

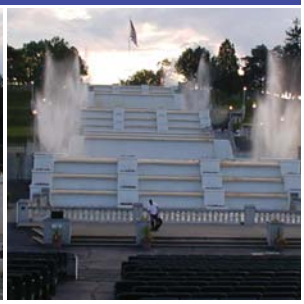

Report for the
Restoration and Renovation of the
Cascades
at Sparks Foundation Park

prepared by:

Spicer group

June 13, 2012

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Executive Summary

The Cascades is a remarkable amenity to Jackson County and the region. It is many things at once; a monument, public art, a gathering place, public entertainment, and truly a remarkable result of one man's vision to have a classical fountain on a grand scale for public use. As the first step in restoring this vision to the functional and aesthetic quality present when it was opened to the public on May 10, 1932, Spicer Group was selected to perform a complete assessment of all components, and then offer recommendations to restore the Cascades to its original grandeur. Thank you for this opportunity.

Our team of electrical, structural, mechanical, and process engineers worked with our Planning and Architectural team to perform a complete field assessment of the Cascades in March, then again in May when the systems were in operation. Team members also attended shows to see how the entire facility functions and observe the public interface with this unique attraction. All components were assessed to determine the extent of remaining service life, the options for rehabilitation, and our recommendations for restoration. We have estimated the total project cost on page 3 for the primary goal of restoring the functional systems and reducing operating costs. We have also estimated a cost for restoring the original aesthetic of the Cascades by eliminating the wall and raised amphitheater.

Fencing around the Cascades

From a Focus Group meeting on April 29, 2012, we understand that in addition to the goal of restoring the crumbling infrastructure of the Cascades, one of the highest priorities from the public input to the recent Master Plan is to restore the original aesthetic by removing all of the obstructions to viewing, primarily the wall and fencing. We have provided a conceptual design in Figure 2 to complement the preliminary cost estimate noted above.

Cascades view from Brown Street

To summarize our findings, as indicated in our previous report, the majority of the components have reached their service life, and we found several workplace safety concerns that represent a significant risk management liability to the County. The following are the key points of our report:

1. No elements of the electrical systems or power supply are salvageable.

2. Replacement electrical components, lighting, pump motors, etc will result in close to a 50% savings in energy costs. Maintenance labor will also be reduced.

3. Rebates will be available from Consumer's Power in 2013 for energy saving improvements.

4. All major elements of the mechanical system need to be replaced, but the following minor components can be salvaged:
   a. Chlorination system
   b. Water filtration system
   c. 2" water line for irrigation and fountain "make up" water

5. Based on a cost-benefit analysis, we estimate that adding an iron removal system will pay for itself in 5 years or less, through reduced maintenance and operational expenses related to staining of the Cascades, corrosion, and the reduction in amount of chlorination required.

6. As noted in our Progress Update, there is major specialty concrete work required. On a positive note, based on your questions, we have determined that only about 20% of all concrete needs to be replaced, as shown in Figure 1.

7. Relative to the wall and amphitheater, we have worked with County officials to value engineer an alternative similar to that shown in the Master Plan, at a savings of nearly $2M, while providing a more flexible space. This will help meet a stated goal of the Administration to create a space that can be used more days per year and more hours per day, possibly generating more revenue.

8. There are at least 4 existing and 3 desired uses for building program space that require better definition by the Owner. Total building square footage and relationship of uses to amphitheater space are two critical drivers for the Concept Plan. The next step should be a program space needs assessment. It is important to fix the building footprints before performing design or construction at the Cascades or amphitheater area.

9. Our detailed recommendations and estimates resolve a wide range of safety and liability issues.

10. Construction is feasible in a single construction season if design commences the prior fall. To minimize risk and upfront costs while maintaining a specific construction schedule, a phased design and construction program could start with just the electrical and mechanical systems.

Finally, at the conclusion of the April 29, 2012 Focus Group meeting, the group thought that if the cost was affordable, it would be beneficial to include the plaza improvements in with the bonded improvements for the other Cascades work. There was a thought that if all the Cascades work was completed without the plaza/amphitheater improvements, the public may be disappointed with spending all that money and not really seeing any improvements in the overall setting. So with that thought in mind we developed a plaza/amphitheater conceptual plan (see Figure 2) and a corresponding cost estimate to assist with the decision whether or not to include wall removal and related work now.

The following report provides substantial detail regarding our observations, analysis, conclusions, and recommendations regarding the Structural, Mechanical, and Electrical systems, along with an overview of our Concept level planning analysis to ensure that functional system improvements are consistent with a specific vision. The intent of the Conceptual Plan is to trigger input from stakeholders, therefore it should be considered an overview of possibilities to discuss and refine during the design process. We appreciate the opportunity to take the first step toward a process to ensure this unique community amenity will be there for our children's children to enjoy.

PRELIMINARY PROJECT COSTS

CASCADES REHABILITATION

• Electrical, Lighting, and Controls	$3,030,000
• Mechanical	$1,250,000
• Structural	$1,300,000

Sub-Total Cascades Costs: $5,600,000

AMPHITHEATER RECONSTRUCTION (See Figure 2 for Concept Plan)

• Remove wall, Build Plaza Flex Space	$2,600,000
• *New Buildings (2 @2,500 sft)	$1,350,000

Total Cascades Plus Amphitheater and Buildings: $9,550,000

*Space programming to be determined with owner

More detailed preliminary cost estimates are provided for each component in the Appendix at the end of this report.

FIGURE #1

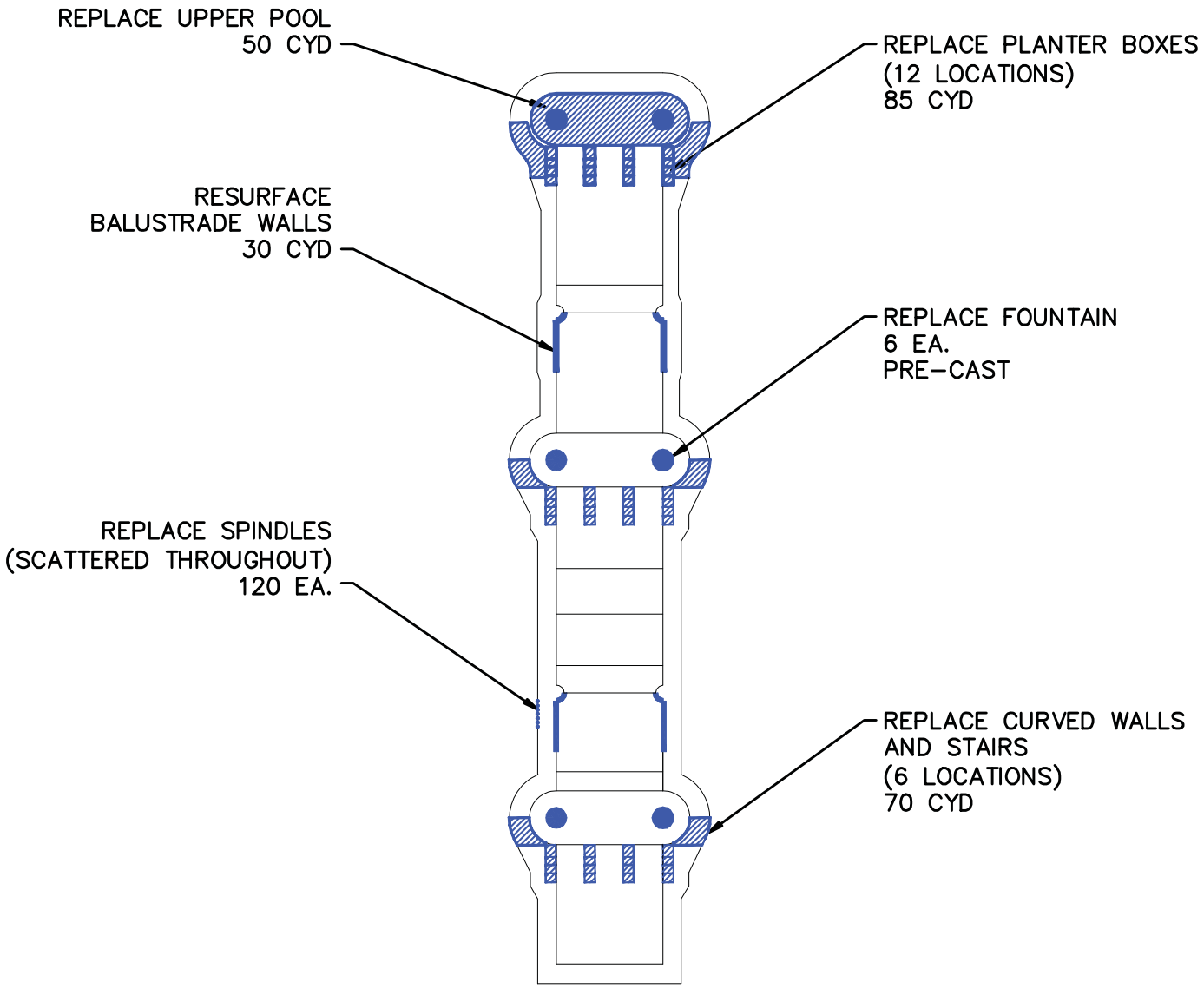

REPLACE UPPER POOL
50 CYD
REPLACE PLANTER BOXES
(12 LOCATIONS)
85 CYD
RESURFACE
BALUSTRADE WALLS
30 CYD
REPLACE FOUNTAIN
6 EA.
PRE-CAST
REPLACE SPINDLES
(SCATTERED THROUGHOUT)
120 EA.
REPLACE CURVED WALLS
AND STAIRS
(6 LOCATIONS)
70 CYD

FIGURE #2

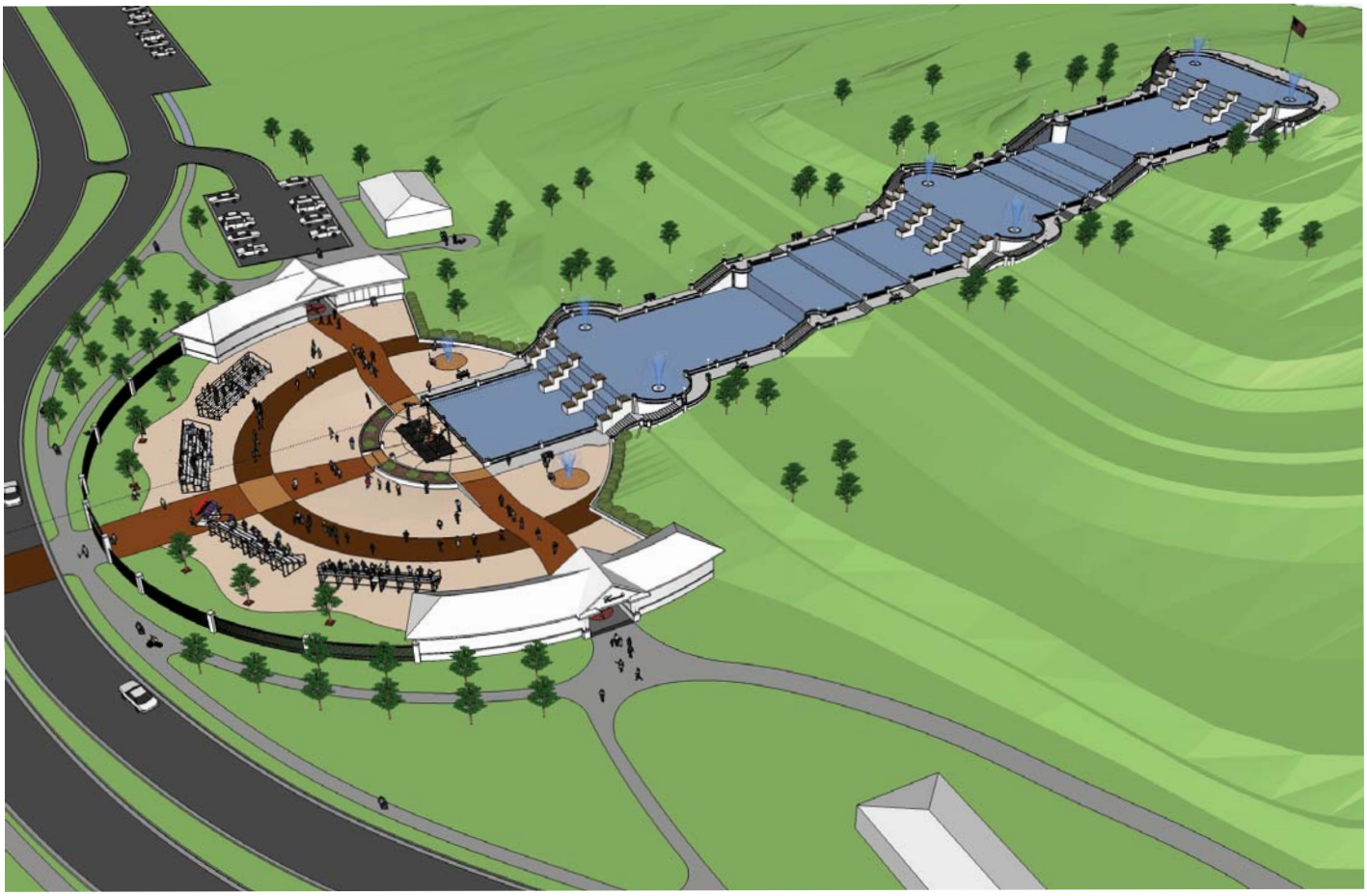


FIGURE #3

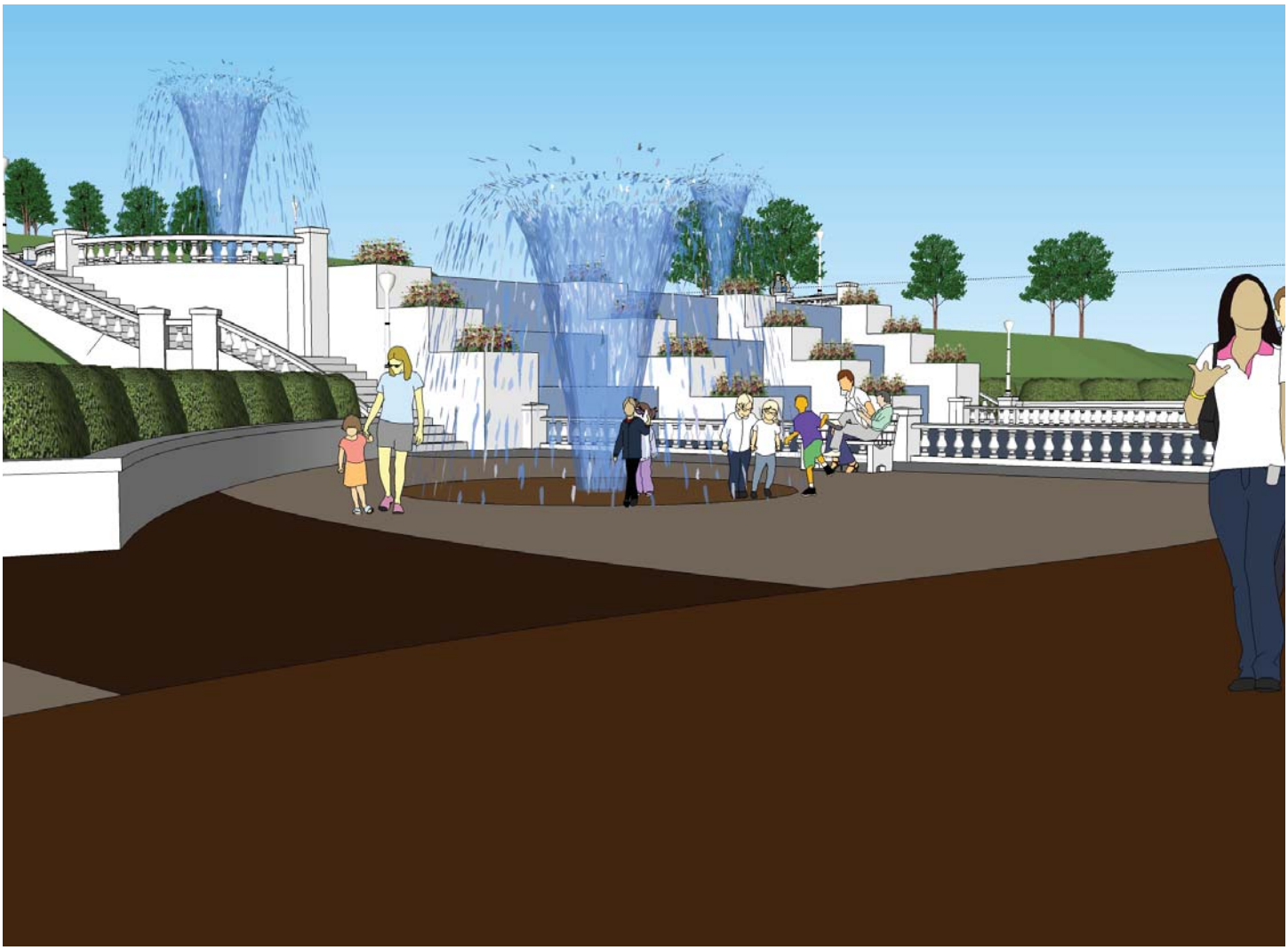


FIGURE #4

Flower Boxes, Curved Walls, and Railings

From a structural standpoint, the Cascades is a concrete structure built in the 1930s that has been repaired, with mixed results, throughout its long life. 80-odd Michigan winters and constant wet conditions during the operating seasons have taken a toll on the structure. Although there are few immediate structural concerns or safety issues to note, major work will be necessary to extend the life of this structure for another 50 years.

One of the major components of the Cascades is the three-step waterfall with a curved pool. At each end of these three curved pools is an approximately 8-foot tall curved retaining wall. Repairs have been attempted on these curved walls twice in the past – first with a fiberglass patch in the 1970s, and again in the 1990s with a steel mesh and gunnite surface. Gunnite is a spray-on material with limited structural properties, and is mainly used for patching and resurfacing.

Rebound hammer tests on the gunnite indicated a strength of about 7,800 pounds per square inch (psi), actually stronger than typical concrete. However, the surface of these gunnite repairs has "map cracked" and is very aesthetically unpleasant. More vital than aesthetics is the detrimental effect this gunnite repair is having on the remaining structural reinforced concrete. By forming an imperfect barrier in front of the original concrete wall, this gunnite repair is both letting moisture in and keeping it from escaping – the original wall is continually deteriorating from this moisture and is unable to "breathe". In a few locations, chipping through the gunnite revealed a concrete wall that has literally crumbled.

In our experience, walls of this age and with this type of deterioration are very difficult (if not impossible) to patch and repair. The best course of action, in our opinion, would be to completely demolish these six curved walls and install new reinforced concrete walls matching the original design.

Adjacent to these curved walls is a stairway and a set of planter boxes. Because of the extent of the work required to replace these curved walls, it would be cost-effective to remove and replace both the stairs and planter boxes at the same time as the curved walls. Additionally, a large portion of the stair treads are cracked and delaminated – replacement would bring them back to original condition. The same is true for the planter boxes. Several large cracks are present on most of these boxes, and replacement is likely the best course of action to obtain an extended lifespan.

Aside from the structural benefits of this work, full replacement would allow for the restoration of a design feature that has been lost for the better part of half a century – the ornamental inset details found on these walls and planter boxes originally. These recessed panels are still visible on many of the railing end blocks, but were covered up on the curved walls, likely at the time of the first fiberglass repair. Likewise, the planter boxes have had these inset areas patched over. It does not appear that this was done for structural reasons, but may have been done at the same time as the curved wall repairs in order to match the lack of inset detail. The aesthetic improvement would be substantial, taking the walls and planter boxes from their current map cracked state to the very pleasant, ornamental, original architectural features they once were.

Concrete Deterioration at Upper Pool

Another element of the structure that we are recommending complete replacement of is the upper pool. Based on our evaluation and the existing documentation, it appears as if this upper pool is still the original concrete. Sounding indicated numerous delaminations and significant spalling. In addition, there are numerous large cracks throughout the entire 6" thick slab. Much of the water lost during the operating season is likely lost through poor concrete like what is found in this upper slab. Given the relatively shallow depth of this concrete, repairing the surface is not likely feasible, leaving replacement as the best option. Not only will this return the structural integrity to this upper pool, replacement will also reduce water loss and reduce the need for surface coating work, which will be discussed next.

Existing Concrete Coating, Failing in Numerous Locations

The pools all have numerous cracks and repairs, and leaking/water loss is an issue (and expense) during operation. Spicer Group has had success with long term repairs to exterior structural concrete exposed to water by using a concrete sealant and waterproof coating called Xypex. Troweled on the surface, this Xypex coating fills voids and cracks, forms an impermeable (yet breathable) cementicious barrier, and eliminates water loss. This has been used to successfully stop leaking on wastewater structures exposed to sunlight (a similar application as this). Another benefit of this coating would be that all of the pools would receive this treatment, giving a long-lasting, uniform appearance to all of the pools.

Based on our field observations, it appears that the surfaces of most of the railings and other concrete have been coated with a thin cementicious material. In many locations, this is flaking off, giving a lot of the structure an unpleasant appearance. We are recommending that the entire structure be high-pressure washed, removing all of this remaining coating. With that complete, a full structural assessment could be made to the remaining concrete, any necessary surface repairs completed, and the entire structure could receive a new, advanced, and breathable concrete coating, which would both prolong the life of the structure and improve aesthetics

It was noted during one of the site visits that the stair treads become slippery during operation. Water from the pools leaks onto the stairs and spray from the Cascades is windblown onto them as well. Spicer has used nonskid coatings in the past, and we would recommend that all of the stairs throughout the structure receive this nonskid treatment. Prior to doing this, a full assessment of the structural integrity of the stairs needs to be completed and any stairs needing repair should be either fully replaced, or if possible, have a deep surface repair completed. This would again drastically improve aesthetics, as well as provide a safe environment for patrons well into the future.

Deterioration of Stairs, Common at Numerous Locations

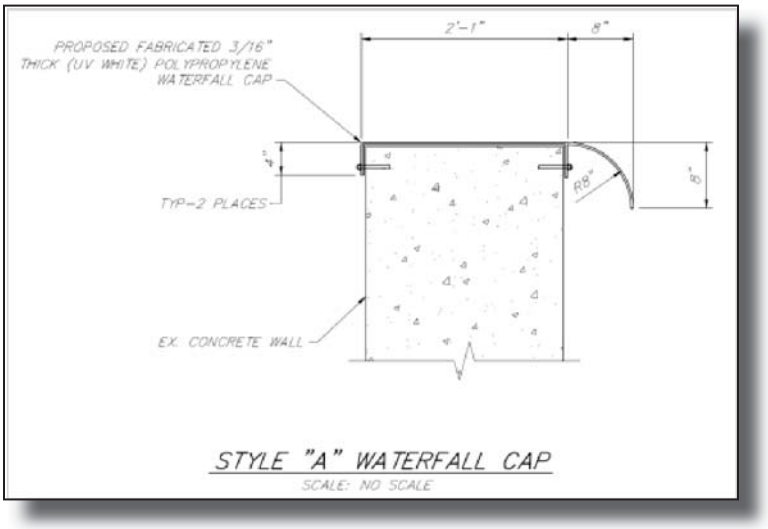
A major feature of the Cascades is its ornamental baluster railing system. This consists of concrete upper and lower rails with concrete spindles (balusters) in between. These have been present at the Cascades from its original completion, and add a very decorative, ornamental touch to the entire structure. Unfortunately, time has taken its toll on many of these spindles.

Given the complexity of their shape and the desired lifespan of this repair work, we would recommend fully replacing any spindles exhibiting cracking or spalling. At this date, we are estimating that 120 spindles will need to have replacements cast and be replaced. In addition, approximately 600 spindles will likely need to be removed, salvaged, and reinstalled as part of other structural work being done.

Cracked Concrete Spindles, Scattered Throughout Structure

Site observations also indicated that a large quantity of time, energy, and caulk was being used in an attempt to seal the tops of the weirs and the crests over the lights at each of the Cascades. It appears that the concrete at these locations is in poor condition, and the metallic (steel, brass) crests suffer from corrosion and do not perform their intended purpose well. In addition to providing the waterfall aesthetic, these caps are over the colored lights. The cracking noted above allows water under the cap and into the lighting and electrical systems.

Spicer has years of experience working with and designing polypropylene structures, and we recommend using an ultraviolet-stabilized polymer, such as polypropylene, to fabricate new, seamless waterfall caps would drastically improve the appearance of the structure, cut down on maintenance needs, and provide consistent, beautiful Cascades for the enjoyment of the patrons.



Mechanical – Process

In summary, during the site inspections performed on March 13th and May 30th, we investigated all mechanical systems, rooms, and piping that was not buried, and identified that most of the mechanical systems are well beyond their useful life. Many components are from the original construction in the 1930's, and even the newest components are nearly 20 years old. The systems do not perform as they once did in that over the years, valves and solenoids which control many of the original unique features of the falls have failed and the system has gone from individual jet operation/control to joint fountain operation.

System and component conditions have deteriorated due to sheer age, intermittent use and resultant corrosion. The operations staff has done an excellent job of keeping things functional, but the systems are very labor intensive to operate and prepare for operation annually. Given current budget levels, preventative maintenance and gradual parts replacements have not been possible, meaning the system is prone to costly failures and emergency repairs occur in order for "the show to go on". The following is a brief summary of the mechanical components that have been evaluated and their current condition.

Entry Point to Underground Mechanical Room

Wet, uneven, failing existing stairs

Underground Pump Room Equipment

With the exception of the well pump, many primary equipment and components (listed below) are located in an underground room, which is a significant safety risk. First, this room and stairwell leaks groundwater and the old electrical components installed in this damp and wet environment are not rated for this type of environment, so the electrical hazards in this environment are severe and not compliant with current code. Second, this underground room is a confined space and further has only one means of ingress/egress. This means that per current OSHA standards there are risks of entrapment, flooding, electrical hazards and inadequate ventilation for chemical storage for which the employer is fully liable. Guidelines require multiple staff members to be trained and follow specific procedures for confined space entry.

In general, a single person should not enter this room alone. Third, there is limited space between equipment – in many situations, staff must step across equipment and piping, which is also a compliance and liability issue for the County. Finally, the existing stairs are a trip hazard. Staff must enter this room down stairs that are wet, uneven and crumbling, with no skid protection.

Primary Equipment and Components

- A non-potable well supplies the water to the Cascades. The well was installed in 1994 and is functional. The water quality has a higher than desired iron content which causes staining of the Cascades which increases maintenance costs for painting and cleaning. The high iron levels also promote corrosion and pipe diameter loss due to build up in the lines. The well supplies the water to the storage tank and from there it is pumped to the top of the Cascades. The well pump has not been serviced since installation and is rated for 225 gallons of flow per minute (gpm). Operation of the well pump is controlled by the water level in the storage tank.

- The main pump is the original pump from 1930s and is rated for 2000 gpm. This capacity pump gives the desired performance of the jets and water flow over the Cascades. This pump was out for service during our initial inspection. The pump had a new shaft, packing and inner rings replaced. The main pump is used to transfer water up to the top of the Cascades to spill down the Cascades, and serves as the main water flow in the Cascades.

- The back-up main pump is also original to the system but is only rated for 1000 gpm. This pump does not produce enough flow to keep debris from accumulating on the weirs/lips of the Cascades. This pump is generally only used when the main pump is not working properly. Typically, a redundant pump is of equal size as the main pump in order to provide a true equivalent back up.

Aged mechanical equipment in underground vault

- Since the water from the Cascades returns to the storage tank in a closed, looped system, all the debris that falls into the pools gets into the storage tank. There is a filter system that uses two pool grade filters to remove debris and fine particles from the water before it gets pumped back up to the top of the Cascades. This filter system operates continuously by drawing water from the storage tank and returning the filtered water to the storage tank. This continuous operation provides complete tank turn over in approximately eight hours.

Location of original pump from 1930s

When the pressure in the filter system reaches a high level, the filters are manually backwashed by the operators. The backwash process was previously automated, but there were issues with flooding the underground room due to control malfunctions. This is just one example of a hazardous condition in this underground room. This is not only a risk of damage to mechanical and electrical equipment, but a risk to personnel who have to enter this confined space to resolve the problem. The filter system is only a couple of years old, is functional and can be continued to be used, but the automatic controls and flooding issues need to be addressed.

- Chlorine is fed to the water at a minimum of 15 gallons per day to help prevent algae and biological growth in the pools. Higher concentrations of chlorine would be preferred as it would help with corrosion control, but chemical usage has been limited due to budget restraints. Liquid sodium hypochlorite is used and is delivered weekly in 150 gallon increments. The chlorine is currently fed into the filtered water line that returns to the storage tank. There are no issues with the tank or metering pumps and they can continue to be used; however, the space is not properly vented for chemical storage as there are not enough air changes in this room to provide enough fresh air for occupancy by personnel. Again, this is a risk management and liability issue for the County.

Chlorine storage and feed area

The piping and valves in this room show signs of corrosion. Recently a rotten section of pipe and a barely functional isolation valve have been replaced due to corrosion. In addition to the exterior corrosion, it is also believed that there is internal build up and pipe restrictions due to the high iron contents and as demonstrated by the abnormally high readings on the pressure gauges during pipe operation. Basket strainers are also used to help remove debris, but they are also substantially corroded due to the damp environment.

Tunnel Equipment/Undergroud Piping

- There are three booster pumps, one located in each of the three tunnels at each of the fountain levels. These pumps draw water from the pools through a filter that supplies water to the brass nozzles, foggers and center jets. The filter generally gets clogged from the debris from the pool which results reduced fountain performance, and additional maintenance. There is also debris that makes it through the filters that causes nozzle plugging, malfunction and additional maintenance. The booster pumps are original construction but the motors have been replaced. The pump name plate information was unreadable but given age would anticipate replacement especially if a revised system configuration were used, a different pump would be needed to meet the new operating conditions.

- Tunnel pipe and valves have corrosion throughout, and some of the valves are not functional. It is expected that there is significant internal pipe corrosion given the high iron content of water and with the intermittent operation of the system, that water is allowed to sit in the pipes and continue to develop scaling and obstructions. Over the years, the effective pipe diameter would be significantly reduced.

Severely corroded tunnel piping and valves

- There are vitrified clay tile drain lines that run along the south side of the Cascades and under the Cascades. Tree roots have broken and obstructed most of these lines preventing water from draining adequately from the area. When the fountains operate, the spray can drift as well and create areas of standing water and wet stairs which can be a slip and fall hazard for the public.

Fountain Components

- The nozzles, foggers and center jets in the fountains are not currently able to function independently with the solenoid valves out of service. Anecdotal evidence suggests that the fountains may have sprayed to a greater height in the past. The Parks Department has indicated that they would like to maintain the current performance as far as flow and height of spray, but would also like to re-establish the ability of independent component and independent fountain operation for the shows. The nozzles, foggers and center jets are fixed components that could continue to be used with some chemical cleaning, especially for the brass nozzles. This cleaning may result in improved spray performance.

Fountain with clogged nozzles in left foreground

Existing spray fountain (1 of 6)

Mechanical Recommendations

Having all of the critical equipment required for the Cascades performance located in the unsafe underground room needs to be corrected. We recommend that the mechanical and electrical equipment be replaced and relocated above ground in a new

building, into a space currently programmed at 50' x 25'. This space may be adjusted during final design, and the building may be larger if other uses (such as fountain and A/V controls) are incorporated into the same building. Schematic drawings are provided in the Architectural/Planning section of this report.

Relocation would also allow a single staff member to safely enter the building and perform maintenance in compliance with OSHA requirements. The five major mechanical systems noted below will be placed to allow safe equipment access:

1. This new building would have a new main and back up pump of equal size to provide true redundancy for the pumping system with more efficient motors for reduced electrical usage.

2. An iron removal system would be installed in this building in order to provide iron removal to reduce staining to maintain aesthetics of the park without annual painting and cleaning which is highly labor intensive. The new iron removal system would remove the iron from the raw water directly from the well, before it reached the storage tank. So the water would be treated prior to reaching the storage tank. This will not only prevent the staining of the Cascades, but will also minimize corrosion in the piping systems. Coupled with the labor cost savings, this asset management approach will substantially reduce your life cycle and annual maintenance costs. We have estimated that the iron removal system would pay for itself within no more than 5 years.

3. Chlorine would continue to be used to prevent algae growth and with the iron removal system may be more effective at the lower concentrations due to the reduced levels of minerals that can consume the chlorine in the water. The feed point for the chlorine may change to only chlorinate the water as it is pumped to the Cascades. The existing chlorine system and filter system would be relocated to the new building to manage costs, as this is one of the few components that is salvageable.

4. The existing filter system is the other salvageable component and will also be relocated to this building. The existing filter system is a manually operated backwash system due to a flooding issue in the past with the automated system. With the filter system located in the underground room, this was problematic and dangerous. The automated backwash and controls would be re-established which would alleviate the amount of effort required for operations. The filter system would continue to be used for the water coming back from the pools and would continue to operate continuously to filter the water from the storage tank.

5. The new booster pumps would be located in the new building as well. One pump for each fountain level would be used for better fountain control and performance.

As currently proposed, the mechanical building would be located on the south side of the Cascades, west of the parking lot. The building would be approximately 50'x35' depending on the final design and equipment selection. Having an above ground environment for the mechanical and electrical equipment will extend the life of the equipment as it is a drier environment to minimize corrosion, more visible so if there is a problem, it can be caught sooner, and equipment will be more accessible in order to safely perform routine maintenance and repairs.

Consideration was also given to having three individual buildings to house the booster pumps, valves and controls. These small above ground buildings could be located at each of the three fountain levels for the new equipment and eliminate the confined space entries and hazardous work environments of the tunnels. However, we felt that having a building at each level would detract from the aesthetics of the Cascades, even if partially set into the slope or placed near the existing chain link fence. The cost to have multiple buildings was also greater, as would be the cost to maintain multiple buildings. So this option was eliminated prior to finalizing this report.

The existing tunnels would be used solely for the piping and electrical component replacement. The piping and valves in the tunnels would be removed and new lines would be routed in the tunnels, up through the concrete and into the fountains where the existing fixed components would be cleaned and reused. The three existing tunnels would be opened up on the south end in order to install the new piping. Access hatches and steps would be added so that the piping can more safely be accessed in the future if needed. The second access point also improves the safety for staff to access these areas by improving ventilation and having a second point of entry. It would not be necessary to enter the tunnels for any normal maintenance or operational activities.

There are existing 2" water lines that run up the Cascades for irrigation purposes and for refilling the fountains that lose water due to leakage. These lines would be extended to provide a spigot near each of the planters for watering. Currently, there are a few isolation valves and drain valves in and around the Cascades that would be replaced to restore functionality as well. The main line that provides the water to the Cascades appeared to be original, and needs to be replaced and potentially resized and relocated based on the new system configuration. The existing drain lines must be replaced to restore the required drainage around the Cascades as well as the pool drain lines. To improve drainage, trench drains will be added in the stair systems to prevent water accumulation, and reduce slip and fall liability.

Other than the filter system, the chlorine system and the fountain components listed above, the rest of the equipment is not salvageable for reuse, only for scrap as they are fully depreciated at this point and their continued ability to operate is severely questionable.

The proposed recommendations will also enable to the Cascades to operate more reliably for longer periods throughout the season. This will help the County realize their goal of increasing usage of the facility by having reliable, multi functional equipment. By understanding your long term goals of future expansion, we are able to incorporate those future needs and possible uses into the proposed recommendations so the systems can serve multiple purposes. For example, the booster pumps can be utilized for spray areas when they are not being used for the fountains. The demand for extended hours is definitely there as we observed during our site visit in May. When we were observing the Cascades for functionality, people were drawing to the Cascades and wanting to see it in operation.

5,000 Volt gear in Vault

Step Down Transformer in wet vault under Cascades

Electrical System

During the site inspection performed on March 13th we observed a unique electrical and control system for the control of the falls as well as its theatrical lighting and sound systems. The electrical system has portions of the primary distribution that is original to the facility though many upgrades were made in 1993. Much of the equipment that was observed is at the end of its useful life and we recommend the replacement of these existing systems completely. The reliability of these systems in their current condition is marginal at best and there are several safety and code issues with the current configuration.

The electrical system is fed from a 5000 Volt (5000V) primary service. The 5000V feeder is an original cable system made of lead, typically used in the 1930s. This cable runs to the separate locations of the site providing local power via step down transformers at each site. The cable and its supporting gear are in poor condition, are no longer used in the industry, and are well past their useful life. Furthermore, very few electricians are familiar with this equipment.

There are locations throughout the site where there are exposed 5000V electrical parts in wet areas where operators have erected makeshift plywood barriers for safety and there are primary transformers with standing water underneath them. It is important to understand that the plywood barriers offer limited protection and are not compliant with current code. These conditions are a substantial liability to the County, are unsafe, and need to be remedied.

We recommend that the existing electrical service be replaced with a new 480V service. This will allow all of the systems to be nominal voltages that are easily supported by any electrician and not require the special safety and operational constraints that come with medium voltage gear (anything over 600 Volts). This new electrical gear would be installed in the new mechanical building noted above, would support all of the needs of the complex and would be easily and safely accessible. This new gear would support the mechanical functions of the falls as well as the lighting, sound and controls. All of the electrical gear would be moved out of the tunnels and the tunnels would only be used for wiring and conduit to feed end use items such as lights.

5,000 Volt connections covered by plywood

There are also a number of receptacles which have grounding and weatherization issues, as well as an ungrounded security lighting system. We recommend that all of this electrical infrastructure be replaced in its entirety. This new electrical system would greatly improve safety, County liability, and reliability as well as comply with current codes.

Corroded Electrical Equipment in Tunnel (Wet Environment Typical)

<u>Controls</u>

The existing controller is an Allen Bradley Programmable Logic Controller (PLC) which controls the lighting and mechanical systems. This equipment was reported to be vulnerable to electrical surges and the lighting is also connected to custom analog electronic circuits which are well beyond their life cycle. In May 2012, the PLC failed and required a new card and software reinstallation, at a cost of some $5,000. Due to age, software compatibility with current hardware was a problem for IT staff. The replacement of this equipment is tedious and expensive with marginal reliability.

We recommend that the existing control system be replaced with a new, commercially available, theatrical control system which will seamlessly integrate the controls for the lights, mechanical systems, and sound. This design would allow for the greatest functionality and reliability as there would be no need to try to integrate multiple systems. This system would also support secured wireless access to allow for greater ease in operationally for shows and trouble shooting. The control system would be distributed to each tunnel location, but located outside the tunnels and these locations would be tied together with fiber optic cable for networking and have isolated and surge protected power to provide adequate surge protection. The main control console would be computer operated with the main operator interface located in the proposed mechanical building. This system would support DMX theatrical lighting and sound control and be readily supported. It would allow for the lighting, sound and fountain components or a show to be readily and easy developed or modified.

Sound System

The existing sound system is composed of an array of 4 Bose speakers located at the bottom of the falls and 2 horns located at the top of the falls mounted to the flag pole. This sound system is functional but does not provide theatrical grade audio to the audience and has some holes in the coverage, particularly noted is a delay between the speakers at the top of the falls and the bottom. The sound system is based upon audio cassette technology with cues placed on the audio cassettes. This equipment and the control computer are well beyond their useful life and maintaining and repairing this equipment is getting more and more problematic and will become impossible at some point in the near future. We recommend replacing the sound system with a new system designed to provide high quality audio to all patron occupied spaces. This systems design would be based upon a theatrical audio/visual (AV) system with digital control. This would be seamlessly integrated as part of the lighting controls to allow for ease of use and increased reliability and flexibility.

Waterfall Lighting

The existing lighting system for the Cascades is based upon 1,630 individual incandescent red, blue and green waterproof fixtures in the fountains and bare incandescent fixtures in sockets behind the waterfalls using the same technology as when the Cascades first opened.

These fixtures, while functional require significant maintenance and lamp replacement each season. We recommend replacing this system with a waterproof LED light fixture system. These LED fixtures would use roughly half the electricity and last 100,000 hours of run time. Furthermore, the LED fixtures would be mounted in groups on removable racks, dramatically reducing annual installation effort and reducing the quantity of incandescent breakage during installation and removal each year. The high breakage rate is due to the unusual configuration and tight access space to bulbs, along with the sheath for each bulb.

Each fixture would also be individually controlled through the control system allowing for greater flexibility in the shows as the lights could be programmed to depict movement or to simply function just as they do now. Submersible LED lights would be used in the fountains and be similarly programmable.

Light sockets under waterfall cap

Site lighting

The current site lighting, stair lighting and security lighting systems are not optimal for the site and should be reconfigured with new energy efficient fixtures, particularly if it is desired to open up the site more often to the public.

Corroded Stair Lighting

The stair lighting does not adequately light the stairs and should be replaced. The security lighting around the perimeter of the fence is an ungrounded mercury vapor system. These lights are dated, provide poor light rendition and have a dated look not matching the aesthetic of the rest of the falls site. We recommend that the existing decorative acorn fixtures be retrofitted with new energy efficient fixtures with the same style and look while reusing the poles.

Site Security

There is currently no security system for the site. We would recommend a system with motion sensors on the doors of buildings, an appropriate number of cameras, and signage to alert potential vandals to the security system. This system should have internet access to allow for remote monitoring of the security system as well as dial out, text and email alarming of critical items. This internet access could also be used to provide trouble shooting and control system access remotely by the AV integrator.

The Cascades is a remarkable amenity to Jackson County and the region. It is many things at once; a monument, public art, gathering place, public entertainment, and truly a remarkable result of one man's vision to have a classical fountain on a grand scale. In many ways, the initial vision is still intact, but in many ways, the vision has also been scarred by time. One obvious difference is that the Cascades have not been visible from many places for some 40 years. As we understand it, the primary goal is to get the Cascades working and looking like it did the day of the grand opening on May 10, 1932.

At a group meeting held on April 19th, 2012, located at the Parks and Recreation Department, we discussed the setting of The Cascades and making potential improvements to the overall site and amphitheater area. It began with the group members discussing what was most important to them about the Cascades. We heard:

- "The Cascades are the Crown Jewel of the park"
- "Make the Cascades more visible"
- "We must protect this asset"
- "The top priority is to get them working in their original condition"
- "The Cascades are very important to Jackson County"
- "The Cascades have had a lot of band aids, and are expensive to operate"
- "We don't want to have to re-do any repairs – this needs to last 50 years"
- "I want to see the Cascades made whole again – the top priority is to get them working right "
- "The Cascades are a major liability issue with regard to safety for operations staff."
- "We want the Cascades functional, they are an economic draw for the community"
- "I am concerned that they will stop working"

After this discussion the group then discussed the plaza/amphitheater area. We looked at the master plan and discussed the proposed improvements in the Master Plan. The Master Plan lays out a new vision for the amphitheater. This vision lowers the amphitheater into the ground. We discussed the overall estimated cost for this exceeding six million dollars. The group went on to say what was important when considering this area:

- We need to keep the improvements in context
- Think about how the improvements will fit
- We need additional seating in the front area for fireworks and other events
- What are ways to increase revenue?
- We must be able to create a market
- We need to take down the wall
- Maybe include a spray park component

From these discussions we came away with a list of potential improvements for the overall Cascades area and for the plaza/amphitheater area.

- Consider opportunities to increase use of this area outside of summer evening Cascades operations
- Remove the amphitheater wall
- Remove the chain link fence and the barbed wire
- If needed, replace with lower decorative fence
- Selectively remove trees the hinder the Cascades from view. Leave trees if they are desirable.
- Remove the existing amphitheater seating
- Open up the space with a wider plaza area
- Plan new restroom and concession buildings
- Increase the plaza space in front of the Cascades
- Think Flexible space for this plaza area. Permanent seating may limit opportunities.
- Improve sight lines to the Cascades.
- Possibly include a children's play area with a water feature or spray play area near the plaza
- The Plaza flex space could handle a variety of potential uses such as, vendor space, an ice rink, the amphitheater, weddings, firework viewing, family outings, rental area, etc.

We also learned that there are space planning issues that are directly and indirectly related to the buildings in the amphitheater area and nearby enough to impact the design and layout of the amphitheater area. There are at least 4 existing and 3 new uses for building program space that require better definition by the Owner. Existing uses include Concessions, Museum, A/V Control Room, and Restrooms. Desired/Needed uses are: Gift Shop, Daytime Concessions (possibly leasing space to a private coffee shop), and Storage, especially for the new portable seating, and also for general maintenance.

Total building square footage and relationship of uses to amphitheater space are two critical drivers for the Concept Plan. The next step in amphitheater planning should be a program space needs assessment, due to these impacts and the County's desire to minimize re-work for any future projects. It is important to fix the building footprints before performing design or construction in adjacent areas.

The group then thought that if the cost was affordable, it would be beneficial to include the plaza improvements in with the bonded improvements for the other Cascades work. There was a thought that if all the Cascades work was completed without the plaza/amphitheater improvements, the public may be disappointed with spending all that money and not really seeing any improvements in the overall setting.

So with that thought in mind we developed a plaza/amphitheater conceptual plan and a corresponding cost estimate to assist with the decision as whether or not to include this work at this time.

Based on the information above, we have provided detailed sketches in this report, and a separate full-sized drawing for your review and use in refining concepts in future stages of design. Figure 2 is a Concept Plan of the plaza and amphitheater area. Figures 3 and 4 provide Conceptual elevation views of the new entry at Brown Street, and the widened north and south entries, with a potential look that better matches the classical architecture of the Cascades while providing an open and accessible view of the Cascades as originally intended.

Appendix

PRELIMINARY ESTIMATE OF COST
CASCADE FALLS
REHABILITATION WORK

Item No.	Estimated Quantity	Unit	Description	Unit Price	Amount
CONCRETE REPLACEMENT					
1	1	x LSUM	**Demolition** Complete demolition of req'd conc.	$120,000.00	$120,000
2.	50	x CYD	**Upper Pool** (Pool No. 11, 6" slab)	$800.00	$40,000
3.	30	x CYD	**Pool Curved Walls** (6) Walls at 1' thick	$800.00	$24,000
4.	40	x CYD	**Curved Wall Stairs** (6) Sets of stairs	$800.00	$32,000
5.	30	x CYD	**Balustrade** (4) Sets of walls with 6" depth	$1,200.00	$36,000
6.	85	x CYD	**Flower Boxes** (12) sets of flower box replacement	$800.00	$68,000
7.	50	x CYD	**Miscellaneous Concrete** Misc. concrete patching	$800.00	$40,000
8.	285	x CYD	**Concrete Form/Finish/Cure** Surcharge for historic/decorative conc.	$500.00	$142,500
9.	19,500	x lbs	**Reinforcing Steel** 3 lbs per cu. ft. of concrete	$2.00	$39,000
10.	6	x Each	**Circular Fountain Basin (Replace)** Precast, Installed	$9,700.00	$58,200
11.	4,000	x Sq Ft	**Stairway Tread Coating** Nonskid coating applied to all stairs	$5.00	$20,000
12.	800	x Sq Ft	**Stairway Tread Repair** Assume 20% of stairs repaired	$60.00	$48,000
13.	600	x Each	**Salvaging Spindles** For curved walls, stairs, and balustrade	$25.00	$15,000
14.	120	x Each	**Replacement Spindles** Spindles that cannot be salvaged	$200.00	$24,000
15.	16,000	x SYD	**Slope Restoration** Total for all 5 paths	$4.00	$64,000
16.	960	x Feet	**Waterfall Cap** Polypropylene, installed	$20.00	$19,200
17.	3600	x SYD	**Concrete Surface Coating** Coating all non-pool surfaces	$10.00	$36,000
18.	7,500	x lbs	**Waterproof Coating**	$10.50	$78,750

19.	1	Lump Sum	Xypex Coating **Mobilization**	10%	$91,000
				Total Construction Estimate of Cost	$910,000
				20% Contingency	$185,000
				Construction Subtotal	$1,095,000
				Survey, Design, Testing, Construction Staking, Construction Administration	$200,000
TOTAL PRELIMINARY ESTIMATE OF COST					**$1,300,000**

Cascade Falls Rehabilitation Project
Recommended Mechanical and Process Improvements
Conceptual Estimate of Cost

Item	Qty	Unit	Description	Unit Price	Cost
1.	2	Ea	Main and back up pump	$60,000	$120,000
2.	3	Ea	Booster pumps	$35,000	$105,000
3.	1	LS	Yard Piping	$250,000	$250,000
4.	1	LS	Building piping and valves	$40,000	$40,000
5.	1	LS	Tunnel piping	$40,000	$40,000
6.	1	LS	Iron removal treatment system	$100,000	$100,000
7.	1	LS	Removal/abandonment of unused equipment in pump room	$25,000	$25,000
8.	1	LS	Removal/abandonment of piping, valves and booster pumps in tunnels	$25,000	$25,000
9.	1	LS	Relocate and reinstall of chlorine and filter systems	$10,000	$10,000
10.	1	LS	Pump/Treatment Building	$150,000	$150,000
11.	1	LS	Cleanup and Seeding	$25,000	$25,000
12.	1	LS	Soil Erosion	$5,000	$5,000

Construction Subtotal	**$895,000**
Contingencies (20%)	$180,000
Engineering, Bidding and Construction Admin	$165,000
Total Estimated Project Cost	**$1,250,000**

Cascade Falls Rehabilitation Project
Recommended Electrical, Lighting and Sound and Control Improvements
Conceptual Estimate of Cost

Item	Qty	Unit	Description	Unit Price	Cost
1.	1	LS	New Electrical Service	$125,000	$125,000
2.	1	LS	Consumers Energy Charges	$50,000	$50,000
3.	1,240	EA	LED Behind Falls Lighting	$750	$930,000
4.	42	EA	LED Fountain Lighting	$1,250	$52,500
5.	1	LS	LED Site Lighting	$70,000	$70,000
6.	1	LS	Security Lighting	$50,000	$50,000
7.	1	LS	Sound System	$200,000	$200,000
8.	1	LS	Lighting/Sound/Mechanical Control System	$300,000	$300,000
	1	LS	Electrical Power Distribution System	$400,000	$400,000
9.			including all new wire and conduit throughout		
10.	1	LS	Security System	$15,000	$15,000
11.	1	LS	Stair Lighting System	$50,000	$50,000
				Total Construction Estimate of Cost	$2,250,000
				20% Contingency	$450,000
				Construction Subtotal	$2,700,000
			Survey, Design, Testing, Construction Staking, Construction Administration		$325,000
			TOTAL PRELIMINARY ESTIMATE OF COST		**$3,030,000**

PRELIMINARY ESTIMATE OF COST
CASCADE FALLS

JACKSON, MICHIGAN
AMPHITHEATER RECONSTRUCTION

Item No.	Estimated Quantity	Unit	Description	Unit Price	Amount
1.	3,600	S.F.	Buiilding Demolitior	$7.50	$27,000
2.	380	S.Y.	Pavement Demolition	$35.50	$13,490
3.	550	L.F.	Walls & Seat Demolitior	$11.50	$6,325
4.	7,000	C.Y.	Earthwork Demolition	$9.50	$66,500
5.	1,500	L.F.	Fence Demolition	$2.50	$3,750
6.	65,000	each	Plaza Pavement - 6" Thick	$8.00	$520,000
7.	1	Lump Sum	Viewing Balcony	Lump Sum	$100,000
8.	1	Lump Sum	Fountain Plaza	Lump Sum	$100,000
9.	2,500	each	Portable Seating	$95.00	$237,500
10.	1	Lump Sum	Lighting/Electrical	Lump Sum	$100,000
11.	750	L.F.	Ornamental Fencing - 8' tall	$200.00	$150,000
12.	45	each	Fence Piers	$1,500.00	$67,500
13.	1	Lump Sum	Drainage	Lump Sum	$50,000
14.	5000	S.F.	(2)Restroom/Concessions Bldg's 2,500 SF eac	$225.00	$1,125,000
15.	1	Lump Sum	Landscape/Irrigation	Lump Sum	$50,000
16.	1	Lump Sum	Electrical and Lighting	Lump Sum	$150,000
				Total Construction Estimate of Cos	$2,770,000
				20% Contingency	$560,000
				Construction Subtotal	$3,330,000
			Survey, Design, Testing, Construction Staking, Construction Administratio		$600,000
TOTAL PRELIMINARY ESTIMATE OF COST					**$3,950,000**