

## **Executive Summary: Chilled Water Air Conditioning System Revitalization and Operational Enhancement**

As at January 11, 2024

### **System Description:**

The chilled water HVAC system, currently referred to as RELAC, is comprised of a complex system of components to provide air conditioning to various homes and commercial facilities in Reston. For this to work it utilizes an open-loop and closed-loop water circuit. The open-loop includes four lift pumps for drawing water from Lake Anne through an intake to be used in a continuous thermal exchange process and then exhausted back into the lake. The closed-loop has clean, treated water and four chillers; each chiller consists of a centrifugal compressor, compressor drive motor, evaporator, and condenser that super-cool the water through a thermodynamic process. That chilled, treated water is then distributed to users' systems by four recirculation pumps through a network of pipes and control valves, and returned to the chillers for the cycle to continue during system operation. The two circuits interact in the heat exchangers to transfer heat but do not mix; the lake water is not routed to homes.

### **Overview:**

The current state of the system necessitates urgent attention and strategic improvements. To address these challenges and enhance the efficiency and reliability, the following multifaceted approach encompassing equipment repairs, infrastructure restoration, and the implementation of innovative solutions should be considered.

### **Operational Challenges:**

#### **1. Critical Component Issues:**

- One uninstalled, possibly inoperable lift pump and potentially broken impeller shaft. Conditional determination and repair/installation needed.
- Chiller #1 centrifugal compressor has been completely inoperable for over 12 years. Feasibility of compressor replacement or complete chiller replacement is needed.
- Chiller #2 motor bearing needs to be replaced before it completely fails; it is currently operating but makes noise indicative of impending failure.
- Chiller #4 motor has failed due to ingestion of another part from the ducting. The motor needs to be evaluated for repair feasibility or replaced. The duct flap needs to be repaired as well. A repair source has been identified.

#### **2. Infrastructure and Maintenance Needs:**

- Urgent repair or replacement of major system components is imperative for redundancy and overall plant operation.
- Aging underground pipes pose a risk to system reliability.
- Some main control valves remain unlocated, hindering precise control. Continued efforts to locate them should be considered.

- Repairs to valve pits, the lift station building, and replacement of the lift station crane are essential.

### **Operational Enhancement and Cost-Saving Suggestions:**

#### **1. Customer Communication and System Maintenance:**

- Improve communication strategies to minimize misinformation and enhance customer understanding of the system's operation.
- Enhance system component maintenance inside homes, emphasizing awareness and care.

#### **2. Preventing Unauthorized Use and System Tampering:**

- Take measures to prevent unauthorized use, including installing robust lock devices on internal system control valves in non-payer units. Consider cutting and capping pipes.
- Evaluation and implementation of measures to prevent unauthorized maintenance by homeowners and chilled water loss from bleed spigots.

#### **3. Cost-Saving Measures:**

- Exploration of cost-saving opportunities, such as renegotiating current high off-season reserve power charges with Dominion Energy. Excessive charges have been levied for potential start-up loads during off-season periods.
- Replacement of two legacy recirculation pumps for increased electrical efficiency.
- Replacement of legacy bleed valve controllers for efficiency and modernization.

### **Mitigating Risks and Improving System Efficiency:**

#### **1. Water Supply Sustainability:**

- There is a need to recognize the risk associated with low water levels impacting cooling operations and potentially cutting off the heat exchanger supply-this is exacerbated by a local golf course irrigating with lake water.
- Consider dredging a deeper intake area and modifying the intake design or installing a remote pump in a deeper area of the lake to supply water to the pump station to decrease intake water temperatures.

**Recommendation:** Urgent approval and implementation of the proposed repairs, upgrades, and operational enhancements are crucial to ensure the long-term reliability, efficiency, and sustainability of the chilled water air conditioning system. This comprehensive approach not only addresses immediate concerns but also positions the infrastructure for future demands, fostering a resilient and customer-centric HVAC system.