Assess Existing Pumping Capacities, Permits and Current and Future Vulnerabilities
Scope of Work

1 - Review Existing Permit Information
Scope of Work

2 – Identify Floodplains and Wetlands
Scope of Work

3 – Assess Existing Conditions and Examine Vulnerability Data
Surveyed 51

Total pump stations that are located on Green, Red, Orange, Blue, and Silver Lines
Total pump stations: 51

- Green Line: 9
- Blue Line: 8
- Silver Line: 1
- Orange Line: 9
- Red Line: 24
Total of 104 Pumps
Scope of Work
4 – Capture Site Survey Information
Investigation Procedure

- Reviewed pump rooms
- Survey apps
- Collector app
- 360 photos
Survey123 App

- Survey123 is an app or website that you can fill out questions you’d like to answer during site visits/surveys
- Mott MacDonald used an iPad as collecting data tool
  - Built in camera allows to take pictures to put in the forms
Survey123 Forms Consisted of

- Condition of drainage system (inlets, grating, pipe, etc.)
- Condition of discharge outlet structure/pipe (if location is known and visible).
- General condition of pipe, valves and electrical equipment.
- Signs condition of pipe, valves, and electrical equipment.
- Signs of excessive infiltration, structural defects or other apparent deficiencies
- Last recorded maintenance
Survey123 Forms Consisted of

- Pump discharge locations and backflow protection based on visual observation and available record drawings.

- Record electrical equipment type and location likely impacted during flooding.

- Record pump control panel location.

- Identify where possible backup/standby power supply can be located.

- Record rated pump capacities, manufacturer, model, motor HP, voltage
Survey123 Forms Consisted of

- Inventory vulnerability data for MBTA’s drainage pumping system assets such as:
  - Station or facility served and pump location
  - Approximate elevation of assets (pumps, motors, electrical equipment, controls, SCADA, etc.)
  - Resiliency of assets (type of equipment, impact from submergence)
  - Age of assets
  - Any existing flood protection measures
  - Role of pump(s)
  - Sources of water influent to the pump station (drainage pipes, culverts, surface, infiltration)
  - Pump discharge location and backflow protection
360 photos

- Used 360 camera
- Wi-fi compatible to enable us to use it through iPad
- Gives advantages to “re-visit” the pump rooms and examine the details in 360
Prudential in **Green Line**
Nearest station: Copley Station.

Enter by riding the green line and getting off at the pump room in the tracks.
Symphony in Green Line
Nearest station: Symphony

400ft down the ROW platform. Enter through a single door on the ROW
Harvard Station in Red Line
Nearest station: Harvard Station

Located below abandoned station. Enter through maintenance area across outbound tracks and through cable bundle.
Findings and Recommendations
## Survey Results

<table>
<thead>
<tr>
<th>Condition State 1 (Good)</th>
<th>Condition State 2 (Fair)</th>
<th>Condition State 3 (Poor)</th>
<th>Condition State 4 (Severe)</th>
<th>Condition State 5 (Undefined)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All pumps function with no leaks, vibrations, unusual noises.</td>
<td>• All pumps function with minimal noise, vibrations, and leaks.</td>
<td>• At least one installed pump functions.</td>
<td>• Pumps not present or not in operable state.</td>
<td>• Pump room site under construction or not accessible at all.</td>
</tr>
<tr>
<td>• Little to no corrosion present.</td>
<td>• Some corrosion present.</td>
<td>• Presence of noise, vibrations, and leaks</td>
<td>• Severe leaks present.</td>
<td></td>
</tr>
<tr>
<td>• No notable equipment distresses</td>
<td>• Check or gate valve failed.</td>
<td>• High levels of corrosion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Issue with accessibility</td>
<td></td>
<td>• Pump nearing end of life.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total: 0</td>
<td>Total: 4</td>
<td>Total: 27</td>
<td>Total: 18</td>
<td>Total: 2</td>
</tr>
</tbody>
</table>
E-Report
## Survey Results

### 4.1 Condition State One

<table>
<thead>
<tr>
<th>Condition State</th>
<th>Line</th>
<th>Pump Room Name</th>
<th>Condition Summary</th>
<th>Survey Forms</th>
<th>360 Pics</th>
<th>Final Recommendation and Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Good Condition</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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### 4.2 Condition State Two

<table>
<thead>
<tr>
<th>Condition State</th>
<th>Line</th>
<th>Pump Room Name</th>
<th>Condition Summary</th>
<th>Survey Forms</th>
<th>360 Pics</th>
<th>Final Recommendation and Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Fair Condition</td>
<td>Blue</td>
<td>Under Harbor East</td>
<td>Pumps in good condition, noise present</td>
<td>62.3.7</td>
<td>63.3.7</td>
<td>5.1.1</td>
</tr>
<tr>
<td></td>
<td>Orange</td>
<td>Haymarket</td>
<td>Pumps in fair condition, noise present, minor corrosion</td>
<td>62.7.6</td>
<td>63.7.6</td>
<td>5.2.1</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Mass Ave</td>
<td>Pumps in fair condition, noise present, leaks present, and shaking</td>
<td>62.4.17</td>
<td>63.4.17</td>
<td>5.1.3</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Welles Ave</td>
<td>Pumps in fair condition, noise present</td>
<td>62.4.23</td>
<td>63.4.23</td>
<td>5.1.4</td>
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</table>

### 4.3 Condition State Three

<table>
<thead>
<tr>
<th>Condition State</th>
<th>Line</th>
<th>Pump Room Name</th>
<th>Condition Summary</th>
<th>Survey Forms</th>
<th>360 Pics</th>
<th>Final Recommendation and Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Poor Condition</td>
<td>Blue</td>
<td>Government Center</td>
<td>Pump 1 did not operate</td>
<td>62.3.1</td>
<td>63.3.1</td>
<td>5.2.1</td>
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<tr>
<td></td>
<td>Blue</td>
<td>Prescott St</td>
<td>Pump 2 is corroded</td>
<td>62.3.6</td>
<td>63.3.6</td>
<td>5.2.2</td>
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<tr>
<td></td>
<td>Blue</td>
<td>Under Harbor West</td>
<td>Both pumps in poor condition, rusted and corroded</td>
<td>62.3.8</td>
<td>63.3.8</td>
<td>5.2.3</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>Beacon St</td>
<td>Both pumps operate, but very corroded and leaks present</td>
<td>62.1.1</td>
<td>63.1.1</td>
<td>5.2.4</td>
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<tr>
<td></td>
<td>Green</td>
<td>Church St</td>
<td>Pump 1 is very corroded but operates. Pump 2 does not operate because motor is not hooked up</td>
<td>62.1.2</td>
<td>63.1.2</td>
<td>5.2.5</td>
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<tr>
<td></td>
<td>Green</td>
<td>Copley Station</td>
<td>Pump 1 did not operate, both pumps in poor condition.</td>
<td>62.1.4</td>
<td>63.1.4</td>
<td>5.2.6</td>
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<tr>
<td></td>
<td>Orange</td>
<td>Muddy River</td>
<td>Both pumps very corroded, loud noise present.</td>
<td>62.3.7</td>
<td>63.3.7</td>
<td>5.2.7</td>
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<tr>
<td></td>
<td>Orange</td>
<td>Charles River/Accolom Way</td>
<td>Pump 2 did not operate. Both pumps in poor condition.</td>
<td>62.2.2</td>
<td>63.2.2</td>
<td>5.2.8</td>
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<tr>
<td></td>
<td>Orange</td>
<td>Stourbridge St</td>
<td>Pump 1 did not operate, unusual noise present</td>
<td>62.2.5</td>
<td>63.2.5</td>
<td>5.2.10</td>
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<tr>
<td></td>
<td>Orange</td>
<td>Follen St.</td>
<td>Pump 3 did not operate.</td>
<td>62.2.4</td>
<td>63.2.4</td>
<td>5.2.9</td>
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<tr>
<td></td>
<td>Orange</td>
<td>Gurney St.</td>
<td>Pump 1 did not operate. Unusual noise present</td>
<td>62.2.2</td>
<td>63.2.2</td>
<td>5.2.10</td>
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<tr>
<td></td>
<td>Orange</td>
<td>Besford Underpass</td>
<td>All pumps run, but pump 2 is in poor condition.</td>
<td>62.2.8</td>
<td>63.2.8</td>
<td>5.2.11</td>
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<tr>
<td></td>
<td>Red</td>
<td>A St.</td>
<td>Pump 2 did not operate.</td>
<td>62.4.1</td>
<td>63.4.1</td>
<td>5.2.12</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Andrew</td>
<td>Pump 1 did not operate. Motor runs but not engaging with pump</td>
<td>62.4.2</td>
<td>63.4.2</td>
<td>5.2.13</td>
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<tr>
<td></td>
<td>Red</td>
<td>Central</td>
<td>Both pumps are very corroded. Pump 2 is missing motor</td>
<td>62.4.3</td>
<td>63.4.3</td>
<td>5.3.14</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Clifton St</td>
<td>Pump 1 did not operate.</td>
<td>62.4.4</td>
<td>63.4.4</td>
<td>5.2.15</td>
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<tr>
<td></td>
<td>Red</td>
<td>D St.</td>
<td>Both pumps operate, but pump 1 is in very poor condition</td>
<td>62.4.6</td>
<td>63.4.6</td>
<td>5.2.16</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>East of Kendall</td>
<td>Both pumps operate, but they're nearing their end life.</td>
<td>62.4.8</td>
<td>63.4.8</td>
<td>5.2.17</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Garfield</td>
<td>Pumps and motors are all in poor condition. Wire on the ground with water, very dangerous.</td>
<td>62.4.10</td>
<td>63.4.10</td>
<td>5.2.18</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Granite</td>
<td>Both pumps operate, but they're in poor condition. Very corroded</td>
<td>62.4.11</td>
<td>63.4.11</td>
<td>5.2.19</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Harvard Busway</td>
<td>Pump 1 severely corroded. Both pumps in very bad condition</td>
<td>62.4.12</td>
<td>63.4.12</td>
<td>5.2.20</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Harvard Station</td>
<td>Pump 2 does not operate. Very poor condition and out of place</td>
<td>62.4.14</td>
<td>63.4.14</td>
<td>5.2.21</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Hawley St.</td>
<td>Pump 2 does not operate. Both pumps in severe condition</td>
<td>62.4.15</td>
<td>63.4.15</td>
<td>5.2.22</td>
</tr>
<tr>
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<td>Red</td>
<td>Porter Station</td>
<td>Pump 2 did not operate.</td>
<td>62.4.19</td>
<td>63.4.19</td>
<td>5.2.23</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>Route 2N&amp;S</td>
<td>Pump 1 did not operate. Other pumps in poor condition, corroded</td>
<td>62.4.20</td>
<td>63.4.20</td>
<td>5.2.24</td>
</tr>
<tr>
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<td>Red</td>
<td>South Station</td>
<td>Pumps in fair condition, minor corrosion. One of pumps not in operation</td>
<td>62.4.21</td>
<td>63.4.21</td>
<td>5.2.25</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>West Kendall</td>
<td>Pump 2 did not operate. Pump 1 severely corroded. Both pumps in very poor condition.</td>
<td>62.4.24</td>
<td>63.4.24</td>
<td>5.2.26</td>
</tr>
</tbody>
</table>
5 Recommendations and Findings

5.1 Condition State 2 recommendations

5.1.1 Under Harbor East - Blue Line

5.1.1.1 Environmental and Permitting Scope
- TBD

5.1.1.2 Civil Scope
- Record drawings available (M-A:25044 through 25047). East Pump station 321+25 discharges to 6" pipe to station 309+27 then up to SMH structures on Marginal Street. See Appendix 6.5.3.7

5.1.1.3 Pump Room Scope
- Doors shall be provided with a lock
- New check and gate valves shall be provided
- New belts shall be provided
- Discharge system seal shall be provided
- Upgrade the control system and provide remote monitoring and control
- Pump room need structural repairs.

5.1.2 Haymarket – Orange Line

5.1.2.1 Environmental and Permitting Scope
- TBD

5.1.2.2 Civil Scope
- Record plans for review not available.

5.1.2.3 Pump Room Scope
- Provide new gate valves
- New belts shall be provided
- Upgrade the control system and provide remote monitoring and control

5.1.3 Mass Ave – Red Line

5.1.3.1 Environmental and Permitting Scope
- TBD

5.1.3.2 Civil Scope
- No drawings provided. See Appendix 6.5.4.17

5.1.3.3 Pump Room Scope
- Replace/repair pump room access door
- Provide link seal to the vent pipe.
- Provide new check valves and belts.
- Vent pipe to wet well shall be replaced.
- Upgrade controls to provide remote monitor/control.

5.1.4 Wolles Ave. – Red Line

5.1.4.1 Environmental and Permitting Scope
- TBD

5.1.4.2 Civil Scope
- Per DRT Section 3, Plan No. 18190, 2-10" WI pump discharges directed out of pump well to DMH in Wells Ave. (inv:-155.00) with 18" SD outlet (inv:-154.90). 1-10" WI pump discharges directed out of pump well to DMH in Wells Ave. with 10" VC 3D outlet (inv:-154.90). See Appendix 6.5.4.22

5.1.4.3 Pump Room Scope
- Repair leakage.
- Maintain pump and change belts and check bearings. Pump may have some cavitation.
- Structural repair shall be provided.
- Upgrade controls to provide remote monitor/control

5.2 Condition State 3 Recommendations

5.2.1 Government Center – Blue Line

5.2.1.1 Environmental and Permitting Scope
- TBD

5.2.1.2 Civil Scope
- Record drawings available sheet nos. 1, 2, 156, 157, 19, 54, 68F, 304-314, 371, 376, of 401. 18" DI Class 55 discharge pipe shown on Sheet No. 54 passes through Durham Street. The continuation discharged pipe missing possibly shown on Sheet Nos. 51-53. See Appendix 6.5.3.1

5.2.1.3 Pump Room Scope
- One of the pumps needs to be investigated and replaced.
- Pipe penetrations requires seals.
- Pipe needs to be replaced due to corrosion.
- Upgrade the control system and provide remote monitoring control (future upgrade).
- Structural repair shall be provided.
E-Report Navigation
Next Step?
Flood Map

Pump Room
Condition State

1  2  3  4  5

Note: Equipment is nearing end life.

Maintenance activities
Design and construction
Global Recommendations

- GIS map
- Remote control/monitor
- Security
- Asset Database
Gurney St.

- Orange Line
- Nearest Station: Roxbury Crossing
- Enter through a hatch located next to parking lot on street level.
Thank you