2023 RESERVE STUDY FOR ROLLING VALLEY OFFICE PARK

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Part A - Reserve Study and Funding

I. General

1. The Origin of RVOP. Dominion Green, a Condominium (DBA Rolling Valley Office Park) is a commercial condominium complex, organized under the Virginia Condominium Act, §55.1-1900, *et seq*., Code of Virginia, as amended, pursuant to a Declaration with Bylaws attached, recorded in Deed Book 7143 at Page 35 and corrected in Deed Book 7166 at Page 1278 and Deed Book 73 at Page 174, *et seq.,* among the land records of Fairfax County, Virginia. Construction of RVOP was completed in 1988.

2. Composition of the Complex. The RVOP condominium complex consists of three separate buildings, with 42 individual condominium units, owned by approximately 29 different unit owners. The unit owners form the RVOP unit owners' association. Two of the RVOP buildings consist entirely of three floors, divided into a combination of one and two level townhouse style units. These units vary in size from 649 square feet to 1,479 square feet. Most units are used as commercial office space, although there are a variety of other uses, including medical, barber, salon and religious services. The third building consists of three identical three story units, each containing 1,480 square feet of office space.

3. Funding for Replacements. This document is a funding reserve study, made as of January 1, 2023. It is an assessment of the RVOP commercial condominium property and it contains projections regarding anticipated future projects and expenses necessary to maintain the RVOP property in good condition. Included are the major components of the RVOP property that are likely to require repair, restoration, or replacement during the next five to fifty years. Excluded are items covered in the annual operating budget and items that are not part of the RVOP community property.

II. Reasons for Funding a Reserve Study

1. General. Why should RVOP do a funding reserve study or why should RVOP fund a reserve account? While these questions seem simple, reasons and motivations vary, depending on whether you are a property manager of leased or rented units, a member of the RVOP Board of Directors, a RVOP unit owner or a RVOP tenant. The basic principle is simply that adequately funding the reserves protects and enhances the physical assets of RVOP as a community. Reserve funding also protects and enhances the investment that each unit owner has made in buying property in the community. It does this by making sure that funds are available to replace worn out RVOP components on a timely basis while avoiding the need for special assessments on unit owners or borrowing money to meet unanticipated capital requirements.

2. Equitable Distribution. The most fair and equitable means to fund the RVOP reserves is by making sure that all unit owners contribute their fair share over the period that the unit owners benefit from use commonly-owned assets, or community property, or in legal jargon, the "common elements appertaining" to condominium unit pursuant to the original RVOP Declaration of Condominium. All persons who own units within a community pay a share toward repairs and replacements as part of the individual condominium assessments for each unit. In the absence of a funding reserve study, it would be impossible to determine what that "fair share" should be.

3. Soundness of Reserve Planning. Sound financial planning is the practicable principle behind funding for the eventual repair, refurbishment and/or replacement of the commonly-owned RVOP components. In the absence of sound planning, it is likely that when a funding emergency arises, a large and vital part of the community's annual budget would be needed to pay for the emergency. If the Reserve funding has not been properly planned, then special assessments or commercial borrowing will likely be necessary to cover funding emergencies .

4. Fiduciary Duties. The RVOP Board of Directors has the same fiduciary responsibility to RVOP unit owners as does any corporate director to company stockholders. Each Board member has a fiduciary duty to operate the association using sound business judgments. Further, even though RVOP as a "not-for-profit" organization, RVOP Board members are held to the same standard of duty by which any other corporate directors are measured, i.e., to "exercise their duties in the manner consistent with the judgment of a prudent business person." If the RVOP Board of Directors fails to consider

reserve funding, the directors, individually and collectively, will be ignoring a large and important part of the association's fiscal duty and responsibility, and each director could be held civilly liable if reserve funding is shown to be lacking for funding a particular emergency.

III. Authority for Reserve Planning

1. RVOP Bylaws. Even though the RVOP Bylaws do not specifically require a financial reserve study, Article 5.1(d) of the RVOP Bylaws, requires the RVOP Board of Directors "to build up and maintain reasonable reserves for working capital, operations, contingencies and replacements."

2. Virginia Condominium Act. Notwithstanding the lack of a specific reserve study requirement in the RVOP Bylaws, §55.1-1965 of the Virginia Condominium Act does contain such a requirement, providing that, "except to the extent otherwise provided in the condominium instruments, the [condominium] executive board (e.g., the RVOP Board of Directors) of each Virginia condominium community shall:

a. Conduct a study at least once every five years to determine, pursuant to §55.1-1900 of the Act, the necessity and amount of reserves required to repair, replace, and restore the capital components for which the unit owners' association has the obligation for repair, replacement, or restoration and for which the executive board determines funding is necessary;

b. Review the results of that study at least annually to determine if reserves are sufficient; and

c Make any adjustments the executive board deems necessary to maintain reserves, as appropriate.

3. Reserve Budget Requirements. Article 5.1(d) of the RVOP Bylaws contemplates that where working capital is insufficient to fund emergencies, the RVOP Board of Directors will provide for adequate funding for such emergencies, either through the budget process or by special assessments. Further, to the extent that a reserve study conducted in accordance with §55.1-1965 of the Condominium Act, indicates a need to budget for reserves, the unit owners' association budget shall include:

a. The current estimated replacement cost, estimated remaining life, and estimated useful life of the capital components for which the executive board determines reserve funding is necessary;

b. As of the beginning of the fiscal year for which the budget is prepared, the current amount of accumulated cash reserves set aside to repair, replace, or restore the capital components and the amount of the expected contribution to the reserve fund for that fiscal year;

c. A statement describing the procedures used for estimation and accumulation of cash reserves pursuant to this section; and

d. A statement of the amount of reserves recommended in the study and the amount of current cash for replacement reserves.

IV. RVOP Reserve Funding Study

1. Prior RVOP Reserve Study. This study is the first known reserve study for RVOP in the 35 years since the initial RVOP construction in 1988. This study is intended to provide a rational basis for the RVOP Board of Directors to make decisions about annual budgets and future capital funding. This report identifies the most practicable method for funding RVOP projected future reserve expenses. These are to be understood as examples only, not as mandated solutions. The RVOP Board of Directors has the responsibility and authority to decide funding.

2. Ideal Funding Methods. The ideal system for planning reserve funds for replacement, repair and/or restoration of

RVOP capital components, and their concomitant expenditures, would be to identify with some particular specificity an estimated year for which a particular replacement, repair or restoration is necessary. For example, the last resurfacing of the RVOP parking area was 2018. The estimated useful life of an asphalt parking lot is approximately 25 years, depending on maintenance factors and weather. Given an estimated useful life of 25 years, one approach would be to add 25 years to 2018, and then plan for a parking lot restoration in 2043.

a. Unfortunately, this sort of planning presumes an unrealistically static situation of relatively no change to the condition of a particular capital component, such as a parking lot. In reality, at best the RVOP Board of Directors would be able to estimate a few years out from any particular needed replacement or restoration. Accordingly, this situation demands a sufficiently large reserve fund to meet needs as they arise, and demands that expenditures from the reserve funds be replaced as soon as reasonably possible. The RVOP goal for a reserve fund should probably be at least $200,000.00 at any given time. This amount would normally be sufficient to replace, for example, the RVOP parking areas and within one or two years thereafter, if faced with the necessity to replace one of RVOP's roofs or faced with a failure of an RVOP retaining wall, sidewalk or curb or of the RVOP underground cabling system, have sufficient funds to meet those additional demands.

b. A reserve study is not a spending plan. The RVOP Board of Directors should assess the condition of the RVOP property and those components for which the RVOP unit owners' association has the obligation for repair, replacement, or restoration, each year and make spending decisions based on then-current circumstances. This reserve study is not intended to mandate RVOP assessment levels or spending. However, the RVOP Board of Directors should periodically review the study's recommendations and make decisions accordingly.

3. Calculating Reserve Fund Amount. In calculating funding requirements for reserves, the following factors were considered in completing this study: (i) all RVOP common element components, their quantities, and expected service life; (ii) the current conditions, remaining service lives, and values of those components; and, (iii) the impact inflation of costs over time.

a. RVOP reserve funding needs are calculated by estimating the cost and timing for repair, restoration, or replacement projects during the next 5-50 years. For the purposes of this study, inflation costs are assumed to be five (5%) percent annually when estimating the total reserve expenses by year. The current RVOP budget only contains estimates for the next five years.

b, Funding for all RVOP estimated expenses is expected to come entirely from RVOP unit owner regular assessments. Assessments, based on a 2019 RVOP Board of Directors resolution, shall be increased by five percent every year.

4. RVOP Reserve Fund Additions. RVOP experience has demonstrated that it is impracticable to have a specific amount in a budget-line addition allocated for reserves on an annual basis. The most practicable approach for RVOP reserve funding is to allocate, on an annual basis, the difference between year-end cash on hand and those funds needed for RVOP operations. For example, for year 2022, RVOP ended the calendar year with $147,627.71 cash on hand, so with $50,000.00 allocated for operating funds to begin calendar year 2023, the base-line contribution to the reserve account fund for 2022 would be $97,617.71. This is the base-line year and amount for RVOP reserves. Its projected increase/decrease is shown on the RVOP Five-Year Budget 2023 to 2027.

V. RVOP Areas Requiring Reserve Funding

1. General. It is difficult, if not impossible to project the actual years in which major expenses will be required from the RVOP reserve account funds. The projected useful life of those portions of the RVOP infrastructure which will require major repair, restoration and/or replacement vary widely in years. Accordingly, the object of RVOP reserve-fund planning should be directed at assuring there are adequate reserve funds on hand when each need arises.

2. Parking Areas and Streets. The only infrastructure replacement which lends itself to something of a specific plan,

is the asphalt parking lot. The RVOP parking area was completely resurfaced in 2018. Our study has found that the useful life of asphalt surfaces will be approximately 25 years, if properly maintained.

a. The RVOP Board of Directors should consider a proactive maintenance program for the RVOP parking area. Such an effort could pay significant dividends at extending their life expectancy. In this regard, the Board should plan for either a substantial expenditure for a maintenance-catch up plan in the near term (i.e., 1-2 years) or plan for a major expenditure of funds for resurfacing in the mid term (5-7 years). For example, the current RVOP five-year (2023-2027) budget illustrates an expenditure of $125,000.00 in 2027 for capital expenses from the reserve funds, probably for asphalt repairs or resurfacing.

b. If the $125,000.00 is expended for parking lot resurfacing, this would mean we would have concluded that our parking areas only had a useful life of 9-15 years. A proactive near-term maintenance approach, however, could likely extend the useful life of RVOP parking surfaces by an additional 10-15 years.

3. <u>Sidewalks and Curbs</u>. RVOP sidewalks and curbs have retained their generally good condition over the years. Some replacement has been done in conjunction with water intrusion problems, and in general there are some places that could use some attention. The condition of RVOP sidewalks and curbs should be reviewed periodically, and given special attention when parking lot resurfacing is done. In general, however, given the expected useful life of sidewalks and curbs, it is unlikely that RVOP will need to undertake major sidewalk or curb replacement in the next 10-20 years. Nevertheless, as part of reserve funding plans, such replacement, or even significant maintenance, would be costly enough to require funding from reserves.

4. <u>Roofs</u>. The roofs of RVOP three buildings were all replaced in 2019 to 2021. Our study suggests a useful life of 25-50 years, depending on several factors, the most significant of which is weather. RVOP planning at this stage could reasonably assume a 30-year useful life of all three roofs. This would mean the RVOP reserve fund for roof replacement should have at least $200,000.00, just for roof replacements. in the 2053-2060 time frame.

5. <u>Underground Cables.</u> Reserve funding for possible replacement of underground cables and repairs is the most difficult. Those expenditures would be episodic and not at all subject to planning. The current generation of underground systems requires less maintenance, and refurbishment is only required every 40 or 50 years, which is the specified lifespan of a transmission line. RVOP construction, including the RVOP underground cabling system, was completed in 1988 (1988 + 40-50 years = 2028 - 2038). It is possible that RVOP will experience no failures and require no repairs in its underground cable system for another generation. Nevertheless, given the potential extensive costs of repairs, it is essential to have reserves sufficient to cover such unexpected events.

6. <u>Maintenance of Brick Surfaces</u>. Brick commercial buildings offer an upscale look, increased value and great protection of the property. One of the most dominant features of RVOP is the extensive presence of brickwork. Brick is known for its durability, but lack of maintenance or poorly done repairs can cause troubles. Faulty materials, workmanship or design can also lead to deterioration. A little attention to common problems with bricks will prolong the life of the brickwork and ensure that it retains its value and beauty.

a. All three RVOP buildings are constructed with brick exteriors. Also, RVOP has a significant number of brick retaining walls, most of which form the northwestern border of the RVOP property. RVOP also has a couple of "free standing" retaining walls, one around the trash dumpster area and one adjacent to the western side and stairway of the 9310-9318 Building. While most of the brick surfaces within RVOP have remained in excellent condition, the retaining wall adjacent to the stairway on the western side of the 9310-9318 building has developed several cracks and is leaning, which suggests this wall will require major repair some time in the next several years.

b. To ensure the RVOP brickwork reaches its true longevity and keeps RVOP brick structures and buildings safe, occasional maintenance and cleaning is required. If the brick has not been cleaned for some time, green algae or black mildew may appear growing on the bricks or in the grout lines. If that is the case, a power wash of the brick may be appropriate. For structures less than 80 years old, such as RVOP retaining walls and buildings, it is best to use a low pressure power washing.

c. Given the overall condition of the brick surfaces on RVOP buildings and retaining walls, it is likely that power washing of some of RVOP brick surfaces will be necessary in the next couple of years, possibly necessitating use of RVOP reserve funds.

Part B - Useful Life of Asphalt Parking Lots

1. Life Cycle of Asphalt. Like all things, asphalt paving has a life cycle, beginning the moment it's first laid down. How long it lasts depends on a number of factors, the main one being the extent of usage, but nearly as important is the level of maintenance it undergoes during its lifetime and any adverse weather events to which the asphalt area may be subjected. With the right preventative care measures, the service life of asphalt paving can last 25 years or more. The RVOP parking area was completely resurfaced in 2018. The current RVOP five-year (2023-2027) budget illustrates an expenditure of $125,000.00 in 2027, probably for parking lot resurfacing.

2. The Life Cycle of Asphalt Paving. It's important to keep up the care and maintenance routine to ensure a long life for an asphalt parking lot. It is equally important to understand where and when to focus maintenance efforts, and thus hopefully extend the useful life of the asphalt parking area. The life cycle of asphalt paving is illustrated as follows:.

a. Years 0-5. During this stage, asphalt paving is new, sturdy, and durable. There may be a few small cracks developing or perhaps some surface discoloration from sun damage or vehicle use. Largely, however, the asphalt is still in excellent condition though.

b. Years 5-7. The next two years are when most owners of asphalt paved parking lots begin preventative maintenance routines. Maintenance like seal coating and crack sealing is best performed at this age.

c. Years 7-15. As an asphalt parking lot reaches around a decade in age, minor repairs are usually warranted, depending on use and exposure to adverse weather events. Patch repairs, which are less intensive and are designed to prolong asphalt life, can be utilized. Standard maintenance should still be regularly performed.

d. Years 15-25. At this age, a parking lot will usually begin to need more extensive, major repairs, the extent of which depends largely on how well the parking lot has been maintained. Large cracks may form that need to be sealed, or if the asphalt has been very frequently used, resurfacing may be necessary.

e. Years 25-35. Coming to the end of the life cycle, asphalt of this age is often brittle from heavy use and exposure to the elements and may be significantly damaged. At this point, extensive repairs or a complete reconstruction are likely required. This could include structural maintenance.

3. Improving the Life of Asphalt Parking Lots. While the above description is the typical life cycle of asphalt paving, with the correct maintenance plan, this lifetime can be extended. After each major parking lot maintenance or repair, the selected asphalt contractor, should be requested to design a preventative maintenance routine for the asphalt, ensuring the longest life possible. This routine could help keep asphalt in great condition throughout the entirety of its life. Preventative maintenance, such as seal coating and crack sealing, performed in the early years of a parking lot's life and when cracks are small and manageable, can significantly extend the life of a parking lot. Implementing low impact maintenance means a more durable parking lot and a more cost-effective future.

4. Maximizing the Lifespan of Asphalt Areas. As soon as the asphalt begins to cool, the life cycle of the parking lot begins – and it is never too early to begin the preventative maintenance needed to keep it strong for many years. Examples of such preventative maintenance are as follows:

a. Closely watch any cracks which form in the asphalt, as these can let in moisture which then expands, weakening the structure of asphalt and causing further cracks.

b. Make sure the parking lot drains properly. Pooling water reduces the durability of the asphalt, resulting in damage.

c. Keep the parking lot clean and free from debris and spills, like water, oil, or chemicals, as these can all impact the structural integrity of the lot.

Part C - Lifespan of a Roof

1. Life Expectancy. The average lifespan of a roof usually ranges between 25 to 50 years. However, a roof's life expectancy ultimately depends on the quality, durability and type of material chosen. Typically, the larger the investment for a new roof, the longer it will provide building protection. There are many options property owners should consider when choosing the best type of roofing material. Seeking and utilizing professional assistance in choosing the right material is important.

2. Variables in Roof Lifespan. People often wonder how long their roof will protect their property and what they can do to get the most out of this investment. Oftentimes, the type of roof can have the greatest impact on a roof's life expectancy, but this is just one step of the decision making process. There are many considerations to ensure a particular roof replacement is a smart investment. Several of the factors which impact the average lifespan of a roof are as follows:

a. Type of Materials. The materials used on a roof and their durability are large factors which impact the average lifespan of a roof. In many cases, cost and longevity are directly correlated with roofing materials.

b. Quality of Materials. No matter what type of roof materials are used on a particular building, there are low and high quality versions of each material. Low quality roofing materials typically lead to more repairs and lower roof life expectancy, so it's best to choose a superior product. Hiring a reputable contractor that uses high quality materials will help to make a decision to get the most out of a roof.

c. Underlayment. Roofing underlayment is one of the most crucial components of roof replacements. Underlayment is a layer of waterproofing protection in the event that the exterior roof gets damaged. This additional layer of defense prevents moisture buildup and mold issues and are essential so materials don not start to rot away.

d. Workmanship of Installation. Before selecting a roofing contractor, it is important to investigate qualifications, insurance and liability coverage and to review testimonials. Choosing a licensed professional could significantly affect the average lifespan of a roof.

e. The Elements. The climate and sun exposure to a roof are large factors that impact a roof's lifespan. Generally Virginia's weather is moderate; however, if exposed to drastic and irregular temperatures along with extreme storms, a roof's health could suffer, so it's important to choose durable options. Temperatures frequently going from hot to cold, like we experience in the spring and fall, can cause splits and cracks in shingles. Wind, hail, tornadoes and other storms can cause even more harm by leaving divots in the roof, removing protective granules from shingles and building up moisture that leads to mold and roof leaks. Lastly, pay attention to the trees near a roof - check that the branches are not rubbing away at the shingles, and be sure to dispose of any leaves or debris built up in the gutters.

f. Color of Materials. In some cases, the color of shingles chosen can affect a roof's life expectancy. For example, in sunny climates, lighter materials are recommended, because dark products will absorb more heat from the sun. Overheated shingles are more likely to experience wear and tear, and it will make ventilating a roof more difficult.

g. The Slope of a Roof. The pitch of a roof impacts drainage, and a roof with poor drainage abilities may require more frequent repairs or replacements. Property owners with flat roofs and roofs with low slants need to be more cautious of checking for water accumulation that could lead to mold and fungus growth or cause more serious damage that leads to roof leaks.

h. Ventilation. Having appropriate ventilation methods for a roof are a key part of property health that will increase the roof's life expectancy. When the roof can maintain a consistent temperature the materials are less likely to crack under pressure, it can reduce the risk of overheating or freezing and the entire property is more likely to run efficiently. Improper ventilation can lead to costly damages, so it's important to be on the lookout for signs of poor roof ventilation and take precautions to control it.

i. Regular Roof Maintenance. Performing periodic maintenance will extend the average lifespan of a roof. Annual roof inspections help identify any warning signs that may suggest the need for a new roof or a major repair. When a problem is identified, it can be resolved quickly before it gets out of hand.

J. Roof Inspections. Many property owners wonder how to know when it's time for a roof inspection, and the answer may depend on the roof's current health or other circumstances. Roofing contractors generally recommend getting regular evaluations once per year and more often if the roof is subjected to frequent or severe storms or other events which could cause roof damage.

3. Warranty Compared to Lifespan of a Roof. Typically, the roof's life expectancy will be greater than the warranty offered on a roof, but the roof warranty is important in case the roof's lifespan is cut short by a major storm or other incident. This will protect the property owner's investment, often insuring costly roof repairs from unexpected damages will be covered. Higher quality roofing materials will have longer warranties and cover over more time since these durable products are projected to last for the long-haul.

Part D - Expected Useful Life for Sidewalks and Curbs

1. Lifespan. Generally, the information provided herein applies to both sidewalks and curbs. If best practices are followed, the expected sidewalk and curb materials service life can be as long as: concrete, approximately 80 years; bricks and interlocking concrete pavers, approximately 80 years. By far the best way to maintain sidewalks and curbs is to start by building them to last. Some common types of sidewalk damage can be prevented or slowed through the use of exceptional practices in initial sidewalk construction. In particular, close attention to specific design details can result in sidewalks that require low or lower levels of maintenance over their lifespan, thereby improving access in a community and reducing +property owner costs.

2. Design and Construction. Initial design and construction methods greatly influence the long-term maintenance and lifespan of sidewalks. Historically concrete has been the material of choice because of its ease of installation, durability, reliability and availability of materials. The thickness of the sidewalk material, use of reinforcing bars or mesh, use of aggregate base, depth of sub-base below the sidewalk, distance from trees, and other design details impact how well a sidewalk will age over time.

3. Early Maintenance. Although the lifespan noted above is achievable, it is likely that at about 25 years, significant maintenance will be necessary to achieve the expected lifespan for a concrete sidewalk. While some data exists on construction methods that can mitigate the potential for future damage, more research is needed on sidewalk construction best practices.

4. Sidewalk Failure. Sidewalks and curbs fail for a variety of reasons including damage due to:

a. Poor base soils and sub-base preparation causing differential settlement;

b. Nearby trees roots causing displacement or cracks;

c. Heavy vehicle loading on sidewalks not designed to take such loads; and

d. Insufficient concrete thickness or lack of reinforcement where design dictates reinforcement use.

5. Avoiding Failure. Much the sidewalk and curb damage can be avoided or delayed by using proper construction techniques that take into account the type of soils underlying the sidewalk, seasonal conditions that impact soils underlying sidewalks, tree type and placement and sidewalk design (thickness, use of aggregate, sub-drainage, and reinforcement).

a. Subgrade. The type of soil underlying a sidewalk may be the greatest determinant if the sidewalk will fail before the end of its projected lifespan. Comprehensive studies have shown significant correlation between sidewalk failure and the underlying soil type, even more so than between sidewalks and the presence of nearby trees. Providing an adequate subgrade below sidewalks may deter many of these failures by providing stability and good drainage, which will help the sidewalk be more resistant to seasonal changes. Subgrade design and preparation should be carefully considered and based on local soil conditions and policies.

b. Concrete Thickness. Sidewalk thickness is just another aspect of the overall sidewalk "pavement" design, and should take into consideration expected loading, local soil conditions and policies. Concrete sidewalk thicknesses in warm climates that do not need to support heavy vehicles may be as low as 3.5 inches; areas that experience a winter freeze and must accommodate heavy vehicles (known as vehicle loading) may require thicknesses of six inches or more. In theory, the thicker the sidewalk, the less likely it will fail prematurely. It is important to ensure that sidewalks are constructed with enough thickness to support expected vehicle loading which may include maintenance vehicles or more substantial loads at driveway crossings. In some cases reinforcement (usually with a welded wire mesh or re-bar) can be used to increase the loading capacity of sidewalks.

c. Drainage. Proper sidewalk drainage is important for maintenance purposes and to provide a safe and comfortable experience for users. It is important to provide a slight cross slope on sidewalks to ensure proper drainage and prevent pooling of water, especially in climates where ice can form. Accessibility requirements prescribe a maximum cross slope of two percent. This provides adequate drainage, but does not adversely impact access for people with disabilities. Sidewalks immediately behind curbs should be considered for installation of a sub-drain system parallel to the curb to facilitate drainage away from the base and reduce frost heave in cold climates. Additionally, providing a subgrade of quick-draining material as noted above will help reduce frost heave in areas with soils that drain poorly.

d. Control Joints and Scoring Patterns. Control and expansion joints should be provided in all concrete sidewalks to minimize cracking and guide where cracking should occur. Saw cutting control/contraction joints is recommended because it provides a smoother surface than troweling joints into the surface. Joints should be level and as narrow as possible. Full depth expansion joints should be placed adjacent to existing rigid structures such as poles, walls, hydrants and buildings. Isolation joints should also be located at the beginning and end of curved sections of sidewalk and at all intersections.

e. Curb Ramps & Detectable Warning Fields. Curb ramps and detectable warning surfaces present unique maintenance needs. The primary issues with detectable warning fields are debris collection, detachment from the sidewalk, or damage to the domes in the warning fields themselves. Detectable warning fields tend to collect dirt and debris between raised domes where pooling occurs during rain events. During the design, it is important to maintain a gutter slope that allows water entering the curb ramp to drain and carry away the debris. The primary solution to this issue is frequent sweeping. Seasonal pressure washing of detectable warning fields may also be of value, and may help retain the color contrast between the detectable warning field and the surrounding sidewalk.

6. Detectable Warming Surfaces. Curb ramps and detectable warning surfaces present unique maintenance needs. The primary issues with detectable warming fields are debris collection, detachment from the sidewalk, or damage to the domes in the warming fields themselves. Detectable warming fields tend to collect dirt and debris between raised domes where pooling occurs during rain events.

a. During the design, it is important to maintain a gutter slope that allows water entering the curb ramp to drain and carry away the debris. The primary solution to this issue is frequent sweeping. Seasonal pressure washing of detectable warming fields may also be of value, and may help retain the color contrast between the detectable warming field and the surrounding sidewalk.

b. Detectable warming surfaces pressed directly into fresh concrete are not recommended because they suffer from two problems. First, it is common for some of the concrete domes to be only partially formed during the initial installation on the curb ramp. When this occurs, it is likely that the incomplete domes will break off. Second, snow removal equipment, even snowblowers, can cause damage to concrete domes. If concrete detectable warming fields are used, a regular inspection schedule should be developed to monitor the integrity of the fields and perform necessary maintenance.

Part E - Useful Life of Underground Cables

1. Lifespan. The current generation of underground systems requires little maintenance, and refurbishment is only required every 40 or 50 years, which is the specified lifespan of a transmission line. RVOP construction, including the RVOP underground cabling system, was completed in 1988. (1988 + 40-50 years = 2028 - 2038)

2. History of Underground Cables. Underground cable lines first appeared back in 1890, when the first successful installation was pioneered by Vincent de Ferranti using his famous 10,000-volt concentric cable in the United Kingdom. Since then, underground power transmission has evolved dramatically. Twenty years ago in Europe, an agreement was signed with the French government to limit the length of overhead lines after an unexpected storm damaged the French grid (3.7 million households without electricity) and caused blackouts for up to three weeks. In the years since, research and development resulted in a significant reduction in the cost of undergrounding, through longer lines and mechanized installation.

3. Uses for Underground Cables. Traditionally, underground cables are used in urban areas where overhead lines are often not feasible; in areas where an overhead line may risk lives; or in scenic areas where aesthetics is an important consideration. Cables are usually buried at a depth of three feet for distribution grids, and four or five feet for transmission grids. In terms of safety, there is no disturbance at the ground surface when a short circuit occurs or a very high amount energy is released, because the soil contains the fault. The soil also protects against third-party damage as long as proper authorization procedures are followed before digging, especially in urban areas.

a. Underground cables are better protected against extreme weather and other catastrophic events than overhead lines. In addition to proper depth, proper installation is equally important. It is generally recommended that cables be installed using ducts, where installers obtain one permit so they only have to dig once and then pull the cable inside.

b. Challenges for underground cables include the lifespan of a transmission line and high cost. However, underground cables not only protect against blackouts during peak load hours and severe weather events, but also from an environmental point of view provide massive electrification, which is the best way to decarbonize our energy system.

4. RVOP Underground Cables. In recent years, RVOP has had only one instance in which the extant underground cabling system failed. Fortunately, this failure only affected one RVOP unit. The failure occurred when water somehow intruded into the cable housing, causing the line to fail. In this case it was not reasonable to repair the cable because the route from the electrical input box to the unit serviced by the cable ran under an outside stairway and beneath about 25 feet of concrete sidewalk

5. The Necessity for Reserve Funding. In the future, if there are multiple-unit line failures, RVOP maybe unable to avoid the extensive expense of excavating and replacing the underground cable. The expense for providing an alternative electrical-service line to the unit whose line had failed was approximately $18,000.00. Multiple-line failures would be significantly more expensive. Current estimated expense to lay underground electrical cable varies from between $10,000 and $20,000 per five hundred linear feet. RVOP has approximately 2,000 linear feet of underground cable. It is easy to extrapolate the approximate cost of current replacement as conservatively $15,000 x 4 = $60,000. This estimate seems low, particularly in consideration of the excavation and sidewalk replacement costs that would be necessary. Future reserves to cover replacement of underground cable should probably be at least $150,000. However,

for planning purposes, it is worth considering that it is likely that this portion of the RVOP infrastructure would be the last it time to fail.

Part F - Useful Life of Brickwork

1. Useful life of Brick. Brickwork can be expected to last for the life of a building or other structure, probably100 years or more. Lifespan of brick surfaces and retaining walls mainly depends on the material, climate, drainage, maintenance, design and unexpected events. And, with repointing of the mortar, if and as needed, plus other regular maintenance, it is possible for RVOP brick surfaces and structures to survive for hundreds of years.

2. Lifespan Issues. There are multiple problems that can arise to shorten the life of a brick building or structure, or require extensive and costly repairs. How long brick surfaces and structures will last depends on a number of factors:

a. **Climate.** Consistent storms and harsh weather can wear brick surfaces down more quickly. Milder climates tend to have less of an impact on how long brick surfaces and structures will last.

b. **Drainage.** Poor drainage causes harm to brick in multiple ways. It pushes against the brick surfaces, makes the soil heavier when pushing against those surfaces, and, poor drainage can wear away at the brickwork to make the structure or building weaker.

c. **Maintenance.** Regularly maintained brick surfaces and structures tend to last longer, absent unexpected events. Maintenance is also a great way to find out if anything is going wrong before it causes too much damage.

d. **Design.** Poorly designed brick structures will fail faster. Poor design allows damages to occur more quickly and can lead to deterioration of the ability of the brick to support brick structures. Fortunately, as a general proposition, RVOP brickwork all seems to have been properly designed and constructed, with the possible exception of the retaining wall adjacent to the stairway on the western side of the 9310-9318 building.

e. **Unexpected Events.** Extremely bad weather and soil erosion are examples of potential damage to brick surfaces and structures. A vehicle ramming into a brick surface by accident can also cause substantial damage.

3. Routine Inspections. Generally, properly made and installed brickwork does not require much maintenance. But if components in the brickwork, such as lintels, sills, copings or sealant joints, are damaged, they can lead to further deterioration. Routine inspections, ideally at least annually, will help identify potential issues. Problems to look for during inspections for include the need for repairs using cement mortar, which can trap moisture. Also if a particular area of the brickwork receives little sunlight it could be prone to be damp, so the inspection should check closely for moss or mold. Moss and mold can be removed with a mild bleach solution. Power washing may be necessary in area more extensively covered with moss or mold.

a. Routine maintenance, together with a little cleaning, should be performed regularly. Like any cleaning, this should be done using the least caustic process possible by gently removing loose dirt with a garden hose. One currently available commercial product that does a good job of cleaning algae and mold and some dirt from brick surfaces is "Wet and Forget," which can be applied with a garden hose and hose-end sprayer. Once cleaned, potential maintenance items may be more apparent.

b. Deterioration, even when seemingly limited should not be ignored, and when noted may require knowledge as well as a great deal of patience, and may require the services of an expert. Damaged mortar must be removed with caution, to avoid damaging the surrounding brickwork.

c. Heavy vegetative growth, such as vines, on bricks can cause problems such as eroding mortar, blocking gutters and downspouts, damaging soft wall surfaces and holding moisture against the brickwork. Vegetation can even get in the way of inspections and repair work. In removing large, mature vines from brickwork, caution must be exercised because the removal may cause additional damage to the brickwork.

d. When dealing with brick maintenance, it may be wise to seek advice and assistance from a professional. It is important to work with others who understand brickwork and will help keep it in good condition for a long time to come.

4. Damaged Mortar. One common problem with brickwork is damage to the mortar between the bricks. Over time, the weather and other elements can cause the original mortar between the bricks to deteriorate. It may become necessary to repoint the brick. Whether to repoint is a tricky question and should be referred to an expert, e.g., a brick mason. The damaged mortar must be removed or the new mortar when applied directly will not hold up. This means replacing the whitish or gray material between the bricks when it has become cracked or eroded. The new mortar is then applied in layers. If the brickwork is old, it is possible and may require the assistance of an expert, to find and use new mortar matches the original, thus maintaining the beauty of the original brickwork.

5. Conclusion. Bricks are durable and therefore sustainable and reusable. The vast majority of brickwork will last for at least 150 years, probably much longer than RVOP will be around. Historically the brick industry has been cautious about advocating the reuse of brick, due to the uncertainties around the product performance. However, with the increasing emergence of the climate change and emerging biodiversity knowledge, the industry has become committed to developing understanding of the important end of life cycle stage regarding brickwork. Compared to other cladding systems, such as timber and vinyl, brick has the advantage at the end of its life cycle to be more easily refurbished, reused and recycled. So perhaps RVOP brickwork, like the venerable alley cat, will have several more lives to live.