Projects. The assumed time of concentration used to determine the values was five minutes.

Site	Event (yr)	Pre-development and Maximum Post-Development Discharge Rate (cfs)
BCCB	2	1.91
	10	3.14
	25	3.94
	100	4.91
819 Beacon Street	2	4.71
	10	6.82
	25	8.17
	100	9.81

**Standard #3:** *Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to the maximum extent practicable. The annual recharge from the post development site should approximate the annual recharge from the pre-development or existing site conditions, based on soil types.*

Compliance: The proposed Projects will explore the use of recharge to the maximum extent feasible.

**Standard #4:** *For new development, stormwater management systems must be designed to remove 80% of the average annual load (post-development conditions) of Total Suspended Solids (TSS). It is presumed that this standard is met when: Suitable nonstructural practices for source control and pollution prevention are implemented; Stormwater management best management practices (BMPs) are sized to capture the prescribed runoff volume; and Stormwater management BMPs are maintained as designed.*

Compliance: The proposed designs will include BMPs intended to remove TSS. Within the proposed Projects' limit of work, there will be mostly roof, landscaping, and pedestrian areas. Any paved areas that would contribute unwanted sediments or pollutants to the existing storm drain system will be collected by deep sump, hooded catch basins and conveyed through water quality units or tanks before discharging into the BWSC system.

**Standard #5:** *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If, through source control and/or pollution prevention, all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be*

*suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L.c. 21, §§ 26-53 and the regulations promulgated there under at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

Compliance: The proposed Projects are not associated with Higher Potential Pollutant Loads.

***Standard #6:*** *Stormwater discharge to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters (ORWs), shellfish beds, swimming beaches, cold-water fisheries and recharge areas for public water supplies.*

Compliance: The proposed Projects do not discharge to a critical area.

***Standard #7:*** *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

Compliance: The proposed designs will comply with this Standard. The proposed Projects will comply with the Stormwater Management Standards to the extent practicable and are anticipated to improve upon existing conditions.

***Standard #8:*** *Erosion and sediment controls must be implemented to prevent impacts during construction or land disturbance activities.*

Compliance: Sedimentation and erosion controls will be incorporated as part of the design of these Projects and employed during construction.

***Standard 9:*** *A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

Compliance: An O&M Plan will be developed during the design process of the buildings.

***Standard 10:*** *All illicit discharges to the stormwater management system are prohibited.*

Compliance: There will be no illicit connections associated with the proposed Projects.

## 8.4 Protection of Utilities

Existing public and private infrastructure located within the public right-of-way will be protected during construction. The installation of proposed utilities within the public way will be in accordance with BWSC, Boston Public Works Department, the Dig-Safe Program, and governing utility company requirements. All necessary permits will be obtained before the commencement of work. Specific methods for constructing proposed utilities where they are near to, or connect with, existing water, sewer, and storm drain facilities will be reviewed by the BWSC as part of its site plan review process.

## 8.5 Construction Coordination

The Proponent will continue to work and coordinate with the utility companies to assure compliance and integrity to the proposed Projects.

## 8.6 Sustainable Design/Energy Conservation

Energy conservation measures will be an integral part of the Projects' infrastructure designs. The buildings will employ energy-efficient and water-conservation features for mechanical, electrical, architectural, and structural systems, assemblies, and materials where possible. Mechanical and HVAC systems will be installed to the current industry standards and full cooperation with the local utility providers will be maintained during design and construction. Additional information on sustainable design is provided in Chapter 5.

In connection with construction of the BCCB, Children's will develop a Central Utilities Plant in the sub-basement of the BCCB that will include a 1,200 kilowatt (kW) gas-fired reciprocating engine and waste heat boiler (together a CHP unit) and two 30 thousand pound per hour (kpph) dual-fuel fire tube boilers. In addition, electrically operated chiller units will be placed in the sub-basement of the BCCB and will be sized to reliably provide 100% of the chilled water needs for the BCCB.

CHP is the simultaneous production of electrical or mechanical energy (power) and useful thermal energy from a single energy source. By capturing and using heat energy from an effluent stream that otherwise would be discharged to the environment, CHP systems can operate at efficiencies that are not achieved when heat and power are produced through separate processes.

## 8.7 Boston Children's Clinical Building

### *8.7.1 Wastewater*

Local sanitary sewer service is provided by the BWSC. The Core Campus site is serviced by sewer mains in the adjacent public and privately-owned streets. All wastewater collected by BWSC facilities are conveyed to the Massachusetts Water Resources Authority's (MWRA) Deer Island treatment plant where, after treatment, it is discharged into Massachusetts Bay.

Adjacent to the Core Campus are the following sanitary sewer lines:

- ◆ Two 12-inch gravity sewers in Binney Street;
- ◆ 39 x 41-1/4-inch gravity sewer in Blackfan Circle;
- ◆ 12-inch gravity sewer in Children’s Way;
- ◆ 12-inch gravity sewer in Shattuck Street; and
- ◆ 15-inch and 24-inch gravity sewer in Longwood Avenue.

The BCCB will require either new or modified sanitary sewer service. The BCCB, which will consist of clinical space and clinical support space is located on the BCH Core Campus and will generate approximately 77,525 gallons per day (gpd) of wastewater, according to the Massachusetts State Environmental Code (Title V) at 310 CMR 15.203 as indicated in Table 8-1. The CUP will be located on the Core Campus in the basement of the BCCB.

**Table 8-1 Net New Wastewater Generation – Full Project Build Out**

Proposed Project Component	Gross Floor Area (gsf)	Flow Rate (gpd)	Sewage Generation (gpd)
<b>BCCB</b>			
Clinical	354,700	200/1,000 sf	70,940
Clinical support	87,800	75/1,000 sf	6,585
<b>Total New Wastewater Generation</b>			<b>77,525</b>

The BCCB, will generate over 50,000 gpd of sewage. Currently, buildings generating these flow rates are required to file a Sewer Connection Permit with MassDEP. Under the current design, the CUP is not expected to generate any appreciable quantity of sewage.

The sewer service connections at the Core Campus may tie directly into the 15-inch main located in Longwood Avenue or the 12-inch main located in Shattuck Street.

The Proponent will coordinate with the BWSC on the design of the proposed connections to the sewer system. In addition, the Proponent will submit a General Service Application and site plan for review as the Projects progress.

**8.7.2 Water Infrastructure**

Domestic and fire protection water is provided by the BWSC. There are five different water systems/service districts within the City, which provide service to portions of the City based on ground surface elevation. The five systems are southern low (commonly known as low

service), southern high (commonly known as high service), southern extra high, northern low, and northern high. The Core Campus is serviced by the BWSC southern low water system. BWSC has the following water mains in the streets adjacent to the Core Campus:

- ◆ 8-inch main in Binney Street;
- ◆ 12-inch main in Blackfan Circle;
- ◆ 8-inch and 12-inch main in Children's Way;
- ◆ 12-inch main in Shattuck Street; and
- ◆ 12-inch main in Longwood Avenue.

Domestic water demand is based on estimated sewage generation with an added factor of 10 percent for consumption, system losses, and other use. Based upon these assumptions, the BCCB will require approximately 85,278 gallons of water per day. Under the current design, the CUP facility is not expected to require any appreciable quantity of water.

The proposed BCCB and CUP facility will both connect to the BWSC's low service system located on Longwood Avenue. Service connections required by the proposed Project will meet the applicable city and state codes and standards, including cross-connection backflow prevention.

Compliance with the standards for the water system service connections will be reviewed as part of BWSC's site plan review process. The review includes, but is not limited to, sizing of domestic water and fire protection services, calculation of meter sizing, backflow prevention design, and location of hydrants and siamese connections conformance to BWSC and Boston Fire Department requirements.

### **8.7.3 Fire Protection System**

The fire protection system for the BCCB Project will be designed in compliance with the latest Massachusetts Building Code, which refers to the *National Fire Protection Association Handbook*. In addition, the fire protection system will meet all applicable standards and requirements as set forth in the *Boston Fire Prevention Code*, the *Massachusetts Fire Prevention Regulation* (527 CMR), and the *Massachusetts Fire Prevention Laws* (MGL CH 148).

Compliance with the standards for the fire protection system connections will be determined as part of BWSC's site plan review process.

At the BCCB, the proposed fire suppression system may connect to the BWSC's low service system located in Longwood Avenue. Water service connections required by the Project will be designed to meet the applicable city and state codes and standards, including cross-connection backflow prevention.

In addition to fire protection connections to the BWSC system, the current edition of the Massachusetts State Building Code requires that high-rise buildings in certain seismic design categories provide on-site storage of a sufficient volume of water to service the most demanding zone of the building fire protection system for a period of 90 minutes. To meet this requirement, the BCCB will include storage for 150,000 gallons of fire protection water.

Emergency vehicle site access to the BCCB, including the siamese building connections, will be provided. The Proponent will seek input from the Boston Fire Department as the Project's designs progress.

The Proponent will obtain required permits pursuant to the Boston Fire Prevention Code, CMR 527 and MGL Chapter 148.

#### ***8.7.4 Stormwater***

The Core Campus is serviced by a 15-inch and 24-inch drain line in Longwood Avenue which then conveys stormwater down Blackfan Street. A 12-inch drain line is also located in Shattuck Street connecting to the same system.

The existing BCCB site is currently 68% impervious and includes little to no stormwater controls. Much of the site's runoff discharges untreated to the drainage system in the surrounding streets.

Construction of the proposed Project is expected to result in a decrease in the rate and quantity of stormwater runoff from the site. As part of the BWSC's review process, the Proponent will consider measures wherever applicable to minimize flows from the site.

The Proponent is exploring the use of rainwater harvesting tanks and/or stormwater infiltration systems as well as vegetated terrace areas on the BCCB site. The potential infiltration stormwater management options will promote the infiltration of stormwater runoff into the ground and evapotranspiration and reduce the rate and quantity of stormwater discharge to the drainage system. Rainwater harvesting would reduce both runoff and domestic water demand.

### **8.7.5**      *Natural Gas Service*

It is anticipated that National Grid will provide gas service from a 20 psi main for the BCCB, and if constructed, the CUP Facility. The demand associated with the CUP being considered is such that National Grid would provide reinforcement to the existing grid to handle the load. The Proponent will work with National Grid to confirm adequate system capacity as the Project designs are finalized.

The estimated combined gas demand for the BCCB and CUP is 40,000 cubic feet per hour (CFH).

### **8.7.6**      *Electrical Service*

The electrical service for the BCCB building is anticipated to be provided by the local electrical utility, NSTAR. The BCCB will require an NSTAR service entrance room and 15 KV, three phase, three wire switchgear lineup. The potential CUP facility, located within the BCCB, may also require a separate NSTAR service entrance room and a 15 KV, three phase, three wire switchgear lineup. The estimated electrical output for the BCCB is 3.4 MW. The estimated electrical load for the CUP facility is 2 MW.

### **8.7.7**      *Telecommunications*

The Proponent will select private telecommunications companies to provide telephone, cable, and data services. There are several potential candidates with substantial Boston networks capable of providing service. Upon selection of a provider or providers, the Proponent will coordinate service connection locations and obtain appropriate approvals.

## **8.8**      **819 Beacon Street**

### **8.8.1**      *Wastewater*

Local sanitary sewer service is provided by the BWSC. The 819 Beacon Street site is serviced by sewer mains in the adjacent public and privately-owned streets. All wastewater collected by BWSC facilities are conveyed to the Massachusetts Water Resources Authority's (MWRA) Deer Island treatment plant where, after treatment, it is discharged into Massachusetts Bay.

The 819 Beacon Street site is located adjacent to 12-inch and 20-inch sewer mains located along Beacon Street.

The 819 Beacon Street Project will require new sanitary sewer service. The site will be primarily office and administrative space which will generate approximately 15,696 gpd of wastewater as indicated in Table 8-2.

**Table 8-2 Net New Wastewater Generation – Full Project Build Out**

Proposed Project Component	Gross Floor Area (gsf)	Flow Rate (gpd)	Sewage Generation (gpd)
Office/Administrative	202,950	75/1,000 sf	15,222
Retail	9,480	50/1,000 sf	474
<b>Total New Wastewater Generation</b>			<b>15,696</b>

At 212,430 sf, the 819 Beacon Street building will generate over 15,000 gpd of sewage. Buildings generating flow rates between 15,000 gpd and 50,000 gpd are currently required to file a Sewer Connection Self-certification with MassDEP.

It will potentially tie directly into the 20-inch main located in Beacon Street.

The Proponent will coordinate with the BWSC on the design of the proposed connections to the sewer system. In addition, the Proponent will submit a General Service Application and site plan for review as the Projects progress.

**8.8.2 Water Infrastructure**

Domestic and fire protection water is provided by the BWSC. BWSC has a 12-inch main in Beacon Street adjacent to the 819 Beacon Street site.

Domestic water demand is based on estimated sewage generation with an added factor of 10 percent for consumption, system losses, and other use. Based upon these assumptions, 819 Beacon Street will require approximately 17,266 gallons of water per day.

The 819 Beacon Street building will most likely connect to the existing water main in Beacon Street. Service connections required by the proposed Project will meet the applicable city and state codes and standards, including cross-connection backflow prevention.

Compliance with the standards for the water system service connections will be reviewed as part of BWSC’s site plan review process. The review includes, but is not limited to, sizing of domestic water and fire protection services, calculation of meter sizing, backflow prevention design, and location of hydrants and siamese connections conformance to BWSC and Boston Fire Department requirements.

**8.8.3 Fire Protection System**

The fire protection systems for 819 Beacon Street will be designed in compliance with the latest Massachusetts Building Code, which refers to the *National Fire Protection Association Handbook*. In addition, the fire protection system will meet all applicable standards and

requirements as set forth in the Boston Fire Prevention Code, the Massachusetts Fire Prevention Regulation (527 CMR), and the Massachusetts Fire Prevention Laws (MGL CH 148).

Compliance with the standards for the fire protection system connections will be determined as part of BWSC's site plan review process.

For the 819 Beacon Street building, the proposed fire suppression system may connect to BWSC's low service system location in Beacon Street. Water service connections required by the Project will be designed to meet the applicable city and state codes and standards, including cross-connection backflow prevention.

In addition to fire protection connections to the BWSC system, the current edition of the Massachusetts State Building Code requires that high-rise buildings in certain seismic design categories provide on-site storage of a sufficient volume of water to service the most demanding zone of the building fire protection system for a period of 90 minutes.

Emergency vehicle site access to the Project, including the siamese building connections, will be provided. The Proponent will seek input from the Boston Fire Department as the Project's design progresses.

The Proponent will obtain required permits pursuant to the Boston Fire Prevention Code, CMR 527 and MGL Chapter 148.

#### ***8.8.4 Stormwater***

The 819 Beacon Street site will potentially tie into either a 12-inch line located in Maitland Street and/or a 24-inch line located in Beacon Street. Preference will be given to the 12-inch line in Maitland Street as noted by reviewers.

The 819 Beacon Street site is currently 100% impervious. The 819 Beacon Street Project is currently contemplating an approximately 7,000 sf vegetated roof area, which will reduce stormwater runoff. Therefore, construction of the Project is not expected to produce an increase in the rate and volume of stormwater runoff.

In addition, the Proponent is exploring the use of rainwater harvesting tanks and/or stormwater infiltration system on the 819 Beacon Street site. These potential infiltration stormwater management options will promote the infiltration of stormwater runoff into the ground and evapotranspiration and reduce the rate and quantity of stormwater discharge to the drainage system. Rainwater harvesting would reduce both runoff and domestic water demand.

With the potential implementation of these stormwater management options, the construction of the proposed 819 Beacon Street Project is expected to result in a decrease in the rate and quantity of stormwater runoff from the site. As part of the BWSC's review process, the Proponent will consider measures wherever applicable to minimize flows from the site.

#### ***8.8.5 Natural Gas Service***

It is anticipated that National Grid will provide gas service. The Proponent will work with National Grid to confirm adequate system capacity as the Project designs are finalized.

The estimated gas demand for 819 Beacon Street is 6,500 CFH.

#### ***8.8.6 Electrical Service***

The electrical service for the building is anticipated to be provided by the local electrical utility, NSTAR. The proposed 819 Beacon Street building will require an exterior pad mounted transformer. The estimated electrical load for the 819 Beacon Street Project is 2.1 MW.

#### ***8.8.7 Telecommunications***

The Proponent will select private telecommunications companies to provide telephone, cable, and data services. There are several potential candidates with substantial Boston networks capable of providing service. Upon selection of a provider or providers, the Proponent will coordinate service connection locations and obtain appropriate approvals.

### **8.9 Conclusion**

The Projects will use the existing water, sewer, electrical, and natural gas systems available in public streets adjacent to the Project sites. Research and coordination to date indicate that these services are adequately sized to support the increased demands associated with the development of the Projects. The proposed Projects are consistent with MassDEP's Stormwater Management Policy, and incorporate a number of sustainable design and energy conservation measures.