



Chautauqua Sustainability and Resilience Strategy

STUDY GROUP REPORTS:

INFRASTRUCTURE

ENERGY

FIRE & HEAT

VEGETATION

RESILIENCE DISTRICT



Chautauqua Sustainability and Resilience Strategy

STUDY GROUP REPORT: INFRASTRUCTURE

The Chautauqua Sustainability and Resilience (S&R) Steering Committee identified five Study Groups to review and further expand options in the following areas: Energy Systems, Fire and Heat, Infrastructure, Vegetation, and Resiliency District. Study Groups have been tasked with reviewing the preliminary options identified in the S&R Vulnerabilities Assessment, developing additional options, as needed, and evaluating all options according to the Evaluation Criteria below and any other evaluation methods identified by the Study Group. The purpose of this report is to summarize the Study Group’s work, identify key findings and make recommendations to the S&R Steering Committee.

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Study Area: Infrastructure

Study Group Members:

Name	Title
Douglas Sullivan – Chair	Principal Engineer - Utilities, COB
Chris Olson	Civil Engineer – Utilities, COB
Candice Owen	Program Supervisor – Water Quality, COB
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Bryan Ortiz	Stormwater & Flood Management Supervisor, COB
Jeff Medanich	Director – Preservation & Sustainability, CCA
Tom Thorpe	Board Member, CCA



Backgroundⁱ:

City infrastructure serves the Chautauqua area through wet utilities (drinking water, wastewater, and stormwater), and transportation systems. These services transition to private infrastructure at connections to private residences or businesses. Dry utilities (gas, electric, and communications) are provided by private utility companies. This workgroup reviewed concerns for the wet utility and transportation systems outlined in the S&R Vulnerabilities Assessment, conducted further review of those systems, and recommended actions to minimize those vulnerabilities.

Summary of Workⁱⁱ:

Water Utilities

The city provides potable water to the Chautauqua area through the distribution system shown in Figure 1. Most of this area is a fully looped (or redundant system), through three primary connections:

- 18" from the northwest, through the open space park
- 12" from Baseline to the north
- 8" from the east, and a 12" from the north

Much of the system was replaced in 1992. Pipe materials are primarily metallic, matching approximately 67% of the rest of the city. These materials are prone to corrosion which can be reduced by installing corrosion protection systems, such as sacrificial anodes, impressed current systems, or polyethylene wrap around pipe. The new pipes installed in 1992 were provided with this type of wrap, while older portions of the system are unknown. Valves are provided at each block, which minimizes the number of residences that are impacted by waterline breaks. Two branch lines extend to the south that could be tied together with a new line on Lupine Lane to provide a looped network for the residences on Goldenrod Drive south of Aster Lane.

There are 7 fire hydrants throughout the Chautauqua area. The city's design and construction standards require residences be no further than 250 feet from a hydrant. Most buildings are within 200 feet of a hydrant, although some structures on the southern edge of Chautauqua are as far as 400 feet from the nearest hydrant. Waterlines serving these structures are also dead-end pipelines, which should have hydrants installed at their ends for flushing capabilities.



Figure 1. Existing Water Distribution System



Water utilities can support buildout peak hour water demands, as well as maximum month demands with fire flows. Available fire flows vary by location, but generally the system can support a fire flow of 3,500 gallons per minute throughout the center of the campus, while some areas in the north and south are limited to between 500 and 2,500 gallons per minute. If wildland fire suppression systems identified in the heat and fire chapter progress, the ability of the water utility to support this concept should be evaluated in greater detail, and in coordination with the city's plans for wildland firefighting in the area.

The 18" transmission line from the west that traverses the Chautauqua is slated for replacement, likely within the next five to ten years. The upcoming waterline project should consider alignments that minimize impacts during construction. Should portions of the alignment be within Chautauqua, this project may be an opportunity for other utility improvements (primarily drainage) in the area.



Sanitary Sewer Utilities

City utilities provide sanitary sewer service to the area using the system shown in Figure 2. The system generally flows south to north through vitrified clay pipes. Most pipes were recently lined as part of a citywide rehabilitation program, restoring structural integrity to aging pipes. The lines in this area are primarily 6", except for the local collector line along Wild Rose Road, which is 8". City standards no longer allow the installation of 6" lines due to the difficulties in cleaning, inspecting, and trenchless repairing pipes that are smaller than 8". While these lines do not meet the city's current design standards, they have adequate capacity for the 25-year level of service goal for the wastewater system. Pipes that are lined in the area are considered closed out, with no long-term work planned. Unlined pipes are slated for replacement with an 8" line in the sewer system long range planning.

Manholes in the area have a need for attention at some level. The city's manhole rehabilitation program is evaluating and ranking manholes throughout the entire city and prioritizing assets at a citywide level. Some of the manholes in Chautauqua will be rehabilitated as they move up the priority list.

Stormwater Drainage

Stormwater drainage is a visible infrastructure component and has been identified as a high need by Chautauqua. Currently, stormwater is conveyed through a series of rock swales located at roadway edges generally from south to north. Eastern flows, generally from Goldenrod Drive are intercepted in a catch basin west of the auditorium, and into the city's stormwater network. Remaining flows from the site continue north to Baseline Road, and eventually into the collection network there. The local topography has significant slopes, which leads to excessive velocities through these swales. These excessive velocities damage the swales, as well as scour sediment and debris down the swales, which deposits in quiescent areas, or continues into the city's system. This sediment transport has been a maintenance challenge for CCA staff.

The vulnerabilities assessment identified drainage systems as a significant risk to roadways, walking paths, retaining walls, and structures. In fact, 13 of the 26 identified vulnerabilities were related to drainage concerns. Several past studies detailed improvements to stormwater systems

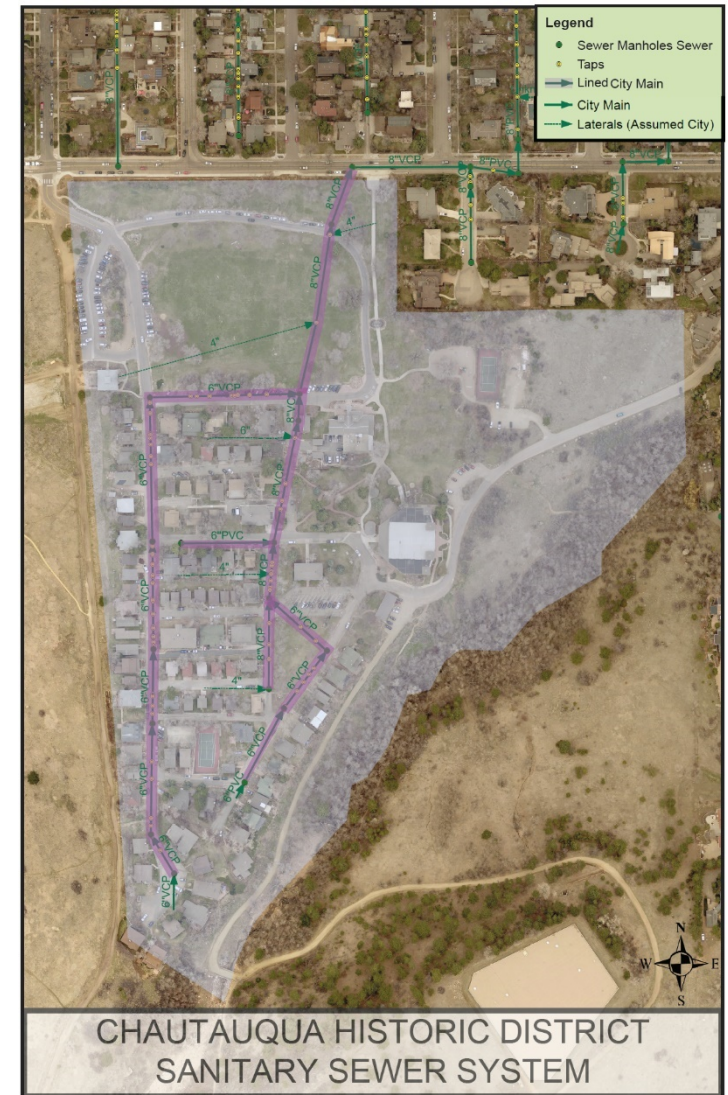


Figure 2. Existing Sanitary Sewer System



in the area. A recent planning effort recommended converting the swales to permeable structures with a collector pipe running underneath, similar to a bioswale or French drain, but still with a permeable stone cap. These lines would tie together in a 24" pipe and discharge into the city's stormwater system. Unfortunately, the stormwater network downstream has limited capacity, and is unlikely capable of supporting this added flow. That is not to say much of this plan is not viable, however further analysis must be completed to determine what downstream improvements are needed or to identify alternative outfall sites. Clearly, there is a need for a comprehensive stormwater evaluation for the area. Such an evaluation should not only review drainage systems along roadways/swales, but also evaluate potential flood risks around structures, protect structures from foundation damage, and improve retaining wall drainage.

Perhaps the largest challenge to implementing drainage improvements at Chautauqua is integration with citywide planning efforts, and prioritizing funding and staffing needs with competing citywide priorities. As the city begins to develop the comprehensive stormwater and flood master plan (CFS); improvements to the Chautauqua should be implemented into this long-term planning effort. By incorporating into the CFS, potential projects at Chautauqua will have an execution avenue where one does not currently exist.



Figure 3 Figure 3. Existing Stormwater System



Green Infrastructure Opportunities

While Chautauqua presents several drainage challenges as explained above, the large open areas and existing infrastructure of the park provide opportunities to implement more natural and sustainable mitigation measures such as green infrastructure. Green infrastructure is the routing of stormwater to permeable areas where the water can infiltrate providing both a reduction in quantity and improvement in quality of stormwater. While not a “fix all” for drainage problems, green infrastructure can assist with local flooding and should be considered to help address the current issue of the undersized storm system downstream of the park. Areas with the greatest potential for green infrastructure retrofits include creating rain gardens around existing buildings to capture roof water, developing new rain gardens or bioretention areas in strategic locations throughout the park, routing existing flow patterns through level spreaders and into grassy areas, installing bioswales with energy dissipation and infiltration capacity along eroding roadside ditches and retrofitting an existing detention basin in the northwest corner of the park. Some of these options are called out in the 2017 study by JVA, but a more comprehensive look at the most advantageous installations should be conducted.



Retrofit Existing Detention Basin to Bioretention

Figure 4. Green Infrastructure Opportunities

Dry Utilities

Dry utilities include gas, electric, and telecommunications lines. The energy futures workgroup is addressing recommendations for improvements to electrical systems, while other dry utilities are beyond this assessment’s scope, as they are owned by private companies.

Transportation

Streets

Chautauqua includes a network of public streets, alleys, and pathways that provide access for pedestrians, cyclists and motorists. Access to Chautauqua occurs via Kinnikinnick Road and 12th Street. The internal streets are used to access the cottages, public facilities (Auditorium, Dining Hall, etc.) and the adjacent Open Space/Mountain Parks trails. Primary internal circulation occurs via Kinnikinnick Road, Morning Glory Drive and Goldenrod Drive. The streets and alleys vary in width, are narrow (18 feet or less) and provide two-way circulation and on-street parking. Pedestrians, cyclists, and motorists share the streets. Street drainage



is handled through unimproved swales, stone swales, stone curb, and concrete curb. Except for limited areas around the General Store, Dining Hall, and Auditorium there are not separate sidewalks/paths for pedestrians and cyclists.

Pavement Condition

The city is responsible for street maintenance. The internal Chautauqua streets/alleys are paved in asphalt and are generally in poor condition. There are significant areas of distress. The streets were never constructed to carry the loads of larger vehicles (trash and delivery trucks).

The city has a Pavement Management Program (PMP) that rates the streets city-wide and directs city pavement maintenance. Figure 4 shows the current pavement condition of the Chautauqua streets. With limited resources the PMP prioritizes proactive maintenance spending on cost-effective maintenance investments. Many/most of the Chautauqua streets are in a condition that will require total reconstruction.

Street Drainage

Street drainage is historic and not well defined. Even minor storm events result in street drainage leaving the street drainage features and flowing into the cabin areas.

Right of Way/Easements/Ownerships

Chautauqua is held as a single tract of land owned by the city of Boulder. None of the streets are platted as public right of way typical of other streets in the city.

Lighting

Area lighting with Chautauqua is provided on an ad-hoc basis. Pedestrian-scale lighting was added in 2019 from King's Gate and the Dining Hall/Auditorium. Additional pedestrian-scale lighting is planned for the area around the Auditorium. Limited Xcel Energy-based intersection street lighting is provided by luminaires mounted on overhead power-poles.



Figure 5. Existing Pavement Condition



Parking Management

Parking within Chautauqua is open to the public. In 2018 a Chautauqua Access Management Plan (CAMP) was developed to manage access to Chautauqua and the adjacent Open Space/Mountain Parks. CAMP established a system of paid parking in the adjacent neighborhood and the Open Space/Mountain Parks Parking Lot coupled with a weekend transit service. In addition, parking is restricted to residents and guests only within Chautauqua on Colorado Music Festival event evenings.

Summary of Options:

Option	Description	Evaluation <u>Criteria Rating</u>	Summary of Rating
18" Waterline Planning*	Review alternative alignments for the 18" waterline replacement when available. Areas through Chautauqua should consider drainage and pavement improvements when that project is executed		
New Hydrant Installation*	Install fire hydrant at the terminus of the 8" waterline on Bogges Cir		
Added Waterline Loop*	Install waterline along Lupine Lane to provide loop for residents on Goldenrod south of Aster Lane		
Sanitary Sewer Improvements*	Replace unlined 6" sanitary sewer pipes with 8" lines		
Drainage System Planning*	Incorporate improvements to Chautauqua's drainage system into the CFS master plan development. This evaluation should consider: <ul style="list-style-type: none"> - Green infrastructure opportunities to slow runoff and improve water quality - Collection and conveyance infrastructure to improve the historic swales - Conduct detailed evaluation of downstream stormwater infrastructure or review alternative outfall options 		



Pavement Maintenance – continue response-based practice*	Current practice is to perform response-based maintenance (small patching) as pavement fails. Existing pavement maintenance resource funding is inadequate to fund more comprehensive approach.		
Pavement Maintenance – comprehensive repaving*	Chautauqua streets are in poor or failed condition and require reconstruction. Current pavement resource funding is limited and inadequate to cover the cost of this level of investment. Additional funding sources would be required.		
Pavement maintenance – coordinate with water/stormwater system projects*	The construction of a Chautauqua stormwater system will require significant street reconstruction to integrate with stormwater improvements. Reconstructed streets would be coordinated with stormwater system construction.		

*New option identified by study group



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: 18" Waterline Planning		
Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	3.0	This will be buried infrastructure, regardless of its location.
2. The action aligns with one of more of the defined "systems" areas and identified vulnerabilities	1.0	This pipeline is identified as a vulnerability for the water utility, in planning efforts outside of this S&R study
3. The action is economically feasible	3.0	While costly, this is an identified project in upcoming capital projects
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2.0	Replacing this pipeline will reduce the risk of an aging transmission main breaking in Chautauqua.
5. The action is practical from an implementation perspective	2.0	This project is planned for execution in the water capital improvements program
6. The action is potentially innovative	3.0	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	3.5	
8. The action has broad reaching advantages that could leverage additional financial support, grants	2.5	This project is planned for execution in the water capital improvements program
9. The action is replicable	3.0	



10. The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	3.0	
TOTAL	26.0	Average Score = 2.6 Some Agreement

Option: New Hydrant Installation

Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	3.0	
2. The action aligns with one of more of the defined "systems" areas and identified vulnerabilities	1.5	
3. The action is economically feasible	2.0	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2.0	
5. The action is practical from an implementation perspective	1.5	
6. The action is potentially innovative	4.0	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	3.5	
8. The action has broad reaching advantages that could leverage additional financial support, grants	2.5	
9. The action is replicable	3.0	



10. The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	3.0	
TOTAL	26.0	Average Score = 2.6 Some Agreement

Option: Sanitary Sewer Improvements

Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	3.5	
2. The action aligns with one of more of the defined "systems" areas and identified vulnerabilities	3.5	
3. The action is economically feasible	3.5	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	3.0	
5. The action is practical from an implementation perspective	3.5	
6. The action is potentially innovative	4.0	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	3.5	
8. The action has broad reaching advantages that could leverage additional financial support, grants	2.5	
9. The action is replicable	4.5	



10. The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	4.0	
TOTAL	35.5	Average Score = 3.55 Neutral

Option: Drainage System Planning

Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	3.0	
2. The action aligns with one of more of the defined "systems" areas and identified vulnerabilities	1.0	
3. The action is economically feasible	3.7	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2.0	
5. The action is practical from an implementation perspective	2.0	
6. The action is potentially innovative	2.0	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	2.0	
8. The action has broad reaching advantages that could leverage additional financial support, grants	2.3	



9. The action is replicable	3.0	
10. The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	2.3	
TOTAL	23.3	Average Score = 2.33 Some Agreement

Option: Pavement Maintenance – continue response-based practice

Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>4</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	3	
3. The action is economically feasible	1	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>3</u>	
5. The action is practical from an implementation perspective	1	
6. The action is potentially innovative	5	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	5	



8. The action has broad reaching advantages that could leverage additional financial support, grants	5	
9. The action is replicable	1	
10. The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	4	
TOTAL	32.0	Average Score = 3.2 Neutral

Option: Pavement Maintenance – comprehensive repaving*

Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	3	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	2	
3. The action is economically feasible	4	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>4</u>	
5. The action is practical from an implementation perspective	4	
6. The action is potentially innovative	4	



7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	4	
8. The action has broad reaching advantages that could leverage additional financial support, grants	4	
9. The action is replicable	3	
10. The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	3	
TOTAL	35.0	Average Score = 3.5 Neutral

Option: Pavement maintenance – coordinate with water/stormwater system projects*

Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	3.0	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	1.5	
3. The action is economically feasible	2.5	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2.0	
5. The action is practical from an implementation perspective	2.0	
6. The action is potentially innovative	3.0	



7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	3.0	
8. The action has broad reaching advantages that could leverage additional financial support, grants	2.5	
9. The action is replicable	3.0	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	3.0	
TOTAL	25.5	Average Score = 2.55 Some Agreement

Key Findings and Considerations for the Steering Committee in making recommendationsⁱⁱⁱ:

Water Infrastructure

The water system infrastructure currently serves the Chautauqua community very well. The water distribution system is well looped which provides adequate redundancy. The water system is also well valved which permits quicker rehabilitation when addressing pipe breaks, and limits impacts to residents as less of the system is affected by outages. The properties located at the southern tip pf the campus are 400-500 feet from the closest hydrant. This distance is reasonable, but there is a single service line to these structures which represents a single point of failure and the inability to flush the line without taking the homes out of service. The city has identified an 18-inch diameter water main that is scheduled for replacement. Utilities staff will coordinate with Chautauqua on this project’s timing to minimize the impacts. Any plans for wildland fire sprinkler systems should be coordinated with the city’s approach to fighting wildland fires in this area.

Wastewater Infrastructure

Similar to the water utility, the wastewater infrastructure also serves the Chautauqua community very well. The city’s wastewater utility has an aggressive sewer rehabilitation program and many of the lines located in the Chautauqua area have already been addressed. Trenchless technologies permit efficient and cost-effective sewer rehabilitation with minimal impacts to the community. There are several wastewater lines that are 6-inch diameter. The city prefers an 8-inch minimize size for the wastewater collection system sewer lines. These existing 6-inch lines have adequate capacity to address the limited flows for the areas they serve, but these lines are more difficult to inspect and maintain. The city’s TV inspection equipment is designed for use in 8-inch or larger lines.



Stormwater Infrastructure

The stormwater infrastructure represents a more complex situation than that associated with the water and wastewater infrastructure and will require greater investment and more time to address. The existing stormwater infrastructure located on the Chautauqua campus and in the Chautauqua area is inadequate to address the desired “level of service” goals. The stormwater infrastructure is comprised of various components that convey runoff across the Chautauqua campus and discharge to the city’s stormwater infrastructure. Above ground infrastructure includes curb and gutter along streets, and swales and ditches intended to convey water along streets and away from structures. Detention facilities are another example of above ground infrastructure that are utilized to attenuate or reduce the peak runoff in each drainage basin.

Additional analysis will be required to comprehensively address the Chautauqua stormwater runoff needs. The city’s Stormwater & Flood Management Utility includes capital programs to address its numerous major drainageways as well as its stormwater conveyance infrastructure. Stormwater infrastructure improvements are typically constructed beginning at the downstream end to provide greater conveyance capacity such that the improvements do not contribute greater flows to an “unimproved” area.

Transportation Infrastructure

Chautauqua’s streets are in generally poor condition and were not designed to handle large vehicular traffic. Surface renewal or replacement is an actionable option, however, given funding constraints and known drainage concerns, a more practical approach to addressing these pavement issues is to address these pavement concerns in concert with larger potable water and drainage improvements.





Chautauqua Sustainability and Resilience Strategy

STUDY GROUP REPORT: ENERGY

The Chautauqua Sustainability and Resilience (S&R) Steering Committee identified five Study Groups to review and further expand options in the following areas: energy systems, fire and heat, water and drainage, vegetation, and resiliency district. Study Groups have been tasked with reviewing the preliminary options identified in the S&R Vulnerabilities Assessment, developing additional options, as needed, and evaluating all options according to the Evaluation Criteria below and any other evaluation methods identified by the Study Group. The purpose of this report is to summarize the Study Group’s work, identify key findings and make recommendations to the S&R Steering Committee.

Each Study Group Chair is responsible for completing and submitting this document to Clare Brandt by 5:00pm on Monday, August 31st.

Note: if the text is grey, it will be deleted before the report is published; if the text is green, it will automatically disappear when you enter your text; items in blue contain document bookmarks or more information.

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1. Study Area: Energy Systems

Study Group Members:

Name	Title
Jonathan Koehn– Chair	Chief Sustainability & Resilience Officer, COB
Tom Thorpe	Former Board member, CCA
Nan Anderson	Board President, CCA
Alison Ecklund	Community Relations Officer, OSMP, COB
Dan Burke	Director of Open Space & Mountain Parks, COB
Kayla Carey	Sustainability Coordinator, CCA
Laurel Mattrey	Sustainability Coordinator III, COB



2. Backgroundⁱ:

To successfully transition Chautauqua to a low- or zero- emission, renewable energy-based system, and to address current and future vulnerabilities, actions must be incorporated that address both the energy supply and energy consumption. Truly sustainable and resilient energy systems should be clean, renewable, and have the ability to provide ongoing benefits, not just during times of outage and other power emergencies. Designing a resilient power system at Chautauqua should consider incorporating a more diverse portfolio of electricity generation technologies to increase reliability and allow for service disruptions to be mitigated and resolved quickly. With a general sense of the energy system at Chautauqua, the Sustainability and Resilience Plan should consider actions in three core energy-related areas when identifying short- and long-term investment strategies. These include the ongoing energy consumption patterns at Chautauqua, how energy is currently distributed at the site, and how alternative energy supplies could mitigate existing risks and vulnerabilities.

Energy consumption – Energy demand from visitors and cottage owners is likely to change over time. A critical area of infrastructure that is becoming increasingly at risk due to the heat signatures is the demand for power within the Chautauqua NHL District. As temperatures continue to rise in the summer, both visitors and residents will increasingly demand the ability to install air conditioning in buildings. Cooling degree days (CDDs) is a metric used to estimate the amount of cooling that is needed in a certain area. Historically this metric was low enough that cooling was not widely used. It is projected that the number of CDDs will increase 25 percent to 50 percent by 2030 and 60 percent to 100 percent by 2050. The increases in potential air conditioning installations coupled with these increases in energy needed to cool the buildings along with any future electrification of heating loads as well as the potential for vehicle charging will create a very significant increase in power demand.

Ongoing improvements to buildings will reduce the need for additional generation through continued improvements in energy efficiency and productivity, however the increased demand for changes to the cottages may require CCA and the City of Boulder to revise existing guidelines to specifically address these changes. In other words, the increasing temperature profile is creating new vulnerabilities for both the built and natural environment. Similarly, as usage patterns change due to temperature variations, considerations must be given as to when peak loads are encountered at the site. By continuing to prioritize actions that reduce overall demand, need less power to survive Can meet your power needs through a range of options Decrease your threats of your infrastructure being destroyed.

Energy distribution – The continued health and reliability of the energy system will require a complete redesign of the distribution system within the Chautauqua NHL District. Relying on century old power poles is neither sustainable nor safe. The existing energy system is at risk from increasing wind events due to the above-ground location of the utilities. An engineering analysis of the vulnerability of these systems to extreme events should be conducted to ensure their reliability and resilience during event scenarios. In addition to redesigning the existing energy delivery system to make it more reliable and more secure, it will need to be designed to support an increasingly diverse mix of electricity sources, particularly on-site distributed resources. it's questionable as to whether the historic power distribution systems can handle increased power distribution requirements.



The Chautauqua NHL District and surrounding neighborhoods have electric power infrastructure that is amongst the oldest in the city. With electric lighting dating back to the founding in 1898 and multiple electric poles dating back to at least 1910, the electricity infrastructure was designed for a different set of environmental conditions. It's questionable as to whether the historic power distribution systems can handle any significant increase in power distribution requirements. Additionally, the interplay between the power lines and the natural environment should be raising significant concerns about the potential for power lines to cause a fire incident. This historic infrastructure raises concerns as to its fire safety considering projected increasing winds as well as interactions with the vegetation now surrounding the poles. As seen in California, the demand for increased power combined with the increasingly harsh summer environment is leading to catastrophic consequences. Consideration must be given to how to reduce the threat from historic power lines that are exposed to the increasingly harsh elements.

On-Site energy supply – Decentralizing energy sources is a technique used to enhance power system resilience. On-site renewable energy generation (or other generators) can reduce the disruption to a site of a grid outage, mitigating the impacts of a long-term outage. Microgrids are often implemented where on-site renewable energy is combined with energy storage to support resilience. Systems that are designed to operate in islanded mode can be isolated from a larger grid, allowing the system to generate and distribute energy on-site in the event of a power outage. The capability of microgrids to operate in islanded mode can be critical in supporting resilience by providing a backup resource during a grid outage while also allowing certain loads to be covered as the larger grid is secured.

The unique geographic position of the Chautauqua NHL District along with Boulder's commitment to renewable energy creates a distinct opportunity for CCA to explore on-site energy sources that support both climate and resilience objectives. The inclusion of distributed energy generation has been a priority of CCA's since 2008. With the potential for increasing energy demand associated with higher cooling loads from rising summer temperatures, along with increased consumption from the electrification of buildings and vehicles, CCA has a unique opportunity to examine the best way to meet both short and long-term energy demands. On-site energy generation, if feasible, will help assure the sustainability of the site by reducing the reliance on the aging infrastructure, avoid potential disruptions in service, stabilize long-term costs and help set an example for other communities, not limited to historic sites, for the potential to integrate evolving clean energy technologies. Any and all potential for on-site or nearby renewable energy systems should be thoroughly explored and evaluated for implementation. Integration of the most suitable technologies and locations will need to be explored, along with the technical, financial and legal feasibility of implementation. Consideration should be given to placement of alternative systems on non-contributing buildings, structures or sites or on contributing resources in a manner that is consistent with the Chautauqua Design Guidelines.

3.Summary of Workⁱⁱ:

The Energy Study Group met twice virtually, reviewed the options via email, scored the options via email, and edited the final report via email. The group members relied on a series of recent analyses to identify the key considerations in designing a sustainable and resilient energy system at Chautauqua. Those include:



1. Carbon Neutral Cities Alliance (CNCA) *2016 Colorado Chautauqua Energy Project Report*
2. City of Boulder Resilience Strategy
3. City of Boulder *Climate Commitment* and *Climate Mobilization Action Plan (CMAP)*
4. CCA Conceptual Infrastructure Master Plan (CIMP) Part 1- JVA Report & Part 2 Ludvik Electric Report
5. “Conceptual Design of a New Electrical Underground Utility,” prepared by Ludvik Electric

4. Summary of Options: *List all options, the Evaluation Criteria rating for each, and a summary of the rating for each. Add a * next to the newly identified options.*

When considering the potential energy-related actions that could be taken at the Chautauqua site, it’s important to recognize the significance of the utility provider when describing those actions that are technically possible, but not allowed in the current regulatory structure. As of September 1, 2020, the Boulder community and the entire Chautauqua site is supplied electrical and gas energy by Xcel Energy. Since Colorado does not allow more than one utility to provide retail service to a specific area, customers within Boulder city limits have no choice in who provides them with power. This “Buyer/Seller” arrangement with Xcel is governed by very strict rules and regulations that dictate the allowed installation and connection of non-Xcel owned generation. This means that even if a solar project is theoretically, technically and economically feasible, it may not be possible to execute based on the legal restrictions of the current system. Examples of these restrictions include such limitations as:

- To qualify for net energy metering (an accounting mechanism that significantly improves the economics of many PV projects), the annual source power output (kWh) of an on-site PV system can be no greater than 120% of the total customer usage from the previous 12 months.
- An individual customer (such as the City of Boulder) cannot install a net metered solar system at one location (such as on top of a utility water tank) and use the output to offset consumption at other locations.
- Customers cannot sell their excess solar generation to neighbors (e.g. Neighbor A has a large unshaded roof ideal for rooftop PV while neighbor B has a small, shaded roof not suitable for PV).
- A single customer can subscribe to no more than 60% of the output of an individual community (off-site) solar project.
- Customers can only purchase the output of a community solar project built within the county or a neighboring county of their home or business.

BOULDER/XCEL ENERGY PARTNERSHIP ACTIVITIES

In July 2020, the City of Boulder and Xcel Energy reached a potential settlement agreement that could create new pathways to reach the city’s energy goals and halt the city’s decade-long municipalization effort. This agreement will not go into effect until approved by city council and Boulder voters.



The goal of the settlement negotiations was to explore whether the city could reach an agreement with Xcel Energy that would satisfy six goals:

- **Decarbonize:** Renewable and clean fuel sources should be maximized as much as possible, as quickly as possible, minimizing both short- and long-term environmental impacts and maximizing energy independence over time.
- **Decentralize:** Energy should be generated locally or within the region to the maximum extent feasible, reducing reliance on external fuel sources; customers should be able to manage and reduce their energy use as directly and effectively as possible; and energy service companies should be empowered to compete and innovate within a diverse and robust local energy economy.
- **Democratize:** Customers should have more direct control and involvement in decisions about their energy, including opportunities to invest in their long-term energy needs and to have a say in energy investments made on their behalf.
- **Rates:** Our energy future must ensure competitive rates, balancing short-term and long-term interests.
- **Reliability:** Our energy future should ensure a stable, safe and reliable energy supply.
- **Renewables:** Our energy future should maximize local renewable resources.

As part of the agreement, Boulder and Xcel would partner on many specific grid-related projects. Under the potential agreement, the city and Xcel would work together to achieve Boulder's renewable electricity target: 100% by 2030. The city and Xcel would work together to update Boulder's electric grid, share data and develop innovative demonstration projects under the guidance of a community board. The parties have also committed to work collaboratively to change current regulations that limit innovation and local renewable development:

- Elimination or substantial increase of the state's 120% limitation on on-site generation
- Development of a new tariff to facilitate the rapid conversion of bus fleets to electric busses
- Removal of barriers to large amounts of local distributed generation
- Facilitation of microgrids in specific projects at Chautauqua and Alpine Balsam
- Data-sharing

In addition, the potential agreement includes \$33 million dollars in undergrounding investment by Xcel Energy, with approximately half of the investment being made in the first five years of the franchise.



Chautauqua was identified as a potential site for innovative partnership projects should Boulder voters approve the settlement. This includes support for the potential micro-gridding at Chautauqua as well as priority planning for undergrounding of powerlines. While the outcome of the November 3, 2020 vote is not known, several of the identified actions in the summary below could be prioritized as part of the Boulder-Xcel partnership activities.

SCORING SUMMARY			
Option	Description	Evaluation Criteria Rating	Summary of Rating
		Total Score, and average score reflective of 7 raters	Example: Ranked low in cost, high in X, medium in X.,
ENERGY CONSUMPTION STRATEGIES			
Demand-side management	Energy demand management, also known as demand-side management or demand-side response, is the modification of consumer energy use through education and behavior change; energy efficiency measures; and financing incentives, such as utility tariff structuring. During short-term extreme events, demand-side management can reduce peak loads as well as the need for increased generation over time. This technique can reduce the loads needed to be met by on-site generation or battery storage capacity.	Total: 154 Average: 2.20	Along with the continued deployment of energy efficiency strategies, enhancing demand-side strategies scored generally high across all criteria except in the categories of innovation. Along with efficiency and conservation, demand-side strategies should be considered “no-regret” strategies for their ability to reduce overall consumption of energy at the site. While generally cost effective, actions in these two categories do not address energy supply or energy resilience directly, though they do support the implementation of other actions when paired.
Continued/Enhanced Energy Efficiency and Conservation efforts	Continue to implement CCA’s energy conservation strategies that seek to reduce energy demand, while enhancing visitor comfort in our historic cottages and public buildings, through an integrated approach that balances sustainability “best practices” in insulation /	Total: 150 Average: 2.14	(See Above)



	<p>air sealing, lighting, appliances, windows, heating / cooling, hot water and passive shading within historic preservation guidelines and constraints. Efforts could include continued deployment of:</p> <ol style="list-style-type: none"> 1. Lighting – LED conversions 2. Occupancy Sensors – Occupancy sensors are typically easy to install and provide a method to increase savings which removes the human behavior component 3. Thermostats- Smart thermostats are typically an easy installation and provide a similar benefit to occupancy sensors. However, in older buildings it is likely that the constant power wire was not run and it is possible the thermostats have mercury in them. In this case it may not be advantageous to replace them. 4. Pipe Insulation - This is an extremely easy and in expensive way to cut down on wasted heat. 5. Window Film - Adding window film reduces heat from natural lighting while still allowing illumination. Many products are now not visible to the naked eye. 6. Air Sealing - Maintaining a tight building envelop seal is one of the most critical activities to reducing energy use. However, this gets increasingly difficult with the age of the building. 7. Service Equipment Rebates are typically available for EnergyStar® products. All appliances and service equipment should be EnergyStar® rated 8. Updating and optimizing HVAC Equipment 		
Beneficial Electrification (BE)	<p>A critical aspect to becoming completely carbon neutral is to remove natural gas loads. Beneficial electrification (or strategic electrification) is a term for replacing direct fossil fuel use (e.g., propane, heating oil, gasoline) with electricity in a way that reduces overall emissions and energy costs. There are many</p>	<p>Total: 161 Average: 2.33</p>	<p>Beneficial electrification scored high in level of benefit and its ability to be replicated. This is due in large part to its pairing with other potential actions as retrofits are made to replace natural gas infrastructure. Switching to “all electric” can be costly but is beneficial</p>



	opportunities across the residential and commercial sectors. This can include switching to an electric vehicle or an electric heating system – as long as the end-user and the environment both benefit.		from an environmental standpoint when paired with cleaner electricity sources. Care should be given to the implementation and cost of electrification. While there are many options for the residential application, commercial electrification options are still maturing. Up-front costs, timing and customer preferences represent additional challenges.
ENERGY SUPPLY STRATEGIES			
ON-SITE GENERATION			
On-Site Solar (large-scale)	The Enchanted Mesa Reservoir area offers 2 acres of flat roof area just a few feet above ground which provides an ideal site for a solar panel array. This provides the most synergies in construction and installation; however, because of current Public Utilities Commission (PUC) rules, we cannot simply run a single wire down into the park and then interconnect each building to then transmit power where needed. We must run the supply to the individual meters. The water storage roof is capable of housing a 500kW system, which consists of 1495 modules that would provide just over 700,000 kWh/yr. However, we will actually be limited to 120% of the typical use of any meter connected to the supply. The maximum amount we could actually install would be 667,000 kWh.	Total: 161 Average: 2.30	Onsite energy generation sited at the water storage tank scored high in terms of benefit, replicability and support of environmental goals. It scored low in terms of economic feasibility; however, a financing plan was not included in the preliminary evaluation. There are opportunities to pair this action with another energy generation strategy such as a Community Solar Garden to finance the project. The water tank concept scored the highest of all of the onsite energy generation strategies identified. The outstanding question relates to where the power generated on the tank would be fed. The cost of this action remains high as it was intended to be hard-wired to specific facilities at Chautauqua. The alternative is a grid-tied system (<i>see below</i>).
PV Grid-Tied System	The simplest and cheapest method but has the distinct disadvantage of using a “micro-inverter”, which needs	Total: 193 Average: 2.76	A Grid-Tied PV system that generates on site but is fed directly into the larger distribution



	grid power to function. Thus, if the grid is down, the solar panels can NOT supply energy to the system, even if they are generating energy. This system also does not use a battery back-up and is very limited in its functionality.		system scored high for implementation and cost effectiveness, while remaining linked to the specific goals of the site. It scored low on innovation and support of resilience objectives given the inability to store any of the generated energy to be used during outages. See actions below that incorporate back-up storage.
DC-Coupled Grid-Tied system with a battery back-up.	This system uses a dual-function inverter which can operate without grid power. Solar+storage refers to a microgrid system that pairs solar photovoltaic (PV) and battery technology, enabling buildings that have solar PV arrays to continue to generate and use solar power when the grid fails. With net metered, grid-tied solar arrays, the grid functions as an energy bank for any excess energy produced. However, under emergency situations when the grid shuts down, grid-tied solar arrays are designed to also shut down to prevent excess energy from being fed back into the grid and endangering line workers. With on-site battery storage and islanding capacities, solar+storage systems can disconnect from the central grid and rely on locally stored solar electricity to power buildings during grid failures.	Total: 171 Average: 2.44	Similar to an onsite solar project either fed directly to site facilities or to the grid, a DS or AC grid tied system scored well in terms of aligning with existing vulnerabilities and supporting broader energy and climate goals. Both Grid tied projects (see below) incorporate the added element of battery backup to provide uninterrupted service during outages. Both have high capital costs, as there would be a cost to develop the generation and back-up storage, but also to hard-wire the system to existing facilities. This is essentially the design of a site microgrid.
AC-Coupled system with a battery back-up	In addition to what the DC-Coupled system can do, the AC system can also charge its batteries from grid power, in the event the solar panels are not charging the batteries. This system has the most hardware and highest capital cost but provides the most flexibility and the potential for the lowest operating cost if properly optimized.	Total: 170 Average: 2.43	(See above)
On-Site Solar (distributed)	Chautauqua has several options to develop solar energy supply on-site. Several buildings have rooftops	Total: 220 Average: 3.14	Distributed Solar is also known as roof-top solar, in that it is deployed on individual sites



	<p>that are structurally stable and have sufficient solar exposure. A majority of the individual buildings are suitable for solar panel installations. The two major exceptions being the Auditorium (previous structural analysis show insufficient load capacity) and the Community House (roof design includes dormers making panel installation difficult). In most cases roof space is sufficient to power 100% of that building's demand. The biggest exception to this is the Dining Hall facility which is a year-round fully functional restaurant and draws over 50% of the entire load.</p> <p>Based on the inability to supply the Dining Hall with sufficient solar from its roof, the solution of multiple locations was reviewed. This solution has the least amount of synergy in construction but will allow for 100% of energy to be generated on-site.</p>		<p>where electricity is being consumed. On site solar can negatively impact the historic character of facilities at Chautauqua. While solar panels installed on a historic property in a location that cannot be seen from the ground will generally meet the Secretary of the Interior's Standards for Rehabilitation. Conversely, an installation that negatively impacts the historic character of a property will not meet the Standards. Given the site suitability for rooftop solar at the site, it scored low in its ability to preserve historic and cultural character of Chautauqua. It also scored low in innovation or the ability to educate about sustainability or resilience. In comparison to other onsite generation options, distributed PV scored low. That said, there may be the ability to integrate rooftop solar in strategic locations as long as strong guidelines can be met and benefits outweigh those of other options.</p>
Battery Storage	<p>Battery storage for each individual building was reviewed. Based on the configuration of the solar installation, the amount of supply from the batteries will vary. In most cases it is possible to provide full resiliency, i.e. all critical loads could be continuously supplied (assuming no more than 1 full day of no solar radiation). However, battery storage quickly becomes uneconomical based on its amount of use. Batteries have the disadvantage of needing to be charged before they can supply power; and, without grid power they are at the limited by the attached solar supply and cannot scale their production.</p>	<p>Total: 192 Average: 2.74</p>	<p>Stand alone battery storage can be cost prohibitive in its ability to integrate with the existing energy system on site. Typically, storage is paired with onsite generation to store electricity for use during outages. This action scored high in innovation and replicability, but low in practicality or economic feasibility. Battery Storage along with fuel cell technologies should be considered when paired with onsite generation. Storage will also be a critical</p>



			component of designing any microgrid at Chautauqua.
Combined Heat & Power	Combined Heat and Power (CHP), also known as cogeneration, is a process of energy generation that captures the thermal energy emitted from a natural gas or biomass generator and uses that waste heat to heat or cool buildings and water on-site. CHP is typically 40–60% more efficient than non-CHP natural gas production. Because of the on-site utilization of waste heat, CHP systems are used as on-site generation for large buildings or facilities, offsetting some or all of the electricity purchased from a utility. CHP systems can be designed to island from the utility grid, therefore offering high-capacity onsite generation that can continue to operate when the electricity grid fails.	Total: 243 Average: 3.47	CHP only scored well in relation to supporting the broader goals of the city's climate efforts as it represents an efficient use of existing power infrastructure. Because there are existing cogeneration facilities at Chautauqua, nor the commercial/industrial type loads typically associated with CHP, it does not represent a viable solution for the site.
Integration of additional stand-by generators	Additional standby generators could be integrated into the Chautauqua system to maintain power during an outage. They would be installed outside individual buildings (like an AC unit) and come on automatically within seconds of a power outage. Generators run on propane or natural gas.	Total: 259 Average: 3.70	Stand by generators are practical and replicable, and received a representative score. While generators are viable options to address intermittent outages, the expense coupled with the fact that they are not a sustainable solution resulted in an overall low score. Additionally, installing back-up generators at individual cottages and facilities is likely at odds with the historic and cultural character at Chautauqua.
Fuel Cells	Hydrogen fuel cells can be installed and used for back-up energy supply in place of batteries. These installations are currently ~15% more expensive on initial install; but, because they run on natural gas supply, they are inexpensive to operate and can scale instantaneously. While a hydrogen fuel cell will have zero emissions, its natural gas fuel source is not considered renewable.	Total: 213 Average: 3.04	Similar to battery storage options, integrating fuel cells for back up power supports overall energy resilience at the site, but as the scoring represents, they can be cost prohibitive. Fuel cells scored high in innovation and support of resilience goals and innovation, but low in practicality, replication and suitability. Additionally, fuel cell technologies could be



			considered when paired with onsite generation. Storage will also be a critical component of designing any microgrid at Chautauqua.
Geothermal heat pumps	<p>A geothermal heat pump (GHP) or ground source heat pump (GSHP) is a central heating and/or cooling system that transfers heat to or from the ground.</p> <p>It uses the earth all the time, without any intermittency, as a heat source (in the winter) or a heat sink (in the summer). This design takes advantage of the moderate temperatures in the ground to boost efficiency and reduce the operational costs of heating and cooling systems, and may be combined with solar heating to form a geosolar system with even greater efficiency.</p>	Total: 211 Average: 3.01	Heat pumps are good options in many applications, particularly new construction. Groundsource and air heat pumps scored well for climate and resilience, innovation and a systems approach, but given their large upfront cost, difficulty in installation, and the fact that many penetrations need to be made in existing building cladding in the case of retrofits, they scored low when considering the feasibility, suitability or replicability. Heat pumps are typically a strategy included in a beneficial electrification strategy, in which case site suitability could be explored more thoroughly.
OFF-SITE GENERATION			
Community Solar Garden (OFF- SITE)	<p>Currently Colorado regulation allows customers to subscribe to community solar developments, which are physically in the same county or an adjacent county to the physical location of the customer. In this solution, the community solar developer finances the project, but the contracts with the customer are typically 20 years. These sites typically generate around 2 MW of solar power, to which any customer may subscribe. Community solar still uses the existing infrastructure of poles and wires to transmit electricity; and, while it is renewable, it is no more reliable than the existing grid. An offsite community solar garden subscription through Xcel Energy's Solar Rewards Community provides bill</p>	Total: 185 Average: 2.64	Rather than developing energy generation at the Chautauqua site, there are several options to "purchase" or subscribe to renewable energy options. Subscribing to community solar at a solar project in another location (must be in same or adjacent county) scored well for cost, ease of implementation and economics. However, the scores were low for innovation, ability to leverage grants or funding. Further, because subscribers do not retain the Renewable Energy Credits, subscribers do not contribute to overall climate goals. And, as is the case with all



	credits for the solar energy produced, which are then applied to a subscriber's bill. However, there is also a subscription fee paid to the SG subscriber organization. This would not be onsite solar; and, customers do not get to claim the renewable energy credits or claim they are renewably powered.		offsite generation options, CSG's do not support overall site resilience. NOTE: There is the option to design a community solar garden at the Enchanted Mesa Water Tank. While the actual electricity produced would not add resilience, the optics of solar at the site may be attractive in selecting this alternative (<i>see Grid tied solar project above.</i>)
Renewable Connect	Individual customers can sign up for a subscription fee on Xcel Energy Bills. Does not result in on-sight generation. Contract length is 0-10 years, but allows customers to claim the RECs. Resources are intended to be a mix of utility scale solar and wind.	Total: 212 Average: 3.01	Annual subscriptions to either RC or Windsource (see below) score high from an ease of implementation and practicality perspective. They also require no changes at the site and are simply a financial transaction, so there is no impact to the historic and cultural character at Chautauqua. However, the subscription-based alternative is not particularly innovative, nor do they support overall climate goals or add any resilience to site. Therefore, they both scored low on "cost/benefit", ability to leverage funding, innovation, or economic feasibility as the subscription is an annual expense with no return.
Windsource	Individual customers can sign up for a subscription fee on Xcel Energy Bills. Does not result in on-sight generation, no contract length, customers cannot claim RECs.	Total: 221 Average: 3.16	See above
ENERGY DISTRIBUTION STRATEGIES			
Undergrounding of utility infrastructure	Develop and implement detailed plans for the long-term undergrounding of the system, leveraging programs such as the City's Capital Improvement Planning, to ensure timely and efficient implementation of an undergrounding program.	Total: 164 Average: 2.34	Undergrounding the existing electricity distribution system at Chautauqua from overhead to underground score well in connecting the overall "systems" thinking at the site as well as a broader cost/benefit and



			support of climate and resilience goals. While undergrounding is typically cost prohibitive, there is a high probability that Chautauqua will be a high priority project to be funded from the city's undergrounding fund, and a likely project identified through the Boulder Xcel partnership should voters approve the franchise in Nov 2020. Undergrounding electric distribution infrastructure supports the historic and cultural character, though care must be given to the location and process of burying the equipment. An undergrounding plan was included in the previous Master Planning efforts at the site.
Micro-gridding	A microgrid is a locally controlled electrical power system of energy loads and resources with distinct boundaries that is both connected with the main electric grid and can disconnect ("island") and function independently. A microgrid connects to the grid at a point of common coupling, maintaining voltage at the same level as the main grid, until there is some sort of problem on the grid or other reason to disconnect. A switch can separate the microgrid from the main grid automatically or manually, and it then functions as an island. Despite the title, there is no standard size that defines microgrids— they are smaller relative to the centrally regulated grid from which they can connect and disconnect.	Total: 156 Average: 2.23	Microgridding at the Chautauqua site scored high in innovation, support for climate and resilience objectives, cost/benefit, and the ability to align with a broader systems approach. This is primarily because many of the identified strategies in this assessment would be incorporated into a broader microgrid approach. A functioning microgrid would require the integration of onsite generation and storage along with system-level upgrades. Microgrids dramatically improve site resilience. Microgrids have high upfront costs and can be technically challenging. Depending on what elements are included in a Chautauqua microgrid, there may be some negative impact on the cultural and historic character. Additional analysis will be necessary to determine the true cost benefit analysis of a full microgrid versus a



			phased approach combining ongoing EE/DSM, onsite generation, storage, and ultimately islanding capabilities.
Relocating or fortifying vulnerable assets	Understanding where the most at-risk assets exist within the power system will help with activities, such as relocating assets away from potential high-risk areas	Total: 241 Average: 3.44	The identification and relocation of critical energy assets scored low in virtually all categories except the ability to identify vulnerabilities. Given the types of energy related assets at the site, there are few opportunities to relocate to less-vulnerable locations. Many of these actions have been taken already. That said, it is instructive to forecast the types of risks that may be amplified or encountered in the future and evaluate existing facilities from that standpoint.



RANKING	SCORE	STRATEGY
1	150	<i>Continued/Enhanced Energy Efficiency Measures</i>
2	154	<i>Demand-Side Management, Demand Side Response to reduce or shift consumption patterns</i>
3	156	<i>Comprehensive Micro-gridding of the Chautauqua site</i>
4 (tie)	161	<i>Large-scale Onsite Energy Generation (water tank installation/site integrated)</i>
4 (tie)	161	<i>Beneficial Electrification</i>
5	164	<i>Undergrounding of Utility Distribution System Assets</i>
6	170	<i>AC Grid-tied PV Coupled with Battery Backup</i>
7	171	<i>DC Grid-tied PV Coupled with Battery Backup</i>
8	185	<i>Offsite Community Solar (Subscription-based)</i>
9	192	<i>Implementation of Strategic Battery Storage</i>
10	193	<i>Grid-tied Onsite Solar project</i>
11	211	<i>Heat Pumps (Air/Ground Source)</i>
12	212	<i>Renewable Connect (Annual Subscriptions)</i>
13	213	<i>Implementation of Hydrogen Fuel-Cells (storage)</i>
14	220	<i>Distributed (Small-Scale) Solar (Rooftop)</i>
15	221	<i>Windsources (Annual Subscriptions)</i>
16	241	<i>Identification and Relocation of Vulnerable Energy Assets</i>
17	243	<i>Combined Heat and Power</i>
18	259	<i>Implementation of Gas Backup Generation Units</i>



5.Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Demand Side Management		
Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>16</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	8	
3. The action is economically feasible	22	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	11	
5. The action is practical from an implementation perspective	18	
6. The action is potentially innovative	20	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	17	
8. The action has broad reaching advantages that could leverage additional financial support, grants	17	
9. The action is replicable	15	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	10	
TOTAL	154	out of possible 50 (Average score 1.5 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Continued/enhanced Energy Efficiency Initiatives		
Criteria	Score 1-5	Comments
1. The action preserves the historic and cultural character of Chautauqua	<u>14</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	8	
3. The action is economically feasible	14	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	19	
5. The action is practical from an implementation perspective	15	
6. The action is potentially innovative	29	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	14	
8. The action has broad reaching advantages that could leverage additional financial support, grants	19	
9. The action is replicable	9	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	9	
TOTAL	150	out of possible 50 (Average score 1.5 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Beneficial Electrification		
Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>18</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	11	
3. The action is economically feasible	22	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	12	
5. The action is practical from an implementation perspective	24	
6. The action is potentially innovative	14	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	13	
8. The action has broad reaching advantages that could leverage additional financial support, grants	16	
9. The action is replicable	16	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	15	
TOTAL	161	out of possible 50 (Average score 1.6 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Large-scale onsite electricity generation		
Criteria	<u>Score 1-5</u>	Comments
1. The action preserves the historic and cultural character of Chautauqua	<u>22</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	11	
3. The action is economically feasible	27	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	13	
5. The action is practical from an implementation perspective	27	
6. The action is potentially innovative	12	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	9	
8. The action has broad reaching advantages that could leverage additional financial support, grants	12	
9. The action is replicable	19	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	9	
TOTAL	161	out of possible 50 (Average score 1.6 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Grid-tied large-scale PV		
Criteria	Score 1-5	Comments
1. The action preserves the historic and cultural character of Chautauqua	<u>28</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	12	
3. The action is economically feasible	15	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	25	
5. The action is practical from an implementation perspective	28	
6. The action is potentially innovative	28	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	15	
8. The action has broad reaching advantages that could leverage additional financial support, grants	17	
9. The action is replicable	14	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	10	
TOTAL	193	out of possible 50 (Average score 1.9 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: DC Grid-coupled PV with battery backup		
Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>24</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	11	
3. The action is economically feasible	26	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	17	
5. The action is practical from an implementation perspective	26	
6. The action is potentially innovative	14	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	13	
8. The action has broad reaching advantages that could leverage additional financial support, grants	13	
9. The action is replicable	18	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	9	
TOTAL	171	out of possible 50 (Average score 1.7 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: AC Grid-tied PV with battery backup		
Criteria	Score 1-5	Comments
1. The action preserves the historic and cultural character of Chautauqua	<u>24</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	11	
3. The action is economically feasible	31	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	18	
5. The action is practical from an implementation perspective	27	
6. The action is potentially innovative	10	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	13	
8. The action has broad reaching advantages that could leverage additional financial support, grants	9	
9. The action is replicable	16	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	11	
TOTAL	170	out of possible 50 (Average score 1.7 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Distributed (small-scale) PV		
Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>31</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	11	
3. The action is economically feasible	23	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	24	
5. The action is practical from an implementation perspective	27	
6. The action is potentially innovative	30	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	16	
8. The action has broad reaching advantages that could leverage additional financial support, grants	21	
9. The action is replicable	24	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	13	
TOTAL	220	out of possible 50 (Average score 2.2- Some Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Stand-alone integrated battery storage		
Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>21</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	11	
3. The action is economically feasible	30	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	23	
5. The action is practical from an implementation perspective	27	
6. The action is potentially innovative	16	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	14	
8. The action has broad reaching advantages that could leverage additional financial support, grants	18	
9. The action is replicable	20	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	12	
TOTAL	192	out of possible 50 (Average score 1.9 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Combined heat/power		
Criteria	Score 1-5	Comments
1. The action preserves the historic and cultural character of Chautauqua	<u>31</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	14	
3. The action is economically feasible	33	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	27	
5. The action is practical from an implementation perspective	31	
6. The action is potentially innovative	24	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	19	
8. The action has broad reaching advantages that could leverage additional financial support, grants	26	
9. The action is replicable	26	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	12	
TOTAL	243	out of possible 50 (Average score 2.4 - Some Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Integration/expansion of backup gas generators		
Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	33	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	19	
3. The action is economically feasible	20	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	34	
5. The action is practical from an implementation perspective	12	
6. The action is potentially innovative	33	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	34	
8. The action has broad reaching advantages that could leverage additional financial support, grants	32	
9. The action is replicable	13	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	29	
TOTAL	259	out of possible 50 (Average score 2.6 - Some Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Hydrogen Fuel Cells		
Criteria	Score 1-5	Comments
1. The action preserves the historic and cultural character of Chautauqua	<u>22</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	14	
3. The action is economically feasible	31	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	19	
5. The action is practical from an implementation perspective	30	
6. The action is potentially innovative	17	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	17	
8. The action has broad reaching advantages that could leverage additional financial support, grants	23	
9. The action is replicable	25	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	13	
TOTAL	211	out of possible 50 (Average score 2.1 - Some Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Heat pumps (air or geothermal)		
Criteria	Score 1-5	Comments
1. The action preserves the historic and cultural character of Chautauqua	<u>22</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	14	
3. The action is economically feasible	31	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	19	
5. The action is practical from an implementation perspective	30	
6. The action is potentially innovative	18	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	17	
8. The action has broad reaching advantages that could leverage additional financial support, grants	23	
9. The action is replicable	25	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	14	
TOTAL	211	out of possible 50 (Average score 2.1 - Some Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Off-site Community Solar Garden (subscription-based)		
Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>9</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	20	
3. The action is economically feasible	14	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	26	
5. The action is practical from an implementation perspective	9	
6. The action is potentially innovative	26	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	22	
8. The action has broad reaching advantages that could leverage additional financial support, grants	30	
9. The action is replicable	14	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	15	
TOTAL	185	out of possible 50 (Average score 1.9 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Annual Renewable Connect subscriptions		
Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>9</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	24	
3. The action is economically feasible	19	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	29	
5. The action is practical from an implementation perspective	8	
6. The action is potentially innovative	28	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	26	
8. The action has broad reaching advantages that could leverage additional financial support, grants	31	
9. The action is replicable	13	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	24	
TOTAL	211	out of possible 50 (Average score 2.1 - Some Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Annual Windsource subscriptions		
Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>8</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	24	
3. The action is economically feasible	23	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	31	
5. The action is practical from an implementation perspective	9	
6. The action is potentially innovative	31	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	26	
8. The action has broad reaching advantages that could leverage additional financial support, grants	31	
9. The action is replicable	13	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	25	
TOTAL	221	out of possible 50 (Average score 2.2 - Some Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Undergrounding of electric distribution infrastructure		
Criteria	<u>Score 1-5</u>	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>15</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	7	
3. The action is economically feasible	25	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	11	
5. The action is practical from an implementation perspective	21	
6. The action is potentially innovative	30	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	18	
8. The action has broad reaching advantages that could leverage additional financial support, grants	10	
9. The action is replicable	16	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	11	
TOTAL	164	out of possible 50 (Average score 1.6 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Energy Microgrid at Chautauqua site		
Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>22</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	8	
3. The action is economically feasible	30	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	11	
5. The action is practical from an implementation perspective	25	
6. The action is potentially innovative	9	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	8	
8. The action has broad reaching advantages that could leverage additional financial support, grants	13	
9. The action is replicable	23	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	7	
TOTAL	156	out of possible 50 (Average score 1.6 - Strong Agreement)



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: Relocation of vulnerable energy-related assets		
Criteria	Score 1-5	Comments
1. The actions preserves the historic and cultural character of Chautauqua	<u>14</u>	
2. The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	7	
3. The action is economically feasible	28	
4. The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	26	
5. The action is practical from an implementation perspective	30	
6. The action is potentially innovative	33	
7. The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	31	
8. The action has broad reaching advantages that could leverage additional financial support, grants	27	
9. The action is replicable	16	
10. The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	29	
TOTAL	241	out of possible 50 (Average score 2.4 - Strong Agreement)



6. Key Findings and Considerations for the Steering Committee in making recommendationsⁱⁱⁱ:

1. *When considering high priority energy-related actions at Chautauqua, there are several “no regrets” actions that should be implemented or continued. Continuing to prioritize the highly effective energy efficiency and conservation efforts should be foundational in any broader sustainable and resilient energy plan.*
2. *Many of the identified actions “nest” within another, thus, it can be difficult to contrast between certain strategies. In addition to continuing the investment in “energy consumption” strategies, large-scale onsite solar generation, along with undergrounding the electric distribution infrastructure are key priorities. Many of these actions could be “packaged”. For example, a full deployment of a microgrid will include the integration of on-site electricity generation, storage and islanding capabilities to increase site resilience. Therefore, a possible approach will be to consider the “phasing” or “progression” of certain actions in support of a broader outcome.*
3. *Additional data and analyses are needed to answer the cost/benefit of many of the proposed actions. Understanding the cost of developing onsite generation and storage capabilities must be evaluated against the future costs and anticipated threats. However, this first-level analysis provides the basic architecture for an approach to a sustainable and resilient energy strategy this should include: the continuation of EE/DSM, large scale onsite generation (versus distributed), some integration of storage technologies and the hardening of the existing infrastructure.*

7. Recommended Options







Chautauqua Sustainability and Resilience Strategy

STUDY GROUP REPORT: FIRE & HEAT

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9/1/2020

Study Area: Fire and Heat

Study Group Members:

Name	Title
Jeff Medanich-Chair	Director Preservation & Sustainability, CCA
Brian Oliver	Wildland Fire Division Chief, COB
Kayla Carey	Sustainability Coordinator, CCA
James Hewat	Senior Historic Preservation Planner, COB



Backgroundⁱ:

The Chautauqua National Historic Landmark (NHL) is located within the City of Boulder urban/wildland interface. The built environment within the historic district consists of wood structures, many of which are over one hundred years old. These historic structures are built in very close proximity to one another. The age and density of the buildings provide a ready source of fuel for fire and their location makes wildfire a particular threat. Flying embers from a nearby fire can reach a structure up to a mile away. Wildfires have been visible from the CCA campus in recent years, and over the past thirty years over 16,000 acres and 260 buildings have been lost to wildfires in Boulder County (see Vulnerabilities Assessment, January 2020).

For over a decade, CCA has conducted annual fire mitigation assessments of the CCA campus with City of Boulder fire department personnel. These assessments include identified risks and areas of concern. Recommendations from those assessments always emphasize the importance of preserving the property. Developing a resilience strategy is another step in our collaborative effort to protect the irreplaceable buildings and structures that make up this NHL. A well-researched and thoroughly vetted strategy for fire mitigation, fire suppression, and increased temperatures specific to a NHL and the preservation of its historic assets is an essential element of a long term Preservation and Sustainability Strategy for Chautauqua and the City.

Summary of Workⁱⁱ:

The Fire and Heat Study Group consists of individuals from CCA and COB. The Study Group met twice with the first meeting being an on-site tour of the CCA campus. Additional background information and resources were provided to the group for review by Brian Oliver.

Summary of Options: *List all options, the Evaluation Criteria rating for each, and a summary of the rating for each. Add a * next to the newly identified options.*

Option	Description	Evaluation Criteria Rating	Summary of Rating
1. Apply Fire Resistant Paint	White-based flame resistant and retardant paint can be applied to wood as a primer with historically appropriate, owner-selected color used for finish coats. <ul style="list-style-type: none">• May be used for both interior and exterior fire retardation on wood surfaces	20	Fire resistant paint ranks well in historic/cultural, systems, cost/benefit, practical, replication, and policy. It ranks moderate in economic leverage. It ranks poor in education, innovation, and economically feasible.



2. Utilize Wet Chemical Fire Suppression	<p>High expansion foam concentrate</p> <ul style="list-style-type: none"> • May be used for both interior and exterior fire suppression • Often used in constrained areas • Specific equipment is required so concentrates can mix with water from an overhead application • Foam concentrates can be used as an exterior barrier 	28	Wet chemical fire suppression ranks well in systems and policy. It ranks moderate in economic leverage, cost/benefit, and historic/culture. It ranks poor in economic feasibility, practical, innovation, education, and replication.
3 . Utilize Dry Chemical Fire Suppression	<p>Dry chemicals are used for fire suppression. The specific chemical used may/may not be harmful to the environment and historic materials as certain systems contents may change to acid once in contact with water.</p> <ul style="list-style-type: none"> • May be used for both interior and exterior fire suppression • Similar to contents of most hand-held fire extinguishers • Specialized overhead systems • Cleanup with a vacuum or broom 	24	Dry chemical fire suppression ranks well in systems and policy. It ranks moderate in practical, cost/benefit, economic feasibility, economic leverage, and historic/cultural. It ranks poor in innovation, education, and replication.
4. Assess Existing Poles & Power Lines	<p>A potential fire hazard in the district are the aging electricity poles. Downed lines can create sparks and fire. An assessment of this risk would reduce this potential fire start</p>	19	Assessment of existing poles ranks well in historic/cultural, systems, economic feasibility, practical, replication, cost/benefit, and policy. It ranks moderate in education. It ranks poor in innovation and economic leverage.
5. Install Wildfire Protection Sprinkler System	<p>Exterior sprinkler system designed to create 100% humidity to dampen structures and landscapes for increased fire resistant.</p> <ul style="list-style-type: none"> • Exterior Sprinkler Systems have assisted to save structures during wild fires • Automatic response similar to interior systems • Multiple ground and overhead applications can generate 	23	Wildfire protection sprinkler system ranks well in systems, cost/benefit, economic leverage, replication, and policy. It ranks moderate in historic/cultural, economic, practical, and education it ranks poor in innovation.



	<p>fog, mist, and water streams to quickly respond to encroaching fire</p> <ul style="list-style-type: none">• Environmentally friendly• No clean-up required		
<p>6. Implement Site specific Fire Mitigation Plan*</p>	<ul style="list-style-type: none">• Utilize historic data comprised from numerous inspections to develop site specific checklist for CCA• Develop consistent addressing system for cottages and buildings• Consider building material selection when reviewing design guidelines	<p>16</p>	<p>The implementation of a site-specific fire mitigation plan ranks well in historic/cultural, systems, economic feasibility, cost/benefit, practical, education, replication, and policy. It ranks moderate in innovation. It ranks low in economic leverage.</p>

*New option identified by study group

Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option 1: Apply Fire Resistant Paint		
Criteria	Score 1-5	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	1	Intumescent coatings are inert until exposed to high temperatures when they swell, forming a char layer over the materials to be protected
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	2	This is a relatively low impact approach to protecting historic structures from fire damage



3. Economic: The action is economically feasible	2	The effective service life of these type of coatings is approximately twenty five years. Although the coatings are expensive, the frequency of required recoating is low, making them a viable option
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	1	See above rationale for being an economic alternative related to the cost benefit analysis
5. Practical: The action is practical from an implementation perspective	2	This is a practical alternative only slightly impacted by the need for application to be done by a specialty contractor
6. Innovation: The action is potentially innovative	4	This is a widely used practice and not terribly innovative.
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	2	While the fire retardant coating will be obscured by final coats of paint, documentation of the application can be preserved and used as an educational tool for others.
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	3	The demonstrated effectiveness of this approach makes it a viable candidate for potential funding sources
9. Replication: The action is replicable	1	The action is highly replicable
10. Policy: The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	1	This approach aligns with both CCA's and COB's environmental initiatives
TOTAL	19	out of possible 50 (Average score 1.9, Strong Agreement)

Option 2: Utilize Wet Chemical Fire Suppression

Criteria	Score 1-5	Comments
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1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	4	Wet chemical fire suppression is better suited for type K fires and fuels such as grease and kitchen fires. It is most likely that fires at CCA would be structure fires with wood as the primary fuel source. Application of wet chemical suppression could further damage historic materials.
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	3	This does align with the vulnerability’s assessment for fire mitigation
3. Economic: The action is economically feasible	4	The application of wet chemical fire suppression is expensive and repeated use may not be economically feasible
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	4	Due to potential additional damage to historic materials by inundating with liquid and the cost of the applications does not create a high value from a cost/benefit analysis
5. Practical: The action is practical from an implementation perspective	4	Based on the types of fire most likely at Chautauqua, this approach is low in practicality
6. Innovation: The action is potentially innovative	4	This is a widely used approach to fire mitigation and not innovative in nature
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	3	The application of wet chemical fire suppression does not have a high education value
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	3	Not likely to be eligible for grant funds
9. Replication: The action is replicable	2	If deemed a beneficial option to fire suppression, wet chemical application is replicable.



10. Policy: The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	2	The action aligns with CCA and COB initiatives. Clean up can be accomplished using soap and water
TOTAL	33	out of possible 50 (Average Score 3.3, Neutral)

Option 3: Utilize Dry Chemical Fire Suppression

Criteria	Score 1-5	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	2	No negative impact to CCA
2. Systems: The action aligns with one of more of the defined "systems" areas and identified vulnerabilities	1	Aligns with systems identified in vulnerabilities assessment
3. Economic: The action is economically feasible	3	This approach is somewhat economical, depending on cost of suppression system
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2	Less invasive to historic materials than wet fire suppression system
5. Practical: The action is practical from an implementation perspective	1	This approach is practical and widely used for fire suppression on historic structures
6. Innovation: The action is potentially innovative	4	Not considered innovative as system is common and widely used



7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	3	If this was successful, it would be educational. Education would depend on outreach/presentations.
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	2	Proven to be a viable approach to fire suppression for historic structures which may facilitate further grant opportunities
9. Replication: The action is replicable	2	Is replicable
10. Policy: The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	2	The action does align with CCA & COB initiatives
TOTAL	22	out of possible 50 (Average Score 2.2, Some Agreement)

Option 4: Assess Existing Poles & Power Lines

Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	1	Although utility poles are not necessarily an historic feature, overhead lines and poles have been present since the beginning
2. Systems: The action aligns with one of more of the defined "systems" areas and identified vulnerabilities	2	Aligns with systems identified
3. Economic: The action is economically feasible	1	Cost to replace posts would be absorbed by utility company
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2	Low cost, high benefit to Chautauqua
5. Practical: The action is practical from an implementation perspective	2	Practical from a safety and aesthetic perspective



6. Innovation: The action is potentially innovative	4	Not innovative
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	4	Not much education value
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	2	Economic in the cost would be deferred to the utility company
9. Replication: The action is replicable	1	Protocol for assessment and replacement already in place. Action is replicable
10. Policy: The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	1	Aligns with both COB and CCA environmental initiatives
TOTAL	20	Out of possible 50 (Average Score 2.0, Some Agreement)

Criteria

Option 5: Install Wildfire Protection Sprinkler System

Criteria	Score 1-5	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	3	Would have potential visual impact to historic structures dependent on design and location of sprinkler system
2. Systems: The action aligns with one of more of the defined "systems" areas and identified vulnerabilities	2	The action does align with systems identified in vulnerabilities assessment



3. Economic: The action is economically feasible	4	Cost to retrofit suppression system in existing historic structures could be prohibitive
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	4	Cost to benefit analysis difficult to assess
5. Practical: The action is practical from an implementation perspective	4	Practicality is commensurate with cost/benefit
6. Innovation: The action is potentially innovative	3	Not very innovative or original
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	2	The system could provide an educational aspect related to protecting historic structures depending on outreach
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	2	Since Chautauqua is a nonprofit run NHL adjacent to Open Space, there is potential that this project could be eligible for grants. There may be FEMA grants available.
9. Replication: The action is replicable	2	Easily replicated
10. Policy: The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	2	If paired with other options and wildfire protection strategies, the action could make Chautauqua more resilient in the age of more severe wildfires.
TOTAL	28	out of possible 50 (Average score 2.8, Some Agreement)

Option 6: Implement Site specific Fire Mitigation Plan*



Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	1	Assessments done in the past have always considered their historic preservation impact on the site
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	1	This action aligns with the built, neighborhood, ecological, and cultural systems.
3. Economic: The action is economically feasible	1	Requires staff time some of which is already dedicated to this initiative.
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2	Low cost, high benefit to CCA
5. Practical: The action is practical from an implementation perspective	1	Highly practical
6. Innovation: The action is potentially innovative	3	Utilizing some what tried and true approaches
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	2	Education of the public on protecting both historic and non-historic structures highly valuable
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	4	Not a very high cost approach, probably self funded
9. Replication: The action is replicable	1	Easily replicated
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	2	Aligns with COB and CCA policies
TOTAL	18	out of possible 50 (Average Score 1.8, Strong Agreement)



Key Findings and Considerations for the Steering Committee in making recommendationsⁱⁱⁱ:

Recommended Options^{iv}:

Identify recommended options for inclusion in the final S&R Strategy, including the expected timeframe for implementation.
[Click here to enter text.](#)

Recommended Option(s)	Group Average Score	Reasoning (Why was this option chosen?)	Timing (short 1-2 years; medium 3-5 years; long term more than 5 years)	Estimated Cost Range
Option 6: Implement Site specific Fire Mitigation Plan*	1.8 - Strongly Agreement	This program is partially in place due to years of implementation	Could be implemented in year 1 and refined as program develops	\$10K-15K
Option 4: Assess Existing Poles & Power Lines	2.0 - Strong/Some Agreement	This program is in progress; several poles were replaced in 2020	Implementation has begun	No cost to CCA or COB

*Estimate cost as closely as possible





Chautauqua Sustainability and Resilience Strategy

STUDY GROUP REPORT: VEGETATION

The Chautauqua Sustainability and Resilience (S&R) Steering Committee identified five Study Groups to review and further expand options in the following areas: energy systems, fire and heat, water and drainage, vegetation, and resiliency district. Study Groups have been tasked with reviewing the preliminary options identified in the S&R Vulnerabilities Assessment, developing additional options, as needed, and evaluating all options according to the Evaluation Criteria below and any other evaluation methods identified by the Study Group. The purpose of this report is to summarize the Study Group’s work, identify key findings and make recommendations to the S&R Steering Committee.

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Study Area: Vegetation

Study Group Members:

Name	Title
Jeff Haley – Chair	Planning & Ecological Svcs. Mgr., COB
Kathleen Alexander	City Forester, COB
Rella Abernathy	Integrated Pest Management Coordinator, COB
Morgan Gardner	Associate Planner, COB
Jeff Rump	Staff Horticulturalist, CCA



Backgroundⁱ:

The ecological aspects of the site and especially the vegetation within the site will provide a significant role in the sustainability and resilience to changes in climate. The site is naturally high prairie with vegetation like what you see within the surrounding open space with the addition of more formal landscape areas with irrigated trees and turf to support visitor use and enjoyment. While this is not an advocacy for a return to this natural environment, it is increasingly apparent that the current landscape environment today is not sustainable at the site. The surrounding context of open space and the transition zone between Chautauqua and the natural ecology must be considered with relation to habitat, wildlife species and native vegetation. Trees provide many benefits to the site and surrounding ecology but require supplemental irrigation and ongoing management due to weather events such as snow, wind and drought. An additional concern for the site is the extensive use of former Kentucky bluegrass turf. Kentucky bluegrass (bluegrass) is the most widely used lawn grass across the United States and is seen in many common areas and between cabins across the Chautauqua NHL District. There was a time when bluegrass was used as the default planting medium. However, due to the high-water requirements, intolerance to hot and dry summers, maintenance needs and limited water absorption abilities, reconsideration has been given to the frequent use of bluegrass. The bluegrass turf is necessary in many areas of the site to support visitor use and events such as the large “green” that is permitted for many types of uses. Other areas within the site require the lawn to support the idyllic park setting and the visitor experience. However, many areas that are currently turf, can certainly be reconsidered for a more sustainable ground cover. The overall understanding of the site is that more comprehensive ecological assessment is needed to fully understand the opportunities and constraints of the vegetation and choices that could be made.

Summary of Workⁱⁱ:

Throughout the past several weeks, the vegetation study group met as a team three different times to discuss the vulnerabilities and develop options to address the vulnerabilities. The first meeting was introductory to get all team members in alignment related to the report, the role of the group, previous work and our approach. The second meeting consisted of brainstorming options and discussing any relevant plans and studies that are already in place. The final meeting allowed the group to review all the options and agree on the final identified options. In between the second and third meetings, the study group had homework to refine the list on their own and be prepared for group discussion to finalize at the third meeting. Due to the COVID-19 pandemic, each of the group meetings were held virtually and information had to be shared electronically. The team would benefit from a site visit or more opportunity to review specific situations and vegetation on site.



Summary of Options: *List all options, the Evaluation Criteria rating for each, and a summary of the rating for each. Add a * next to the newly identified options.*

Option	Description	Evaluation <u>Criteria</u> <u>Rating</u>	Summary of Rating
1. Conduct a comprehensive tree assessment and develop a specific management plan and prioritized tree planting plan for the site.	Complete assessment, analysis, and strategy to manage and replace existing, notable, and historic trees including site considerations that are needed to support their long-term health (i.e. irrigation, root zone protection, etc.) This would include management best practices and specific considerations for future ongoing storm events such as snow damage, drought, and wind events. Provide additional new tree plantings to support the Urban Forest Strategic Plan and overall citywide goal of 16% urban tree canopy. This is also an action item within COB Resilience Strategy. The 2003 Chautauqua Landscape Assessment & Plan recommended restoring the original street tree plantings of large mature trees lining the CCA roads. Could also include restoration of OSMP drainage to south of Chautauqua Park.	14	This is a best practice that will ensure the long-term sustainability specifically of the tree canopy of the site that strongly supports many of the criteria.
2. Develop comprehensive maintenance standards and guidelines for the site that will be shared by all management agencies that align the best practices for managing all resources.	Develop a shared maintenance and stewardship standards manual that adopts best practices for the criteria at CCA including sustainability, tree diversity, climate, water use, pesticide free maintenance, optimizing for insect and wildlife habitat, etc. This manual would allow staff to develop metrics and monitor the effectiveness of the standards for care.	17	Medium cost and a longer-term solution that might require new equipment and materials to meet some of the standards and guidelines that are developed.



3. Inventory and Assessment of OSMP vegetation surrounding Chautauqua including an ongoing management and restoration plan in alignment with applicable OSMP standards.	Develop an inventory and analysis of vegetation surrounding the CCA to inform management actions that ensure compatibility among the various ecosystems. This would include focus areas such as invasive species threat, notable species to preserve, wildfire risk and pollinator friendly species (i.e. ash trees along Bluebell that need removal)	23	Provides better integration of interface zone between natural open space properties and the more managed ecology of the site. Could be innovative and bring in additional funding and research.
4. Implement strategic replacement of bluegrass lawn areas with more sustainable ground cover methods.	Assess and prioritize specific locations for replacement of Kentucky bluegrass that is under-utilized and without trees (not used by the public or for traditional lawn purposes such as the green) with xeric lawn alternatives (may still be walked on, appear similar or may hold more visual interest but may require less maintenance and significantly less water) – i.e. Cottage campus areas.	17	Provides more sustainable management while also resource savings in terms of funding for maintenance and water usage, etc.
5. Increase amount of native and historic vegetation to the site.	Replace the use of non-native perennials and shrubs with native plants which will require less maintenance, use less water, and help support a more historic appearance in the landscaping. Choosing a variety of plant species that support habitat needs, including connectivity throughout CCA and to surrounding open space land and adjacent neighborhoods. This approach should be a comprehensive ecosystem service that use tools to quantify ecosystem services such as cooling, storm water mitigation, soil water and carbon holding capacity, habitat support etc. and model the impact of proposed changes to prioritize and optimize ecosystem services. (there are tools such as InVEST and ReScape that we could potentially use).	19	Would be a demonstration by meeting many of the criteria related to innovation, economics, and education. This option is also very practical and can be implemented at minimal cost.
6. Develop and implement an education and interpretation program for	Develop and implement an educational and interpretive framework for CCA that educates and informs the community and visitors on the ecological aspects and stewardship of CCA.	23	This option meets many of the criteria and provides economic opportunities through providing



the site that highlights the ecological services.	Consider options for plant tours, arboretum and innovative online and digital options for visitors to learn about the programs. Use community (formally known as "citizen) science to gather ecological information, while educating the community.		education and demonstration to other communities and agencies.
7. Complete the implementation of the existing Cultural Landscape Assessment Plan for the site.	Review and solicit approval from all applicable boards and Council for the existing plan to be implemented at the site. This will include information on CCA working on upgrades to irrigation system to make it more water efficient, adding new street trees annually but should be higher priority to help ensure shared funding and resources.	18	This option supports many of the criteria as well as highlighting the historic character of the site and its context in the ecological aspects of the region.
8. Coordinate with all other focus areas such as drainage, infrastructure, and fire to implement smart practices in the ecology of the site.	The intention is to ensure that the other study groups and focus areas understand the comprehensive impact on the ecology of many actions and decisions such as stormwater management, wildfire mitigation, paving, etc.	19	This option will align all the other systems to have a truly integrated approach to the S&R strategy.

*New option identified by study group



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: 1 Conduct a comprehensive tree assessment and develop a specific management plan and prioritized tree planting plan for the site.		
Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>1</u>	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	<u>1</u>	
3. Economic: The action is economically feasible	<u>1</u>	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>2</u>	
5. Practical: The action is practical from an implementation perspective	<u>1</u>	
6. Innovation: The action is potentially innovative	<u>3</u>	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	<u>1</u>	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	<u>2</u>	
9. Replication: The action is replicable	<u>1</u>	
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	<u>1</u>	
TOTAL	14	out of possible 50 (Average Score = 1.4 Strong Agreement)



Option: 2 Develop comprehensive maintenance standards and guidelines for the site that will be shared by all management agencies that align the best practices for managing all resources.

Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>2</u>	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	<u>2</u>	
3. Economic: The action is economically feasible	<u>2</u>	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>1</u>	
5. Practical: The action is practical from an implementation perspective	<u>1</u>	
6. Innovation: The action is potentially innovative	<u>3</u>	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	<u>2</u>	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	<u>2</u>	
9. Replication: The action is replicable	<u>1</u>	
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	<u>1</u>	
TOTAL	17	out of possible 50 (Average Score = 1.7 Strong Agreement)



Option: 3 Inventory and Assessment of OSMP vegetation surrounding Chautauqua including an ongoing management and restoration plan in alignment with applicable OSMP standards.

Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>3</u>	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	2	
3. Economic: The action is economically feasible	<u>2</u>	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>3</u>	
5. Practical: The action is practical from an implementation perspective	<u>2</u>	
6. Innovation: The action is potentially innovative	<u>3</u>	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	<u>2</u>	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	<u>3</u>	
9. Replication: The action is replicable	<u>1</u>	
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	<u>2</u>	
TOTAL	23	out of possible 50 (Average Score = 2.3 Some Agreement)

Key Findings and Considerations for the Steering Committee in making recommendationsⁱⁱⁱ:



Option: 4 Implement strategic replacement of bluegrass lawn areas with more sustainable ground cover methods.

Criteria	Score 1-5	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	2	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	1	
3. Economic: The action is economically feasible	1	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	1	
5. Practical: The action is practical from an implementation perspective	1	
6. Innovation: The action is potentially innovative	4	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	2	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	3	
9. Replication: The action is replicable	1	
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	1	
TOTAL	17	out of possible 50 (Average Score = 1.7 Strong Agreement)



Option: 5 Increase amounts of native and historic vegetation to the site.

Criteria	Score 1-5	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	2	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	1	
3. Economic: The action is economically feasible	2	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2	
5. Practical: The action is practical from an implementation perspective	1	
6. Innovation: The action is potentially innovative	4	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	2	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	3	
9. Replication: The action is replicable	1	
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	1	
TOTAL	19	out of possible 50 (Average Score = 1.9 Strong Agreement)



Option: 6 Develop and implement an education and interpretation program for the site that highlights the ecological services.

Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>3</u>	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	<u>3</u>	
3. Economic: The action is economically feasible	<u>2</u>	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>4</u>	
5. Practical: The action is practical from an implementation perspective	<u>2</u>	
6. Innovation: The action is potentially innovative	<u>4</u>	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	<u>1</u>	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	<u>2</u>	
9. Replication: The action is replicable	<u>1</u>	
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	<u>1</u>	
TOTAL	23	out of possible 50 (Average Score = 2.3 Some Agreement)



Option: 7 Complete the implementation of the existing Cultural Landscape Assessment Plan for the site.

Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>1</u>	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	<u>2</u>	
3. Economic: The action is economically feasible	<u>3</u>	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>2</u>	
5. Practical: The action is practical from an implementation perspective	<u>2</u>	
6. Innovation: The action is potentially innovative	<u>3</u>	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	<u>1</u>	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	<u>2</u>	
9. Replication: The action is replicable	<u>1</u>	
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	<u>1</u>	
TOTAL	18	out of possible 50 (Average Score = 1.8 Strong Agreement)



Option: 8 Coordinate with all other focus areas such as drainage, infrastructure, and fire to implement smart practices in the ecology of the site.

Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>3</u>	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	<u>1</u>	
3. Economic: The action is economically feasible	<u>3</u>	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>2</u>	
5. Practical: The action is practical from an implementation perspective	<u>1</u>	
6. Innovation: The action is potentially innovative	<u>3</u>	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	<u>2</u>	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	<u>2</u>	
9. Replication: The action is replicable	<u>1</u>	
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City’s Climate Mobilization Action Plan	<u>1</u>	
TOTAL	19	out of possible 50 (Average Score = 1.9 Strong Agreement)

The key findings of the group related to the vegetation and overall ecology of the site include:



1. There are many relevant plans and studies that already exist that should be considered, adopted and implemented at the site including the cultural landscape assessment, the city's urban forest strategic plan and a variety of studies and reports related to ecological services specifically in the realm of habitat and pollinator protection. These plans already outline key actions that are applicable to the site and the context of the vegetation.
2. More assessment and comprehensive evaluation are needed for the ecology of the site and the context of the adjacent open space. When considering the ecology of the site, everything is connected and subtle changes in any one category or area of vegetation could have impacts to other aspects. For example, reducing the amount of irrigation or planting areas or trees could impact the habitat connectivity through the site or important aspects of pollinator species.
3. The site can benefit from a standardized and agreed upon approach to management and stewardship of vegetation and ecological aspects of the site to include City OSMP, P&R and CCA. This would ensure that all partners are aligned in their approach to the ecological management regardless of the jurisdiction or boundaries. This would also recognize all the options that are being considered in how best to manage the site with S&R in the forefront of decision-making.
4. Many opportunities exist to create the site as a demonstration and education opportunity for the region and other agencies with similar site context. Many opportunities for volunteerism, community engagement, citizen science and other avenues to bring in many partners and resources both in funding and capacity.
5. The outcome of this work should prioritize funding and outline the goals and objectives to combine resources to ensure that implementation of the options is realized. With a shared approach and clear goals, city and CCA funding should be leveraged to create capacity and opportunities for other funding sources to allow city staff, CCA and the community to implement the plan and the many benefits that will be realized.

Recommended Options^{iv}:

The options below represent the most important options that are warranted to support the overall sustainability and resilience of the site.



Recommended Option	Reasoning (Why was it chosen?)	Timing (short 1-2 years; medium 3-5 years; long term more than 5 years)	Estimated Cost Range
Conduct a comprehensive ecological assessment including vegetation, habitat, soils, etc. and develop a prioritized plan for the site that outlines tree planting, turf replacement, native plantings, green infrastructure opportunities and methods for monitoring effectiveness for efficiency and sustainability metrics.	This is really the overall opportunity for the site to allow us to comprehensively understand the most appropriate approach to long term S&R in that we will understand all variables in the equation related to ecological sustainability and not negatively impacting any of the aspects of the ecology. From this initiative, clear priorities will be outlined to guide implementation.	Short Term	\$
Complete the implementation of the existing Cultural Landscape Plan for the site.	The existing Cultural Landscape Assessment is still relevant and has many appropriate and important recommendations and priorities for the site that will support the current criteria outlined for the S&R initiative.	Long Term	\$\$
Develop comprehensive maintenance standards and guidelines for the site that will be shared by all management agencies.	Having a shared approach and adopted standards and guidelines will allow all agencies to manage the site and adopt stewardship principles that will reinforce the vision and goals of the S&R principles. This will also align resources	Short Term	\$
Develop and implement an education and interpretation program for the site that highlights the ecological services.	Opportunity to engage that community in helping learn about the initiatives of the S&R as well as seek partnership in funding and resources. Engage the community in monitoring and volunteering.	Medium Term	\$\$
Implement strategic replacement of bluegrass lawn areas (not the green) with more sustainable ground cover methods.	Direct changes to the vegetation and landscape that will begin to reduce resource use and adapt to anticipated climate changes.	Medium Term	\$\$\$
Increase amount of native and historic vegetation to the site.		Long Term	\$\$\$



Conduct a comprehensive tree assessment and develop a specific management plan and prioritized tree planting plan for the site.	Complete assessment, analysis, and strategy to manage and replace existing, notable, and historic trees including site considerations that are needed to support their long-term health (i.e. irrigation, root zone protection, etc.) This would include management best practices and specific considerations for future ongoing storm events such as snow damage, drought, and wind events. Provide additional new tree plantings to support the Urban Forest Strategic Plan and overall citywide goal of 16% urban tree canopy. This is also an action item within COB Resilience Strategy. The 2003 Chautauqua Landscape Assessment & Plan recommended restoring the original street tree plantings of large mature trees lining the CCA roads. Could also include restoration of OSMP drainage to south of Chautauqua Park.	Short Term	\$
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*Estimate cost as closely as possible





Chautauqua Sustainability and Resilience Strategy

STUDY GROUP REPORT: RESILIENCE DISTRICT

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Study Area: Resilience District

Study Group Members:

Name	Title
Bill Briggs	CCA Board Member
Chris Hagelin	COB Transportation and Mobility Department
Lauren Tremblay	COB Climate Initiatives Department
Alice Trembour	CCA Board Member
Elizabeth Vasatka	COB Climate Initiatives Department
Deryn Wagner	COB OSMP Department



Backgroundⁱ:

Within the City of Boulder (COB), the Colorado Chautauqua is a distinctly unique community. Not only is it one of the most popular visitor sites in the state of Colorado, attracting over a million visitors per year, it is also a National Historic Landmark (one of only 25 in Colorado), a premier regional arts and cultural destination, a commercial lodging and dining operation, and the site of a longstanding residential community. Geographically, the Colorado Chautauqua is bordered by Open Space on three sides and is subject to several environmental vulnerabilities, including fire, flood, and drought. Because Chautauqua is a unique neighborhood that serves as a well-defined cultural, commercial, recreational and geographical community, and is especially vulnerable to natural hazards, it lends itself well to designation as a “Resilience District.”

A Chautauqua Resilience District would allow the city to address Chautauqua’s unique vulnerabilities at a district level, rather than at a city level, which has proven critical for other cities (e.g., New Orleans Gentilly Resilient District) in terms of problem-solving, managing reinvestment, and increasing innovation. In addition, a Chautauqua Resilience District could provide an umbrella for the variety of recommendations and approaches to water, fire, and land management emerging from other four S&R working groups. When implemented together, a Chautauqua Resilience District would set a precedent for the city and demonstrate the potential for integrating district-wide resilience thinking into city design, planning, and budgeting, as well as becoming a model for preserving, sustaining and increasing the resiliency of an important historic site and community treasure. The study group felt strongly that a Chautauqua Resilience District must have a distinctive component devoted to social, economic, racial, and environmental equity, ensuring that Chautauqua—its grounds and programs—is equally accessible to all local residents and visitors.

A resilience district can take many forms and requires extensive planning, community input, and often new statutory or regulatory initiatives. Acknowledging the complexity of this approach, the Resilience District study group is also proposing two additional action that acknowledge CCA’s and COB’s current efforts to preserve and protect Chautauqua and require fewer staff resources.

Summary of Workⁱⁱ:

The study group met three times online, reviewed the options via email, scored the options via email, and edited the final report via email. The group members educated themselves by reading material on resiliency districts and learning about existing examples of resiliency districts. The group was assisted by the project consultant Paul Chinowsky, CCA CEO Shelly Benford, COB planner James Hewat, and COB Chief S&R Officer Jonathan Koehn.

Summary of Options: *List all options, the Evaluation Criteria rating for each, and a summary of the rating for each. Add a * next to the newly identified options.*



The rating for each criterion is the average of the scores submitted by the study group members.

Low in innovation. High in

Option	Description	Evaluation <u>Criteria Rating</u>	Summary of Rating
<p>*1. CCA continues to focus on its own sustainability and resilience efforts within current budget and staffing limitations in an ongoing quest to become the most sustainable National Historic Landmark in the country.</p> <p>Parts of this option were included in the original options. Other parts of this option are new.</p>	<ul style="list-style-type: none"> Maintain SmartRegs designation for all CCA cottages and public buildings Continue to focus on energy and waste reduction throughout the campus Install EV charging station for electric vehicles Reconfigure current collection and delivery of trash/recycling/compostable materials to a peripheral location to reduce wear and tear on streets and historic swales Create a robust volunteer program to assist CCA with maintenance and groundskeeping tasks 	<p>Average group ranking: 21.67</p>	<p>Low in #6. High in #1, 5, 10.</p> <p>TIME FRAME: Short-term to mid-term.</p>
<p>*2. CCA and COB increase collaboration on various sustainability and resilience initiatives (both ongoing and new)</p> <p>Parts of this option were included in the original options. Other parts of this option are new.</p>	<ul style="list-style-type: none"> COB provides incentives for private cottage owners to meet or exceed SmartRegs requirements COB and CCA refine the Chautauqua Access Management Program (CAMP) to optimize parking and traffic flow in the leasehold and surrounding neighborhoods 	<p>Average group ranking: 20.67</p>	<p>Low in #5, 6, 8. High in #1, 10</p> <p>TIME FRAME: Short-term to mid-term.</p>



	<ul style="list-style-type: none"> CCA and OSMP collaborate on fire mitigation and reducing visitor impacts 		
<p>3. CCA works with COB to create a “Chautauqua Resilience District” through new policies, and regulatory or statutory means.</p> <p><i>This option was one of the original RA options.</i></p>	<ul style="list-style-type: none"> Create the framework to implement best practices in sustainability and resilience based on existing regional and local models of resilient districts Establish a joint governance working group (CCA and COB) to guide the creation of the resilience district and to oversee the enabling ordinances and policies (established incrementally by both statutory and regulatory means) Determine the structure of the district (e.g., eco-district; eco-innovation district; taxing district; improvement district, etc.) Integrate the recommendations of the other four S&R study groups (energy systems, fire and heat, water and drainage, vegetation) into the framework of the resilience district Develop policies and practices to ensure that principles of climate, environmental justice, and social and racial equity are observed and implemented 	Average group ranking: 15.67	<p>Low in #5. High in #7, 9, 10.</p> <p>TIME FRAME: Mid-term to set up district. Long-term to implement.</p>

*New option identified by study group



Evaluation Criteria: Complete a separate rating chart for each of the options. Scoring reference: 1. Strongly agree; 2. Somewhat agree; 3. Neutral; 4. Somewhat disagree; 5. Strongly disagree

Option: CCA continues to focus on its own sustainability and resilience efforts within current budget and staffing limitations in an ongoing quest to become the most sustainable National Historic Landmark in the country		
Criteria	Score 1-5	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>1.33</u>	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	<u>2.33</u>	
3. Economic: The action is economically feasible	<u>2.33</u>	To meet your goals we will need to find funding sources to do more.
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	<u>2.67</u>	The cost of mitigating risk and achieving sustainability should be of highest benefit to CCA. Unsure how much is planned to be spent.
5. Practical: The action is practical from an implementation perspective	<u>1.33</u>	It’s easier to stick to status quo. Trying to become the most sustainable national historic landmark in the country may not be as practical.
6. Innovation: The action is potentially innovative	<u>3.33</u>	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	2.00	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	3.00	This option may offer the fewest opportunities for creative/joint funding.
9. Replication: The action is replicable	2.00	Set the new standard for a site like this.
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	<u>1.33</u>	



TOTAL		21.67	AVERAGE OF SCORES = 2.167, Some Agreement
Option: CCA and COB increase collaboration on various sustainability and resilience initiatives (both ongoing and new)			
Criteria	Score 1-5	Comments	
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>1.33</u>		
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	1.67		
3. Economic: The action is economically feasible	2.33	Varies depending on project. Compared to first option, this would improve ability to secure partnership/grant funding opportunities.	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2.33	Varies depending on project.	
5. Practical: The action is practical from an implementation perspective	2.67		
6. Innovation: The action is potentially innovative	2.67		
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	2.33		
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	2.67	Per Chris Hagelin, declining sales tax revenue and impacts to transportation funding broadly may threaten city’s ability to subsidize the CAMP shuttle.	
9. Replication: The action is replicable	<u>1.67</u>		
10. Policy: The action aligns with CCA’s mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	1.00	Strong alignment with OSMP’s Master Plan regarding increasing visitation, multimodal transportation, welcoming facilities, education,	



		inclusion, cultural resource management, as well as future plans to address sustainable infrastructure improvements at and around the ranger cottage.
TOTAL	20.67	AVERAGE OF SCORES = 2.067 , Some Agreement
Option: CCA works with COB to create a “Chautauqua Resilience District” through new policies, regulatory or statutory means		
Criteria	<u>Score 1-5</u>	Comments
1. Historic/Cultural: The action preserves the historic and cultural character of Chautauqua	<u>1.33</u>	
2. Systems: The action aligns with one of more of the defined “systems” areas and identified vulnerabilities	1.33	
3. Economic: The action is economically feasible	2.00	
4. Cost/Benefit: The action provides a high level of benefit vs. cost in terms of mitigating risk and/or achieving sustainability at Chautauqua	2.33	
5. Practical: The action is practical from an implementation perspective	3.00	
6. Innovation: The action is potentially innovative	<u>1.33</u>	
7. Education: The action provides opportunities to educate about sustainability and/or resilience at Chautauqua and other communities	1.00	
8. Economic: The action has broad reaching advantages that could leverage additional financial support, grants	1.33	Greatest improvement in terms of ability to secure partnership/grant funding opportunities, as well potential for other funding mechanisms like a taxing district.



9. Replication: The action is replicable	1.00	
10. Policy: The action aligns with CCA's mission and the environmental and equity goals defined in the City's Climate Mobilization Action Plan	<u>1.00</u>	Strong alignment with OSMP's Master Plan regarding increasing visitation, multimodal transportation, welcoming facilities, education, inclusion, cultural resource management, as well as future plans to address sustainable infrastructure improvements at and around the ranger cottage.
TOTAL	15.67	AVERAGE OF SCORES = 1.567, Strong Agreement

Key Findings and Considerations for the Steering Committee in making recommendationsⁱⁱⁱ:

1. The concept of a resiliency district fits Chautauqua very well. The idea of designating a small, well-defined community with high community value, special needs, and clear vulnerabilities resonated with the study group and offers a clear path to follow with respect to implementing the overall S&R strategy.
2. A Chautauqua Resiliency District could provide an umbrella for the variety of recommendations and approaches to water, fire, and land management emerging from these working groups. When implemented together, a Chautauqua Resiliency District would set a precedent for the city and demonstrate the potential for integrating district-wide resilience thinking into city design, planning, and budgeting (consistent with the COB *Resilience Strategy*). It can also serve as a model for preserving, improving, and increasing the resilience of an important historic site and community treasure.
3. CCA and COB are currently collaborating on several joint sustainability and resilience initiatives (such as CAMP and SmartRegs) that fit naturally into the concept of a resiliency district. For example, partnering with the COB on a future site plan for the OSMP Ranger Cottage area would provide a demonstration opportunity for applying resiliency principles and practices identified by other study groups. These efforts should be continued and expanded.
4. Sustainability and resilience are already high priorities at Chautauqua. CCA should continue the internal work that can be done independently of COB.



Recommended Options^{iv}:

Based on the scores of six study group members, Option 3 was unanimously chosen as the preferred option. However, it should be noted that parts of Options 1 and 2 could be implemented concurrently with Option 3.

Recommended Option	Average Score	Summary of Recommendation	Implementation Time	Resources Required
3. CCA works with COB to create a “Chautauqua Resilience District” through new policies, regulatory or statutory means	1.6 - Strong Agreement	<p>Systems and additional policies/regulations should be established to set a higher bar for sustainability and resilience for Chautauqua, a nationwide treasure.</p> <p>A resilience district is the best approach to incorporate the variety of efforts needed to support sustainability and resilience at Chautauqua, such as fire, water, land management, and energy. A resilience district would be innovative and would likely lead to significant lasting change. Finally, this large-scale umbrella approach could provide more opportunities for grant funding than just the status quo or a partnered effort because of its more comprehensive and innovative nature.</p>	<p>Mid Term (2-5 years) to set up district.</p> <p>Long term (5 plus years) to implement.</p>	<p>The resources required to create the district would be relatively minimal, consisting mainly of people’s time and the political will to make a resilience district happen. Implementation, however, could cost in the millions of dollars, if the cost of other study group initiatives are included.</p>

