

Item / Issue	Observation	General Recommendation	Specifics (Model #s, type, etc.)	Lead Time	Install Time	Service Life	Budget	Anticipated Savings	Additional Comments
Best Practice, OSHA, and Public Health Recommendations									
Slip and Fall Risk - Vault Access	Entry/egress to/from the vault is cumbersome and can lead to a dangerous fall. Best practice and OSHA would recommend the addition of safety equipment to prevent a fall. The rounded ladder rungs below access elevation coupled with a wet environment create a hazardous entry/exit condition.	Installation of an appropriate anti-slip tape, coating system, or ladder rung high friction tread system to the ladder rungs to provide higher traction while entering and exiting the vault for routine maintenance procedures and major repairs.	McNichols, Brown Cambell, or Equivalent	2 Weeks	1 Day(s)	10 Years	\$750- \$1,500	Direct savings not applicable in day to day function. Risk and exposure due to work related injuries is drastically improved.	S.S. or epoxy coated tread systems are recommended. These systems will provide the strongest resistance to the caustic environment.
Slip and Fall Risk - Vault Access	Entry/egress to/from the vault is cumbersome and can lead to a dangerous fall. Best practice and OSHA would recommend the addition of safety equipment to prevent a fall. A telescoping safety post could provide vertical and lateral support when entering the vault allowing for a 36" 42" extension above the hatch and first ladder rung.	Installation of a telescoping safety post at the top of the access rungs/hatch to allow for a stable support when entering/exiting vault.	Bilco, 3M, or Equivalent	2 Weeks	1 Days	10 Years	\$2,200 - 3,200	Direct savings not applicable in day to day function. Risk and exposure due to work related injuries is drastically improved.	Telescoping safety posts provide a strong and stable base for vault access while having the ability to
System Failure - Mechanical Seals	The mechanical seals within the vault are failing and allowing water to infiltrate into the vault. Patch/Seal attempts have been made; however, the core seals should be replaced with seals which use a longer lasting hardware such as a SS304 grade hardware or above.	Remove failing/corroded link seals. Prepare concrete to receive new units which incorporate a higher corrosive resistant hardware in S.S. 304 or higher due exposure to caustic vault fumes and	GPT Industries, Westlantic, or Equivalent	2-6 Weeks	1 Days	5-10 Years	\$5,700 - \$6,300	Direct savings not applicable in day to day function. Indirect savings due to promoting a dry work environment and reducing water infiltration and possibility for vault flooding.	Due to the caustic nature of vaults which is common as they are sealed which allows for fumes and moisture to build up we would recommend the including higher grade corrosion resistant materials to match the corrosion resistance of the mechanical links.

System Deficiency - Sump Pump & Power Loss	The vault currently has a system which needs to be verified to be sufficient and in operational condition for water removal. Staff were unsure of the condition of the sump system, how the units were sized, and if the system was still in operating condition.	Recommend checking function and discharge rate of sump system and current battery life of battery backup. If discharge rate does not meet recommend line break sizing or if battery/control system has corroded to the point of failure then recommend installation of a new duplex sump system with offset pump heights and a battery backup/auxiliary power source with redundant batteries.	Zoeller, Sumpro, Ion, or Equivalent	2-6 Weeks	1-2 Days	5-10 Years	\$5,500 - \$7,500 (If Replacement Is Required)	Direct savings not applicable in day to day function. Indirect savings due to promoting a dry work environment and reducing water infiltration and possibility for vault flooding and loss of critical MEP and control equipment.	Battery backup sump system is the sole means of protecting all equipment within the vault. This should be a primary concern and focus in advance of any work and especially before any electrical work or new equipment is installed with a focus on condition and being appropriately sized for the application.
System Failure - Anchoring, Support, and Fastening Hardware	There is a high presence of humidity, physical water, and caustic fumes within the vault. This is causing corrosion in several locations including piping and equipment anchoring/support, fastening and control hardware of mechanical/piping components, and electronic controls. Possible signs of di-electric corrosion at autofill assembly.	Removal and replacement of any components showing signs of heavily corroded/damaged hardware and seized/compromised components such as flanges, valves, anchoring/supports, and bracing. Any locations showing potential di-electric corrosion should also be corrected.	Unistrut, Bray, Or Equivalents	1-2 Weeks	1 Week	5 - 20 Years Depending on Room Condition	\$25,000 - \$65,000 (Depending on extent of hardware and equipment to be demolished /removed)	Direct savings not applicable in day to day function. Indirect savings due to increased protection and proper support of vital equipment and MEP system promoting longevity of all components.	
System Improvement - Flood Alarm	Due to the generally unoccupied and unobserved nature of the vault a flood can occur which may have the possibility to overwhelm the sump pump protection system - especially in the event of a power loss.	Incorporation of a flood alarm system using conductivity sensors and battery power to provide water detection of a flood event with the capacity to transmit an audio, visual, or remote communication alarm to maintenance staff in the event of a flooding vault	Custom by Fountain Technologies	4-6 Weeks	2-3 Days	5 - 10 Years	\$7,500 - \$12,000	Direct savings not applicable in day to day function. Indirect savings due to promoting a dry work environment and reducing water infiltration and possibility for vault flooding and loss of critical MEP and control equipment.	

System Deficiency - Chemical Dosing System	The system is missing a means of automatically dosing sanitizing chemicals into the feature via an erosion feeder. Current methods include adding sanitizing pucks by hand manually into the basket strainers creating a hyper-saturated environment and unreliable/uncontrolled chemical dosing of the water feature. Chemical levels will consistently be unstable and difficult to control requiring more potable water, chemical balancing, and maintenance labor to properly maintain.	Recommend modification to filtration system to incorporate an erosion feeder with a set point dial to automatically dose sanitizer into the system at a set and controlled rate.	Pentair, Jandy, or Equivalent	1-2 Weeks	2-3 Days	5-10 Years until part replacement 10-20 Years for full assembly	\$2,500 - \$5,000	Direct savings due to less water usage, less maintenance hours spent balancing water feature chemicals, less chemical usage, and less physical surface cleaning due to bacterial/algal staining. Assuming 2-4 hours of labor saved per week from manually balancing chemicals and physically cleaning the exterior pools during a standard operating season of March 1st through November 30th estimated labor savings per year would be \$3,200 - \$6,400/Year based on \$40/Hour for a yearly operating season.	Current maintenance procedures are creating hyper-saturated points within the water feature system which can cause damage to the system components. Additionally, having an unrated container serving a dual purpose as a dosing point is adding to the offgassing and creating a caustic environment within the mechanical room. This method also removes nearly all dosing control from the system as it is in an uncontrolled and volatile chamber causing undue burden on the water chemistry and thus chemical/potable water demand to try to maintain balance.
System Failure - Waterproofing System	The current waterproofing system is showing signs of failure holistically throughout the water feature footprint. Feature is showing signs of flaking, delamination, and hairline cracks/physical fractures throughout the water feature footprint.	Recommend removal and replacement of existing waterproofing membrane with an elastomeric system which is compatible with environmental and chemical conditions of water feature.	CIM1000 or Equivalent	4-8 Weeks	1 Week	5-10 Year Warranty (Warranty length contingent on mil application thickness of system)	\$45,000 - \$75,000	Direct savings due to less water usage, less maintenance hours spent balancing water feature chemicals, less chemical usage, and less physical surface cleaning due to bacterial/algal staining. Assuming 2-4 hours of labor saved per week from manually balancing chemicals and physically cleaning the exterior pools during a standard operating season of March 1st through November 30th estimated labor savings per year would be \$3,200 - \$6,400/Year based on \$40/Hour for a yearly operating season.	Water feature is showing signs of a slow leak at the membrane/niches in the approximate rate of 30GPH-100GPH depending on level of water above loss points during a static fill test.

System Failure - Lighting System	The water feature lighting system has holistically failed at several points including: lighting niches, lighting units, and conduit system.	Recommend removal and replacement of existing lighting system with a modern equivalent. Niches should be replaced in full with above grade lighting system being patched or removed with electrical conduits extended above grade using embedded fittings within concrete patches where old niches were removed. Lighting units will need to be anchored into concrete or utilize removable disconnects to prevent vandalism/theft of above grade units.	Crystal Fountains or Equivalent	6-12 Weeks	4-6 Weeks	5-10 Years until part replacement 10-20 Years for full assembly	\$85,000 - \$165,000 (Contingent on lighting system implemented, conduction of underground conduit, and amount of concrete demolition /patching required)	Direct savings due to less water usage, less maintenance hours spent balancing water feature chemicals, less chemical usage, and less physical surface cleaning due to bacterial/algal staining. Assuming 2-4 hours of labor saved per week from manually balancing chemicals and physically cleaning the exterior pools during a standard operating season of March 1st through November 30th estimated labor savings per year would be \$3,200 - \$6,400/Year based on \$40/Hour for a yearly operating season.	Lighting niches are showing signs of split bodies, split conduit/coupling connections, and repairs/patch methods which are not suitable for continuous immersion allowing substantial water loss. Additionally, split conduit connections and unpatched connection points have allowed water to infiltrate the lighting system and units causing irreparable damage to lighting units.
System Inspection - Lighting System Underground (Sub Slab) Conduit	The water feature static and dye tests showed system leaks at the lighting niches and lighting niche conduit connections. Conduits are potentially compromised and damaged due to seasonal freeze/thaw cycles as no protection was put in place to seal the lines across seasons.	Recommend a camera inspection to verify conduit integrity, especially those underneath the concrete slab, prior to performing any waterproofing work or electrical commitments to a new lighting system.	N/A	1 Week	1-2 days	N/A	\$4,000 - \$8,000	Substantial potential savings in avoiding unnecessary electrical lighting system purchases and concrete cutting if conduits prove to be severely compromised.	Strongly recommend recording of camera inspection to be filed and saved for future reference and decision making. Inspection should occur in advance of any major decisions as the condition of the underground electrical system will help guide large dollar value financial decisions.
System Failure - Exterior/Underground Piping	Pump "B" handling the outer ring nozzles was identified as having two substantial failures. One exterior nozzle vertical stem pipe on the outer ring has a vertical fracture several inches long along the length of the pipe. Additionally, when this pump is run substantial amounts of water begin to flood the vault via Pump "B"'s discharge and suction penetrations.	Recommend excavation and repair of pipe break adjacent to vault. Recommend repair of fractured stem pipe at outer ring of nozzles. Perform pressure test post repairs to confirm line has integrity. Depending on pipe depth excavation may need to incorporate a trench box and hand digging to protect adjacent vault piping/conduit.	N/A	1-2 Weeks	1 Week	10-20 Years	\$30,000 - \$50,000	Direct savings due to less water usage, less maintenance hours spent balancing water feature chemicals, less chemical usage, and less physical surface cleaning due to bacterial/algal staining. Assuming 2-4 hours of labor saved per week from manually balancing chemicals and physically cleaning the exterior pools during a standard operating season of March 1st through November 30th estimated labor savings per year would be \$3,200 - \$6,400/Year based on \$40/Hour for a yearly operating season.	Dye testing confirmed a strong leak at the exterior nozzle stem pipe which is then evacuating the system via the line break below grade adjacent to the vault. Water was estimated to be draining through this leak at a rate of ~ 115 - 250 GPH at a static rate and upwards of 300-500 GPH when the pump was activated for a 10-15 minute window.

System Recommendation - O&M Referesher Training	We observed several areas of opportunity to refresh the maintenance staff on in house system diagnosing, preventative maintenance, routine maintenance, and winterization/summerization shutodwn and startup procedures to protect the feature and promote longevity of the equipment.	Custom system O&M refresher training.	Custom by Fountain Technologies	1 Week	1 Day	N/A	\$2,000.00	Direct savings due to proper maintenance procedures, preventativeie maintenance, and chemical balance procedures being	
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