City of Louisville
Internal Decarbonization Plan

RECREATION & SENIOR CENTER
DECARBONIZATION AUDIT REPORT

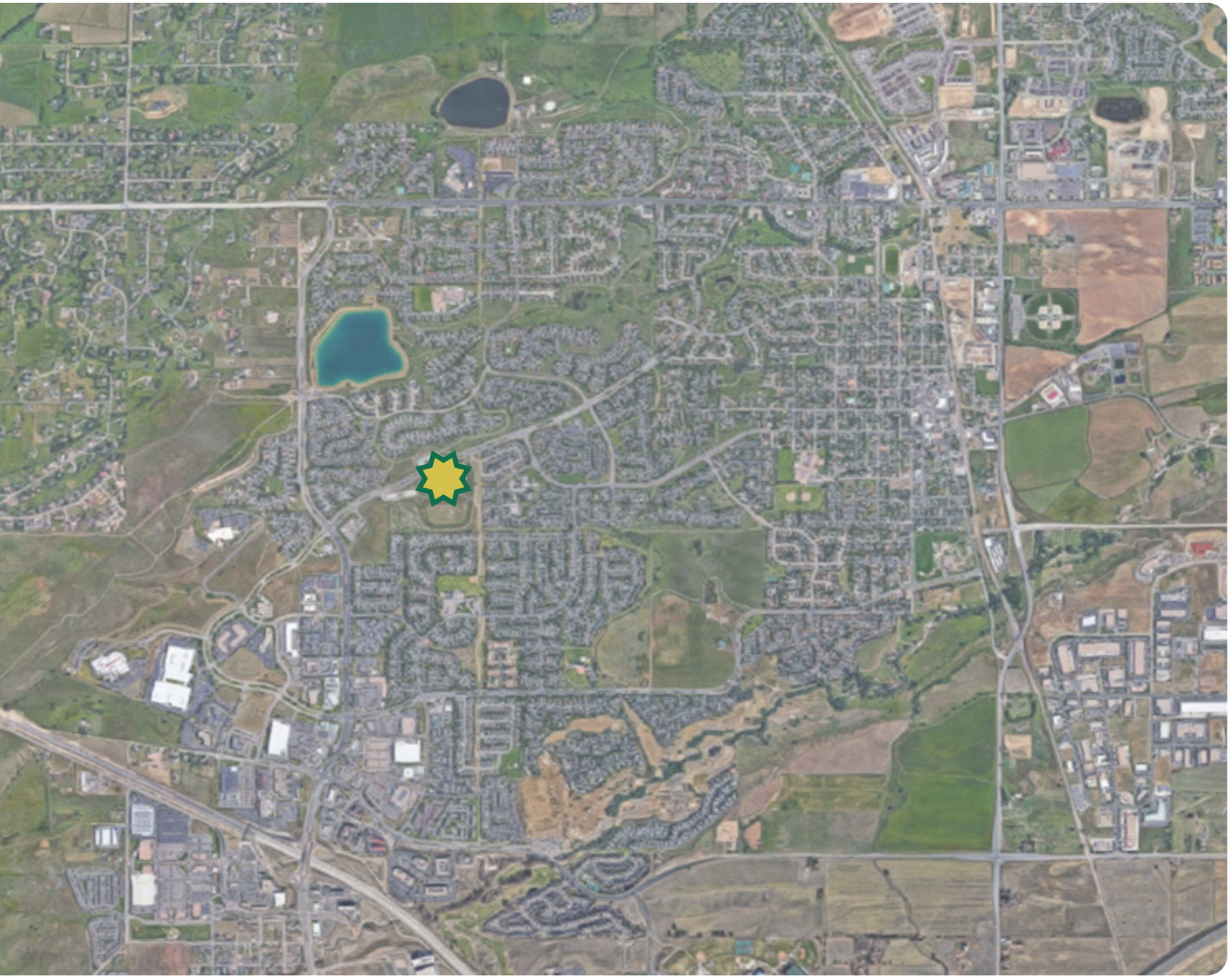
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AUGUST 18, 2023



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McKinstry
For The Life Of Your Building

Table of Contents



SECTION 1:
EXECUTIVE SUMMARY 3

SECTION 2:
BASELINE 4

SECTION 3:
DECARBONIZATION MEASURES 5

SECTION 4:
NEXT STEPS 12

APPENDIX 13

- MECHANICAL SYSTEM MATRIX OPTIONS
- MECHANICAL DECARBONIZATION SCOPING
- ELECTRICAL DECARBONIZATION SCOPING
- STRUCTURAL SCOPING
- ELECTRIC VEHICLE CHARGING NARRATIVE
- RENEWABLES SCOPING
- COST ESTIMATING

Date	Version History
3/28/2023	Version 1 - Issued for City Review and Input
8/18/2023	Version 2 - Issued to City

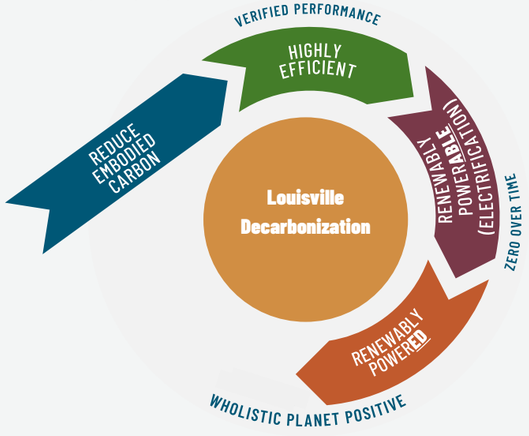
Background

In August of 2019, City Council passed Resolution 25, Series 2019, which set clean energy and carbon emission reduction goals for the municipality and larger community. This resolution sets goals to meet all of Louisville's municipal electric needs with 100% carbon-free sources by 2025, and to reduce core municipal greenhouse gas emissions annually below the 2016 baseline through 2025. The City of Louisville has demonstrated its commitment toward creating a healthy and sustainable environment for its residents, evident through Resolution 25-2019 (Setting Clean Energy and Carbon Emission Reduction Goals), as well as their Sustainability Action Plan (adopted in October 6, 2020). In support of these goals, McKinstry was contracted to identify a strategic roadmap for electri□cation and decarbonization of all City buildings, □eet, equipment and operations* by 2030, and recommend an alternative target if appropriate.

This is an interim report, providing initial directions, findings, as well as a draft set of detailed decarbonization approaches for the Recreation & Senior Center.

**Does not include water, wastewater, street lighting/signals*

There are many possible pathways for decarbonizing Louisville. With guidance from City staff, this report focuses on identification of strategies that provide the highest value, most fiscally responsible path forward to achieve Louisville's decarbonization goals.



Decarbonization Recommendation

The table below outlines the □ndings of the study, and highlights the opportunity to use hybrid electri□cation as a viable and cost-effective path towards carbon neutrality. The total cost is the total amount of money that will need to be allocated for budgetary purposes. The net cost is the total construction costs minus the replacement costs that would've been spent to replace the existing units with like-for-like fossil fuel units. The net cost represents the true cost of this decarbonization effort. All information included in this table is explained in greater detail in this report. **These are "all-in costs" and represent the total cost of construction. They are also Rough Order of Magnitude (ROM) numbers, with a +/-20% range.** See "Construction Pricing Context" section for more detail.

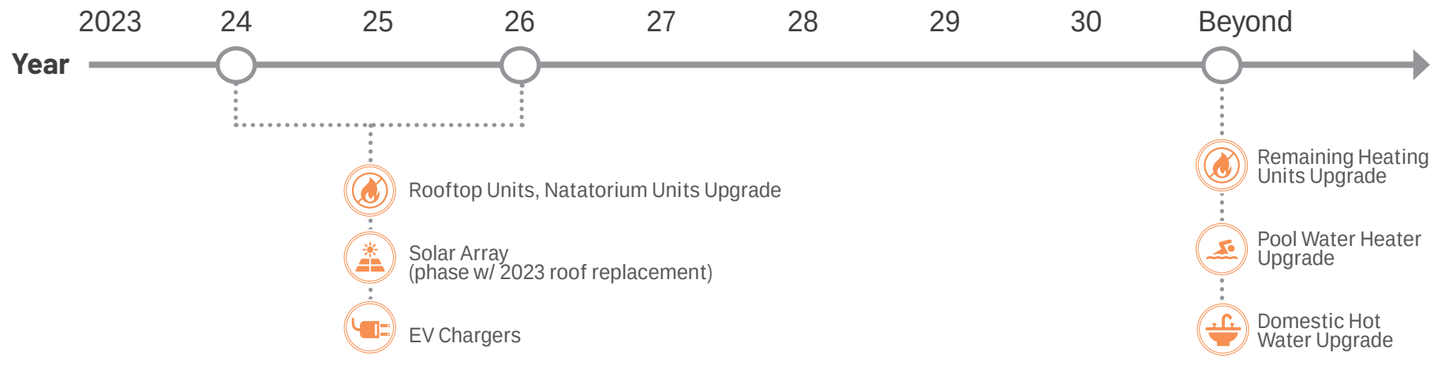
Scenario	Life Cycle Carbon Reduced	Life Cycle Carbon % Reduction	Total First Cost	Net First Cost Over Business as Usual Cost
Full Electrification*	28,000 tons	100%	$16.8M	$10.4M
Hybrid Electrification**	25,000 tons	89%	$10.5M	$4.1M
Renewables	N/A	N/A	$1.2M***	N/A
EV Charging	N/A	N/A	$260k	N/A

*Includes costs associated with new generator to serve fully electrified loads.
**Includes costs associated with connecting new equipment to existing generator. New generator not needed.
***Renewable costs do not account for funding from the Inflation Reduction Act (IRA).

Implementation

A preliminary implementation timeline is shown below, based on the 2023 Capital Improvement Plan (CIP).

Preliminary Implementation Timeline



Baseline Building Use

Baseline Year
2019

Building Size
104,000 ft²

% of City
41%

Building Energy
264 EUI

48%

Building Carbon
1,776 Tons

67%

Building Information

- Built in 1990, with signi□cant remodel/addition in 2018/2019.
- Primary use is Recreation & Senior Center with full gymnasium, (2) lap pools, and (1) recreation splash pool.
- Used as a potential Red Cross shelter site.
- Current listed hours are 5:30AM-8:00PM Monday-Thursday, 5:30AM-7:00PM Friday-Saturday, and 7:00AM-7:00PM Sunday.

Recent Renovations and Energy Improvements

- 2018/2019 - Remodel/Addition
- 2018/2019 - LED upgrades, concurrent with Remodel/Addition





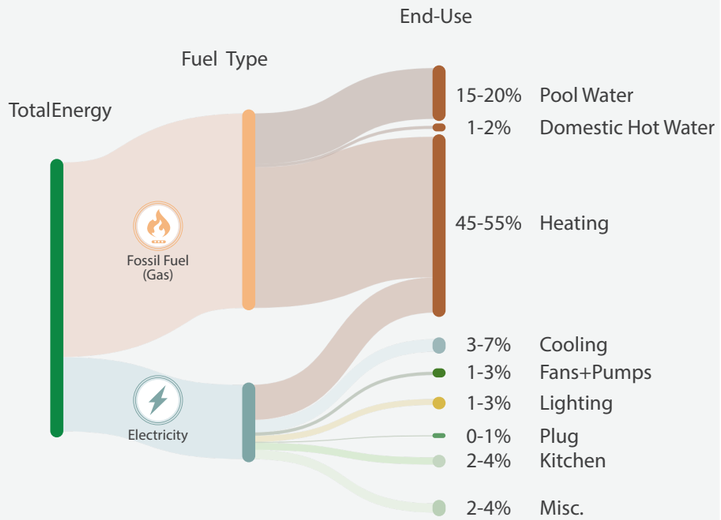
Baseline Energy Use

Baseline energy use at the Recreation & Senior Center is shown below. The energy end-use diagram details how energy is consumed at the building. Baseline Annual Energy Use shows how the Recreation & Senior Center performs relative to the new construction targets for Louisville.

Baseline Annual Energy Use Intensity (EUI)



Baseline Energy End-Use



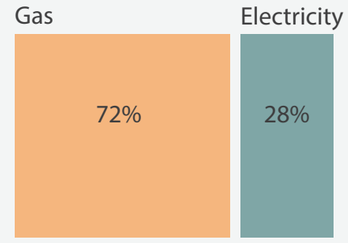
Baseline Carbon Use

The City of Louisville participates in programs to offset their existing electrical consumption with renewable sources. **Therefore, for the purposes of this study the total carbon emissions at Louisville will be solely driven by on-site fossil fuel combustion and emissions associated with electric consumption will be zero.**

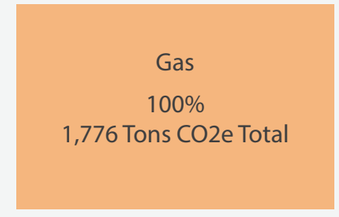
The amount of electric consumption offset needed for zero carbon will be addressed in future phases of this study, and will be evaluated at the portfolio level. The offset will be a function of post-decarbonization electrical consumption considering carbon and load reduction measures, on-site renewable energy provided, and the grid emissions of Xcel Energy and Zero-carbon utility subscription programs.

1 Car emits 5 tons of CO2e per year

Baseline Energy



Baseline Carbon

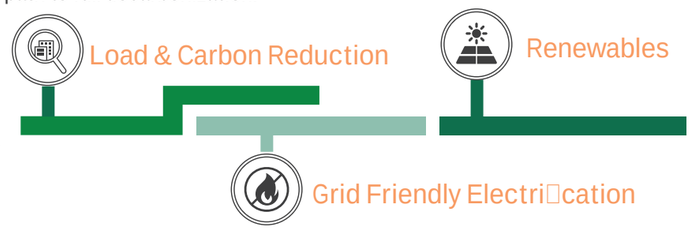


Decarbonization Measures | Decarbonization Process, Load & Carbon Reductions

Decarbonization Process

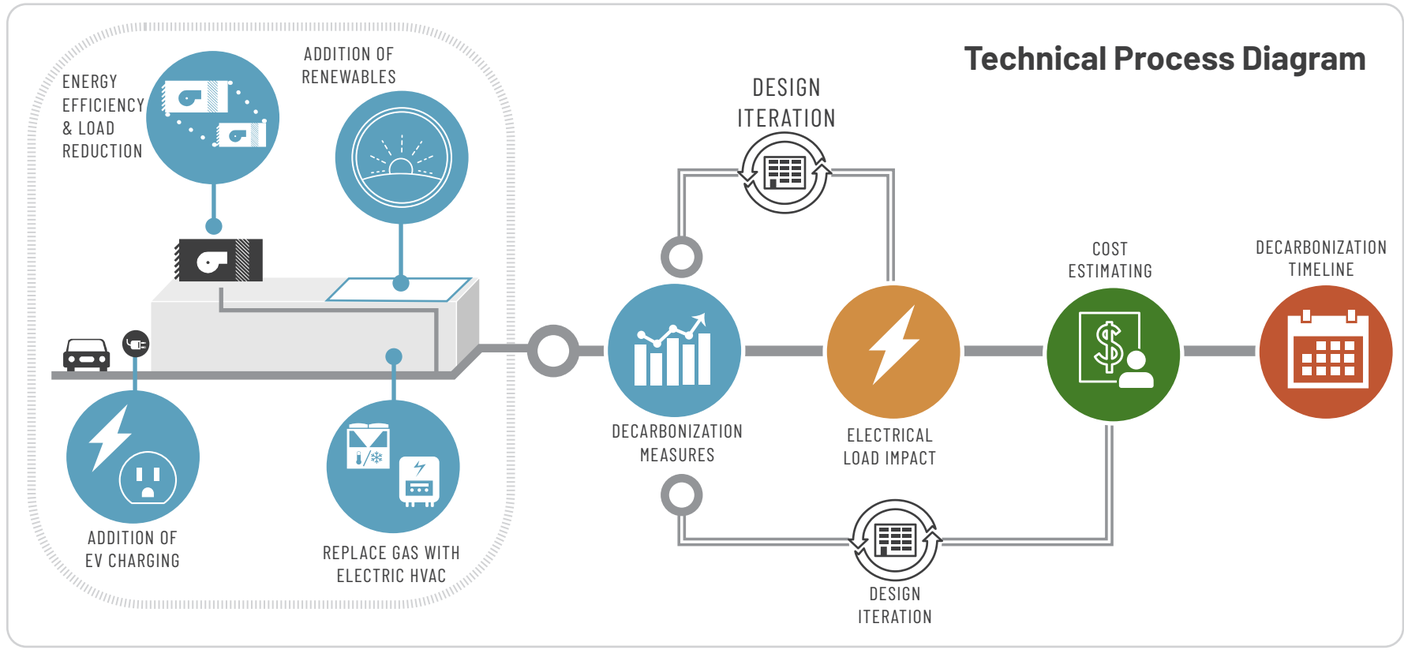
There are a host of measures to employ on the path of decarbonization, ranging from time-tested traditional energy e□ciency measures to the more aggressive electri□cation measures. The key to decarbonization is □nding the right balance between measures, as indicated by the graphic below. With this approach, Louisville will □nd the most cost-effective path to full decarbonization.

The decarbonization solution starts by identifying measures at the building, and continues with design iteration to arrive at the □nal timeline, as seen in the Technical Process Diagram.



Load & Carbon Reduction

The recent shift towards decarbonization still operates on the core foundation of reducing building's overall energy use. Measures can have two functions: reducing annual energy/carbon consumption and reducing peak building demand load. These measures are often incentivized by Xcel and may have shorter paybacks.

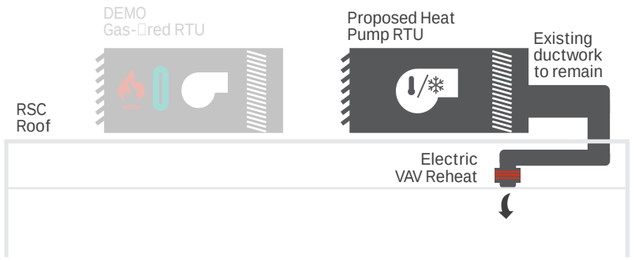


Load	Carbon	Measure	Description
■	■	POOL COVERS	Pool covers on indoor pools reduces evaporation and ventilation requirements. This reduction reduces the amount of heating energy needed to heat the pool and makeup water. While mechanized pool covers are not acceptable to Recreation & Senior Center staff due to maintenance concerns, a liquid pool cover should be explored further in later design stages. Savings from this measure are not currently included in this plan.
□	■	SCHEDULE SAUNA	The sauna currently runs 24/7. Scheduling the sauna to only run during occupied hours would reduce the energy use.
■	■	WINDOW REPLACEMENT	Replacing single pane windows with double pane thermally broken windows can greatly improve occupant comfort while also reducing energy use of the space.
□	■	SCHEDULING	The building currently has a building automation system. By reviewing the current schedule and checking that it meets the building usage and tightening up the occupied hours, savings can be realized by not conditioning the spaces when not occupied.
□	■	CONTROLS OPTIMIZATION / RETRO-COMMISSIONING (RCX)	This measure consists of reducing energy use through ongoing commissioning. This work focuses on identifying low- and no-cost opportunities to drive energy savings and optimize operational practices in the facilities. This is primarily accomplished through ongoing site audits, data analysis, training, and collaboration with the facility's operational team.
■	■	DUCT AIR SEALING/ INSULATION	Sections of HVAC ducting which provide heating, cooling, and/or ventilation are a signi□cant potential thermal and air leakage point – particularly because they are pressurized/under vacuum. Sealing joints with either mastic or volatilized sealant, and adding insulation saves energy and improves air quality.
■	■	ENVELOPE AIR SEALING	Buildings are often remarkably leaky – the wall/parapet junction being a frequent culprit. Ensuring a building is tight and ventilated right is an effective e□ciency measure that also has durability bene□ts (condensation often occurs at air leakage points) and improves air quality (mold reduction and limiting outside air in□ltration during wild□re events).
□	■	LIGHTING CONTROLS/ VACANCY SENSORS	LED light replacements typically are the most cost effective way for saving electricity in the lighting arena, but adding lighting controls (which turn off lights with vacancy and vary based on available daylight) provide additional savings and better user experience (avoiding over-lighting).
■	■	ADVANCED PLUG LOAD REDUCTION	Items that are plugged into outlets – plug loads – often make up the single largest use of electricity in buildings, after heat pump heating and cooling. A dedicated, ongoing program for ensuring plug load items are actually needed, the most e□cient available, and/or appropriately switched is a great way to save electricity.

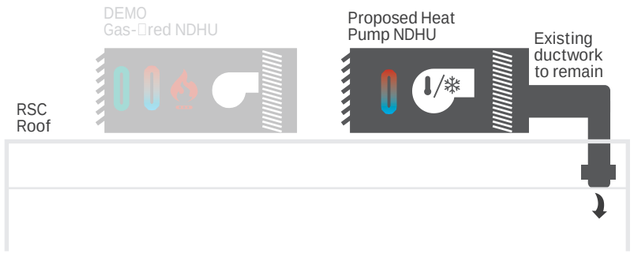
Proposed HVAC Systems

The Recreation & Senior Center's HVAC system consists of packaged Rooftop Units (RTU) serving the non-pool areas of the building and Natatorium Dehumidi□cation Units (NDHUS) serving pool areas. Simple diagrams of this systems and their proposed electri□cation measures are shown below.

Non Pool - Airside



Pool - Airside



NON-POOL AIRSIDE

Ventilation, heating, and cooling are supplied through (17) packaged rooftop units (RTUs), which provide cooling via packaged refrigerant and heating via gas-□red burner. Supply air is sent to VAV electric reheat boxes.

The decarbonized system will replace the gas □red RTUs with heat pump based RTUs that can utilize either electric resistance or gas backup heat. Backup heat is utilized to supplement the heat pump as temperatures drop and heat pump capacity is reduced or when temperatures drop below the heat pump operation limit. This is typically a small amount of time in the year and has minor energy impacts (described in results section).

POOL AIRSIDE

Ventilation, heating, and cooling are supplied through (2) NDHUs, which provide dehumidi□cation through DX cooling and reheat with gas-□red burners. The NDHUs are 100% outside air. NDHUs have signi□cant dehumidi□cation, heating, and cooling loads associated with them. Both units have energy recovery loops, required per energy code. The decarbonized system will replace the gas □red NDHU's with heat pump based NDHU's that can utilize either electric resistance or gas backup heat. The proposed systems will have as much or more heat recovery as the existing units.

DOMESTIC HOT WATER

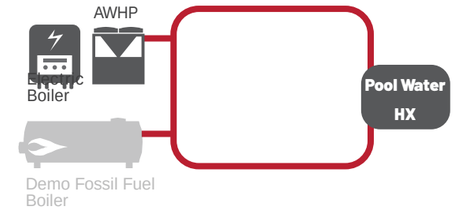
Domestic hot water (DHW) is currently served by gas water heaters and is a small proportion of the total building's gas load. The decarbonized system can be a heat pump water heater or an electric resistance water heater.

The appendices to this Summary include:

- Appendix 1: Additional decarbonized mechanical systems that were considered. This includes a geothermal heating system, which was evaluated but ultimately not recommended.
- Appendix 2: Decarbonized mechanical system scoping documents and sketches.

Pool Water Heating Systems

The Recreation & Senior Center's pool water is heated by fossil fuel gas boilers. These boilers supply hot water which is then sent to a heat exchanger which provides heating water to the pool. Heat pump solutions can be a good opportunity for pool water heating because they do not require signi□cantly high water temperatures. Challenges can exist in □nding units that are large enough to serve pool heating demand load.



Based on existing audit information, it is believed that there could be opportunity to down-size the pool water heating equipment. This could lead to signi□cant construction cost savings, but needs to be veri□ed in a future detailed design phase.

Thermal storage using pool water was explored, but not considered viable due to the temperature maintenance requirements in the two lap pools.

Beneficial Electrification

Electri□cation of mechanical systems provides value beyond energy and carbon savings. These include, but are not limited to:

- Enhanced ventilation control (outside-air supply, CO_2 Control, etc.) with new RTUs
- Improved thermal comfort with right-sized RTUs and updated controls
- Improved resiliency of newer units

All Electric vs Hybrid Systems

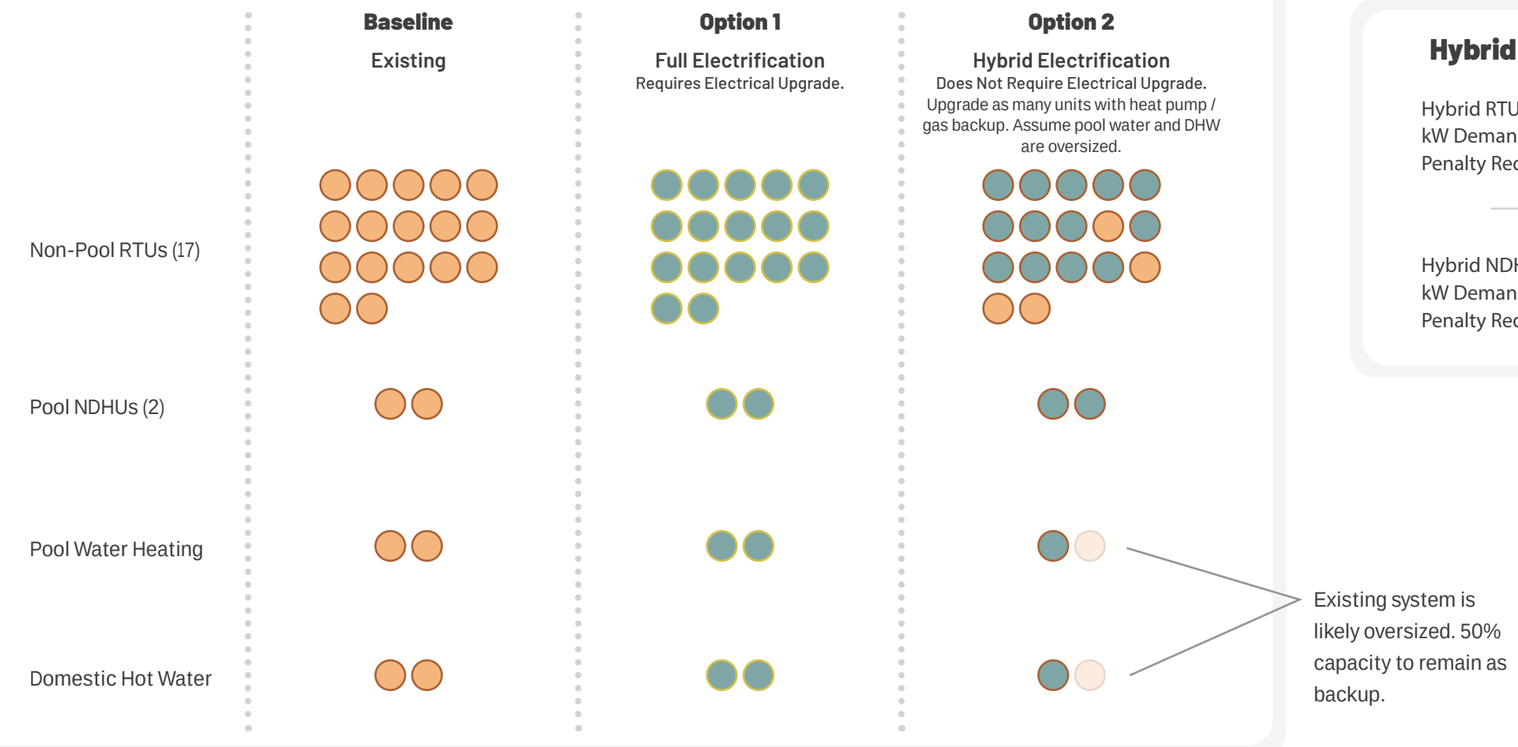
Hybrid systems are a useful tool for **sensible and cost-effective decarbonization**, as they strike a balance between carbon reduction, construction costs, and utility demand costs. In general, it can be expensive to electrify the "last 10%", because the system is sized for the coldest day of the year, which rarely occurs. In many cases, using gas as the peaking fuel source on the coldest day will mitigate need for an electrical upgrade while still achieving signi□cant carbon reductions.

The following options for the Recreation & Senior Center have been developed ranging from full electrification to hybrid electrification. Hybrid options upgrade units to heat pumps that utilize gas as a backup, and do not require an electrical service upgrade.

Recreation & Senior Center Electrification Options

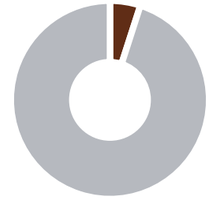
Key

Gas Primary | Heat Pump w/ Electric Backup | Heat Pump w/ Gas Backup



Demand Savings Impact

Hybrid gas systems will also provide value by reducing annual demand (kW) costs in comparison to an all-electric alternative. Gas-backup systems have the option to lockout the primary heating (heat pumps) when temperatures are lower to avoid potentially costly demand (kW) charges. This strategy can help alleviate some of the demand penalty associated with the all-electric option, but it will also come at the price of slightly more energy usage and more fossil fuel combustion. The □gure below shows the impact on annual demand costs for gas backup RTUs systems in comparison to all-electric RTUs, if the heat pumps are locked out at 10°F and below.



Temperatures are below 10°F for approximately 5% of the year

Hybrid Electrification Vs. Full Electrification kW Demand Impact

Hybrid RTU vs Full Electric RTU kW Demand $ Penalty Reduction	~$15k (20%) Demand ($/kW) penalties associated with RTU electrification are reduced by approximately 20% when using hybrid RTUs instead of full electric RTU
Hybrid NDHU vs Full Electric NDHU kW Demand $ Penalty Reduction	~$6k (15%) Demand ($/kW) penalties associated with NDHU electrification are reduced by approximately 20% when using hybrid RTUs instead of full electric RTU

Decarbonization Measures | Renewables & Electric Vehicle Chargers

Renewables

Renewable energy plays the important role of offsetting remaining carbon emissions after building load reductions and electri□cation has been made. This can be handled through a variety of avenues – behind-the-meter systems, Community Solar Gardens, and utility subscriptions. Since City of Louisville already offsets its current electricity with renewable utility subscriptions, we focused on customer-owned, behind-the-meter systems that would provide more value to the City of Louisville.

At the Recreation & Senior Center, three individual systems were evaluated - rooftop, ground mount, and carport. Based on feedback from Louisville Facilities and cost information, a 380 kW ground mount system is recommended. Additional information on this analysis and the options is included in Appendix 6. City of Louisville could install a 380 kW □xed-tilt ground mount solar PV system, a 140 kW □at rooftop system, or both.



ON-SITE VERSUS GRID PURCHASE

Some of the bene□ts of on-site solar vs renewables purchased from the grid are listed below.

- Avoid solar sprawl at scale - avoiding offsetting of impacts to rural areas.
- Avoid electrical energy loss due to transmitting power over long distances.
- Dispersed approach is typically grid bene□cial, especially when on-site renewables are a small percentage of the total usage of building - most solar on this bldg would be self used.
- Enable future resiliency through addition of batteries and storage.
- Demonstrate decarbonization to local Louisville community.

AVAILABLE ROOF SPACE & RACKING MODALITY

Solar systems bene□t from economies of scale – generally, the larger the system, the cheaper it is per kW. The □rst constraint on system size is the available space on the property. Since ground mounts are typically the least expensive racking modality, we evaluate this □rst followed by rooftop and then parking canopies. In the area south of the parking lot, the Louisville Recreation & Senior Center could □t a 380 kW ground mount without encroaching much on the open trail space. The rooftop has several faces that are relatively open and uncluttered by rooftop equipment. However, its size limitation is better described by the available structural capacity of the building.

STRUCTURAL CAPACITY

As will be discussed in future sections, there is very limited rooftop structural capacity at this site. Most of the roof faces would require structural reinforcement to the framing to be suitable for PV. The faces identi□ed for the proposed rooftop system have the potential to move forward without reinforcement in a mostly mechanically attached scenario, but need to be further vetted with racking drawings and structural evaluation.

SIMPLE PAYBACK

Payback is an easy way to determine the value of a solar system. Solar PV systems last around 25-30 years. McKinstry typically only recommends systems that – including In□ation Reduction Act credits, utility incentives, and/or other funding sources – will pay back within the system lifetime. At this stage of evaluation, simple payback is used. However, if the project advances, more detailed cash □ows and paybacks can be calculated.

INTERCONNECTION METHOD & INCENTIVES

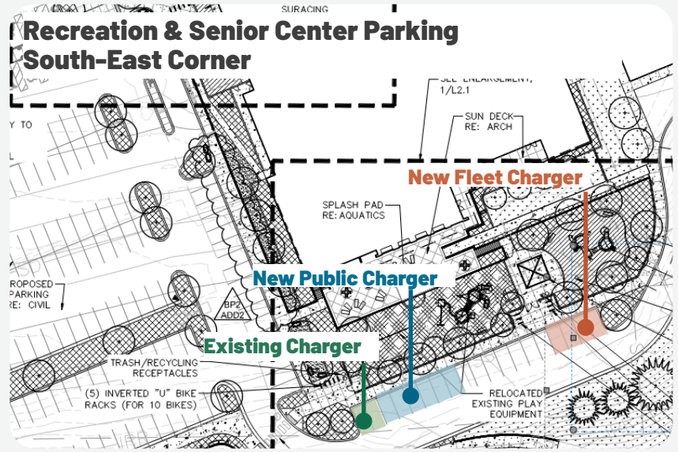
The Recreation & Senior Center arrays would interconnect behind the utility meter and would qualify for Xcel's Solar*Rewards C&I Tier 1 or Tier 2 incentives. These arrays were not considered for Community Solar since those gardens must typically be much larger (500kW-AC+) to make □nancial sense. Additionally, this solar project would be eligible for the In□ation Reduction Act (IRA) incentives, giving 25-30% of the solar cost back to City of Louisville depending on the chosen □nancing mechanism. **Note that first costs shown in this report do not yet account for the IRA savings.**

Electric Vehicle (EV) Chargers

The Recreation & Senior Center has 3 vehicles. One is considered a heavy-duty vehicle and the other two are passenger vehicles. These vehicles are primarily used at the rec center.

We recommend installing 5 chargers and upgrading the electrical infrastructure to support them. Currently there is no direct replacement for the van or heavy duty truck (used to plow the parking lot). It is anticipated those vehicles will be available in the next 5 to 10 years. We also recommend installing publicly available chargers for the city residents. The table below shows the number of recommended chargers.

Existing Public Charging Stations	Existing Public Charger Level	Quantity of New Level 2 Public Chargers	Quantity of New Level 3 Public Chargers	Quantity of New Level 2 Fleet Chargers	Quantity of New Level 3 Fleet Chargers
1	2	2	1	1	1



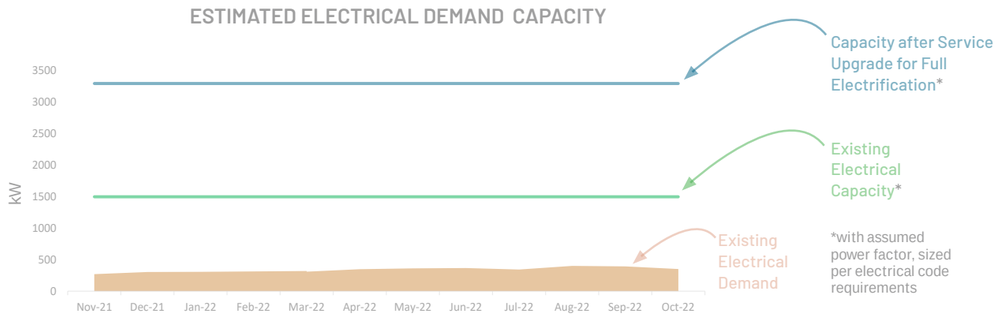
At this site the chargers were split into two groups, public and □eet. The number of □eet chargers selected to be installed here were based on the number of vehicles stored on-site plus one extra to account for visiting □eet vehicles. In addition, one of the □eet chargers was selected to be a Level 3 charger to allow for quick recharge of a □eet vehicle if needed. An example of such a use case maybe for the plow vehicle used to clear the parking lot.

The quantity of public chargers selected for this site was based on the remaining parking spots located in that parking strip area and proximity to the electrical services that will be in the area for the □eet chargers. More or less spots could installed or located in other areas but this will affect the cost. One Level 3 charger was included in the public area to allow a fast charging option for the public.

Electrical Impacts

The existing service to the Recreation & Senior Center is 480 Volts (V), 3 phase, 2500 Amps (A).

Utility data was analyzed for the date range 11/2021 – 10/2022. This data shows the existing annual maximum demand of the Recreation & Senior Center is 403kW. Remaining existing capacity available for electri□cation projects (building HVAC or EV) is approximately 1,830A, equating to approximately 1,222kW of additional equipment. Furthermore, we observed that the peak winter demand of the Recreation & Senior Center is lower at 320kW. As the bulk of load addition is heating, we can utilize the winter demand as the base case for load addition of approximately 1,968A, equating to approximately 1,314kW. It should be noted that future changes in building occupancy or consumption patterns from the date range where data was provided may impact the service demand and available capacity for electri□cation.



ELECTRICAL UPGRADE OPTIONS

SINGLE PROJECT FULL ELECTRIFICATION – MAJOR SERVICE UPGRADES REQUIRED

To support a single project full electri□cation effort, service upgrades are required. 2 options were considered mechanically, which required addition of either a 3,000A or 4,000A service in addition to the existing 2,500A service. This upgrade is viable and has been conceptually designed and estimated as part of this project.

STAGGERED PROJECT HYBRID ELECTRIFICATION – NO SERVICE UPGRADE

This option takes a phased approach to implementation, which will allow for additional electri□cation without requiring a service upgrade. It is also in-line with the electri□cation upgrade scoped for the Congressionally Directed Spending Request.

The National Electric Code (NEC) requires new construction load addition to be calculated based on prescriptive demand factors. At a high level, demand factors are 125% for continuously operating equipment (EV charging, Electric resistance heating etc) and 100% for motors or non-continuous operating equipment. In general, prescriptive demand factors represent a worst-case scenario (all equipment operating concurrently and at nameplate output) that is rarely observed in practice.

The NEC allows measurement of existing load to be used as a basis to determine remaining capacity (multiplied by a 125% adjustment factor). By means of example, the Recreation & Senior Center existing load is calculated at approximately 2,200A per the record drawings, however the utility data shows peak annual demand of 536A and peak winter demand of 426A.

We expect that load addition to the facility will materialize at somewhere between 40% and 70% of nameplate. If electri□cation is staggered over a period of years, the actual materialized load from the early electri□cation phases can be used to determine remaining electrical capacity and to allow subsequent electri□cation phases to proceed over and above the capacity that would be required if all phases were performed concurrently.

Assuming a staggered project consisting of approximately 3 equal tranches, and that load does not materialize above 65%, the existing service could accommodate the following equipment electri□cation:

- RTUs 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14 (hybrid option with fossil gas backup for peaking and cold weather)
- Make up Air Units (MAUs)
- Natatorium Dehumidi□cation Units (NDHUs)
- Energy Recovery Ventilators (ERVs)
- A single Domestic Water Heat Pump stage representing approximately 33% of existing DHW capacity (fossil gas backup retained for peaking or cold weather operation)
- Pool Heat Pumps equivalent to approximately 50% of existing pool heating capacity (fossil gas backup retained for peaking or cold weather operation)
- Level 2 and Level 3 Electric Vehicle (EV) charging
- 380 kW Ground-mount PV array

BACKUP POWER

The Recreation & Senior Center does not currently have a generator. Code required life safety loads (typically egress lighting) are provided by battery backed □xtures. For resiliency purposes a generator is being considered for this building, but that is outside the purview of this study.

Battery System

A 250 kW battery system was evaluated for this site, mostly for demand reduction and load shifting purposes. However, the high □rst cost was unable to offset the annual demand cost reductions, and resulted in a payback longer than the measure life. While this option is currently not included in this plan, it could become a viable option in the future as the technology improves and becomes more cost-effective.

Structural Impacts

Structural upgrades to the existing roof framing will be required for the proposed rooftop mechanical equipment replacements. The existing roof framing consists of bar joist or open web steel truss supported by trusses or wide □ange beams. The original framing was designed e□ciently for dead and snow loads without signi□cant additional capacity for future rooftop equipment. The proposed mechanical replacement equipment is signi□cantly heavier in weight and will trigger welded reinforcing to be installed underlying bar joist framing. Truss reinforcing will consist of top and bottom chord reinforcing, web reinforcing along with truss panel point reinforcing. In addition, at some locations, added steel framing is to be con□gured above the roof deck to distribute the weight of the overlying mechanical units to engage more truss support framing.

Electrification Options

FULL ELECTRIFICATION – Full electri□cation at the Recreation & Senior Center, including all-electric RTUs, heat pump pool heating and heat pump domestic water heaters. EV charging costs are not included in this option. **This option requires an electrical service upgrade.**

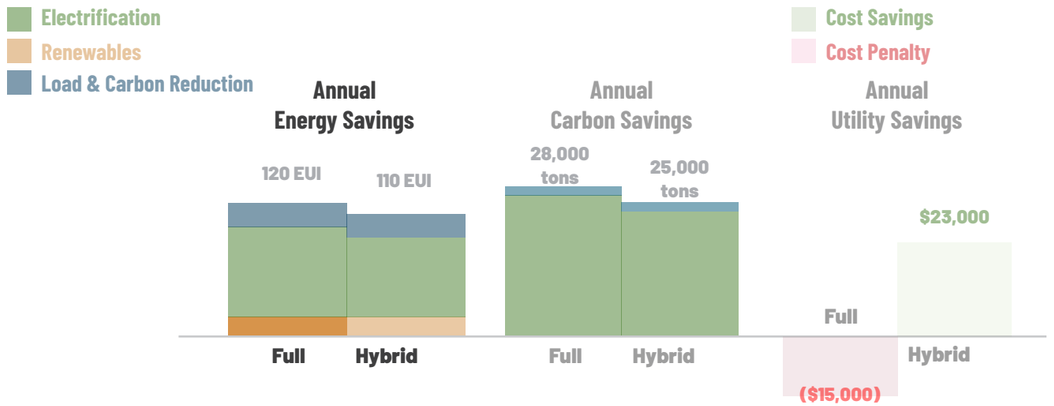
	Load & Carbon Reduction	Grid Friendly Electrification	Renewables
	~~Pool Covers~~ Sauna Schedule Window Replacement Controls Optimization Air Duct Sealing Envelope Air Sealing Lighting Controls Plug Load Reduction	~~Electrification Hybrid~~ Electrification Full	On-Site Ground Mount PV ~~On-Site Roof Mount PV~~
Total Cost	**$170k**	**$16.8M***	**$1.2M****
Base Cost	N/A	$6.4M	N/A
Net Cost of Electrification	**N/A**	**$10.4M***	**N/A**

HYBRID ELECTRIFICATION – Hybrid Electri□cation upgrades as many units as possible without triggering electrical upgrades. The existing natural gas pool and domestic hot water heaters to remain. EV charging costs are not included in this option.

	Load & Carbon Reduction	Grid Friendly Electrification	Renewables
	~~Pool Covers~~ Sauna Schedule Window Replacement Controls Optimization Air Duct Sealing Envelope Air Sealing Lighting Controls Plug Load Reduction	Electrification Hybrid ~~Electrification Full~~	On-Site Roof Mount PV ~~On-Site Roof Mount PV~~
Total Cost	**$170k**	**$10.5M***	**$1.2M****
Base Cost	N/A	$6.4M	N/A
Net Cost of Electrification	**N/A**	**$4.1M***	**N/A**

Proposed Annual Measure Savings

Energy, carbon, and utility cost savings of the proposed options are shown here. The full electri□cation option saves more energy by converting all of the natural gas load over to electricity, which leads to additional carbon savings. The hybrid option provides better annual utility savings by reducing the amount of kW demand penalty associated with electri□cation of heating loads.

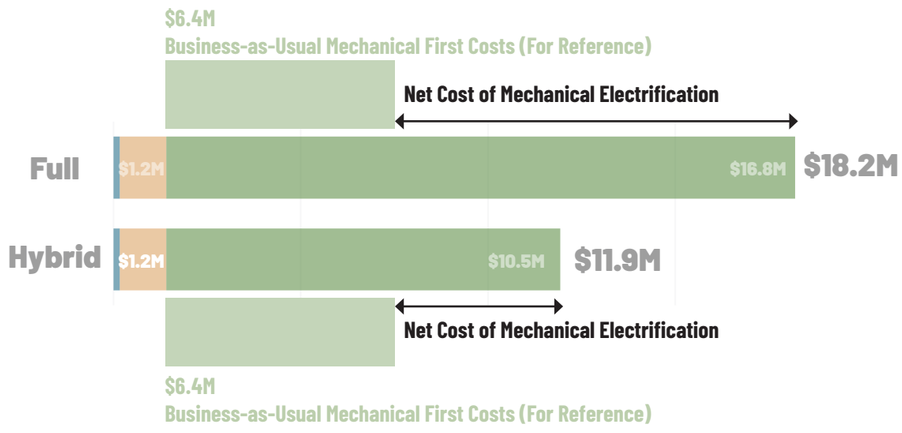


Proposed Total Measure Costs

Electrification
Renewables
Load & Carbon Reduction

Proposed measure costs are shown below, including any structural and electrical upgrades needed for each option. **They are also Rough Order of Magnitude (ROM) numbers, with a +/-20% range.**

The total cost is the total amount that will need to be allocated for budgetary purposes. The net cost represents the total cost minus the replacement cost that would've been spent to replace the existing units with like-for-like fossil fuel units.



Construction Pricing Context

The MEP scope narratives described in previous sections and included in the appendices were used by McKinstry's construction division to provide Rough Order of Magnitude (ROM) pricing. This early ROM budgeting process sought to be reasonable but conservative wherever possible. **Typically for ROM-level pricing a range of +/- 20% is applied to the total construction and start up costs.** This range can be reduced, and the pricing further re□ned, via a deeper understanding of existing building conditions and detailed design. Note this does not account for escalation, which is addressed separately. This pricing represents the total construction and startup cost to Louisville, including:

- General contractor markup
- Design fees
- Engineering energy analysis
- Controls
- Equipment startup, commissioning, testing, and balancing
- Placeholders for miscellaneous trades (e.g. carpentry).
- Allowances speci□c to each building for construction conditions (e.g. crane time)

All construction costs are in 2023 dollars unless noted otherwise.

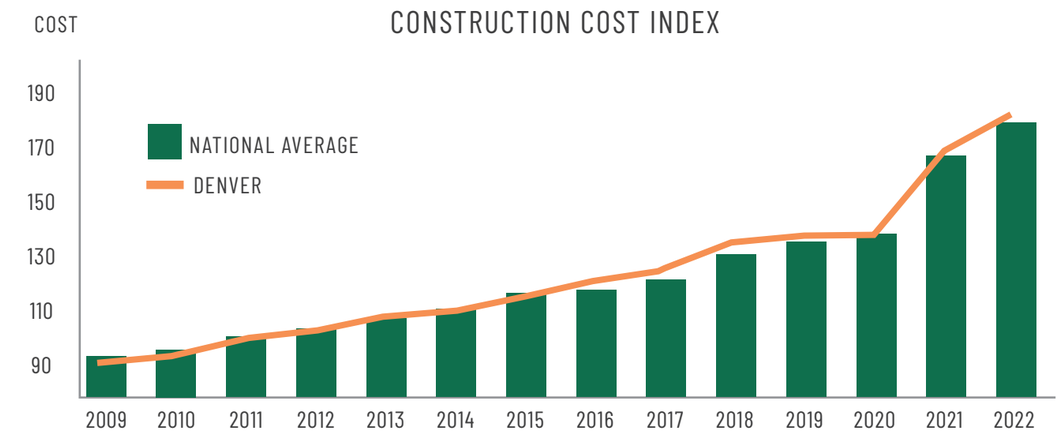
Using These Construction Costs

Throughout this report, differentiation is made between "total construction costs" and "net cost over business-as-usual fossil fuel systems"The distinction between the two is:

- Total costs: these are the total construction costs. This is the total amount of money that will need to be allocated for budgetary purposes.
- Net Cost: these are the total construction costs minus the replacement costs that would've been spent to replace the existing units with like-for-like fossil fuel units. These numbers represent the true cost of this decarbonization effort.

Note the numbers in the 2023 City Budget are budget numbers, and do not represent all costs for replacing the existing units. As such, they should not be used when determining the costs of decarbonization. In addition, the cost estimates in this report assume miscellaneous equipment (e.g. expansion tanks, domestic hot water storage tanks) need to be replaced. This assumption should be validated in detailed design, and could result in the total construction cost being lower if equipment can be reused.

As shown in the graph by the Mortenson, construction costs have been steadily rising since 2009. However, costs rose drastically from 2020 to 2022 (approximately 35%) due to global supply chain issues and unforeseen consequences of the COVID-19 pandemic.



SOURCE: MORTENSON CONSTRUCTION

Constructibility

Recent upheavals in the global supply chain and labor workforce have caused uncertainty in the construction market. Our construction teams are seeing the following trends as of March, 2023:

ELECTRICAL LEAD TIMES:

- Most commodity items, such as conduit, wire, □ttings, etc. are readily available.
- Lead times for Switchboards are being quoted 50-80 weeks. Panel-boards can be 20-40 weeks depending on complexity.

MECHANICAL LEAD TIMES:

- 26-30 weeks for larger and more customized equipment (50 ton RTUs)
- Equipment needs to be ordered earlier in detailed design process to accommodate long lead times. Requires additional coordination earlier in design.

In order to combat these lead time challenges, design teams may need to be □exible with their speci□cations and the products/manufacturers they are selecting.

LABOR MARKET:

While we are seeing a general relaxing of labor shortages in other markets around the country, the contractor and labor shortages continue to persist in the Denver market.

Implementation

A preliminary implementation timeline is shown below, based on the 2023 Capital Improvement Plan (CIP). Given the CIP replacement schedule, the Recreation & Senior Center □ts well within the 2030 timeline, meaning it is on schedule to implement decarbonized measures. The summary below is the implementation recommendation based on age of equipment as well as additional thoughts on emerging technologies and sequence of upgrades.

AIRSIDE

- As RTUs and NDHUs reach end of life, replace with pump alternatives.

RENEWABLES

- Install a 380 kW ground mount PV array
- If the roof array is ultimately pursued, phase it with the scheduled roof replacement in 2023.

DOMESTIC HOT WATER

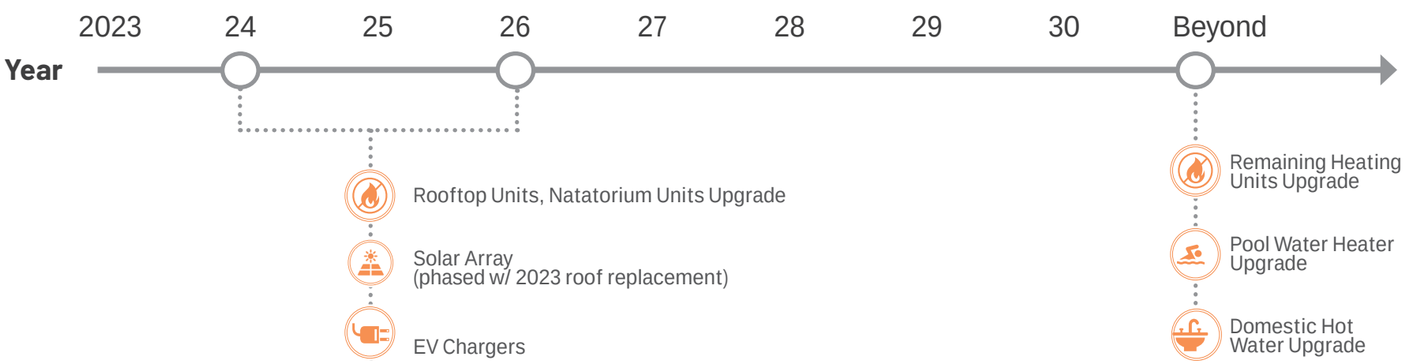
- Provide heat pump water heater at end-of-life.

POOL WATER HEATER

- Provide heat pump water heater plant for pool water heating as existing equipment reaches end-of-life.



Preliminary Implementation Timeline





Appendix

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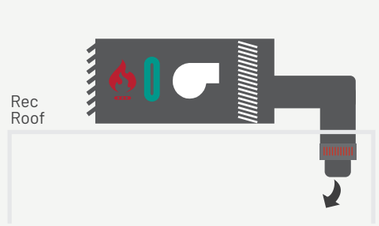
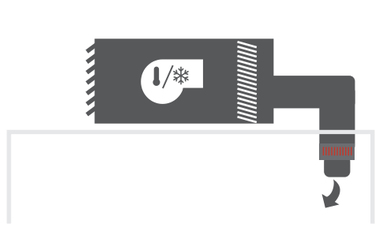
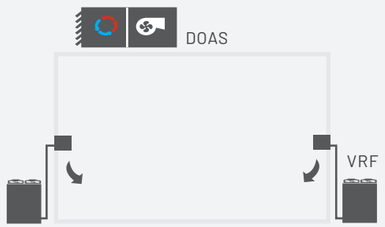
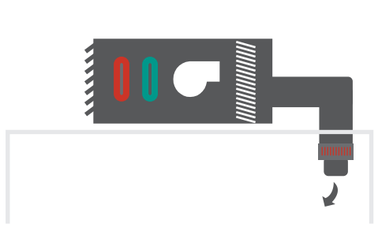
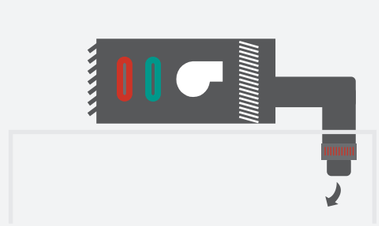
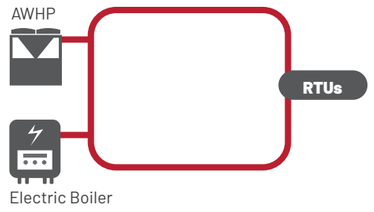
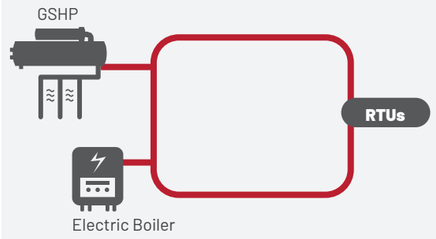
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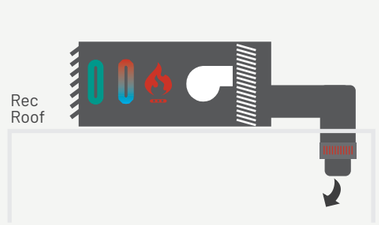
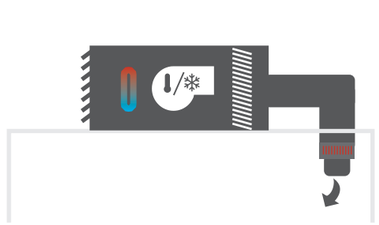
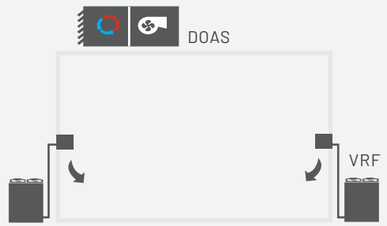
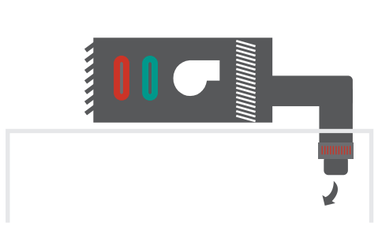
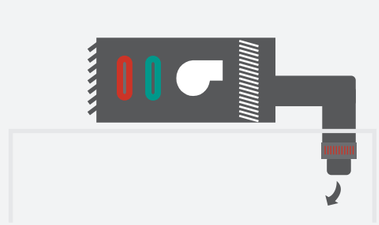
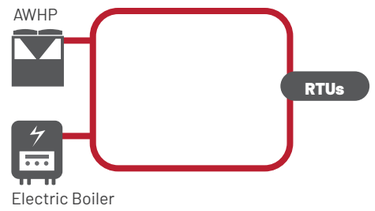
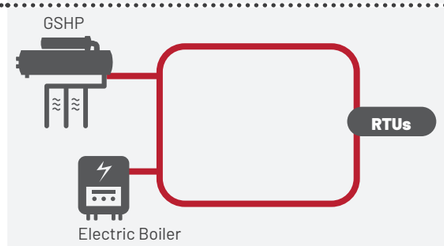
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HVAC System Matrix: Recreation Center: Non-Pool

	Existing System	Recommendation	High Performance Retrofit Alternate	Improved Performance Alternate	Best in Class
General	Gas Rooftop Units	Rooftop Heat Pumps	VRF condenser farm on roof or grade. Zone fan coils with heat recovery. DOAS - ventilation.	Air-to-water heat pump plant serving rooftop units.	Same as best option, with ground source instead of air source
					
Plant Equipment	-	None	VRF condenser farm on roof or grade.	AWHP plant on roof or grade. Lots of 4-pipe CHW/HHW pipes on roof.	Borefield south of building. Backup boiler/ AWHP. Lots of 2-pipe CW piping on roof
	-	None	See Above		
Extent of Retrofit	-	**Minimal** Reuse all downstream equipment	**Extensive.** Remove existing VAV boxes and electric reheat coils. Reuse existing medium pressure ductwork for ventilation air.	**Extensive.** Remove existing VAV boxes and electric reheat coils. Reuse existing medium pressure ductwork for ventilation air.	**Minimal** Reuse all downstream equipment
Electrical Impacts	-	**Upgrade Potentially Needed.** Can be a component of system mix and match to avoid electrical upgrade.	**Upgrade Potentially Needed.** Can be a component of system mix and match to avoid electrical upgrade. Possibly less load due to swapping electric resistance for heat pump.	**Upgrade Potentially Needed.** Can be a component of system mix and match to avoid electrical upgrade. Possibly less load due to swapping electric resistance for heat pump.	**Upgrade Potentially Needed.** Can be a component of system mix and match to avoid electrical upgrade. Possibly less load due to swapping electric resistance for heat pump.
Limiting Factor	-	**None** Can be a component of system mix and match to avoid electrical upgrade.	**Potentially Invasive** Might be too invasive for relatively new building. Large structural roof upgrade.	**Significantly Expensive** Large structural roof upgrade.	**Significantly Expensive** Borefield cost
Verdict	-	**Proceed w/ Detailed Scoping**	**High-Level Consideration** Viability if we can minimize/eliminate electrical upgrade by removing elec resistance heaters.	**Fast Fail** Too expensive, too invasive for relatively new building	**Fast Fail** Evaluated further, but failed. IRA helps with cost gap, but still is a more expensive life cycle system
Non-Pool Water Heating	Gas water heaters	Air-source heat pump water heater	Hydrokit connected to ACVRF condenser farm	Air-source heat pump water heater	Connected to borefield with dedicated WWHP for 140 water. Or air-source HPWH plant.

HVAC System Matrix: Recreation Center: Pool

	Existing System	Recommendation	High Performance Retrofit Alternate	Improved Performance Alternate	Best in Class
General	Natatorium Dehumidifcation Units	Natatorium Heat Pump Dehumidifcation Units	VRF condenser farm on roof or grade. Zone fan coils with heat recovery. DOAS - ventilation.	Air-to-water heat pump plant serving rooftop units.	Same as best option, with ground source instead of air source
					
Plant Equipment	-	None	VRF condenser farm on roof or grade.	AWHP plant on roof or grade. Lots of 4-pipe CHW/HHW pipes on roof.	Borefield south of building. Backup boiler/ AWHP. Lots of 2-pipe CW piping on roof
	-	None	See Above		
Extent of Retrofit	-	**Minimal** Reuse all downstream equipment	**Minimal** Reuse all downstream equipment	**Minimal** **Reuse all downstream equipment**	**Minimal** Reuse all downstream equipment
Electrical Impacts	-	**Upgrade Potentially Needed.** Can be a component of system mix and match to avoid electrical upgrade.	**Upgrade Potentially Needed.** Can be a component of system mix and match to avoid electrical upgrade.	**Upgrade Potentially Needed.** Can be a component of system mix and match to avoid electrical upgrade.	**Upgrade Potentially Needed.** Can be a component of system mix and match to avoid electrical upgrade.
Limiting Factor	-	**None** Can be a component of system mix and match to avoid electrical upgrade.	**Dependent on Non-Pool Systems** No potential for heat recovery as both units serve the same zone. Would make sense if non-pool used ACVRF.	**Significantly Expensive**	**Significantly Expensive** Borefield cost
Verdict	-	**Proceed w/ Detailed Scoping**	**High-Level Consideration**	**Fast Fail** Too expensive, too invasive for relatively new building	**Fast Fail** Evaluated further, but failed. IRA helps with cost gap, but still is a more expensive life cycle system
Pool Water Heating	Gas water heaters	Air-source heat pump water heater	Hydrokit connected to ACVRF condenser farm	Either separate air-source HPWH plant or connected to central AWHP plant via HX	Connected to borefield.



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Recreation and Senior Center - Mechanical Scope Narratives

Option 1 – Full Electrification

This option replaces all existing gas-fired mechanical rooftop units (RTU's, NDHU's, MAU's, and ERV's) with heat pump units with electric resistance backup. It includes installation of heat pump water heaters to provide the full design capacity for the Pool water heating and domestic hot water systems. New electric resistance boilers are included to serve as backup to the heat pump portion of the Pool water heating and domestic hot water plants.

Demo Scope of Work

- Includes removal and disposal of (17) RTUs
- Includes removal and disposal of (1) gas NDHU and (1) removal and disposal of a gas coil from NDHU
- Includes removal and disposal of (2) MAUs
- Includes removal and disposal of (2) ERVs
- Includes removal and disposal of (3) gas-fired DWHs
    - Includes removal and disposal of existing expansion tank and circulation pump
- Includes removal and disposal of (6) gas-fired boilers for Pool water heating
    - Includes removal and disposal of existing expansion tank and circulation pumps
- Includes cut, cap and make safe gas lines to all units
- Includes removal of existing flues and patch and seal of roof
- Assumes flues are accessible for demo, excludes demo/reinstalling of any shaft walls

New Scope of Work

- Includes (17) new air to air heat pumps of varying capacities, with electric resistance backup
    - Includes new curbs
    - Assumes existing ductwork and any sound attenuation to remain and be reused
    - Assumes any condensate off RTUs may drain to existing roof receptors
- Includes (2) new MAUs
    - Includes new curbs
- Includes (1) new NDHU and (1) new NDHU electric heating coil
    - Includes new curbs
- Incudes (2) new ERVs
    - Includes new curbs
- Includes (12) new electric air to water heat pumps for Pool water heating
    - Includes (1) new titanium heat exchanger
    - Includes new circulation pump, mixing valves, expansion tank
- Includes (5) new electric boilers for Pool water heating backup
    - Includes new boiler pumps
- Includes (2) new heat pump electric DWHs
    - Includes new heat exchanger, circulation pump, expansion tank
    - Includes (2) new 500 gallon storage tanks
    - Includes new heating water piping
- Includes (2) new electric DWHs for backup

- Includes (6) new circulation pumps
    - Two for pool water side of HX, two for HP side
    - One pump for each new electric boiler

Option 2 – Hybrid Electrification

This option replaces all existing gas-fired mechanical rooftop units (RTU's, NDHU's, MAU's, and ERV's) with heat pump units with gas backup. It includes installation of heat pump water heaters to provide half the design capacity for the Pool water heating and domestic hot water systems. The existing gas boiler systems for Pool water heating and domestic hot water will remain to serve as backup to the electrified portion of the Pool water heating and domestic hot water plants.

Demo Scope of Work

- Includes removal and disposal of (17) RTUs
- Includes removal and disposal of (1) gas NDHU and (1) removal and disposal of a gas coil from NDHU
- Includes removal and disposal of (2) MAUs
- Includes removal and disposal of (2) ERVs
- Includes cut, cap and make safe gas lines to all units
- Includes removal of existing flues and patch and seal of roof
- Assumes flues are accessible for demo, excludes demo/reinstalling of any shaft walls

New Scope of Work

- Includes (17) new air to air heat pumps of varying capacities, with gas backup
    - Includes new curbs
    - Assumes existing ductwork and any sound attenuation to remain and be reused
    - Assumes any condensate off RTUs may drain to existing roof receptors
- Includes (2) new MAUs
    - Includes new curbs
- Includes (1) new NDHU and (1) new NDHU electric heating coil
    - Includes new curbs
- Incudes (2) new ERVs
    - Includes new curbs
- Includes (6) new electric air to water heat pumps
    - Includes (1) new titanium heat exchanger
    - Includes new circulation pump, mixing valves, expansion tank
- Includes (1) new heat pump electric DWHs
    - Includes new heat exchanger, circulation pump, expansion tank
    - Includes (1) new 500 gallon storage tanks
    - Includes new heating water piping
- Includes (6) new circulation pumps
    - Two for pool water side of HX, two for HP side
    - One pump for each new electric boiler

Mechanical General Inclusions, Clarifications, & Exclusions

- Includes allowance for crane/rigging
- Includes allowance for permits

- Includes allowance for carpentry
- Carrying Seattle labor rates
- Pricing in today's dollars
- Excludes temp HVAC and plumbing
- Excludes overtime work
- Excludes parking
- Excludes any new sound attenuation scope. Assumes ductwork and existing sound attenuation to remain.
- Excludes duct smoke detectors and wiring
- Excludes any heat tracing
- Excludes good faith survey
- Excludes demolishing gas distribution lines/piping back to meter
- Excludes condensate drain piping to roof drains. Assumes piping directly down onto roof.

LOUISVILLE REC CENTER - MECHANICAL PRICING DOCUMENT

OPTION 1 - FULL ELECTRIFICATION

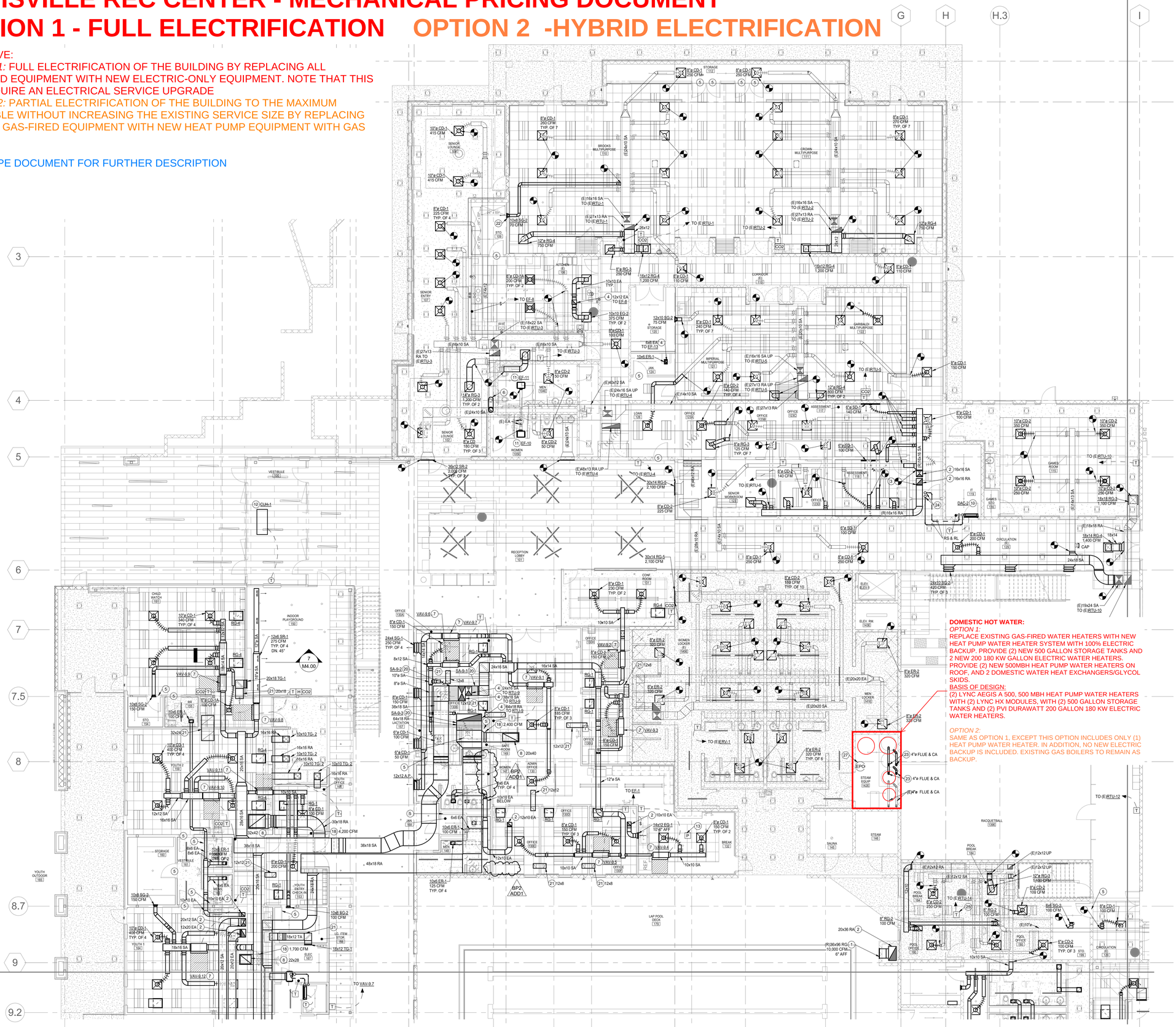
OPTION 2 -HYBRID ELECTRIFICATION

NARRATIVE:

-OPTION 1: FULL ELECTRIFICATION OF THE BUILDING BY REPLACING ALL GAS-FIRED EQUIPMENT WITH NEW ELECTRIC-ONLY EQUIPMENT. NOTE THAT THIS WILL REQUIRE AN ELECTRICAL SERVICE UPGRADE

-OPTION 2: PARTIAL ELECTRIFICATION OF THE BUILDING TO THE MAXIMUM ALLOWABLE WITHOUT INCREASING THE EXISTING SERVICE SIZE BY REPLACING EXISTING GAS-FIRED EQUIPMENT WITH NEW HEAT PUMP EQUIPMENT WITH GAS BACKUP.

SEE SCOPE DOCUMENT FOR FURTHER DESCRIPTION



MAIN LEVEL HVAC FLOOR PLAN - SECTOR 1

SCALE: 1/8" = 1'-0"

MAIN LEVEL HVAC KEYNOTES:

1. RELOCATED AIR DEVICE. TEST AND BALANCE CONTRACTOR TO REBALANCE AIR DEVICE TO AIRFLOW QUANTITY INDICATED.
2. DUCTWORK OF SIZE AND TYPE AS INDICATED UP THROUGH FLOOR AS INDICATED TO MEZZANINE LEVEL.
3. RELOCATED DUCTWORK. CONNECT RELOCATED DUCTWORK TO NEW DUCTWORK OF SIZE AND TYPE INDICATED UP TO MEZZANINE LEVEL. M.C. TO EXTEND EXISTING DUCT TAKEOFFS TO RELOCATED TAPS AS SHOWN.
4. DUCTWORK OF SIZE AND TYPE AS INDICATED UP THROUGH ROOF TO MECHANICAL EQUIPMENT INDICATED. PROVIDE TRANSITION TO EQUIPMENT CONNECTION IN RISE.
5. 3/4" DOOR UNDERCUT BY G.C.
6. FIREPLACE CONCENTRIC DIRECT VENT PIPING ROUTED FROM FACTORY DUCT CONNECTION UP THROUGH ROOF TO MANUFACTURER'S CONCENTRIC VENT TERMINATION. PROVIDE DIRECT VENT PIPING SIZED AND PROVIDED BY THE SUCESSFUL FIREPLACE MANUFACTURER. DIRECT VENT PIPE SHALL BE SPECIFICALLY DESIGNED FOR USE WITH THE SUPPLIED FIREPLACE. INSTALL VENTING IN ACCORDANCE WITH THE FIREPLACE MANUFACTURER'S INSTALLATION GUIDELINES. PROVIDE MAXIMUM OF (2) 45°OFFSET ELBOWS AS SHOWN IN VENT RISE.
7. VARIABLE AIR VOLUME TERMINAL WITH ELECTRIC REHEAT COIL AS INDICATED. REFER TO DETAIL. REFER TO SCHEDULES FOR SIZE AND CAPACITIES. TYPICAL.
8. RETURN AIR OPENING SIZE AS INDICATED IN TOP OF RETURN AIR DUCT. PROVIDE 3/4" BIRD SCREEN. ENSURE 10" CLEAR SPACE ABOVE OPENING FOR THE RETURN AIR PATH.
9. TRANSFER FAN AS INDICATED MOUNTED FROM STRUCTURE ABOVE WITH RUBBER IN SHEAR ISOLATION. REFER TO DETAIL. REFER TO SCHEDULES FOR SIZE AND CAPACITIES.
10. DUCTLESS SPLIT SYSTEM AS INDICATED. MOUNT INDOOR UNIT ON WALL BELOW CEILING WHERE APPLICABLE AND OUTDOOR UNIT ON ROOF. PROVIDE WITH PLENUM RATED CONDENSATE REMOVAL PUMP. REFER TO PLUMBING DRAWINGS FOR CONDENSATE PIPE ROUTING. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENTS. REFER TO SCHEDULES FOR CAPACITIES.
11. EXHAUST FAN AS INDICATED MOUNTED FROM STRUCTURE ABOVE WITH RUBBER IN SHEAR ISOLATION. REFER TO DETAIL. REFER TO SCHEDULES FOR SIZE AND CAPACITIES.
12. ELECTRIC CABINET UNIT HEATER AS INDICATED. REFER TO SCHEDULES FOR SIZE, CAPACITIES AND CABINET CONFIGURATIONS.
13. CEILING MOUNTED ROOM PRESSURE PICK UP PORT FOR ADJACENT SPACE PRESSURE READING AS INDICATED. TCC TO ROUTE TUBING FROM PORT TO PRESSURE TRANSDUCER. REFER TO CONTROL DRAWINGS AND SPECIFICATIONS FOR REQUIREMENTS.
14. TCC TO PROVIDE DOOR CLOSURE SWITCH TO LOCK OUT NDHU-2 COOLING WHENEVER ANY ASSOCIATED LARGE EXTERIOR DOOR IS OPEN.
15. HVLS FAN CONTROLLER AS INDICATED. CONTROLLER TO OPERATE FAN INDICATED. PROVIDE MULTIPLE FAN CONTROLLER IF REQUIRED. COORDINATE FINAL LOCATION WITH OWNER AND E.C. FOR POWER REQUIREMENTS.
16. CEILING FAN AS INDICATED MOUNTED FROM STRUCTURE ABOVE. M.C. TO COORDINATE MOUNTING WITH STRUCTURE. BLADES SHALL BE 1'-0" MINIMUM BELOW BOTTOM CHORD OF STRUCTURE OR CEILING, WHICHEVER IS APPLICABLE. REFER TO SCHEDULES FOR SIZE AND CAPACITIES. COORDINATE EXTENSION LENGTH AND FAN MOUNTING TYPE WITH STRUCTURE. INSTALL PER ALL MANUFACTURER'S INSTALLATION AND CLEARANCE REQUIREMENTS.
17. DRYER VENT FOR EXISTING 75LB DRYER. INCREASE SIZE AS INDICATED TO 10" TO ALLOW FOR VENT RUN AS INDICATED. ROUTE VENT UP THROUGH ROOF TO TERMINATION 2'-0" ABOVE ROOF.
18. TEST AND BALANCE CONTRACTOR TO BALANCE MANUAL VOLUME DAMPER TO AIRFLOW QANTITY INDICATED.
19. RELOCATED DDC SYSTEM NETWORK CONTROLLER. DIVISION 26 SHALL PROVIDE A 20 AMP, 120 VOLT POWER CIRCUIT. EXISTING STATIC IP DATA CONNECTION AND ETHERNET DROP SHALL BE RELOCATED TO THE CONTROLLER LOCATION.
20. ELBOW TYPE SOUND ATTENUATOR. REFER TO SCHEDULES FOR REQUIRED SIZES. REFER TO DETAIL.
21. TRANSFER AIR OPENING FULL SIZE OF TRANSFER AIR DUCT. ENSURE 10" CLEAR SPACE ABOVE OPENING FOR THE TRANSFER AIR PATH.
22. INSTALL AIR DEVICE AS HIGH AS POSSIBLE ON WALL OR AT ELEVATION INDICATED. COORDINATE WITH BLOCK COURSING WHERE APPLICABLE.
23. CPVC FLUE AND COMBUSTION AIR OF SIZE INDICATED FROM WATER HEATER CONNECTIONS UP THROUGH ROOF. REFER TO ROOF PLAN FOR TERMINATION REQUIREMENTS. CONFIRM AND PROVIDE MATERIALS AS REQUIRED BY THE WATER HEATER MANUFACTURER. WRAP THE COMBUSTION AIR PIPE IN 1" INSULATION TO PREVENT CONDENSATION. CONFIRM SIZES, MATERIALS AND ROUTING WITH THE SUCCESSFUL MANUFACTURER.
24. SEPARATELY INSULATED REFRIGERANT LIQUID AND SUCTION LINE SETS UP TO LEVEL ABOVE. SIZE AND INSTALL LINE SETS ACCORDING TO ALL MANUFACTURER'S RECOMMENDATIONS. REFER TO MEZZANINE FLOOR PLAN FOR CONTINUATION.
25. RELOCATE EXISTING DDC SPACE SENSOR TO INDICATED LOCATION. PROVIDE NEW CONTROL WIRING AS REQUIRED.
26. PROVIDE RECTANGULAR MANUAL VOLUME DAMPER IN RECTANGULAR DUCT RISER PRIOR TO FLAT OVAL DUCT TRANSITION. REFER TO SECTION.
27. BOILER ROOM EMERGENCY SHUT OFF SWITCH. SWITCH TO DISABLE ALL POOL HEATERS AND WATER HEATERS WHEN ACTIVATED. REFER TO SPECIFICATION SECTION 23 05 00 FOR REQUIREMENTS.
28. DUCTWORK OF SIZE AND TYPE INDICATED TO BE INSTALLED IN JOIST BAY. COORDINATE EXACT DUCTWORK LOCATION WITH STRUCTURE. COORDINATE JOIST BRIDGING WITH STRUCTURAL CONTRACTOR.
29. DUCTWORK OF SIZE AND TYPE INDICATED TO BE ROUTED THROUGH JOIST WEBBING. COORDINATE EXACT DUCTWORK LOCATION WITH STRUCTURE.
30. ALUMINUM DUCTWORK OF SIZE AND TYPE INDICATED DOWN MECHANICAL CHASE TO LOUVER.
31. POOL RETURN / EXHAUST LOUVER SHALL BE POSITIONED 8" AFF AND ALIGNED WITH BLOCK COURSING.

DOMESTIC HOT WATER:

OPTION 1:

REPLACE EXISTING GAS-FIRED WATER HEATERS WITH NEW HEAT PUMP WATER HEATER SYSTEM WITH 100% ELECTRIC BACKUP. PROVIDE (2) NEW 500 GALLON STORAGE TANKS AND 2 NEW 200 180 KW GALLON ELECTRIC WATER HEATERS. PROVIDE (2) NEW 500MBH HEAT PUMP WATER HEATERS ON ROOF, AND 2 DOMESTIC WATER HEAT EXCHANGERS/GLYCOL SKIDS.

BASIS OF DESIGN:

(2) LYNC AEGIS A 500, 500 MBH HEAT PUMP WATER HEATERS WITH (2) LYNC HX MODULES, WITH (2) 500 GALLON STORAGE TANKS AND (2) PVI DURAWATT 200 GALLON 180 KW ELECTRIC WATER HEATERS.

OPTION 2:

SAME AS OPTION 1, EXCEPT THIS OPTION INCLUDES ONLY (1) HEAT PUMP WATER HEATER. IN ADDITION, NO NEW ELECTRIC BACKUP IS INCLUDED. EXISTING GAS BOILERS TO REMAIN AS BACKUP.

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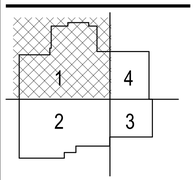
LOUISVILLE RECREATION / SENIOR CENTER EXPANSION

LOUISVILLE, COLORADO 80027

SCD Project No.: 1641

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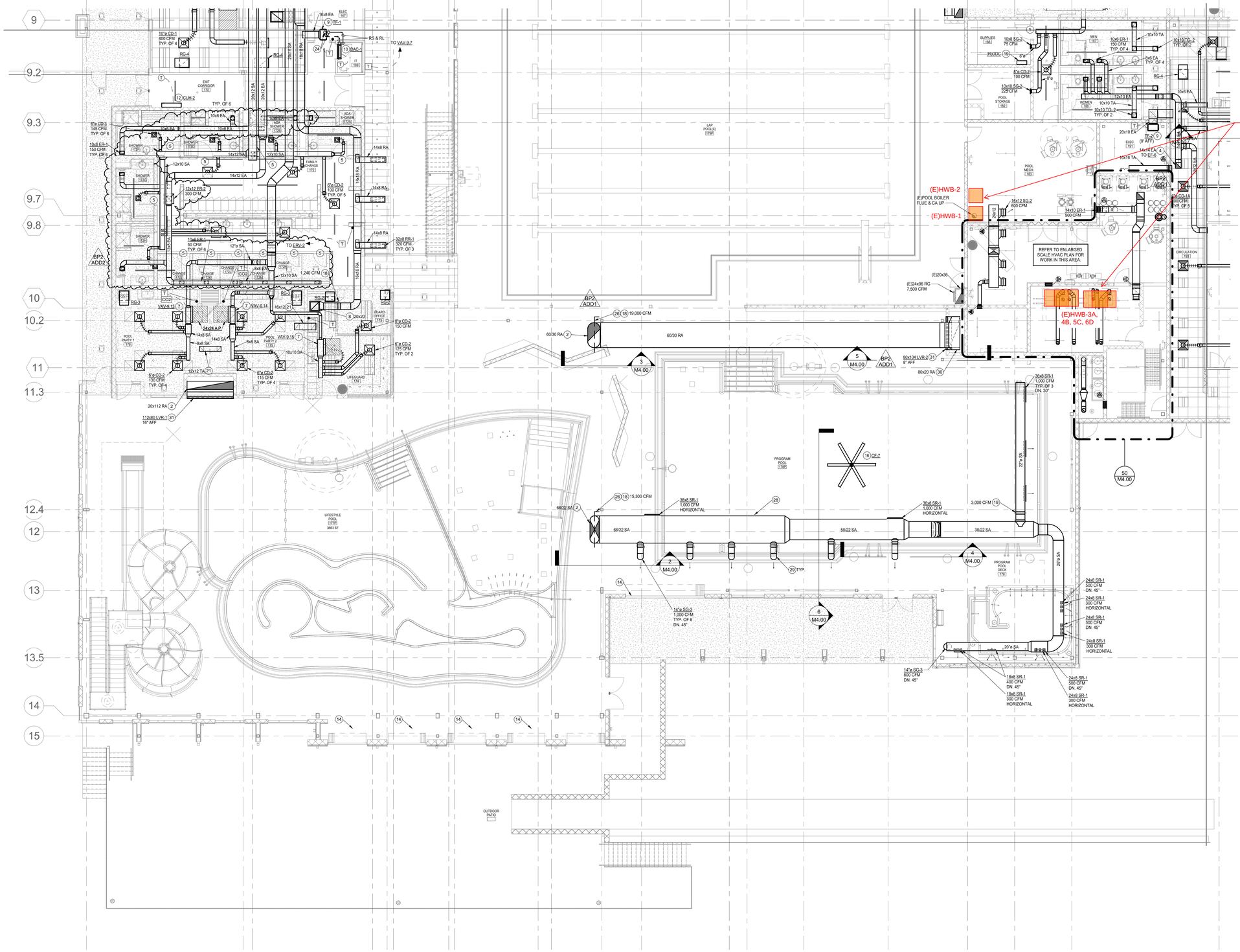
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MAIN LEVEL HVAC FLOOR PLAN - SECTOR 1

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MAIN LEVEL HVAC FLOOR PLAN - SECTOR 2

SCALE: 1/8" = 1'-0"

POOL HEAT:

OPTION 1A:

EXISTING GAS POOL BOILERS WILL BE REPLACED BY (12) ELECTRIC AIR-TO-WATER HEAT PUMPS WITH 100% ELECTRIC RESISTANCE BOILER CAPACITY FOR EMERGENCY BACKUP HEAT IN THE FORM OF (5) 200 KW ELECTRIC BOILERS. THE ELECTRIC HEAT PUMPS WILL BE PIPED IN PARALLEL WITH A CIRCULATION PUMP, CONNECTED TO A TITANIUM HEAT EXHANGER. THE HEAT PUMP LOOP WILL HAVE 30% GLYCOL. ALL EXISTING POOLS WILL BE CONNECTED TO THIS SYSTEM. ON THE POOL SIDE OF THE HEAT EXHANGER, A SECOND CIRCULATION PUMP WILL BE REQUIRED. TWO MIXING VALVES WILL BE PROVIDED ON THE POOL SIDE OF THE SYSTEM SEPARATING THE POOLS AND THE SPA.

OPTION 2:

SAME AS OPTION 1, EXCEPT THIS OPTION INCLUDES ONLY (6) AIR-TO-WATER HEAT PUMPS, IN ADDITION, NO NEW ELECTRIC BACKUP IS INCLUDED. EXISTING GAS BOILERS TO REMAIN AS BACKUP.

THROUGH ROOF TO MANUFACTURER'S CONCENTRIC VENT TERMINATION. PROVIDE DIRECT VENT PIPING SIZED AND PROVIDED BY THE SUCESSFUL FIREPLACE MANUFACTURER. DIRECT VENT PIPE SHALL BE SPECIFICALLY DESIGNED FOR USE WITH THE SUPPLIED FIREPLACE. INSTALL VENTING IN ACCORDANCE WITH THE FIREPLACE MANUFACTURER'S INSTALLATION GUIDELINES. PROVIDE MAXIMUM OF (2) 45°OFFSET ELBOWS AS SHOWN IN VENT RISE.

7. VARIABLE AIR VOLUME TERMINAL WITH ELECTRIC REHEAT COIL AS INDICATED. REFER TO DETAIL. REFER TO SCHEDULES FOR SIZE AND CAPACITIES. TYP.CAL.
8. RETURN AIR OPENING SIZE AS INDICATED IN TOP OF RETURN AIR DUCT. PROVIDE 3/4" BIRD SCREEN. ENSURE 10" CLEAR SPACE ABOVE OPENING FOR THE RETURN AIR PATH.
9. TRANSFER FAN AS INDICATED MOUNTED FROM STRUCTURE ABOVE WITH RUBBER IN SHEAR ISOLATION. REFER TO DETAIL. REFER TO SCHEDULES FOR SIZE AND CAPACITIES.
10. DUCTLESS SPLIT SYSTEM AS INDICATED. MOUNT INDOOR UNIT ON WALL BELOW CEILING WHERE APPLICABLE AND OUTDOOR UNIT ON ROOF. PROVIDE WITH PLENUM RATED CONDENSATE REMOVAL PUMP. REFER TO PLUMBING DRAWINGS FOR CONDENSATE PIPE ROUTING. REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENTS. REFER TO SCHEDULES FOR CAPACITIES.
11. EXHAUST FAN AS INDICATED MOUNTED FROM STRUCTURE ABOVE WITH RUBBER IN SHEAR ISOLATION. REFER TO DETAIL. REFER TO SCHEDULES FOR SIZE AND CAPACITIES.
12. ELECTRIC CABINET UNIT HEATER AS INDICATED. REFER TO SCHEDULES FOR SIZE, CAPACITIES AND CABINET CONFIGURATIONS.
13. CEILING MOUNTED ROOM PRESSURE PICK UP PORT FOR ADJACENT SPACE PRESSURE READING AS INDICATED. TCC TO ROUTE TUBING FROM PORT TO PRESSURE TRANSDUCER. REFER TO CONTROL DRAWINGS AND SPECIFICATIONS FOR REQUIREMENTS.
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DENVER, CO 80203
Tel: 303-308-0200

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City of Louisville

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(303) 988-4514

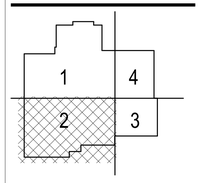
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SCD Project No.: 1641

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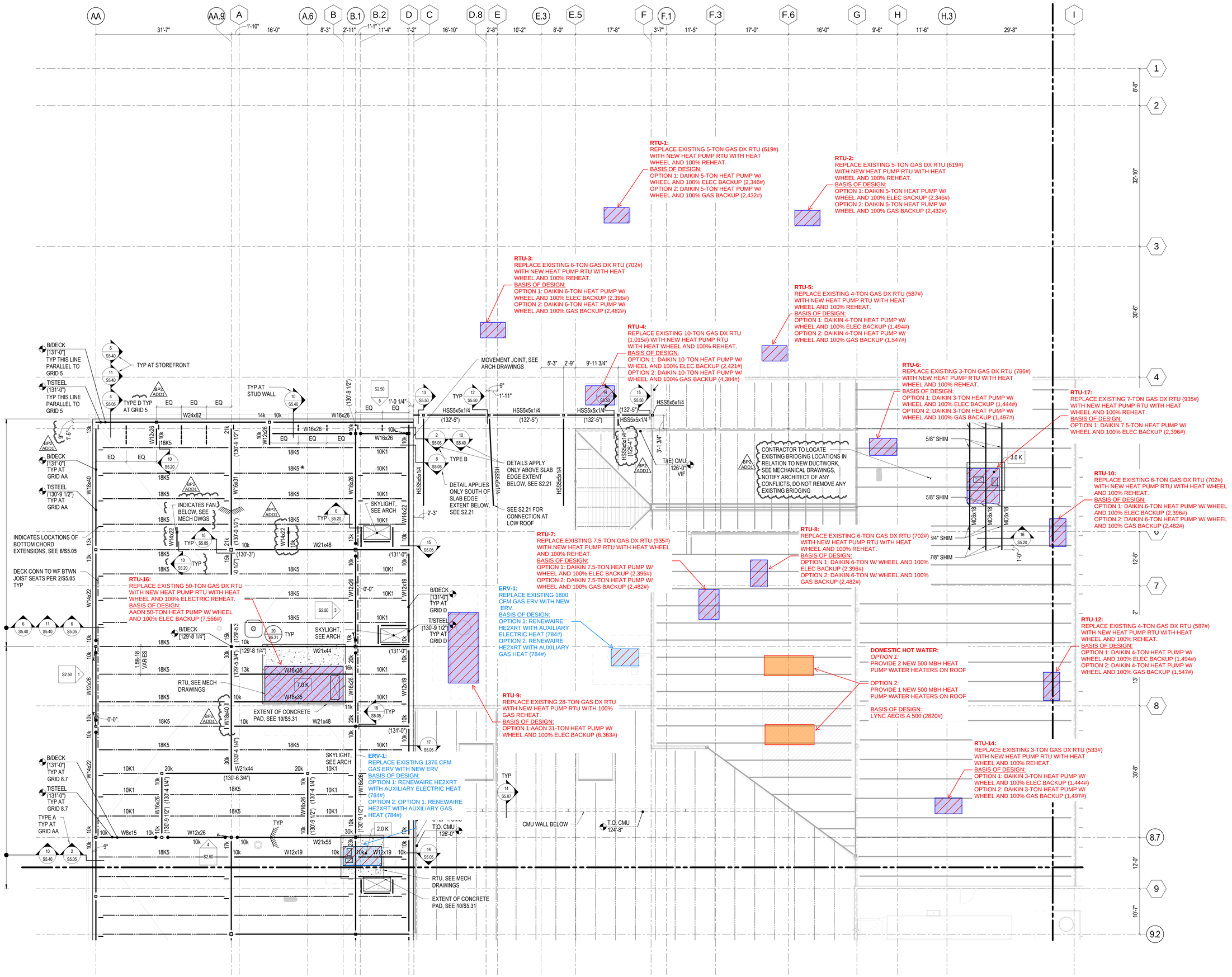
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	BID PACKAGE #2	09/29/2017
BP2 ADD1	BP #2 - ADDENDUM #1	10/13/2017
BP2 ADD2	BP #2 - ADDENDUM #2	11/10/2017



MAIN LEVEL HVAC FLOOR PLAN - SECTOR 2

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ROOF PLAN - SECTOR 1

1/8" = 1'-0"

NORTH

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SUITE 100
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Tel: 303-308-0200

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MAIN 303.431.6100 MARTINMARTIN.COM

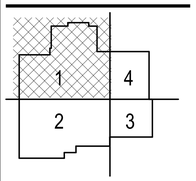
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SCD Project No.: 17.0033.S.01

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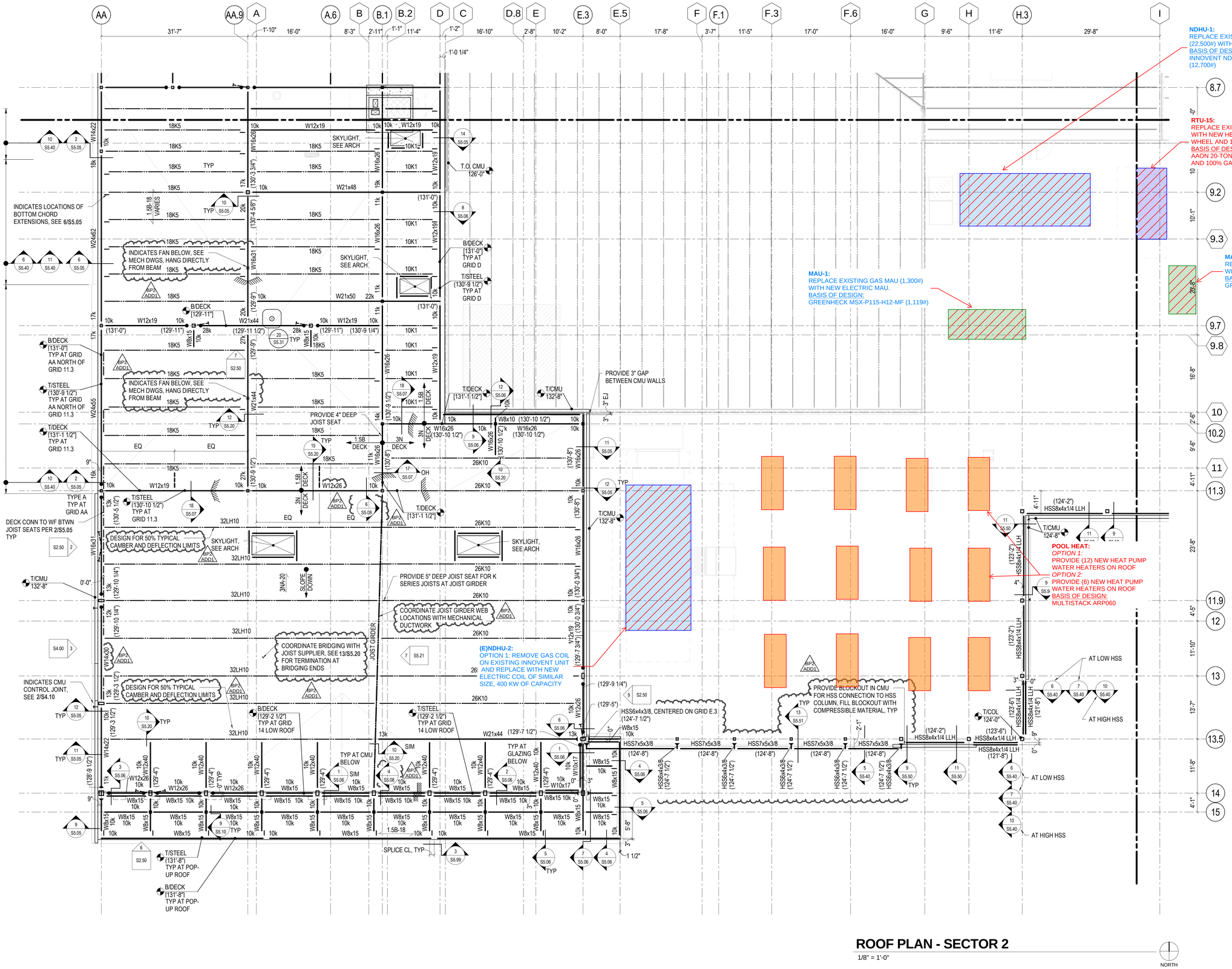
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	BP #1 - REFERENCE	09/15/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD1	BP #2 - ADDENDUM #1	10/13/2017



ROOF PLAN -SECTOR 1

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ROOF PLAN - SECTOR 2

1/8" = 1'-0"

NORTH

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475 LINCOLN STREET
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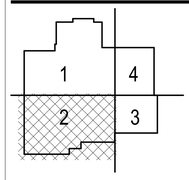
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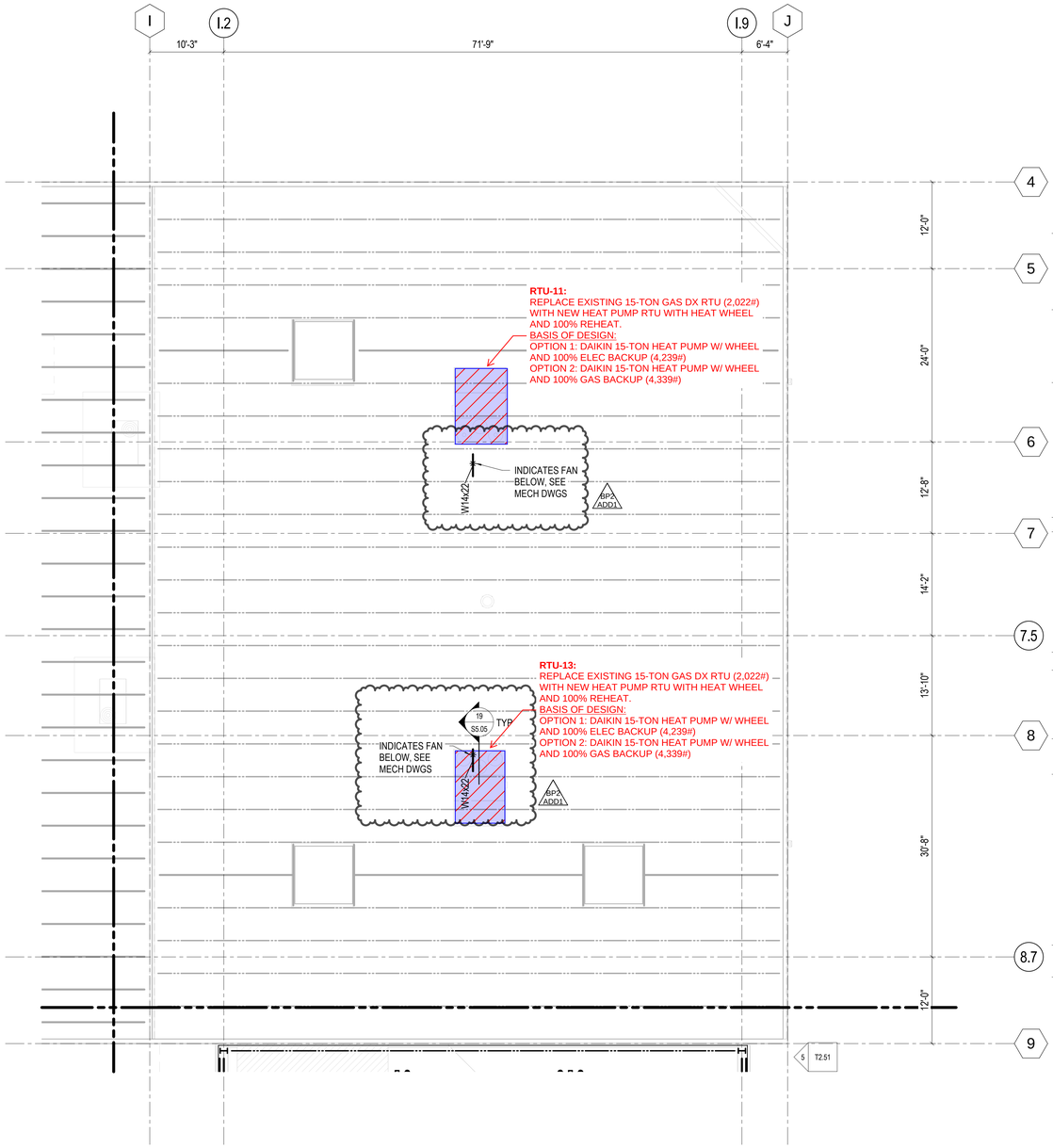
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ROOF PLAN -SECTOR 2

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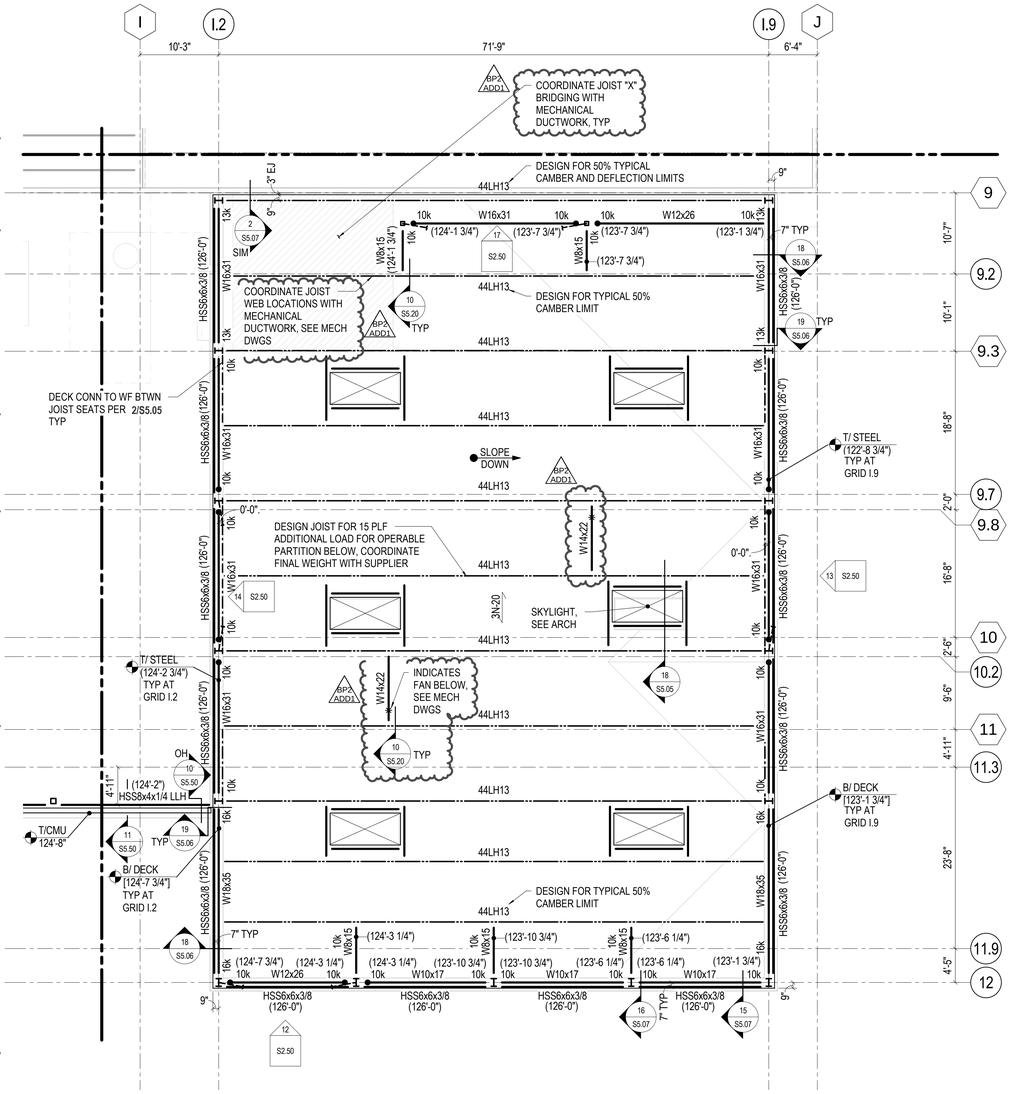
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ROOF PLAN - SECTOR 4

1/8" = 1'-0"

NORTH



ROOF PLAN - SECTOR 3

1/8" = 1'-0"

NORTH

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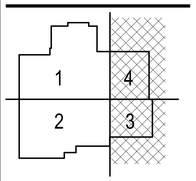
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ROOF PLAN -SECTOR 3 AND 4

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Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

City of Louisville
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Recreation and Senior Center - Electrical Scope Narratives

Option 1 – Full Electrification

A. General: Electrification of HVAC equipment and the addition of EV chargers. An additional switchboard and utility service will be installed to handle the added load with the existing service retained.
B. 30 Day Metering: Metering required on (2) panels. Panel HPA (600A) and panel 2HMA (600A)
C. Electrical Demolition:
    i. See Electrical Equipment Locations pdf for conductor distances.
D. Electrical New Work:
    i. Service upgrade:
        1. Coordinate with utility to install new 2,500 kVA (proposed) 480V secondary utility transformer.
        2. Install new 4000A "MDC2" and utility metering.
        3. Install new 4000A service.
    ii. New infrastructure to serve PV array and BESS line side tap, including:
        1. (3) New CT enclosures, Xcel approved.
        2. New 400A fused disconnect and 400/4 feeder to location of BESS as shown on site plan.
        3. New 500A fused disconnect and 500/4 feeder to location of PV combiner as shown on site plan.
        4. New 350A fused disconnect and 350/4 feeder to location of PV combiner as shown on site plan.
    iii. (1) new panel serving mechanical equipment. See the Electrical Equipment Locations pdf for details and location.
    iv. (1) new panel serving EVSE pedestals and (1) new transformer. See the Electrical Equipment Locations pdf for details and location.
    v. See Electrical Scope Table Option 2 for mechanical equipment connection new scope and Electrical Equipment Locations pdf for conductor distances.

Option 2 – Hybrid Electrification - Staggered hybrid upgrade option, expected to remain within capacity of existing service

A. General: Electrification of RTUs, MAUs, NDHUs, ERVs, HPWHs and addition of EV chargers. Upgrade to be staggered over time, with anticipated measured load (per NEC 220.87) expected to remain within the limits of the existing 2500A service due to the staggered nature of the installations and typical equipment load factors.
B. 30 Day Metering: Metering required on (2) panels. Panel HPA (600A) and Panel 2HMA (600A).
C. Electrical Demolition:
    vi. See Electrical Equipment Locations pdf for conductor distances.

D. Electrical New Work:
   vii. (1) new panel serving EVSE pedestals and (1) new transformer. See the Electrical Equipment Locations pdf for details and location.
   viii. New infrastructure to serve supply side tapped PV array, including:
      1. New 600A CT enclosure, Xcel approved.
      2. New 500A fused disconnect and 500/4 feeder to location of PV combiner as shown on site plan.
   ix. New infrastructure to serve supply side tapped BESS system, including:
      1. New 400A CT enclosure, Xcel approved.
      2. New 400A fused disconnect and 400/4 feeder to location of BESS as shown on site plan.
   x. New infrastructure to serve load side PV array, including:
      1. New 400A CT enclosure, Xcel approved.
      2. New 350A fused disconnect and 350/4 feeder to location of PV combiner as shown on site plan.

E. See Electrical Scope Table Option 2 for mechanical equipment connection new scope.

Exclusions

- Applicable sales, use and B&O tax
- Performance and Payment Bonds
- Utility company charges.
- Refurbishing existing lighting (cleaning, re-lamping, re-trimming, repair, restoration).
- Roof and building envelope penetrations, waterproofing.
- Moving, placing and (re)-calibrating owner equipment.
- Mechanical and plumbing control devices, including wiring, conduit, and components.
- Correcting existing code violations
- Hidden conditions.
- Removing, re-installing and replacing ceiling tiles.
- Opening and repairing walls and ceilings for electrical work.
- Patching and painting.
- Access panels.
- Temporary power and lighting
- Handling hazardous material including but not limited to asbestos, lead and PCB's.
- Overtime and shift premiums.
- Work stoppages, hindrances, multiple trim passes and out-of-sequence installation.
- Electrical engineering, calculations, drawings, peer review services.
- Structural and Seismic Engineering
- Material cost escalation.
- Plywood and specialty backing.

- Low voltage systems (telecom, CCTV, access control, audio visual, etc.).
- Any work not specifically included in this proposal.
- No thermostat relocations are included

Rec Center Option 1 - Full Electrification

EXISTING ELECTRICAL CONNECTION INFORMATION										NEW ELECTRICAL CONNECTION INFORMATION										
EXISTING. EQUIP. TAG	V	PH	FLA	MCA	KVA	PANEL	CKT BRKR (AMPS)	CONDUIT	WIRE	NEW EQUIP. TAG	V	PH	FLA	MCA	KVA	MOCP	PANEL	CKT BRKR (AMPS)	CONDUIT	WIRE	NUMBERED NOTES
RTU-1	480	3	11.84	14.80	12.30	M	40	**3/4"**	**3#12, 1#10G**	RTU-1	480	3	42.00	48.80	34.92	50	**MDC2**	**50**	**1"**	**3#6, 1#10G**	
RTU-2	480	3	11.84	14.80	12.30	M	40	**3/4"**	**3#12, 1#10G**	RTU-2	480	3	42.00	48.80	34.92	50	EQ	**50**	**1"**	**3#6, 1#10G**	
RTU-3	480	3	14.64	18.30	15.21	M	40	**3/4"**	**3#12, 1#10G**	RTU-3	480	3	42.00	48.80	34.92	50	EQ	**50**	**1"**	**3#6, 1#10G**	
RTU-4	480	3	22.48	28.10	23.36	M	60	**3/4"**	**3#10, 1#10G**	RTU-4	480	3	65.90	78.40	54.79	80	**MDC2**	**80**	**1 1/4"**	**3#3, 1#8G**	
RTU-5	480	3	9.76	12.20	10.14	M	40	**3/4"**	**3#12, 1#10G**	RTU-5	480	3	27.50	32.30	22.86	35	EQ	**35**	**3/4"**	**3#8, 1#10G**	
RTU-6	480	3	9.36	11.70	9.73	M	20	**3/4"**	**3#12, 1#12G**	RTU-6	480	3	27.10	31.90	22.53	35	**MDC2**	**35**	**3/4"**	**3#8, 1#10G**	
RTU-7	480	3	16.40	20.50	17.04	M	**30**	**3/4"**	**3#10, 1#10G**	RTU-7	480	3	63.60	75.80	52.87	80	M	**80**	**1 1/4"**	**3#3, 1#8G**	
RTU-8	480	3	14.64	18.30	15.21	M	30	**3/4"**	**3#12, 1#10G**	RTU-8	480	3	42.00	48.80	34.92	50	**1HMB2**	**50**	**1"**	**3#6, 1#10G**	
RTU-9	480	3	61.12	76.40	63.52	MDC	**90**	**1 1/4"**	**3#3, 1#8G**	RTU-9	480	3	191.00	203.00	158.79	255	MDC	**255**	**2 1/2"**	**3#4/0, 1#4G**	
RTU-10	480	3	14.64	18.30	15.21	M	**30**	**3/4"**	**3#12, 1#10G**	RTU-10	480	3	42.00	48.80	34.92	50	M	**50**	**1"**	**3#6, 1#10G**	
RTU-11	480	3	41.52	51.90	43.15	M	**60**	**1"**	**3#6, 1#10G**	RTU-11	480	3	52.50	61.40	43.65	80	M	**80**	**1 1/4"**	**3#4, 1#8G**	
RTU-12	480	3	9.76	12.20	10.14	M	**30**	3/4"	**3#12, 1#10G**	RTU-12	480	3	27.50	32.30	22.86	35	M	**35**	3/4"	**3#8, 1#10G**	
RTU-13	480	3	41.52	51.90	43.15	M	**60**	**1"**	**3#6, 1#10G**	RTU-13	480	3	101.60	104.80	84.47	110	M	**110**	**1 1/2"**	**3#1, 1#6G**	
RTU-14	208	2	23.28	29.10	6.05	L2A	**30**	3/4"	**2#10, 1#10G**	RTU-14	480	3	27.10	31.90	22.53	35	L2A	**35**	3/4"	**3#8, 1#10G**	
RTU-15	480	3	70.00	87.50	58.20	MDC	90	1 1/2"	3#2, 1#8G	RTU-15	480	3	163.00	175.00	135.51	200	MDC	90	1 1/2"	3#2, 1#8G	
RTU-16	480	3	105.20	131.50	109.32	MDC	**150**	**2"**	**3#1/0, 1#6G**	RTU-16	480	3	222.00	241.00	184.56	250	MDC	**250**	**2 1/2"**	**3#250, 1#4G**	
RTU-17	480	3	16.30	19.00	15.80	M	25	**3/4"**	**3#12, 1#10G**	RTU-17	480	3	63.60	75.80	52.87	80	**MDC2**	**80**	**1 1/4"**	**3#3, 1#8G**	
MAU-1	480	3	3.75	4.69	3.12	2HMA	**20**	**3/4"**	**3#12, 1#12G**	MAU-1	480	3	73.44	91.80	61.06	100	2HMA	**100**	**1 1/2"**	**3#2, 1#8G**	
MAU-2	480	3	3.75	4.69	3.12	2HMA	20	**3/4"**	**3#12, 1#12G**	MAU-2	480	3	40.80	51.00	33.92	60	2HMA	**60**	**1"**	**3#6, 1#10G**	
NDHU-1	480	3	78.40	98.00	81.47	EQ	80	**1 1/2"**	**3#1, 1#8G**	NDHU-1	480	3	316.40	395.50	263.04	400	**MDC2**	**400**	**3 1/2"**	**3#600, 1#3G**	
NDHU-2	480	3	154.48	193.10	160.54	MDC	200	2"	3#3/0, 1#6G	NDHU-2A	480	3	154.48	193.10	128.43	200	MDC	200	2"	3#3/0, 1#6G	
										NDHU-2B	480	3	481.14	601.42	400.00	700	**MDC2**	**700**	**(2)3"**	**(2)3#350, 1#1/0G**	
ERV-1	480	3	20.45	25.56	17.00	M	**30**	3/4"	3#10, 1#10G	ERV-1A	480	3	5.20	6.50	4.32	15	M	**15**	3/4"	3#10, 1#10G	
										ERV-1B	480	3	48.11	60.14	40.00	70	EQ	**70**	**1 1/4"**	**3#4, 1#8G**	
ERV-2	480	3	6.80	8.50	7.07	2HMA	15	3/4"	3#12, 1#12G	ERV-2A	480	3	5.20	6.50	4.32	15	2HMA	15	3/4"	3#12, 1#12G	
										ERV-2B	480	3	24.06	30.07	20.00	35	2HMA	**35**	**3/4"**	**3#8, 1#10G**	
GWH-1	120	1	4.00	5.00	0.60	1LMB	20	**3/4"**	**2#12, 1#12G**	EWH-1	480	3	173.60	217.00	144.32	225	**1HMB2**	**225**	**2 1/2"**	**3#4/0, 1#4G**	
GWH-2	120	1	4.00	5.00	0.60	1LMB	20	**3/4"**	**2#12, 1#12G**	EWH-2	480	3	173.60	217.00	144.32	225	**1HMB2**	**225**	**2 1/2"**	**3#4/0, 1#4G**	
GWH-3	120	1	9.60	12.00	1.44	1LMB	20	**3/4"**	**2#12, 1#12G**	DHWHP-1	480	3	73.80	110.00	61.35	175	**1HMB2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										DHWHP-2	480	3	73.80	110.00	61.35	175	**1HMB2**	**175**	**1 1/2"**	**3#1, 1#6G**	
HWB-1	120	1	3.10	3.90	0.47	L2A	20	**3/4"**	**2#12, 1#12G**	HWB-1-A	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
										HWB-1-B	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
HWB-2	120	1	3.10	3.90	0.47	L2A	20	**3/4"**	**2#12, 1#12G**	HWB-2-A	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
										HWB-2-B	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
HWB-3A	120	1	11.68	14.60	1.75	1LPP	20	**3/4"**	**2#12, 1#12G**	HWB-3-A	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
										HWB-3-B	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
HWB-4B	120	1	11.68	14.60	1.75	1LPP	20	**3/4"**	**2#12, 1#12G**	HWB-4-A	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
										HWB-4-B	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
HWB-5C	120	1	11.68	14.60	1.75	1LPP	20	**3/4"**	**2#12, 1#12G**	HWB-5-A	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
HWB-6D	120	1	11.68	14.60	1.75	1LPP	20	**3/4"**	**2#12, 1#12G**	HWB-5-B	480	3	120.40	150.40	100.10	175	**MDC2**	**175**	**2"**	**3#2/0, 1#6G**	
										PHP-1	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-2	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-3	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-4	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-5	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-6	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-7	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-8	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-9	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-10	480	3	73.80	110.00	61.35	175	**MDC2**	**175**	**1 1/2"**	**3#1, 1#6G**	
										EVSE-L2-1	208	2	48.00	60.00	9.98	60	**2A1-2**	**60**	**1 1/4"**	**2#4, 1#10G**	[1]
										EVSE-L2-2	208	2	48.00	60.00	9.98	60	**2A1-2**	**60**	**1 1/4"**	**2#4, 1#10G**	[1]
										EVSE-L2-3	208	2	48.00	60.00	9.98	60	**2A1-2**	**60**	**1 1/4"**	**2#4, 1#10G**	[1]
										EVSE-L3-1	480	3	60.14	75.18	50.00	80	HPA	**80**	**1 1/4"**	**3#3, 1#8G**	[2]
										EVSE-L3-2	480	3	60.14	75.18	50.00	80	HPA	**80**	**1 1/4"**	**3#3, 1#8G**	[2]
TOTALS																					

GENERAL NOTES:

A. BOLD TEXT IN 'EXISTING' COLUMNS INDICATES WORK THAT IS TO BE DEMOLISHED. BOLD TEXT IN 'NEW' COLUMNS INDICATES NEW WORK.

NUMBERED NOTES:

1. ZEFNET-60-CWS OR APPROVED EQUIVALENT. CONFIGURED FOR POWERSHARE (ONLY ONE 60A CIRCUIT REQUIRED PER (2) SINGLE PORT UNITS)
2. TRITIUM RTM50KW OR APPROVED EQUIVALENT (480V)

Rec Center Option2 - Hybrid Electrification

EXISTING ELECTRICAL CONNECTION INFORMATION										NEW ELECTRICAL CONNECTION INFORMATION										
EXISTING. EQUIP. TAG	V	PH	FLA	MCA	KVA	PANEL	CKT BRKR (AMPS)	CONDUIT	WIRE	NEW EQUIP. TAG	V	PH	FLA	MCA	KVA	MOCP	PANEL	CKT BRKR (AMPS)	CONDUIT	WIRE	NUMBERED NOTES
RTU-1	480	3	11.84	14.80	12.30	M	**40**	3/4"	**3#12, 1#10G**	RTU-1	480	3	20.30	21.60	16.88	25	M	**25**	3/4"	**3#10, 1#10G**	
RTU-2	480	3	11.84	14.80	12.30	M	**40**	3/4"	**3#12, 1#10G**	RTU-2	480	3	20.30	21.60	16.88	25	M	**25**	3/4"	**3#10, 1#10G**	
RTU-3	480	3	14.64	18.30	15.21	M	**40**	3/4"	**3#12, 1#10G**	RTU-3	480	3	20.30	21.60	16.88	25	M	**25**	3/4"	**3#10, 1#10G**	
RTU-4	480	3	22.48	28.10	23.36	M	60	**3/4"**	**3#10, 1#10G**	RTU-4	480	3	37.30	43.00	31.01	60	M	60	**1"**	**3#6, 1#10G**	
RTU-5	480	3	9.76	12.20	10.14	M	**40**	3/4"	3#12, 1#10G	RTU-5	480	3	13.10	14.30	10.89	15	M	**15**	3/4"	3#12, 1#12G	
RTU-6	480	3	9.36	11.70	9.73	M	**20**	3/4"	3#12, 1#12G	RTU-6	480	3	12.70	13.90	10.56	15	M	**15**	3/4"	3#12, 1#12G	
RTU-7	480	3	16.40	20.50	17.04	M	**30**	3/4"	3#10, 1#10G	RTU-7	480	3	20.30	21.60	16.88	25	M	**25**	3/4"	3#10, 1#10G	
RTU-8	480	3	14.64	18.30	15.21	M	**30**	3/4"	**3#12, 1#10G**	RTU-8	480	3	20.30	21.60	16.88	25	M	**25**	3/4"	**3#10, 1#10G**	
RTU-10	480	3	14.64	18.30	15.21	M	**30**	3/4"	**3#12, 1#10G**	RTU-10	480	3	20.30	21.60	16.88	25	M	**25**	3/4"	**3#10, 1#10G**	
RTU-11	480	3	41.52	51.90	43.15	M	60	1"	3#6, 1#10G	RTU-11	480	3	39.90	45.60	33.17	60	M	60	1"	3#6, 1#10G	
RTU-12	480	3	9.76	12.20	10.14	M	**30**	3/4"	3#12, 1#10G	RTU-12	480	3	13.10	14.30	10.89	15	M	**15**	3/4"	3#12, 1#12G	
RTU-13	480	3	41.52	51.90	43.15	M	60	1"	3#6, 1#10G	RTU-13	480	3	39.90	45.60	33.17	60	M	60	1"	3#6, 1#10G	
RTU-14	208	2	23.28	29.10	6.05	L2A	**30**	**3/4"**	**2#10, 1#10G**	RTU-14	480	3	12.70	13.90	10.56	15	EQ	**15**	**3/4"**	**3#12, 1#12G**	
MAU-1	480	3	3.75	4.69	3.12	2HMA	**20**	**3/4"**	**3#12, 1#12G**	MAU-1	480	3	73.44	91.80	61.06	100	2HMA	**100**	**1 1/2"**	**3#2, 1#8G**	
MAU-2	480	3	3.75	4.69	3.12	2HMA	**20**	**3/4"**	**3#12, 1#12G**	MAU-2	480	3	40.80	51.00	33.92	60	2HMA	**60**	**1"**	**3#6, 1#10G**	
NDHU-1	480	3	78.40	98.00	81.47	EQ	**80**	**1 1/2"**	**3#1, 1#8G**	NDHU-1	480	3	316.40	395.50	263.04	400	MDC	**400**	**3 1/2"**	**3#600, 1#3G**	
NDHU-2	480	3	154.48	193.10	160.54	MDC	200	2"	3#3/0, 1#6G	NDHU-2A	480	3	154.48	193.10	128.43	200	MDC	200	2"	3#3/0, 1#6G	
										NDHU-2B	480	3	481.14	601.42	400.00	700	MDC	**700**	**(2)3"**	**(2)3#350, 1#1/0G**	
ERV-1	480	3	20.45	25.56	17.00	M	**30**	3/4"	3#10, 1#10G	ERV-1A	480	3	5.20	6.50	44.32	15	M	**15**	3/4"	3#10, 1#10G	
ERV-2	480	3	6.80	8.50	7.07	2HMA	15	3/4"	3#12, 1#12G	ERV-2A	480	3	5.20	6.50	24.32	15	2HMA	15	3/4"	3#12, 1#12G	
										DWHP-1	480	3	73.80	110.00	61.35	175	EQ	**175**	**1 1/2"**	**3#1, 1#6G**	
HWB-1	120	1	3.10	3.90	0.47	L2A	**20**	**3/4"**	**2#12, 1#12G**	PHP-1	480	3	73.80	110.00	61.35	175	EQ	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-2	480	3	73.80	110.00	61.35	175	MDC	**175**	**1 1/2"**	**3#1, 1#6G**	
HWB-2	120	1	3.10	3.90	0.47	L2A	**20**	**3/4"**	**2#12, 1#12G**	PHP-3	480	3	73.80	110.00	61.35	175	MDC	**175**	**1 1/2"**	**3#1, 1#6G**	
										PHP-4	480	3	73.80	110.00	61.35	175	MDC	**175**	**1 1/2"**	**3#1, 1#6G**	
HWB-3A	120	1	11.68	14.60	1.75	1LPP	**20**	**3/4"**	**2#12, 1#12G**	PHP-5	480	3	73.80	110.00	61.35	175	MDC	**175**	**1 1/2"**	**3#1, 1#6G**	
										EVSE-L2-1	208	2	48.00	60.00	9.98	60	2A1-2	**60**	**1 1/4"**	**2#4, 1#10G**	[1]
										EVSE-L2-2	208	2	48.00	60.00	9.98	60	2A1-2	**60**	**1 1/4"**	**2#4, 1#10G**	[1]
										EVSE-L2-3	208	2	48.00	60.00	9.98	60	2A1-2	**60**	**1 1/4"**	**2#4, 1#10G**	[1]
										EVSE-L3-1	480	3	60.14	75.18	50.00	80	HPA	**80**	**1 1/4"**	**3#3, 1#8G**	[2]
										EVSE-L3-2	480	3	60.14	75.18	50.00	80	HPA	**80**	**1 1/4"**	**3#3, 1#8G**	[2]
TOTALS																					

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NUMBERED NOTES:

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2. TRITIUM RTM50KW OR APPROVED EQUIVALENT (480V)

EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE

REFER TO SCOPE TABLE FOR DEMO AND NEW SCOPE OF BRANCH CIRCUITS AND BREAKERS.

TYPICAL OF HWB AND PHP DISCONNECTS

NDHU-2B | RTU-6 | RTU-17 | RTU-1 | RTU-4 | NDHU-1 | HWB-1A | HWB-1B | HWB-2A | HWB-2B | HWB-3A | HWB-3B | HWB-4A | HWB-4B | HWB-5A | HWB-5B | PHP-1 | PHP-2 | PHP-3 | PHP-4 | PHP-5 | PHP-6 | PHP-7 | PHP-8 | PHP-9 | PHP-10

175A NEMA 3R

BESS 250KW / 990 kWh

GROUND MOUNT PV COMBINER 300KW AC (SEE SITE PLAN FOR CONDUIT ROUTING)

ROOF PV COMBINER 200KW AC (SEE SITE PLAN FOR CONDUIT ROUTING)

NEW 2,500 KVA, PROPOSED PRIMARY UTILITY XFMR 480/277V,3P,4W SECONDARY

Upsize ground mount conductors for voltage drop

Neutral shall be downsized to same size as EGC for PV circuits on this one-line

FUSED DISCO 400A

FUSED DISCO 500A

FUSED DISCO 350A

PNL 1HMB2 480Y-277V 800A

AFI= x.xxx KAIC Rating= xxKAIC

Install utility supplied meter base

util

Main breaker to be 100% rated

NEW SERVICE ENTRANCE SWBD "MDC2" 4000A, 480Y/277V, 3P, 4W, NEMA 3R, 65KA SCCR

BP#2 ADD2

L2A PANEL | L2 PANEL | L1 PANEL | EQ PANEL | H1 PANEL | M PANEL

75 KVA | 45 KVA

FRS-R 300 400/3

MDP2 1200A, 480Y/277V

ESTIMATE EVSE SCOPE (INCLUDING FEEDERS & PANEL BREAKERS) AS SEPARATE PRICE ITEM.

PNL 2A1-2 208Y-120V 225A

AFI= x.xxx KAIC Rating= xxKAIC

EVSE-L2-1

EVSE-L2-2

EVSE-L2-3

CAPACITY FOR 3 FUTURE L2 EVSE'S

208V/120V, 3Ø, 4W, 75 KVA

480V, 3Ø, 3W

EVSE-L3-1 | EVSE-L3-2

RTU-9 | RTU-15 | RTU-16 | NDHU-2

REFER TO SCOPE TABLE FOR DEMO AND NEW SCOPE OF BRANCH CIRCUITS AND BREAKERS.

PANEL 2HLA | PANEL 2LPA | PANEL 2LMA | PANEL 2HMA

T2PA 75 KVA | T2MA 45KVA

PANEL 1LPA | PANEL 1LPP | PANEL 1LMB | PANEL 1LPB | PANEL HPA | PANEL 1HLB | PANEL 1HMB

T1PA 45KVA | T1PP 75KVA | 45KVA T1MB | 75KVA T1PB

PANEL 1LPC | PANEL 1HLC | PANEL 1LMC | PANEL 1HMC

T1PC 75KVA | 30KVA T1MC

NEW 1,500 KVA, PRIMARY UTILITY XFMR 480/277V,3P,4W SECONDARY

UTILITY METER

TVSS

2500A3P | GFI | 60A3P | 400A3P SPACE | 600A3P | 70A3P | 600A3P | 30A3P | 100A3P | 125A3P | 150A3P | 150A3P | 250A3P | 400A3P | 125A3P | 30A3P | 200A3P | 60A3P | 125A3P | 400A3P

FILL OUT REMAINING SPACE WITH FULL BUSSING.

3/0 AWG CU GEC TO COLD WATER PIPE AND BUILDING STEEL. 6 AWG CU GEC TO GROUND ROD.

MDC
2500A, 277/480V,3P,4W
NEMA 3R
65,000 AIC FULLY RATED

2 E0.10 NEW ELECTRICAL ONE-LINE DIAGRAM

SCALE: NONE

OPTION 1 - FULL ELECTRIFICATION (NEW SERVICE REQUIRED)

SINK COMBS DETHLEFS
ARCHITECTURE DESIGN
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

COLORADO LICENSED KEVIN M. KEMING 43925 11-10-17 PROFESSIONAL ENGINEER

City of Louisville

innovative electrical systems, inc.
7550 West Yale Avenue, Suite B-130
Denver, Colorado 80227
V:303.988.9305 F:303.984.8603
www.iesystems-inc.com

LOUSVILLE RECREATION/ SENIOR CENTER EXPANSION

LOUISVILLE, CO 80027

SCD Project No.: 1641

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No.	Issues/Revisions:	Date
	DESIGN DEVELOPMENT	06/30/2017
	CD PROGRESS SET	08/29/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD2	BP#2 ADDENDUM #2	11/10/2017

1 | 4
2 | 3

ELECTRICAL ONE-LINE DIAGRAM

E0.10

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ALUMINUM FEEDER SCHEDULE

FEEDER NO.	FEEDER CONDUCTORS	PHASE	AMPS
EQUIPMENT FEEDERS			
E2	2[4-250KCMIL, 1/#1G, 2-1/2"C]	3-4W+G	400
E12	4-250KCMIL, 1/#4G, 2-1/2"C	3-4W+G	200
E16	4-3/0, 1/#4G, 2"C	3-4W+G	155
E17	3-2/0, 1/#4G, 2"C	3-3W+G	135
E20	4-1/0, 1/#4G, 2"C	3-4W+G	120
E23	3/#2, 1/#6G, 1-1/4"C	3-3W+G	75
E26	4/#3, 1/#6G, 1-1/4"C	3-4W+G	65
E27	3/#4, 1/#8G, 1-1/4"C	3-3W+G	55
E32	4/#8, 1/#8G, 1"C	3-4W+G	30
E37	2[4/#500KCMIL, 1/#2/OG]	3-4W+G	600
E38	4/#6, 1/#6G, 1"C	3-4W+G	30
TRANSFORMER SECONDARY			
T1	4-3/0, 1/#4G, 2"C	3-4W+G	150
T2	4-350KCMIL, 1/#2G, 3"C	3-4W+G	250
T3	4-1/0, 1/#6G, 2"C	3-4W+G	100

NOTE:

1. VD IS FOR VOLTAGE DROP
2. ALL CONDUCTORS ARE SINGLE CONDUCTOR, THWN, ALUMINUM UNLESS NOTED OTHERWISE. AMPERAGE BASED ON NEC TABLE 310.16.
3. ALL CONDUITS ARE EMT UNLESS NOTED OTHERWISE. FILL RATIOS BASED ON NEC ANNEX C, TABLE C1.

FEEDER SCHEDULE

FEEDER NO.	FEEDER CONDUCTORS	PHASE	AMPS
SERVICE ENTRANCE FEEDERS			
S1	6[4/#600KCMIL, 4" SCHEDULE 40 PVC]	3-4W	2500
EQUIPMENT FEEDERS			
C11	3-3/0, 1/#4G, 2"C	3-3W+G	200
C15	3-1/0, 1/#4G, 2"C	3-3W+G	150
C21	3/#3, 1/#6G, 1-1/4"C	3-3W+G	85
C23	3/#4, 1/#8G, 1-1/4"C	3-3W+G	70

NOTE:

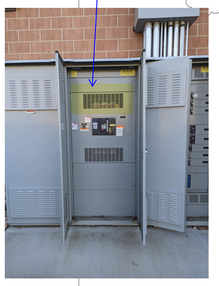
1. ALL CONDUCTORS ARE SINGLE CONDUCTOR, THWN, COPPER UNLESS NOTED OTHERWISE. AMPERAGE BASED ON NEC TABLE 310.16.
2. ALL CONDUITS ARE EMT UNLESS NOTED OTHERWISE. FILL RATIOS BASED ON NEC ANNEX C, TABLE C1.

FAULT CURRENT CALCULATION TABLE

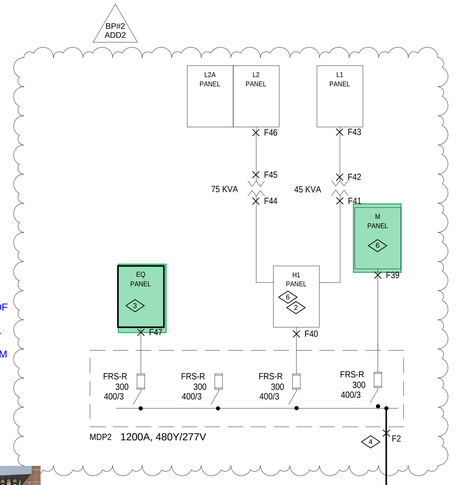
POINT	LENGTH (FT)	ISC AVAILABLE UPSTREAM	ISC AT EQUIP (I3ph) OR (IL-L)	VOLTAGE AT START (VL-L)	VOLTAGE AT END (VL-L)	% V.D. OF FEEDER	TOTAL % V.D. AT BUS
F0	-	--	33,900	--	--	--	--
F1	16	33,900	33,510	480.0	479.6	0.08%	0.08%
F2	20	33,510	31,480	479.6	479.1	0.11%	0.19%
F3	100	31,480	19,154	480.0	477.2	0.59%	0.78%
F4	27	33,510	17,831	479.6	478.9	0.16%	0.24%
F5	0	17,831	3,785	208.0	208.0	0.00%	0.00%
F6	5	3,785	3,719	208.0	207.9	0.07%	0.07%
F7	208	33,510	20,060	479.6	474.0	1.16%	1.24%
F8	8	20,060	18,564	474.0	473.8	0.05%	1.29%
F9	0	18,564	5,978	208.0	208.0	0.00%	0.00%
F10	11	5,978	5,774	208.0	207.7	0.15%	0.15%
F11	196	33,510	1,293	479.6	470.8	1.83%	1.91%
F12	193	33,510	6,649	479.6	474.5	1.07%	1.15%
F13	7	6,649	6,362	474.5	474.3	0.04%	1.20%
F14	0	6,362	3,247	208.0	208.0	0.00%	0.00%
F15	9	3,247	3,160	208.0	207.7	0.12%	0.12%
F16	196	33,510	7,797	479.6	474.2	1.13%	1.13%
F17	0	7,797	5,012	208.0	208.0	0.00%	0.00%
F18	12	5,012	4,855	208.0	207.7	0.16%	0.16%
F19	243	33,510	4,672	479.6	471.2	1.75%	1.83%
F20	185	33,510	4,872	479.6	473.3	1.32%	1.40%
F21	309	33,510	6,461	479.6	469.3	2.15%	2.23%
F22	368	33,510	7,506	479.6	467.6	2.50%	2.58%
F23	323	33,510	5,207	479.6	470.7	1.86%	1.94%
F24	0	5,207	4,402	208.0	208.0	0.00%	0.00%
F25	13	4,402	4,271	208.0	207.6	0.17%	0.17%
F26	332	33,510	1,191	479.6	470.2	1.97%	1.97%
F27	339	33,510	7,648	479.6	470.2	1.95%	2.03%
F28	7	7,648	7,066	470.2	470.1	0.04%	2.07%
F29	0	7,066	3,320	208.0	208.0	0.00%	0.00%
F30	5	3,320	3,242	208.0	207.9	0.06%	0.06%
F31	292	33,510	2,582	479.6	471.0	1.80%	1.88%
F32	284	33,510	5,799	479.6	471.8	1.64%	1.72%
F33	0	5,799	4,573	208.0	208.0	0.00%	0.00%
F34	12	4,573	4,442	208.0	207.7	0.16%	0.16%
F35	298	33,510	13,478	479.6	471.4	1.72%	1.80%
F36	7	13,478	12,346	471.4	471.2	0.04%	1.84%
F37	0	12,346	3,636	208.0	208.0	0.00%	0.00%
F38	5	3,636	3,575	208.0	207.9	0.07%	0.07%
F39	88	31,480	16,305	479.1	473.2	1.23%	1.42%
F40	5	31,480	29,577	479.1	478.7	0.07%	0.27%
F41	168	29,577	3,421	480.0	471.0	1.88%	2.15%
F42	0	3,421	2,728	208.0	208.0	0.00%	0.00%
F43	5	2,728	2,686	208.0	207.8	0.10%	0.10%
F44	10	29,577	24,051	478.7	478.2	0.11%	0.37%
F45	0	24,051	6,175	208.0	208.0	0.00%	0.00%
F46	5	6,175	6,074	208.0	207.8	0.08%	0.08%
F47	215	31,480	8,357	479.1	464.0	3.14%	3.34%

NOTES:

1. CALCULATIONS WERE PERFORMED USING BUSSMANN "POINT-TO-POINT" METHOD.
2. CALCULATIONS BASED ON A 1,500KVA XCEL TRANSFORMER WITH AN IMPEADANCE OF 5.325%



TAP OFF OF SUPPLY SIDE OF MAIN DISCONNECT FOR GROUND MOUNTED ARRAY. REQUIRES FIELD INVESTIGATION TO CONFIRM VIABILITY.



ESTIMATE EVSE SCOPE (INCLUDING FEEDERS & PANEL BREAKERS) AS SEPARATE PRICE ITEM.

REFER TO SCOPE TABLE FOR DEMO AND NEW SCOPE OF BRANCH CIRCUITS AND BREAKERS.

ROOF PV COMBINER 200KW AC (SEE SITE PLAN FOR CONDUIT ROUTING)

FUSED DISCO 350A

REFER TO SCOPE TABLE FOR DEMO AND NEW SCOPE OF BRANCH CIRCUITS AND BREAKERS.

EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE

Neutral shall be downsized to same size as EGC for PV circuits on this one-line

GROUND MOUNT PV COMBINER 300KW AC (SEE SITE PLAN FOR CONDUIT ROUTING)

BESS 250KW / 990 kWh

Upsize ground mount conductors for voltage drop

This is a single distribution section switchboard. Interconnection therefore complies with 705.12 requirements for opposite end of bus (opposite end of horizontal bus from main) when <399kW AC.

Breaker spaces verified with ABB rep. See email in SOW folder

MDC
2500A, 277/480V,3P,4W
NEMA 3R
65,000 AIC FULLY RATED

2 E0.10 NEW ELECTRICAL ONE-LINE DIAGRAM

SCALE: NONE

OPTION 2 - HYBRID ELECTRIFICATION

SINK COMBS DETHLEFS
ARCHITECTURE DESIGN
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

COLORADO LICENSED KEVIN M. SWING 43925 11-10-17 PROFESSIONAL ENGINEER

City of Louisville

innovative electrical systems, inc.
7550 West Yale Avenue, Suite B-130
Denver, Colorado 80227
V/303.988.9305 F/303.984.8603
www.iesystems-inc.com

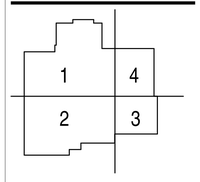
LOUSVILLE RECREATION/ SENIOR CENTER EXPANSION

LOUISVILLE, CO 80027

SCD Project No.: 1641

All information appearing herein shall not be duplicated, discharged or otherwise used without the written consent of Sink Combs Dethlefs

No.	Issues/Revisions:	Date
	DESIGN DEVELOPMENT	06/30/2017
	CD PROGRESS SET	08/29/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD2	BP#2 ADDENDUM #2	11/10/2017



ELECTRICAL ONE-LINE DIAGRAM

E0.10

SCHEMATIC DESIGN
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Switchboard: MDC

Location: | **Volts:** 480/277 Wye | **A.I.C. Rating:** 65KAIC FULLY RATED
Supply From: | **Phases:** 3 | **Mains Type:** MCB
Mounting: | **Wires:** 4 | **Mains Rating:** 2500A
Enclosure: | **MCB Rating:** 2500A/3P

Notes:

CKT	Circuit Description	# of Poles	Frame Size	Trip Rating	Load	Remarks
1	MDP2	3	600 A	600 A	353201 VA	
2	T1PA	3	100 A	70 A	26394 VA	
3	RTU-15	3	400 A	150 A	58197 VA	
4	HPA	3	400 A	400 A	358359 VA	
5	1HLB	3	60 A	60 A	8738 VA	
6	T1PB	3	200 A	125 A	57480 VA	
7	1HMB	3	200 A	150 A	46089 VA	
8	1HLC	3	60 A	60 A	9468 VA	
9	T1PC	3	200 A	125 A	53530 VA	
10	1HMC	3	200 A	150 A	89117 VA	
11	2HMA	3	400 A	400 A	205517 VA	
12	T2PA	3	200 A	125 A	52556 VA	
13	2HLA	3	200 A	200 A	28542 VA	
14	NDHU-2	3	400 A	400 A	160540 VA	
15	RTU-9	3	400 A	150 A	63518 VA	
16	RTU-16	3	400 A	250 A	110574 VA	
17						
18						
19						
20						
				Total Conn. Load:	1679638 VA	
				Total Amps:	2020 A	

Legend:

BP#2 ADD2

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Equipment	10000 VA	100.00%	10000 VA		
Existing Load	318750 VA	125.00%	398438 VA	**Total Conn. Load:**	1679638 VA
HVAC	432061 VA	100.00%	432061 VA	**Total Est. Demand:**	1814817 VA
Heating	231500 VA	125.00%	289375 VA	**Total Conn.:**	2020 A
Kitchen Equipment - Non-Dwelling Unit	6770 VA	65.00%	4401 VA	**Total Est. Demand:**	2183 A
Lighting	74175 VA	125.00%	92719 VA		
Motor	323806 VA	104.17%	337316 VA		
Other	0 VA	0.00%	0 VA		
Power	149120 VA	100.00%	149120 VA		
Receptacle	73980 VA	56.76%	41990 VA		
Owner Equipment	59800 VA	100.00%	59800 VA		

Notes:

Switchboard: MDP2

Location: ELEC. 144E | **Volts:** 480/277 Wye | **A.I.C. Rating:** 65KAIC FULLY RATED
Supply From: MDC | **Phases:** 3 | **Mains Type:** MLO
Mounting: | **Wires:** 4 | **Mains Rating:** 1200A
Enclosure: | **MCB Rating:** --

Notes:

CKT	Circuit Description	# of Poles	Frame Size	Trip Rating	Load	Remarks
1	H1	3	400 A	300 A	34621 VA	
2	EQ	3	400 A	300 A	0 VA	
3	EXISTING PEAK FROM UTILITY X 125%	3	400 A	20 A	318750 VA	
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
				Total Conn. Load:	353201 VA	
				Total Amps:	425 A	

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Existing Load	318750 VA	125.00%	398438 VA		
Kitchen Equipment - Non-Dwelling Unit	6266 VA	70.00%	4386 VA	**Total Conn. Load:**	353201 VA
Lighting	27504 VA	125.00%	34380 VA	**Total Est. Demand:**	437831 VA
Other	0 VA	0.00%	0 VA	**Total Conn.:**	425 A
Receptacle	900 VA	100.00%	900 VA	**Total Est. Demand:**	527 A

Notes:

Branch Panel: H1

Location: ELEC. 144E | **Volts:** 480/277 Wye | **A.I.C. Rating:** 14KAIC FULLY RATED
Supply From: MDP2 | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 400A
Enclosure: Type 1 | **MCB Rating:** --

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	EXISTING	20 A	1	0 VA	700 VA					1	20 A	Lighting	2
3	Lighting	20 A	1			3003...	700 VA			1	20 A	Lighting	4
5	Lighting	20 A	1					2593...	0 VA	1	20 A	EXISTING	6
7				0 VA	0 VA					1	20 A	UNIT HEATER	8
9	TENNIS COURTS	100 A	3			0 VA	0 VA			1	20 A	UNIT HEATER	10
11								0 VA	287 VA	1	20 A	Lighting [1]	12
13	Lighting	20 A	1	418 VA	1709...					1	20 A	Lighting	14
15	Spare	20 A	1			0 VA	1111...			1	20 A	Lighting	16
17	Spare	20 A	1					0 VA	0 VA	1	20 A	EXISTING	18
19	EXISTING GYM LIGHTS	20 A	1	1953...	785 VA					1	20 A	Lighting	20
21	EXISTING GYM LIGHTS	20 A	1			3600...	1001...			1	20 A	Lighting	22
23	EXISTING GYM LIGHTS	20 A	1					1993...	1084...	1	20 A	Lighting	24
25	EXISTING	20 A	1	0 VA	930 VA					1	20 A	Lighting	26
27	Spare	20 A	1			0 VA	930 VA			1	20 A	Lighting	28
29	Lighting	20 A	1					1810...	2052...	1	20 A	Lighting	30
31				0 VA	3241...								32
33	PNT L1	90 A	3			0 VA	540 VA			3	60 A	PNC L1 TRANSFORMER	34
35								0 VA	3385...				36
37	Lighting	20 A	1	510 VA	0 VA					1	20 A	EXISTING	38
39	Lighting	20 A	1			393 VA	234 VA			1	20 A	Lighting	40
41	EXISTING	20 A	1					0 VA	0 VA	1	20 A	EXISTING	42
				Total Load:	10161 VA		11379 VA		13084 VA				
				Total Amps:	37 A		42 A		48 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Kitchen Equipment - Non-Dwelling Unit	6266 VA	70.00%	4386 VA		
Lighting	27504 VA	125.00%	34380 VA	**Total Conn. Load:**	34621 VA
Other	0 VA	0.00%	0 VA	**Total Est. Demand:**	39627 VA
Receptacle	900 VA	100.00%	900 VA	**Total Conn.:**	42 A
				Total Est. Demand:	48 A

Notes:
[1] REPLACE EXISTING BREAKER WITH A NEW 20A/1P BREAKER THAT HAS A LOCKOUT.

Branch Panel: 1LPA

Location: GYM(E) 133E | **Volts:** 120/208 Wye | **A.I.C. Rating:** 10KAIC FULLY RATED
Supply From: T1PA | **Phases:** 3 | **Mains Type:** MCB
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 150A
Enclosure: Type 1 | **MCB Rating:** 150A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	Receptacle	20 A	1	180 VA	360 VA					1	20 A	Receptacle	2
3	Owner Equipment	20 A	1			250 VA	360 VA			1	20 A	Receptacle	4
5	Receptacle	20 A	1					250 VA	448 VA	1	20 A	Motor	6
7	Power	20 A	1	1000...	500 VA					1	20 A	FACP	8
9	ACC	20 A	1			500 VA	500 VA			1	20 A	SEC	10
11	Receptacle	20 A	1					940 VA	1176...	1	20 A	DAC-2 COND. PUMP	12
13	Receptacle	20 A	1	1290...	0 VA					1	20 A	Spare	14
15	Receptacle	20 A	1			720 VA							16
17								250 VA	500 VA	1	20 A	Owner Equipment	18
19	Owner Equipment	30 A	2	250 VA	360 VA					1	20 A	Receptacle	20
21						250 VA	180 VA			1	20 A	Receptacle	22
23	Owner Equipment	30 A	2					250 VA	360 VA	1	20 A	Receptacle	24
25	Receptacle	20 A	1	360 VA	360 VA					1	20 A	Receptacle	26
27	Receptacle	20 A	1			360 VA	360 VA			1	20 A	Receptacle	28
29	Receptacle	20 A	1					360 VA	360 VA	1	20 A	Receptacle	30
31	Power	20 A	1	500 VA	500 VA					1	20 A	Owner Equipment	32
33	Receptacle	20 A	1			360 VA	0 VA			1	20 A	Spare	34
35	Power	20 A	1					500 VA	500 VA	1	20 A	Owner Equipment	36
37	Receptacle	20 A	1	720 VA	800 VA					1	20 A	Owner Equipment	38
39	Owner Equipment	20 A	1			500 VA	500 VA			1	20 A	Owner Equipment	40
41	Receptacle	20 A	1					720 VA	800 VA	1	20 A	Owner Equipment	42
43	Receptacle	20 A	1	900 VA	0 VA					1	20 A	Spare	44
45	Receptacle	20 A	1			720 VA	1600...			1	20 A	Owner Equipment	46
47	Receptacle	20 A	1					900 VA	500 VA	1	20 A	Motor	48
49	Receptacle	20 A	1	360 VA	0 VA					1	20 A	Spare	50
51	Receptacle	20 A	1			900 VA	0 VA			1	20 A	Spare	52
53	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	54
55	Receptacle	20 A	1	1080...	0 VA					1	20 A	Spare	56
57	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	58
59	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	60
61	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	62
63	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	64
65	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	66
67	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	68
69	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	70
71	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	72
73	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	74
75	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	76
77	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	78
79	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	80
81	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	82
83	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	84
				Total Load:	9520 VA		8060 VA		8814 VA				
				Total Amps:	80 A		67 A		74 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	2124 VA	113.84%	2418 VA		
Power	2500 VA	100.00%	2500 VA	**Total Conn. Load:**	24894 VA
Receptacle	12420 VA	90.26%	11210 VA	**Total Est. Demand:**	23978 VA
Owner Equipment	7850 VA	100.00%	7850 VA	**Total Conn.:**	69 A
				Total Est. Demand:	67 A

Notes:

Branch Panel: 1LPP

Location: ELEC. 191 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 10KAIC FULLY RATED
Supply From: TIPP | **Phases:** 3 | **Mains Type:** MCB
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 250A
Enclosure: Type 1 | **MCB Rating:** 250A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	TEACHING POOL CHLORINE PUMP	20 A	1	1500...	1500...					1	20 A	SPLASH PAD CHLORINE PUMP	2
3	FLOW METER POWER	20 A	1			1500...	2000...			1	30 A	Motor	4
5	TEACHING POOL AIR COMPRESSOR	50 A	1					2880...	1500...	1	20 A	WHIRLPOOL FILTER CONTROL PANEL	6
7	WHIRLPOOL HEATER CIRC PUMP	20 A	1	1080...	960 VA					1	20 A	WHIRLPOOL HEATER CONTROL PANEL	8
9	GFCI	0 A	1			0 VA	0 VA			1	0 A	GFCI	10
11	WHIRLPOOL CHEMICAL CONTROLLER CPU	20 A	1					1500...	1500...	1	20 A	SPLASH PAD CHEMICAL CONTROL CPU	12
13	GFCI	0 A	1	0 VA	0 VA					1	0 A	GFCI	14
15	WHIRLPOOL CHEMICAL FEED CIRCUIT	20 A	1			1500...	1500...			1	20 A	SPLASH PAD CHEMICAL FEED CIRCUIT	16
17	GFCI	0 A	1					0 VA	0 VA	1	0 A	GFCI	18
19	LEISURE POOL FILTER CONTROL PANEL	20 A	1	1500...	0 VA					1	20 A	Spare	20
21	SPLASH PAD UV	40 A	2			1500...	1500...			2	40 A	WHIRLPOOL UV CONTROL PANEL	22
23								1500...	1500...				24
25	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	26
27	TEACHING POOL HEATER CONTROL PANEL	20 A	1			960 VA	1500...			1	20 A	WHIRLPOOL CHLORINE BOOSTER PUMP	28
29	GFCI	0 A	1					0 VA	960 VA	1	20 A	LEISURE POOL HEATER CONTOL PANEL	30
31	TEACHING POOL HEATER CIRC PUMP	20 A	1	1080...	0 VA					1	0 A	GFCI	32
33	GFCI	0 A	1			0 VA	1080...			1	20 A	LEISURE POOL HEATER CIRC PUMP	34
35	LEISURE POOL CHLORINE PUMP	20 A	1					1500...	0 VA	1	0 A	GFCI	36
37	Spare	20 A	1	0 VA	960 VA					1	20 A	SPLASH PAD HEATER CONTROL PANEL	38
39	TEACHING POOL FILTER CONTROL PANEL	20 A	1			1500...	0 VA			1	0 A	GFCI	40
41	Spare	20 A	1					0 VA	1500...	1	20 A	LEISURE POOL CHEMICAL CONTROL CPU	42
43	TEACHING POOL CHEMICAL CONTROL CPU	20 A	1	5100...	0 VA					1	0 A	GFCI	44
45	GFCI	0 A	1			0 VA	1500...			1	20 A	LEISURE POOL CHEMICAL FEED CIRCUIT	46
47	TEACHING POOL CHEMICAL FEED	20 A	1					1500...	0 VA	1	0 A	GFCI	48
49	GFCI	20 A	1	0 VA	0 VA					1	20 A	Spare	50
51	SPLASH PAD FILTER CONTROL PANEL	20 A	1			1500...	0 VA			1	20 A	Spare	52
53	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	54
55	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	56
57	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	58
59	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	60
61	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	62
63	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	64
65	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	66
67	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	68
69	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	70
71	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	72
73	Space	--	--	0 VA	0 VA					--	--	Space	74
75	Space	--	--			0 VA	0 VA			--	--	Space	76
77	Space	--	--					0 VA	0 VA	--	--	Space	78
79	Space	--	--	0 VA	0 VA					--	--	Space	80
81	Space	--	--			0 VA	0 VA			--	--	Space	82
83	Space	--	--					0 VA	0 VA	--	--	Space	84
				Total Load:	13680 VA		17540 VA		15840 VA				
				Total Amps:	114 A		149 A		135 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	11240 VA	104.45%	11740 VA		
Power	35820 VA	100.00%	35820 VA	**Total Conn. Load:**	47060 VA
				Total Est. Demand:	47560 VA
				Total Conn.:	131 A
				Total Est. Demand:	132 A

Notes:

Branch Panel: HPA

Location: ELEC. 191 | **Volts:** 480/277 Wye | **A.I.C. Rating:** 35KAIC FULLY RATED
Supply From: MDC | **Phases:** 3 | **Mains Type:** MCB
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 600A
Enclosure: Type 1 | **MCB Rating:** 600A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1				1368...	2400...								2
3	TIPP	125 A	3			1754...	2400...			3	150 A	STEAM GENERATOR	4
5								1584...	2400...				6
7				7482...	942 VA								8
9	P1A-TEACH POOL FILTER	50 A	3			7482...	942 VA			3	15 A	P2A TEACHING JET PUMP	10
11								7482...	942 VA				12
13				2000...	9422...								14
15	TEACHING POOL UV	40 A	3			2000...	9422...			3	70 A	LEISURE POOL FILTER PUMP	16
17								2000...	9422...				18
19				1801...	9422...								20
21	LEISURE POOL PROPULSION PUMP	150 A	3			1801...	9422...			3	70 A	LEISURE POOL ACTIVITY PUMP	22
23								1801...	9422...				24
25				5820...	2000...								26
27	SLIDE PUMP	40 A	3			5820...	2000...			3	40 A	LEISURE POOL UV	28
29								5820...	2000...				30
31				7482...	7482...								32
33	WHIRLPOOL FILTER PUMP	50 A	3			7482...	7482...			3	50 A	WHIRLPOOL JET PUMP	34
35								7482...	7482...				36
37				5820...	3880...								38
39	SPLASH PAD CIRC PUMP	40 A	3			5820...	3880...			3	30 A	SPLASH PAD ACTIVITY PUMP	40
41								5820...	3880...				42
43	Space	--	--	0 VA	0 VA					--	--	Space	44
45	Space	--	--			0 VA	0 VA			--	--	Space	46
47	Space	--	--					0 VA	0 VA	--	--	Space	48
49	Space	--	--	0 VA	0 VA					--	--	Space	50
51	Space	--	--			0 VA	0 VA			--	--	Space	52
53	Space	--	--					0 VA	0 VA	--	--	Space	54
55	Space	--	--	0 VA	0 VA					--	--	Space	56
57	Space	--	--			0 VA	0 VA			--	--	Space	58
59	Space	--	--					0 VA	0 VA	--	--	Space	60
				Total Load:	117446 VA		121306 VA		119606 VA				
				Total Amps:	424 A		439 A		433 A				

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	238539 VA	105.66%	252049 VA		
Power	119820 VA	100.00%	119820 VA	**Total Conn. Load:**	358359 VA
				Total Est. Demand:	371869 VA
				Total Conn.:	431 A
				Total Est. Demand:	447 A

Notes:

EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE

SINK COMBS DETHLEFS
ARCHITECTURE DESIGN
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

COLORADO LICENSED
KEVIN M. SINK
43925
11-10-17
PROFESSIONAL ENGINEER

City of Louisville

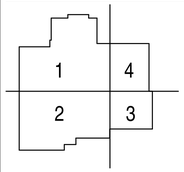
innovative electrical systems, inc.
7550 West Yale Avenue, Suite B-130
Denver, Colorado 80227
V/303.988.9305 F/303.984.8603
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LOUSVILLE RECREATION/ SENIOR CENTER EXPANSION
LOUISVILLE, CO 80027

SCD Project No.: 1641

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No.	Issues/Revisions:	Date
	DESIGN DEVELOPMENT	06/30/2017
	CD PROGRESS SET	08/29/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD2	BP#2 ADDENDUM #2	11/10/2017



ELECTRICAL PANEL SCHEDULES

E0.60

SEPEMNT 5/5/2017
11:26:07 12:42:21 PM
C:\Users\kevin\Desktop\20160505.00 Louisville Rec Center\Elec\Louisville Recreation Center Electrical 2017.rvt

Branch Panel: 1HLB

Location: ELEC. 191
Supply From: MDC
Mounting: Surface
Enclosure: Type 1

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 30A
MCB Rating: 30A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	Lighting	20 A	1	188 VA	993 VA					1	20 A	Lighting	2
3	Lighting	20 A	1			2118...	1943...			1	20 A	Lighting	4
5	Lighting	20 A	1					2339...	0 VA	1	20 A	Spare	6
7	Lighting	20 A	1	1157...	0 VA					1	20 A	Spare	8
9	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	10
11	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	12
13	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	14
15	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	16
17	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	18
19	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	20
21	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	22
23	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	24
25	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	26
27	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	28
29	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	30
		Total Load:		2338 VA		4061 VA		2339 VA					
		Total Amps:		8 A		15 A		8 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting	8738 VA	125.00%	10922 VA		
Other	0 VA	0.00%	0 VA	**Total Conn. Load:**	8738 VA
				Total Est. Demand:	10922 VA
				Total Conn.:	11 A
				Total Est. Demand:	13 A

Notes:

Branch Panel: 1LPB

Location: ELEC. 191
Supply From: T1PB
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 10KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 250A
MCB Rating: 250A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	Receptacle	20 A	1	180 VA	360 VA					1	20 A	Receptacle	2
3	Receptacle	20 A	1			360 VA	540 VA			1	20 A	Receptacle	4
5	Receptacle	20 A	1					180 VA	800 VA	1	20 A	Owner Equipment	6
7	Owner Equipment	20 A	1	504 VA	540 VA					1	20 A	Receptacle	8
9	Receptacle	20 A	1			720 VA	540 VA			1	20 A	Receptacle	10
11	Owner Equipment	20 A	1					1500...	360 VA	1	20 A	Receptacle	12
13	Owner Equipment	20 A	1	1000...	1200...					1	20 A	Receptacle	14
15	Receptacle	20 A	1			940 VA	1000...			1	20 A	Owner Equipment	16
17	Receptacle	20 A	1					540 VA	720 VA	1	20 A	Receptacle	18
19	Receptacle	20 A	1	1260...	0 VA					1	20 A	Spare	20
21	Receptacle	20 A	1			1120...	0 VA			1	20 A	Spare	22
23	Receptacle	20 A	1					900 VA	940 VA	1	20 A	Receptacle	24
25	Receptacle	20 A	1	360 VA	540 VA					1	20 A	Receptacle	26
27	Receptacle	20 A	1			1120...	1500...			1	20 A	Owner Equipment	28
29	Owner Equipment	20 A	1					1000...	1120...	1	20 A	Receptacle	30
31	Receptacle	20 A	1	720 VA	900 VA					1	20 A	Receptacle	32
33	Motor	20 A	1			1176...	200 VA			1	20 A	Owner Equipment	34
35	Receptacle	20 A	1					1120...	1500...	1	20 A	Owner Equipment	36
37	Receptacle	20 A	1	940 VA	1000...					1	20 A	Owner Equipment	38
39	Receptacle	20 A	1			540 VA	0 VA			1	20 A	Spare	40
41	Motor	20 A	1					500 VA	540 VA	1	20 A	Motor	42
43	Receptacle	20 A	1	1120...	5000...					2	70 A	Power	44
45	Spare	20 A	1			0 VA	5000...						46
47	Receptacle	20 A	1					720 VA	540 VA	1	20 A	Receptacle	48
49	Receptacle	20 A	1	1120...	1500...					1	20 A	Owner Equipment	50
51	Equipment	30 A	2			2500...	2500...			2	30 A	Equipment	52
53								2500...	2500...				54
55	Owner Equipment	20 A	1	1500...	0 VA					1	20 A	Spare	56
57	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	58
59	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	60
61	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	62
63	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	64
65	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	66
67	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	68
69	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	70
71	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	72
73	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	74
75	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	76
77	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	78
79	Space	--	--	0 VA	0 VA					--	--	Space	80
81	Space	--	--			0 VA	0 VA			--	--	Space	82
83	Space	--	--					0 VA	0 VA	--	--	Space	84
		Total Load:		19744 VA		19756 VA		17980 VA					
		Total Amps:		167 A		167 A		150 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Equipment	10000 VA	100.00%	10000 VA		
Kitchen Equipment - Non-Dwelling Unit	504 VA	100.00%	504 VA	**Total Conn. Load:**	57480 VA
Motor	1676 VA	117.54%	1970 VA	**Total Est. Demand:**	53324 VA
Power	10000 VA	100.00%	10000 VA	**Total Conn.:**	160 A
Receptacle	18900 VA	76.46%	14450 VA	**Total Est. Demand:**	148 A
Owner Equipment	16400 VA	100.00%	16400 VA		

Notes:

Branch Panel: 1HMB

Location: ELEC. 191
Supply From: MDC
Mounting: Surface
Enclosure: Type 1

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 100A
MCB Rating: 100A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1					9975...	1833...							2
3	T1MB	70 A	3				9995...	1833...		3	15 A	VAV 9.7	4
5									1062...	1833...			6
7					3333...	0 VA					1	20 A	Spare	8
9	CUH-3	20 A	3				3333...	0 VA			1	20 A	Spare	10
11									3333...	0 VA	1	20 A	Spare	12
13	Spare	20 A	1	0 VA	0 VA						1	20 A	Spare	14
15	Spare	20 A	1			0 VA	0 VA				1	20 A	Spare	16
17	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	18
19	Spare	20 A	1	0 VA	0 VA						1	20 A	Spare	20
21	Spare	20 A	1			0 VA	0 VA				1	20 A	Spare	22
23	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	24
25	Spare	20 A	1	0 VA	0 VA						1	20 A	Spare	26
27	Spare	20 A	1			0 VA	0 VA				1	20 A	Spare	28
29	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	30
31	Space	--	--	0 VA	0 VA					--	--	Space	32
33	Space	--	--			0 VA	0 VA			--	--	Space	34
35	Space	--	--					0 VA	0 VA	--	--	Space	36
37	Space	--	--	0 VA	0 VA					--	--	Space	38
39	Space	--	--			0 VA	0 VA			--	--	Space	40
41	Space	--	--					0 VA	0 VA	--	--	Space	42
		Total Load:		15141 VA		15161 VA		15786 VA					
		Total Amps:		55 A		55 A		57 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	1000 VA	100.00%	1000 VA		
Heating	31000 VA	125.00%	38750 VA	**Total Conn. Load:**	46089 VA
Motor	12589 VA	104.95%	13213 VA	**Total Est. Demand:**	54463 VA
Power	1500 VA	100.00%	1500 VA	**Total Conn.:**	55 A
				Total Est. Demand:	66 A

Notes:

Branch Panel: 1LPC

Location: ELEC 167
Supply From: T1PC
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 10KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 250A
MCB Rating: 250A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	Power	20 A	1	500 VA	500 VA					1	20 A	Power	2
3	Receptacle	20 A	1			180 VA	430 VA			1	20 A	Owner Equipment	4
5	Receptacle	20 A	1					180 VA	720 VA	1	20 A	Receptacle	6
7	Owner Equipment	20 A	1	100 VA	430 VA					1	20 A	Owner Equipment	8
9	Receptacle	20 A	1			540 VA	900 VA			1	20 A	Receptacle	10
11	Receptacle	20 A	1					970 VA	1000...	1	20 A	Owner Equipment	12
13	Receptacle	20 A	1	540 VA	800 VA					1	20 A	Owner Equipment	14
15	Owner Equipment	20 A	1			1000...	1080...			1	20 A	Receptacle	16
17	Receptacle	20 A	1					1080...	1160...	1	20 A	Receptacle	18
19	Owner Equipment	20 A	1	980 VA	1300...					1	20 A	Owner Equipment	20
21	Receptacle	20 A	1			180 VA	180 VA			1	20 A	Receptacle	22
23	Owner Equipment	20 A	1					1600...	2000...	1	30 A	Motor	24
25	Owner Equipment	20 A	1	1500...	180 VA					1	20 A	Receptacle	26
27	Owner Equipment	30 A	2			1500...	180 VA			1	20 A	Receptacle	28
29								1500...	180 VA	1	20 A	Receptacle	30
31	Receptacle	20 A	1	180 VA	180 VA					1	20 A	Receptacle	32
33	Receptacle	20 A	1			360 VA	360 VA			1	20 A	Receptacle	34
35	Receptacle	20 A	1					180 VA	180 VA	1	20 A	Receptacle	36
37	Receptacle	20 A	1	360 VA	360 VA					1	20 A	Receptacle	38
39	Receptacle	20 A	1			360 VA	500 VA			1	20 A	Power	40
41	Receptacle	20 A	1					360 VA	360 VA	1	20 A	Receptacle	42
43	Motor	20 A	1	360 VA	540 VA					1	20 A	Receptacle	44
45	Receptacle	20 A	1			540 VA	720 VA			1	20 A	Receptacle	46
47	Receptacle	20 A	1	540 VA	720 VA					1	20 A	Receptacle	48
49	Receptacle	20 A	1			720 VA	1000...			1	20 A	Power	52
51	Receptacle	20 A	1					720 VA	720 VA	1	20 A	Receptacle	54
53	Owner Equipment	20 A	1	1000...	1000...					1	20 A	Owner Equipment	56
55	Owner Equipment	20 A	1	1000...	500 VA					1	20 A	Power	58
57	Power	20 A	1			1000...	1000...			1	20 A	Owner Equipment	60
59	Power	70 A	2	5000...	180 VA					1	20 A	Receptacle	62
61						5000...	1080...			1	20 A	Receptacle	64
63	Receptacle	20 A	1					1080...	1080...	1	20 A	Receptacle	66
65	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	68
67	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	70
69	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	72
71	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	74
73	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	76
75	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	78
77	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	80
79	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	82
81	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	84
		Total Load:		17250 VA		18310 VA		17970 VA					
		Total Amps:		144 A		154 A		151 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	2000 VA	125.00%	2500 VA		
Power	14000 VA	100.00%	14000 VA	**Total Conn. Load:**	53530 VA
Receptacle	21780 VA	72.96%	15890 VA	**Total Est. Demand:**	48140 VA
Owner Equipment	15750 VA	100.00%	15750 VA	**Total Conn.:**	149 A
				Total Est. Demand:	134 A

Notes:

EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE

Branch Panel: 1LMB

Location: ELEC. 191
Supply From: T1MB
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 10KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 150A
MCB Rating: 150A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	DDC	20 A	1	500 VA	786 VA					1	20 A	TF-2	2
3	Motor	20 A	1			528 VA	100 VA			1	20 A	Power	4
5	EWC	20 A	1					656 VA	796 VA	1	20 A	EF-5	6
7	Motor	20 A	1	796 VA	1176...					1	20 A	Motor	8
9	GWH-2	20 A	1			500 VA	1250...			2	20 A	VAV 9.6	10
11	SE-1	20 A	1					2495...	1250...				12
13	Motor	20 A	2	200 VA	1000...					2	15 A	VAV 9.3	14
15						200 VA	1000...						16
17	Power	20 A	1					100 VA	500 VA	1	20 A	Power	18
19	VAV 9.4	15 A	2	1000...	1250...					2	20 A	VAV 9.5	20
21						1000...	1250...						22
23	Spare	20 A	1					0 VA	656 VA	1	20 A	Motor	24
25	Power	20 A	1	100 VA	500 VA					1	20 A	GWH-1	26
27	VAV 9.2	20 A	2			1500...	1167...			3	15 A	VAV 9.1	28
29								1500...	1167...				30
31	Motor	20 A	1	1500...	1167...								32
33	Motor	20 A	1			1500...	0 VA			1	20 A	Spare	34
35	Motor	20 A	1					1500...	0 VA	1	20 A	Spare	36
37	Space	--	--	0 VA	0 VA					--	--	Space	38
39	Space	--	--			0 VA	0 VA			--	--	Space	40
41	Space	--	--					0 VA	0 VA	--	--	Space	42
		Total Load:		9975 VA		9995 VA		10620 VA					
		Total Amps:		83 A		83 A		89 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	1000 VA	100.00%	1000 VA		
Heating	15500 VA	125.00%	19375 VA	**Total Conn. Load:**	30589 VA
Motor	12589 VA	104.95%	13213 VA	**Total Est. Demand:**	35088 VA
Power	1500 VA	100.00%	1500 VA	**Total Conn.:**	85 A
				Total Est. Demand:	97 A

Notes:

Branch Panel: 1HLC

Location: ELEC 167
Supply From: MDC
Mounting: Surface
Enclosure: Type 1

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 30A
MCB Rating: 30A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	Lighting	20 A	1	455 VA	2518...					1	20 A	Lighting	2
3	Lighting	20 A	1			1065...	1834...			1	20 A	Lighting	4
5	Lighting	20 A	1					1507...	2025...	1	20 A	Lighting	6
7	Lighting [1]	20 A	1	82 VA	0 VA					1	20 A	Spare	8
9	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	10
11	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	12
13	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	14
15	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	16
17	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	18
19	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	20
21	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	22
23	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	24
25	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	26
27	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	28
29	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	30
		Total Load:		3044 VA		2899 VA		3528 VA					
		Total Amps:		11 A		10 A		13 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting	9468 VA	125.00%	11835 VA		
Other	0 VA	0.00%	0 VA	**Total Conn. Load:**	9468 VA
				Total Est. Demand:	11835 VA
				Total Conn.:	11 A
				Total Est. Demand:	14 A

Notes:
[1] PROVIDE A BREAKER WITH A LOCKOUT.

Branch Panel: 1HMC

Location: ELEC 167
Supply From: MDC
Mounting: Surface
Enclosure: Type 1

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 200A
MCB Rating: 200A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1					7202...	3500...							2
3	T1MC	50 A	3				7073...	3500...		3	20 A	VAV 9.9	4
5									7843...	3500...			6
7					2333...	3500...							8
9	VAV 9.8	15 A	3				2333...	3500...			3	20 A	VAV 9.10	10
11									2333...	3500...			12
13					3667...	6000...							14
15	VAV 9.12	20 A	3				3667...	6000...			3	30 A	CUH-1	16
17									3667...	6000...			18
19					3333...	0 VA					1	20 A	Spare	20
21	CUH-2	20 A	3				3333...	0 VA			1	20 A	Spare	22
23									3333...	0 VA	1	20 A	Spare	24
25	Spare	20 A	1	0 VA	0 VA						--	--	Space	26
27	Spare	20 A	1			0 VA	0 VA				--	--	Space	28
29	Spare	20 A	1					0 VA	0 VA	--	--	Space	30
31	Space	--	--	0 VA	0 VA					--	--	Space	32
33	Space	--	--			0 VA	0 VA			--	--	Space	34
35	Space	--	--					0 VA	0 VA	--	--	Space	36
37	Space	--	--	0 VA	0 VA					--	--	Space	38
39	Space	--	--			0 VA	0 VA			--	--	Space	40
41	Space	--	--					0 VA	0 VA	--	--	Space	42
		Total Load:		29535 VA		29406 VA		30176 VA					
		Total Amps:		107 A		106 A		109 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	1176 VA	100.00%	1176 VA		
Heating	78500 VA	125.00%	98125 VA	**Total Conn. Load:**	89117 VA
Motor	9441 VA	101.74%	9605 VA	**Total Est. Demand:**	108906 VA
				Total Conn.:	107 A
				Total Est. Demand:	131 A

Notes:

SINK COMBS DETHLEFS
ARCHITECTURE DESIGN
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

COLORADO LICENSED
KEVIN M. COMBS
43925
11-10-17
PROFESSIONAL ENGINEER

City of Louisville

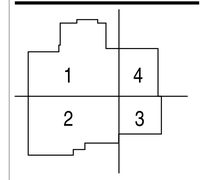
innovative electrical systems, inc.
7550 West Yale Avenue, Suite B-130
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V/303.988.9305 F/303.984.8603
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LOUSVILLE RECREATION/ SENIOR CENTER EXPANSION
LOUISVILLE, CO 80027

SCD Project No.: 1641

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No.	Issues/Revisions:	Date
	DESIGN DEVELOPMENT	06/30/2017
	CD PROGRESS SET	08/29/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD2	BP#2 ADDENDUM #2	11/10/2017



ELECTRICAL PANEL SCHEDULES

E0.61

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11-8-2017 1:52:23 PM
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Branch Panel: 1LMC

Location: ELEC 167
Supply From: T1MC
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 10KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 100A
MCB Rating: 100A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	TF-1, CUH-3	20 A	1	285 VA	1250...					2	20 A	VAV 9.15	2
3	Motor	20 A	1			656 VA	1250...						4
5	DAC-1 COND. PUMP	20 A	1					1176...	2500...	1	30 A	VAV 9.11	6
7	VAV 9.14	20 A	2	1500...	1167...								8
9						1500...	1167...			3	15 A	VAV 9.13	10
11	Motor	20 A	1					1500...	1167...				12
13	Motor	20 A	1	1500...	0 VA					1	20 A	Spare	14
15	Motor	20 A	1			1500...	0 VA			1	20 A	Spare	16
17	Motor	20 A	1					1500...	0 VA	1	20 A	Spare	18
19	Motor	20 A	1	1500...	0 VA					1	20 A	Spare	20
21	Motor	20 A	1			1000...	0 VA			1	20 A	Spare	22
23	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	24
25	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	26
27	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	28
29	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	30
31	Space	--	--	0 VA	0 VA					--	--	Space	32
33	Space	--	--			0 VA	0 VA			--	--	Space	34
35	Space	--	--					0 VA	0 VA	--	--	Space	36
37	Space	--	--	0 VA	0 VA					--	--	Space	38
39	Space	--	--			0 VA	0 VA			--	--	Space	40
41	Space	--	--					0 VA	0 VA	--	--	Space	42
		Total Load:		7202 VA		7073 VA		7843 VA					
		Total Amps:		60 A		59 A		66 A					

BP#2 ADD2

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	1176 VA	100.00%	1176 VA		
Heating	11500 VA	125.00%	14375 VA	**Total Conn. Load:**	22117 VA
Motor	9441 VA	101.74%	9605 VA	**Total Est. Demand:**	25156 VA
				Total Conn.:	61 A
				Total Est. Demand:	70 A

Notes:

Branch Panel: 2HLA

Location: ELEC. 209
Supply From: MDC
Mounting: Surface
Enclosure: Type 1

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 60A
MCB Rating: 60A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	Lighting	20 A	1	616 VA	1516...					1	20 A	Lighting	2
3	Lighting	20 A	1			924 VA	1536...			1	20 A	Lighting	4
5	Lighting	20 A	1					1584...	1716...	1	20 A	Lighting	6
7	Lighting	20 A	1	2866...	4290...					1	20 A	Lighting	8
9	Lighting	20 A	1			3411...	2145...			1	20 A	Lighting	10
11	Lighting	20 A	1					2305...	2145...	1	20 A	Lighting	12
13	EXISTING POOL LIGHTS	20 A	1	1520...	1900...					1	20 A	EXISTING POOL LIGHTS	14
15	Lighting [1]	20 A	1			380 VA	0 VA			1	20 A	Spare	16
17	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	18
19	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	20
21	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	22
23	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	24
25	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	26
27	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	28
29	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	30
		Total Load:		12553 VA		8344 VA		7669 VA					
		Total Amps:		46 A		31 A		28 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Lighting	28542 VA	125.00%	35678 VA		
Other	0 VA	0.00%	0 VA	**Total Conn. Load:**	28542 VA
				Total Est. Demand:	35678 VA
				Total Conn.:	34 A
				Total Est. Demand:	43 A

Notes:
[1] PROVIDE BREAKER WITH A LOCKOUT.

Branch Panel: 2LPA

Location: ELEC. 209
Supply From: T2PA
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 10KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 250A
MCB Rating: 250A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	Owner Equipment	20 A	1	50 VA	820 VA					1	20 A	Receptacle	2
3	Owner Equipment	20 A	1			500 VA	1040...			1	20 A	Receptacle	4
5	Owner Equipment	20 A	1					610 VA	1080...	1	20 A	Receptacle	6
7	Receptacle	20 A	1	940 VA	1000...					1	20 A	Motor	8
9	Receptacle	20 A	1			900 VA	900 VA			1	20 A	Receptacle	10
11	Motor	20 A	1					1176...	250 VA	2	30 A	Owner Equipment	12
13	Receptacle	20 A	1	360 VA	250 VA								14
15	Receptacle	20 A	1			360 VA	360 VA			1	20 A	Receptacle	16
17	Receptacle	20 A	1					1220...	360 VA	1	20 A	Receptacle	18
19	Receptacle	20 A	1	360 VA	500 VA					1	20 A	Owner Equipment	20
21	Power	20 A	1			500 VA	540 VA			1	20 A	Receptacle	22
23	Receptacle	20 A	1					540 VA	540 VA	1	20 A	Receptacle	24
25	Receptacle	20 A	1	540 VA	540 VA					1	20 A	Receptacle	26
27	Receptacle	20 A	1			540 VA	540 VA			1	20 A	Receptacle	28
29	Receptacle	20 A	1					540 VA	540 VA	1	20 A	Receptacle	30
31	Receptacle	20 A	1	540 VA	540 VA					1	20 A	Receptacle	32
33	Receptacle	20 A	1			540 VA	540 VA			1	20 A	Receptacle	34
35	Receptacle	20 A	1					540 VA	720 VA	1	20 A	Receptacle	36
37	Receptacle	20 A	1	540 VA	720 VA					1	20 A	Receptacle	38
39	Receptacle	20 A	1			720 VA	1000...			1	20 A	Owner Equipment	40
41	Owner Equipment	20 A	1					1000...	1500...	1	20 A	Owner Equipment	42
43	Motor	20 A	1	1000...	1500...					1	20 A	Owner Equipment	44
45	Owner Equipment	20 A	1			1500...	1500...			1	20 A	Owner Equipment	46
47	Owner Equipment	20 A	1					1500...	1500...	1	20 A	Owner Equipment	48
49	Owner Equipment	20 A	1	1500...	1500...					1	20 A	Owner Equipment	50
51	Owner Equipment	20 A	1			1500...	1500...			1	20 A	Motor	52
53	Owner Equipment	20 A	1					1500...	1500...	1	20 A	Motor	54
55	Motor	20 A	1	1500...	500 VA					1	20 A	SEC	56
57	Motor	20 A	1			1500...	0 VA			1	20 A	Spare	58
59	Receptacle	20 A	1					720 VA	0 VA	1	20 A	Spare	60
61	Motor	20 A	1	1500...	0 VA					1	20 A	Spare	62
63	Motor	20 A	1			1500...	0 VA			1	20 A	Spare	64
65	Receptacle	20 A	1					540 VA	0 VA	1	20 A	Spare	66
67	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	68
69	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	70
71	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	72
73	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	74
75	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	76
77	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	78
79	Spare	20 A	1	0 VA	0 VA					1	20 A	Spare	80
81	Spare	20 A	1			0 VA	0 VA			1	20 A	Spare	82
83	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	84
		Total Load:		16700 VA		17980 VA		17876 VA					
		Total Amps:		139 A		151 A		150 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Motor	12176 VA	102.41%	12470 VA		
Power	1000 VA	100.00%	1000 VA	**Total Conn. Load:**	52056 VA
Receptacle	19080 VA	76.21%	14540 VA	**Total Est. Demand:**	47810 VA
Owner Equipment	19800 VA	100.00%	19800 VA	**Total Conn.:**	144 A
				Total Est. Demand:	133 A

Notes:

Branch Panel: 2HMA

Location: ELEC. 209
Supply From: MDC
Mounting: Surface
Enclosure: Type 1

Volts: 480/277 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 35KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 400A
MCB Rating: 400A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1				1118...	8333...								2
3	T2MA	70 A	3			1162...	8333...			3	40 A	VAV 16.2	4
5								1066...	8333...				6
7				8333...	4500...								8
9	VAV 16.1	40 A	3			8333...	4500...			3	25 A	VAV 16.4	10
11								8333...	4500...				12
13				4167...	3833...								14
15	VAV 16.3	20 A	3			4167...	3833...			3	20 A	VAV 16.7	16
17								4167...	3833...				18
19				3833...	5167...								20
21	VAV 16.6	20 A	3			3833...	5167...			3	25 A	VAV 16.8	22
23								3833...	5167...				24
25				2167...	5265...								26
27	VAV 16.9	15 A	3			2167...	5265...			3	30 A	HVAC	28
29								2167...	5265...				30
31				7759...	2078...								32
33	EF-NDHU-A,B	60 A	3			7759...	2078...			3	20 A	MAU-1,2	34
35								7759...	2078...				36
37				1912...	0 VA					1	20 A	Spare	38
39	ERV-2	15 A	3			1912...	0 VA			1	20 A	Spare	40
41								1912...	0 VA	1	20 A	Spare	42
43	Spare	20 A	1	0 VA	0 VA					--	--	Space	44
45	Spare	20 A	1			0 VA	0 VA			--	--	Space	46
47	Spare	20 A	1					0 VA	0 VA	--	--	Space	48
49	Space	--	--	0 VA	0 VA					--	--	Space	50
51	Space	--	--			0 VA	0 VA			--	--	Space	52
53	Space	--	--					0 VA	0 VA	--	--	Space	54
55	Space	--	--	0 VA	0 VA					--	--	Space	56
57	Space	--	--			0 VA	0 VA			--	--	Space	58
59	Space	--	--					0 VA	0 VA	--	--	Space	60
		Total Load:		68533 VA		68969 VA		68016 VA					
		Total Amps:		248 A		249 A		246 A					

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	37056 VA	100.00%	37056 VA		
Heating	122000 VA	125.00%	152500 VA	**Total Conn. Load:**	205517 VA
Motor	45261 VA	106.43%	48171 VA	**Total Est. Demand:**	238927 VA
Power	300 VA	100.00%	300 VA	**Total Conn.:**	247 A
Receptacle	900 VA	100.00%	900 VA	**Total Est. Demand:**	287 A

Notes:

Branch Panel: 2LMA

Location: CIRCULATION 208
Supply From: T2MA
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 10KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 150A
MCB Rating: 150A/3P

Notes:

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	Power	20 A	1	100 VA	350 VA					1	20 A	EF-12	2
3	Power	20 A	1			200 VA	0 VA			1	20 A	Spare	4
5	TF-3	20 A	1					285 VA	350 VA	1	20 A	EF-9	6
7	EF-13	20 A	1	656 VA	656 VA					1	20 A	EWC	8
9	EF-2	20 A	1			1656...	656 VA			1	20 A	Motor	10
11	VAV 16.5	20 A	1					1000...	696 VA	1	20 A	KEF-1	12
13	Motor	20 A	1	786 VA	400 VA					2	20 A	Motor	14
15	EF-6	20 A	1			1176...	400 VA						16
17	Motor	20 A	1					656 VA	800 VA	2	20 A	CF-1,2,3,4,5,6	18
19	Motor	20 A	2	400 VA	800 VA								20
21						400 VA	1352...			2	20 A	ACCU-2	22
23	EF-7	20 A	1					1176...	1352...				24
25	EWC	20 A	1	656 VA	1176...					1	20 A	DAC-3 COND. PUMP	26
27	EF-1	20 A	1			1428...	0 VA			1	20 A	Spare	28
29	Spare	20 A	1					0 VA	1352...	2	20 A	ACCU-3	30
31	ACCU-1	20 A	2	1352...	1352...								32
33						1352...	1500...			1	20 A	Motor	34
35	Motor	20 A	1					1500...	1500...	1	20 A	Motor	36
37	Motor	20 A	1	1500...	1000...					1	20 A	Motor	38
39	Motor	20 A	1			1500...	0 VA			1	20 A	Spare	40
41	Spare	20 A	1					0 VA	0 VA	1	20 A	Spare	42
		Total Load:		11184 VA		11620 VA		10667 VA					
		Total Amps:		94 A		97 A		89 A					

BP#2 ADD2

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
HVAC	9288 VA	100.00%	9288 VA		
Heating	1000 VA	125.00%	1250 VA	**Total Conn. Load:**	33471 VA
Motor	21983 VA	101.88%	22397 VA	**Total Est. Demand:**	34135 VA
Power	300 VA	100.00%	300 VA	**Total Conn.:**	93 A
Receptacle	900 VA	100.00%	900 VA	**Total Est. Demand:**	95 A

Notes:

Branch Panel: L1

Location: BROOKS MULTIPURPOSE 110
Supply From: 45
Mounting: Surface
Enclosure: Type 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 10KAIC FULLY RATED
Mains Type: MCB
Mains Rating: 150A
MCB Rating: 150A/3P

Notes:
EXISTING PANEL. ONLY NEW LOADS ARE INDICATED. LOAD REMOVED IS GREATER THAN LOAD ADDED.

CKT	Circuit Description	Trip	Poles	A		B		C		Poles	Trip	Circuit Description	CKT
1	EXISTING RECEP, CLASSROOM	20 A	1	0 VA	0 VA					1	20 A	EXISSTING DRYER	2
3	EXISTING RECEP, CLASSROOM	20 A	1			0 VA	0 VA			1	20 A	EXISTING DRYER	4
5	EXISTING RECEP PARAMOUNT	20 A	1					0 VA	0 VA	1	20 A	EXISTING SIGN	6
7	EXISTING RECEP SPECIAL, OFFICES	20 A	1	0 VA	0 VA					1	20 A	EXISTING RECEPTACLE	8
9	EXISTING RECEP SPECIAL, OFFICES	20 A	1			0 VA	0 VA			1	20 A	EXISTING RECEPTACLE	10
11	EXISTING RECEP WEIGHTS, COPIER	20 A	1					0 VA	0 VA	1	20 A	EXISTING RECEPTACLE	12
13	EXISTING POOL ROOM EWC	20 A	1	0 VA	0 VA					1	20 A	EXISTING KITCHEN RECEP	14
15	EXISTING DESK HEATER SOUTH	20 A	1			0 VA	0 VA			1	20 A	EXISTING KITCHEN RECEP	16
17	EXISTING DESK HEATER NORTH	20 A	1					0 VA	0 VA	2	50 A	**SPARE**	18
19	**Receptacle**	20 A	1	360 VA	0 VA								20
21	EXISTING DESK LIGHTS	20 A	1			0 VA	0 VA			2	50 A	**EXISTING DISHWASHER**	22
23	EXISTING VENDDING MACHINES	20 A	1					0 VA	0 VA				24
25	EXISTING RECEP STAFF	20 A	1	0 VA	0 VA					1	20 A	EXISTING RECEPTACLES	26
27	EXISTING RECEP STAFF	20 A	1			0 VA	0 VA			1	20 A	EXISTING RECEPTACLES	28
29	**COFFEE MAKER**	30 A	2					2881...	0 VA	1	20 A	**EXISTING REFRIGERATOR**	30
31				2881...	0 VA					1	20 A	EXISTING RECEPTACLES	32
33	**Receptacle**	20 A	1			360 VA	180 VA			1	20 A	**Receptacle**	34
35	**REFRIGERATOR**	20 A	1					504 VA	0 VA	1	20 A	**DISPOSER**	36
37	**Spare**	20 A	1	0 VA	0 VA					1	20 A	**Spare**	38
39	**Spare**	20 A	1			0 VA	0 VA			1	20 A	**Spare**	40
41	**EXISTING ICE MACHINE**	20 A	1					0 VA	0 VA	1	20 A	**Spare**	42
		Total Load:		3241 VA		540 VA		3385 VA					
		Total Amps:		30 A		5 A		32 A					

BP#2 ADD2

Legend:

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Kitchen Equipment - Non-Dwelling Unit	6266 VA	70.00%	4386 VA		
Receptacle	900 VA	100.00%	900 VA	**Total Conn. Load:**	7166 VA
				Total Est. Demand:	5286 VA
				Total Conn.:	20 A
				Total Est. Demand:	15 A

Notes:
ITEMS IN BOLD ARE EXISTING TO BE RELOCATED OR NEW. ALL OTHER LOADS ARE EXISTING TO REMAIN.

EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE

SINK COMBS DETHLEFS
ARCHITECTURE DESIGN
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

COLORADO LICENSED
KEVIN M. SINK
43925
11-10-17
PROFESSIONAL ENGINEER

City of Louisville

innovative electrical systems, inc.
7550 West Yale Avenue, Suite B-130
Denver, Colorado 80227
V:303.988.9305 F:303.984.8603
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LOUSVILLE RECREATION/ SENIOR CENTER EXPANSION
LOUISVILLE, CO 80027

SCD Project No.: 1641

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No.	Issues/Revisions:	Date
	DESIGN DEVELOPMENT	06/30/2017
	CD PROGRESS SET	08/29/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD2	BP#2 ADDENDUM #2	11/10/2017

ELECTRICAL PANEL SCHEDULES

E0.62

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11/8/2017 1:35:25 PM
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PAGE INSERTED FROM 2009 DRAWING SET. VERIFY ALL DETAILS

PANEL 'EQ'
Existing Panel

MAINS: 400 A M.L.O
VOLTS: 277Y/480V, 3-PH, 4-W
STYLE: Westinghouse
OCP: 400 A CB
ENCLO.
MOUNT. Surface
INT. RATING: 14kAIC
REMARKS: Existing panel
Indicated Proposed Revised

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	WATERSLIDE PUMP				5,100			B					6900		ELEVATOR	2
3	" "				5,100			A					6900		" "	4
5	" "				5,100			C					6900		" "	6
7	EAST PUMP		1,810				20/3	A					1465		WHIRLPOOLPUMP	8
9	" "		1,810				"	B					1465		" "	10
11	" "		1,810				"	C					1465		" "	12
13	MAIN CIRCUIT PUMP							A					12,000		WATER HEATER	14
15	" "							B					12,000		" "	16
17								C					12,000		" "	18
19	CRC. PUMP		3,533					A							EQ1 FEED	20
21	" "		3,533					B							" "	22
23	" "		3,533					C							" "	24
25	POOL PACK NDHU		29,200			150/3	A									26
27	" "		29,200			"	B									28
29	" "		29,200			"	C									30

LOAD SUMMARIES:	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	CONNECTED LOADS (VA)
A-phase totals	0	0	34,543	5,100	0	60,008
B-phase totals	0	0	34,543	5,100	0	60,008
C-phase totals	0	0	34,543	5,100	0	60,008
TOTALS:	0	0	103629	15300	0	180,024 VA

DEMAND CALCULATION:	A	B	C	TOT		NEC DEMAND:
Lighting totals	0	0	0	0	(x 1.25 NEC continuous load factor =)	0
Receptacle totals	0	0	0	0	(first 10kVA + 0.5 x remainder above 10kVA =)	0
HVAC totals	34,543	34,543	34,543	103629	(x 1.0 + 25% of largest motor =)	109,007
Equipment totals	25,465	25,465	25,465	76395	(x 100% per NEC 220-3 =)	76,395
Other totals	0	0	0	0	(x 100% per NEC 220-3 =)	0
TOTALS:	60,008	60,008	60008	180024	VA	185,402 VA

PHASE CURRENT IMBALANCE: [MAX(A,B,C) - AVERAGE(A,B,C)] / AVERAGE(A,B,C) = 0.00%

CAPACITY CALCULATION:

				Percentage:
OCP Capcity	=	400.0	Amps	100%
NIC Demand / (480V x 1.732)	=	223.1	Amps	55.8%
Spare Capacity (balanced)	=	176.9	Amps	44.2%

PANEL 'EQ1'

MAINS: 100 A M.L.O
VOLTS: 277Y/480V, 3-PH, 4-W
STYLE: Westinghouse
OCP: 100 A CB
ENCLO.
MOUNT. Surface
INT. RATING: 22kAIC
REMARKS: Existing panel

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	BLANK							A	20/1						OZONE SYSTEM	2
3	BLANK							B	20/1							4
5	BLANK							C	20/1							6
7	BLANK							A	20/1							8
9	BLANK							B	20/1							10
11	BLANK							C							BLANK	12
13	MAU						20/3	A	20/2						SWIM TIMER XFMR PNL.	14
15	" "						"	B							" "	16
17	" "						"	C							BLANK	18
19	OZONE 5						15/3	A	15/3						OZONE N.	20
21	" "						"	B	"						" "	22
23	" "						"	C	"						" "	24
25	PUMP						7/3	A	20/3						AIR COMP.	26
27	" "						"	B	"						" "	28
29	" "						"	C	"						" "	30

LOAD SUMMARIES:	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	CONNECTED LOADS (VA)
A-phase totals	0	4,460	0	1,130	0	10,720
B-phase totals	0	4,940	0	1,130	0	14,123
C-phase totals	0	1,680	0	1,130	0	8,793
TOTALS:	0	11,080	0	3390	0	33,636 VA

DEMAND CALCULATION:	A	B	C	TOT		NEC DEMAND:
Lighting totals	500	1,500	0	2000	(x 1.25 NEC continuous load factor =)	2,500
Receptacle totals	4,640	5,740	2,480	12880	(First 10kVA + 0.5 x remainder above 10kVA =)	11,430
HVAC totals	0	1,903	2,483	4386	(x 1.0 + 25% of largest motor =)	4,986
Equipment totals	5,580	4,980	3,830	14390	(x 70% Demand Factor per NEC 220.56)	10,073
Other totals	0	0	0	0	(x 100% per NEC 220-3 =)	0
TOTALS:	10,720	14,123	8793	33636	VA	28,989 VA

PHASE CURRENT IMBALANCE: [MAX(A,B,C) - MIN(A,B,C)] / MAX(A,B,C) = 37.74%

CAPACITY CALCULATION:

				Percentage:
OCP Capcity	=	150.0	Amps	100%
NIC Demand / (208V x 1.732)	=	80.5	Amps	53.7%
Spare Capacity (balanced)	=	69.5	Amps	46.3%

PANEL 'L2B'

MAINS: 125 A M.L.O
VOLTS: 208Y/120V, 3-PH, 4-W
STYLE: GE THQB
OCP: 125 A CB
ENCLO.
MOUNT. Surface
INT. RATING: 10kAIC
REMARKS: Existing panel

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	UNDERWATER POOL LIGHTS						20/1	A	20/1						POOL COVER	2
3	UNDERWATER POOL LIGHTS						20/1	B	20/1						POOL COVER	4
5	DIVING BIRD WINCH						20/1	C	20/1						POOL COVER	6
7	UNKNOWN LOAD GFCI BKR.						20/1	A	20/1						UNKNOWN LOAD GFCI BKR.	8
9	UNKNOWN LOAD GFCI BKR.						20/1	B	20/1						UNKNOWN LOAD GFCI BKR.	10
11	UNKNOWN LOAD GFCI BKR.						20/1	C	20/1						UNKNOWN LOAD GFCI BKR.	12
13								A								14
15								B								16
17								C								18
19								A								20
21								B								22
23								C								24
25								A								26
27								B								28
29								C								30

PANEL 'L2'
SECTION 1

MAINS: 150 A M.L.O
VOLTS: 208Y/120V, 3-PH, 4-W
STYLE: SQ-D NQOD
OCP: 150 A CB IN LRD
ENCLO. NEMA 1
MOUNT. SURFACE
INT. RATING: 10kAIC
REMARKS: FEED THROUGH LUGS

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	Vending Machines						20/1	A	20/1				1,150		Mens dryer closest to shwrs	2
3	Treadmill #2						20/2	B	20/1				1,150		Womens dryer aw ay shwrs	4
5	" "						"	C	20/1				1,150		Mens mkt. dryer	6
7	C.O. pool						20/1	A	20/1				1,150		Womens dryer closest shwrs	8
9	C.O. pool						20/1	B	20/1				1,150		Mens dryer aw ay shwrs	10
11							20/1	C	20/1				1,150		Womens mkt. Dryer	12
13	Boiler control		600				20/1	A	20/2				1,150		Treadmill #1	14
15	C.O. GFCI		200				20/1	B	"				1,150		"	16
17	C.O. Pool, Office		1,080				20/1	C	20/1						Office w ork area	18
19	Computers		1,080				20/1	A	20/1						C.O. boiler rm. sauna lts	20
21	C.O. Childcare & Lobby		1,440				20/1	B	20/1						Front desk W. side	22
23	C.O. family dr/sg rm, Wom locker						20/1	C	20/1						Front desk E. side	24
25	Cardio Equip fan		900				20/1	A	20/1				600		Boiler Control in mens locker	26
27	S. Cardio fans, TV.		900				20/1	B	20/1		800				C.O. Locker Rm	28
29	Spare						20/1	C	20/1		800				C.O. w omens locker Rm	30
31	Security System		200				20/1	A	20/1						C.O. w omens locker counter	32
33	C.O. gym		1,800				20/1	B	20/1						C.O. w omens locker counter	34
35	C.O. Gym		600				20/1	C							Space	36
37	C.O. Gym		600				20/1	A	50/3				400		Sauna	38
39	C.O. Gym, Scorebrd		600				20/1	B	"				400		" "	40
41	Sauna						20/1	C	"				400		" "	42

PANEL 'L2A'
SECTION 2

MAINS: 250 A M.L.O
VOLTS: 208Y/120V, 3-PH, 4-W
STYLE: SQ-D NQOD
OCP: 250 A CB IN LRD
ENCLO. NEMA 1
MOUNT. SURFACE
INT. RATING: 10kAIC
REMARKS:

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	Backboard motor				1,130		20/1	A	20/1	500					Pauls office	2
3	Backboard motor				1,130		20/1	B	20/1	1,500					Lights pool underw ater	4
5	Backboard motor & curtain				1,130		20/1	C	20/1						Spare	6
7	C.O. pool equip rm.						20/1	A	20/1						C.O. flr. 2nd flr.	8
9	C.O. pool equip rm.						20/1	B	20/2			983			Roof Top Unit	10
11	Boiler Control						20/1	C	"			983			" "	12
13	C.O. Vending		1,080				20/1	A	20/1		180				C.O.rooftop gym	14
15	C.O. Storage						20/1	B	20/1			920			Fan	16
17	Spare						20/1	C	20/1			1,500			Fan	18
19	Steam Generator						50/3	A	100/3						L2B panel	20
21	" "						"	B	"						" "	22
23	" "						"	C	"						" "	24
25	Grinder 2nd flr.						20/1	A	20/1						C.O. Vending	26
27	Safe rm dedicated circuit						20/1	B	20/1						C.O. Vending	28
29	Space							C	20/1						Boiler rm rec. & lclr. Doors	30

LOAD SUMMARIES:	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	CONNECTED LOADS (VA)
A-phase totals	0	4,460	0	1,130	0	10,720
B-phase totals	0	4,940	0	1,130	0	14,123
C-phase totals	0	1,680	0	1,130	0	8,793
TOTALS:	0	11,080	0	3390	0	33,636 VA

DEMAND CALCULATION:	A	B	C	TOT		NEC DEMAND:
Lighting totals	500	1,500	0	2000	(x 1.25 NEC continuous load factor =)	2,500
Receptacle totals	4,640	5,740	2,480	12880	(First 10kVA + 0.5 x remainder above 10kVA =)	11,430
HVAC totals	0	1,903	2,483	4386	(x 1.0 + 25% of largest motor =)	4,986
Equipment totals	5,580	4,980	3,830	14390	(x 70% Demand Factor per NEC 220.56)	10,073
Other totals	0	0	0	0	(x 100% per NEC 220-3 =)	0
TOTALS:	10,720	14,123	8793	33636	VA	28,989 VA

PHASE CURRENT IMBALANCE: [MAX(A,B,C) - MIN(A,B,C)] / MAX(A,B,C) = 37.74%

CAPACITY CALCULATION:

				Percentage:
OCP Capcity	=	150.0	Amps	100%
NIC Demand / (208V x 1.732)	=	80.5	Amps	53.7%
Spare Capacity (balanced)	=	69.5	Amps	46.3%

1 EXISTING PANEL SECHEDULES

PANEL 'EQ'
Revised Panel

MAINS: 400 A M.L.O
VOLTS: 277Y/480V, 3-PH, 4-W
STYLE: Westinghouse
OCP: 400 A CB
ENCLO.
MOUNT. Surface
INT. RATING: 14kAIC
REMARKS: Revised Panel

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	PUMP				5,100			A					6900		ELEVATOR	2
3	" "				5,100			B					6900		" "	4
5	" "				5,100			C					6900		" "	6
7	EAST PUMP		1,810				20/3	A					1140		PUMP	8
9	" "		1,810				"	B					1140		" "	10
11	" "		1,810				"	C					1140		" "	12
13	***NDHU-1***		***24,963***				150/3	A					3,570		PUMP	14
15	***" "***		***24,963***				"	B					3,570		" "	16
17	***" "***		***24,963***				"	C					3,570		" "	18
19	AC UNIT		3,533					A					1,465		PUMPS WHIRLPOOL	20
21	" "		3,533					B					1,465		" "	22
23	" "		3,533					C					1,465		" "	24
25	SPACE							A					1,200		HEATER	26
27	SPACE							B					1,200		" "	28
29	SPACE							C					1,200		" "	30

LOAD SUMMARIES:	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	CONNECTED LOADS (VA)
A-phase totals	0	0	30,306	5,100	0	49,681
B-phase totals	0	0	30,306	5,100	0	49,681
C-phase totals	0	0	30,306	5,100	0	49,681
TOTALS:	0	0	90918	15300	0	149,043 VA

DEMAND CALCULATION:	A	B	C	TOT		NEC DEMAND:
Lighting totals	0	0	0	0	(x 1.25 NEC continuous load factor =)	0
Receptacle totals	0	0	0	0	(first 10kVA + 0.5 x remainder above 10kVA =)	0
HVAC totals	30,306	30,306	30,306	90918	(x 1.0 + 25% of largest motor =)	96,296
Equipment totals	19,375	19,375	19,375	58125	(x 100% per NEC 220-3 =)	58,125
Other totals	0	0	0	0	(x 100% per NEC 220-3 =)	0
TOTALS:	49,681	49,681	49681	149043	VA	154,421 VA

PHASE CURRENT IMBALANCE: [MAX(A,B,C) - AVERAGE(A,B,C)] / AVERAGE(A,B,C) = 0.00%

CAPACITY CALCULATION:

				Percentage:
OCP Capcity	=	400.0	Amps	100%
NIC Demand / (480V x 1.732)	=	185.8	Amps	46.5%
Spare Capacity (balanced)	=	214.2	Amps	53.5%

PANEL 'EQ1'

MAINS: 100 A M.L.O
VOLTS: 277Y/480V, 3-PH, 4-W
STYLE: Westinghouse
OCP: 100 A CB
ENCLO.
MOUNT. Surface
INT. RATING: 22kAIC
REMARKS: Existing panel

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	BLANK							A	20/1						OZONE SYSTEM	2
3	BLANK							B	20/1							4
5	BLANK							C	20/1							6
7	BLANK							A	20/1							8
9	BLANK							B	20/1							10
11	BLANK							C							BLANK	12
13	***SPARE***						20/3	A	20/2						SWIM TIMER XFMR PNL.	14
15	***" "***						"	B	"						" "	16
17	***" "***						"	C							BLANK	18
19	OZONE 5						15/3	A	15/3						OZONE N.	20
21	" "						"	B	"						" "	22
23	" "						"	C	"						" "	24
25	PUMP						7/3	A	20/3						AIR COMP.	26
27	" "						"	B	"						" "	28
29	" "						"	C	"						" "	30

LOAD SUMMARIES:	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	CONNECTED LOADS (VA)
A-phase totals	0	4,460	0	1,130	0	10,720
B-phase totals	0	4,940	0	1,130	0	14,392
C-phase totals	0	1,680	0	1,130	0	8,385
TOTALS:	0	11,080	0	3390	0	33,487 VA

DEMAND CALCULATION:	A	B	C	TOT		NEC DEMAND:
Lighting totals	500	1,500	0	2000	(x 1.25 NEC continuous load factor =)	2,500
Receptacle totals	4,640	5,740	2,480	12860	(First 10kVA + 0.5 x remainder above 10kVA =)	11,430
HVAC totals	0	2,162	2,075	4237	(x 1.0 + 25% of largest motor =)	4,837
Equipment totals	5,580	4,980	3,830	14390	(x 70% Demand Factor per NEC 220.56)	10,073
Other totals	0	0	0	0	(x 100% per NEC 220-3 =)	0
TOTALS:	10,720	14,382	8385	33487	VA	28,840 VA

PHASE CURRENT IMBALANCE: [MAX(A,B,C) - MIN(A,B,C)] / MAX(A,B,C) = 41.70%

CAPACITY CALCULATION:

				Percentage:
OCP Capcity	=	250.0	Amps	100%
NIC Demand / (208V x 1.732)	=	80.1	Amps	32.0%
Spare Capacity (balanced)	=	169.9	Amps	68.0%

PANEL 'L2B'

MAINS: 125 A M.L.O
VOLTS: 208Y/120V, 3-PH, 4-W
STYLE: GE THQB
OCP: 125 A CB
ENCLO.
MOUNT. Surface
INT. RATING: 10kAIC
REMARKS: Existing panel

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	UNDERWATER POOL LIGHTS						20/1	A	20/1						POOL COVER	2
3	UNDERWATER POOL LIGHTS						20/1	B	20/1						POOL COVER	4
5	DIVING BIRD WINCH						20/1	C	20/1						POOL COVER	6
7	UNKNOWN LOAD GFCI BKR.						20/1	A	20/1						UNKNOWN LOAD GFCI BKR.	8
9	UNKNOWN LOAD GFCI BKR.						20/1	B	20/1						UNKNOWN LOAD GFCI BKR.	10
11	UNKNOWN LOAD GFCI BKR.						20/1	C	20/1						UNKNOWN LOAD GFCI BKR.	12
13	***KIT. EF-8, LOBBY CF-1***		***1,347***				***20/1***	A								14
15	***BLDG MNGMNT PNL RM 201***		***1,000***				***20/1***	B								16
17	***FA AUX PWR SUPPLY (ALT #4)***		***1,000***				***20/1***	C								18
19								A								20
21								B								22
23								C								24
25								A								26
27								B								28
29								C								30

PANEL 'L2'
SECTION 1

MAINS: 250 A M.L.O
VOLTS: 208Y/120V, 3-PH, 4-W
STYLE: SQ-D NQOD
OCP: 250 A CB IN LRD
ENCLO. NEMA 1
MOUNT. SURFACE
INT. RATING: 10kAIC
REMARKS: FEED THROUGH LUGS

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	Vending Machines						20/1	A	20/1				1,150		Mens dryer closest to shwrs	2
3	Treadmill #2						20/2	B	20/1				1,150		Womens dryer aw ay shwrs	4
5	" "						"	C	20/1				1,150		Mens mkt. dryer	6
7	C.O. pool						20/1	A	20/1				1,150		Womens dryer clesest shwrs	8
9	C.O. pool						20/1	B	20/1				1,150		Mens dryer aw ay shwrs	10
11							20/1	C	20/1				1,150		Womens mkt. Dryer	12
13	Boiler control		600				20/1	A	20/2				1,150		Treadmill #1	14
15	C.O. GFCI		200				20/1	B	"				1,150		"	16
17	C.O. Pool, Office		1,080				20/1	C	20/1						Office w ork area	18
19	Computers		1,080				20/1	A	20/1						C.O. boiler rm. sauna lts	20
21	C.O. Childcare & Lobby		1,440				20/1	B	20/1						Front desk W. side	22
23	C.O. family dr/sg rm, Wom locker						20/1	C	20/1						Front desk E. side	24
25	Cardio Equip fan		900				20/1	A	20/1				600		Boiler Control in mens locker	26
27	S. Cardio fans, TV.		900				20/1	B	20/1		800				C.O. Locker Rm	28
29	Spare						20/1	C	20/1		800				C.O. w omens locker Rm	30
31	Security System		200				20/1	A	20/1						C.O. w omens locker counter	32
33	C.O. gym		1,800				20/1	B	20/1						C.O. w omens locker counter	34
35	C.O. Gym		600				20/1	C							Space	36
37	C.O. Gym		600				20/1	A	50/3				400		Sauna	38
39	C.O. Gym, Scorebrd		600				20/1	B	"				400		" "	40
41	Sauna						20/1	C	"				400		" "	42

PANEL 'L2A'
SECTION 2
Revised Panel

MAINS: 250 A M.L.O
VOLTS: 208Y/120V, 3-PH, 4-W
STYLE: SQ-D NQOD
OCP: 250 A CB IN LRD
ENCLO. NEMA 1
MOUNT. SURFACE
INT. RATING: 10kAIC
REMARKS:

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	Backboard motor				1,130		20/1	A	20/1	500					Pauls office	2
3	Backboard motor				1,130		20/1	B	20/1	1,500					Lights pool underw ater	4
5	Backboard motor & curtain				1,130		20/1	C	20/1						Spare	6
7	C.O. pool equip rm.						20/1	A	20/1						C.O. flr. 2nd flr.	8
9	C.O. pool equip rm.						20/1	B	20/2			***575***			***RTU-14***	10
11	Boiler Control						20/1	C	"			***575***			" "	12
13	C.O. Vending		1,080				20/1	A	20/1		180				C.O.rooftop gym	14
15	C.O. Storage						20/1	B	20/1			***1,587***			***EF-3***	16
17	Spare						20/1	C	20/1			1,500			Fan	18
19	Steam Generator						50/3	A	100/3						L2B panel	20
21	" "						"	B	"						" "	22
23	" "						"	C	"						" "	24
25	Grinder 2nd flr.						20/1	A	20/1						C.O. Vending	26
27	Safe rm dedicated circuit						20/1	B	20/1						C.O. Vending	28
29	Space							C	20/1						Boiler rm rec. & lclr. Doors	30

LOAD SUMMARIES:	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	CONNECTED LOADS (VA)
A-phase totals	0	4,460	0	1,130	0	10,720
B-phase totals	0	4,940	0	1,130	0	14,392
C-phase totals	0	1,680	0	1,130	0	8,385
TOTALS:	0	11,080	0	3390	0	33,487 VA

DEMAND CALCULATION:	A	B	C	TOT		NEC DEMAND:
Lighting totals	500	1,500	0	2000	(x 1.25 NEC continuous load factor =)	2,500
Receptacle totals	4,640	5,740	2,480	12860	(First 10kVA + 0.5 x remainder above 10kVA =)	11,430
HVAC totals	0	2,162	2,075	4237	(x 1.0 + 25% of largest motor =)	4,837
Equipment totals	5,580	4,980	3,830	14390	(x 70% Demand Factor per NEC 220.56)	10,073
Other totals	0	0	0	0	(x 100% per NEC 220-3 =)	0
TOTALS:	10,720	14,382	8385	33487	VA	28,840 VA

PHASE CURRENT IMBALANCE: [MAX(A,B,C) - MIN(A,B,C)] / MAX(A,B,C) = 41.70%

CAPACITY CALCULATION:

				Percentage:
OCP Capcity	=	250.0	Amps	100%
NIC Demand / (208V x 1.732)	=	80.1	Amps	32.0%
Spare Capacity (balanced)	=	169.9	Amps	68.0%

2 REVISED PANEL SECHEDULES

PANEL 'M'
Revised Panel

MAINS: 400 A M.L.O
VOLTS: 277Y/480V, 3-PH, 4-W
STYLE: GE
OCP: 400 A CB
ENCLO.
MOUNT. SURFACE
INT. RATING: 14kAIC
REMARKS: Revised Panel

Pole	Load Description	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Trip/ Poles	Ph.	Trip/ Poles	Lights (VA)	Recpt. (VA)	HVAC (VA)	Equip. (VA)	Other (VA)	Load Description	Pole
1	***(RTU-1, 2)***			***7,222***			40/3	A	30/3			***2,947***			***(RTU-10)***	2
3

LUMINAIRE SCHEDULE

6-Nov-05

KEY	DESCRIPTION	MANUFACTURER CATALOG NUMBER	LAMP QTY	LAMP TYPE	VOLTS	MOUNTING INFORMATION	OVERALL MOUNTING HT.	MAX VA	NOTES
EA1	SINGLE HEAD FULL CUT-OFF LED LUMINAIRE 3000 DEGREES ON A 22'-0" ROUND POLE	LITHONIA: DSX1 LED 60C 700 30K T3M MVOLT SPA BL30 DDBXD	1	LED 3000K	277	22' -0"W / 24" HIGH BASE	24'-0"	131	1
EA2	TWIN 180 HEADS FULL CUT-OFF LED LUMINAIRE 3000 DEGREES ON A 22'-0" ROUND POLE	LITHONIA: DSX1 LED 60C 700 30K T4M MVOLT SPA BL30 DDBXD	1	LED 3000K	277	22' -0"W / 24" HIGH BASE	24'-0"	262	1
EA3	SINGLE HEAD FULL CUT-OFF LED LUMINAIRE 3000 DEGREES ON A 22'-0" ROUND POLE, HOUSE SIDE SHEILD	LITHONIA: DSX1 LED 60C 700 30K T3M MVOLT SPA BL30 HS DDBXD	1	LED 3000K	277	22' -0"W / 24" HIGH BASE	24'-0"	131	1
EA4	SINGLE HEAD FULL CUT-OFF LED LUMINAIRE 3000 DEGREES ON A 16'-6" ROUND POLE, HOUSE SIDE SHEILD	LITHONIA: DSX1 LED 40C 700 30K T3M MVOLT SPA BL30 HS DDBXD	1	LED 3000K	277	16' -6"W / 24" HIGH BASE	18'-6"	91	1
EB	DECORATIVE FULL CUTOFF LED 3000 DEGREES MOUNTED ON A 18'-0" ROUND POLE	SELUX #AST 1 R3 1 LG4105 30 1 18 BZ 277 HL33. POLE AT54 16 BZ BC3	1	LED 3000K	277	18' -0"W / 6" HIGH BASE	18'-6"	47	1
EB2	DECORATIVE FULL CUTOFF LED 3000 DEGREES MOUNTED ON A 18'-0" ROUND POLE	SELUX #AST 1 R5 1 LG4105 30 1 18 BZ 277 HL33. POLE AT54 16 BZ BC3	1	LED 3000K	277	18' -0"W / 6" HIGH BASE	18'-6"	47	1

MOUNTING ABBREVIATIONS

AFF – ABOVE FINISHED FLOOR
BFC – BELOW FINISHED CEILING
RFD – RECESSED FIXTURE DEPTH
BOF – BOTTOM OF FIXTURE
COF – CENTER OF FIXTURE
TOF – TOP OF FIXTURE
PL – PENDANT LENGTH
PH – POLE HEIGHT
CFL– COMPACT FLUORESCENT

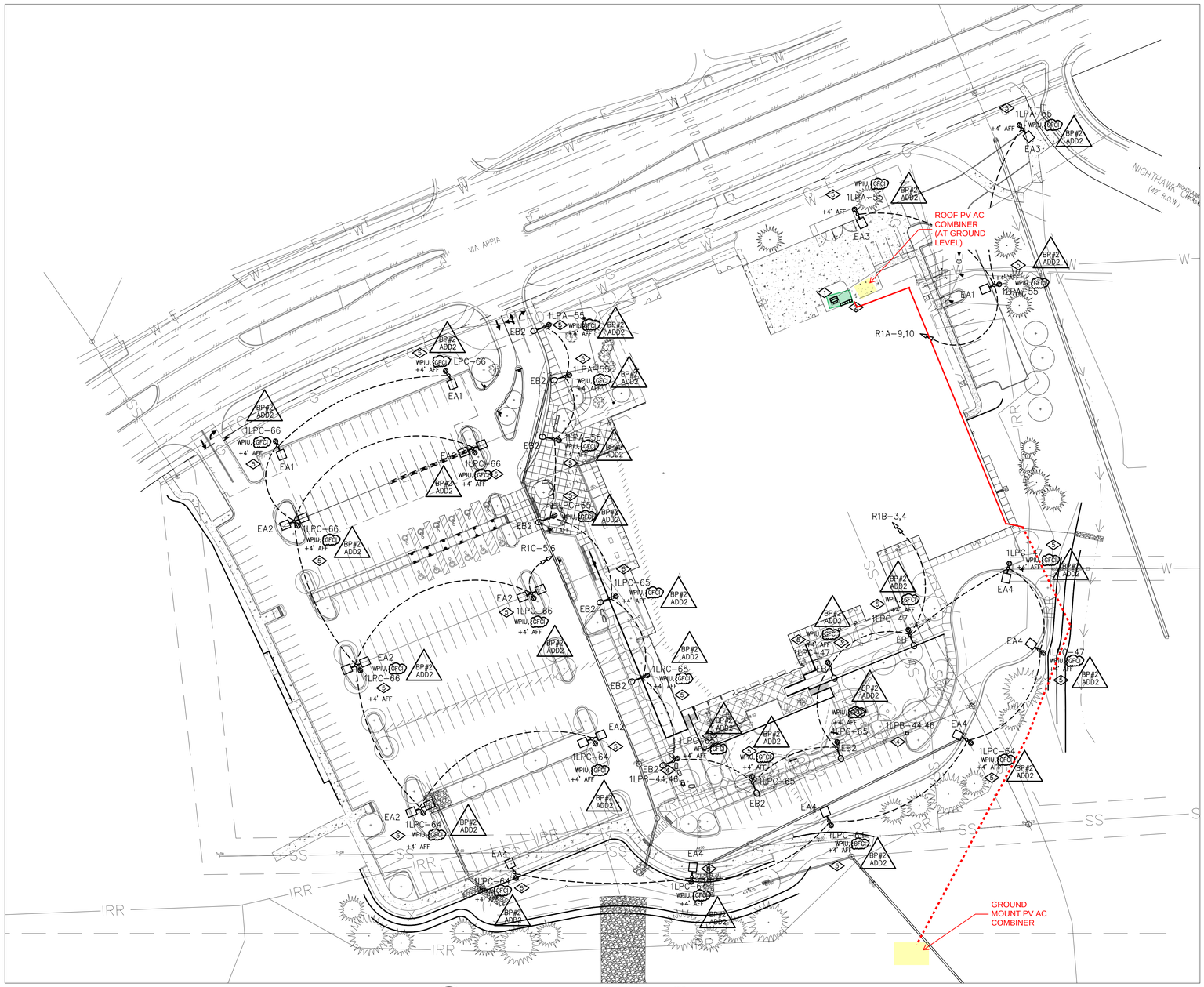
GENERAL NOTES (FOR ALL SCHEDULED LUMINAIRES):
1 ALL SITE EXTERIOR LIGHTS ARE 4000 DEGREES

NOTES SPECIFIC TO SCHEDULED LUMINAIRES (REFER TO 'NOTES' COLUMN WITHIN SCHEDULE):
1. PROVIDE POLE WITH PROVISIONS FOR A DUPLEX OUTLET MOUNTED +4' UP POLE.

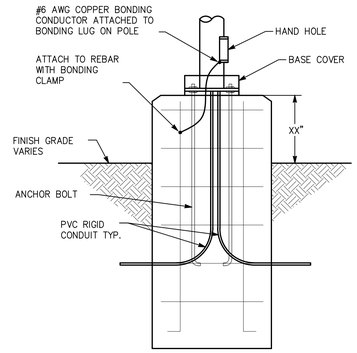
EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

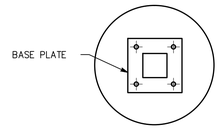
ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE



1 E1.00 ELECTRICAL SITE PLAN
1"=40'-0"
TRUE NORTH



ELEVATION



TOP VIEW

2 E1.00 POLE BASE DETAIL
SCALE: NONE

NOTE:
1. COORDINATE DIMENSIONS, AND STRUCTURAL REQUIREMENTS WITH STRUCTURAL ENGINEER.
2. EDGE OF POLE BASE SHALL BE 2' FROM EDGE OF SIDEWALKS.
3. DIMENSION XX" LISTED BELOW
   3.1. EA1, EA2, EA3, EA4: 24"
   3.2. EB, EB2: 6"

DETAIL NOTES

1. UTILITY TRANSFORMER.
2. EXTERIOR MAIN GEAR. GEAR WILL HOUSE CT CABINET AS WELL AS UTILITY METER. .
3. REFER TO SHEET E1.01 FOR OUTDOOR PATIO LIGHTING.
4. PROVIDE MIDWEST RV STYLE PEDESTAL WITH NEMA 14-50R AND NEMA 5-20R IN A WEATHER TIGHT ENCLOSURE #U055CP6010-P4,PAINT TO MATCH EXTERIOR POLE LIGHTS. PROVIDE 3#4,1#8G IN A 1" SCHEDULE 40 PVC CONDUIT.
5. MOUNT RECEPTACLE ON POLE, 4' UP. POLE TO BE PROVIDED WITH PROVISIONS FOR A DUPLEX OUTLET.

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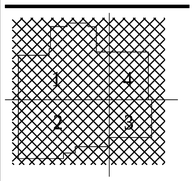
LOUSVILLE RECREATION/ SENIOR CENTER EXPANSION

LOUISVILLE, CO 80027

SCD Project No.: 1641

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No.	Issues/Revisions:	Date
	SCHEMATIC DESIGN	02/17/2017
	DESIGN DEVELOPMENT	06/30/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD1	BP#2 ADD1	10/13/2017
BP2 ADD2	BP#2 ADD2	10/13/2017



ELECTRICAL SITE PLAN

E1.00

SCHEMATIC DESIGN
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EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE

RTU-1:

RTU-2:

RTU-3:

RTU-5:

EWH-1

EWH-2

EWH-3

(EXISTING) GWH-3

NEW 1HMC2

ROUTE 1A

ROUTE 1C

1 LEVEL 01 POWER PLAN SECTOR 1
1/8" = 1'-0"

Keynote Legend	
Key Value	Keynote Text
P2	CONNECT NEW OUTLETS TO EXISTING CIRCUIT FROM DEMO RECEPTACLES BELOW.
P4	PROVIDE EVENLITE INVERTER #LM-52-LC-V2-WB. REFER TO DETAIL 4 SHEET E0.12 FOR SCHMATIC DETAIL FOR EPC UNITS, INVERTERS AND THE CIRCUITS THEY CONTROL.
P8	PROVIDE GFCI ON ALL NEMA 5-20R RECEPTACLES IN KITCHEN.
P11	SUSPEND TRANSFORMER FROM DECK. REFER TO DETAIL 4 SHEET E0.11.
P13	PROVIDE COUNTERTOP MOUNTED RECEPTACLE. PROVIDE HUBBELL #WSBUSB2X2A LU OR EQUAL. STUB POWER AT WALL, RUN CONDUIT UNDER TABLE TO BOX. COORDINATE ROUGH-IN WITH MILLWORK PROVIDOR.
P23	PROVIDE RED MUSHROOM HEAD EPO PUSHBUTTON TO SHUT OFF WATER HEATERS. CONTACT SHALL BE NORMALLY CLOSED, WHEN PUSHED CIRCUIT OPENS AND TURNS OFF BOILER. PROVIDE ONE PER WATER HEATER, TOTAL OF 2,

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DENVER, CO 80203
Tel: 303-308-0200

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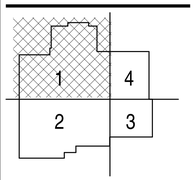
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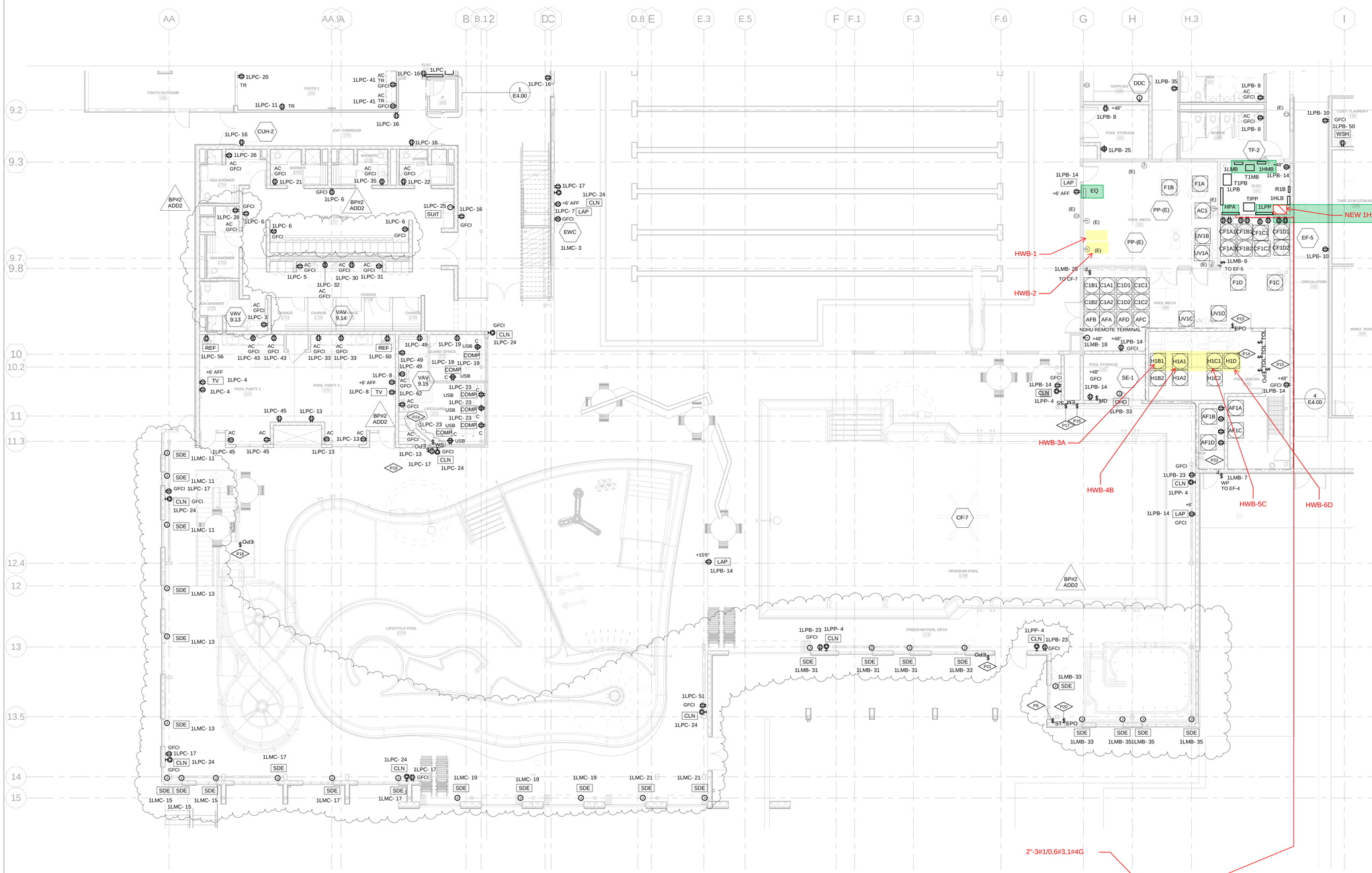
No.	Issues/Revisions:	Date
	DESIGN DEVELOPMENT	06/30/2017
	CD PROGRESS SET	08/29/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD1	BP#2 ADDENDUM #1	10/13/2017
BP2 ADD2	BP#2 ADDENDUM #2	11/10/2017



LEVEL 01 POWER PLAN SECTOR 1

E2.11

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1 LEVEL 01 POWER PLAN SECTOR 2
1/8" = 1'-0"

Keynote Legend	
Key Value	Keynote Text
P6	PROVIDE 15 MINUTE ROTATRY TIMER FOR SPA JET PUMP.
P14	PROVIDE THERMAL OL SWICH FOR POOL HEATER CIRC PUMPS AT DOOR. LABEL SWITCH "POOL HEATER CIRC PUMP" AND PROVIDE A PERMANENT LABEL BELOW THAT READS "TURN OFF HEATER 5 MINUTES PRIOR TO TUNING OFF THE HEATING CIRCULATION PUMP"
P15	PROVIDE RED MUSHROOM HEAD EPO PUSHBUTTON TO SHUT OFF BOILER. CONTACT SHALL BE NORMALLY CLOSED, WHEN PUSHED CIRCUIT OPENS AND TURNS OFF BOILER. PROVIDE ONE PER POOL BOILER, TOTAL OF 4.
P16	PROVIDE RED MUSHROOM HEAD EPO PUSHBUTTON TO SHUT OFF TEACHING POOL PUMPS. CONTACT SHALL BE NORMALLY CLOSED. WHEN PUSHED THE CONTACT OPENS AND TURNS OFF THE TEACHING POOL FEATURE PUMP (P2A). LABEL "TEACHING POOL EM SHUTOFF". PROVIDE IN A WP COVER.
P17	PROVIDE REMOTE START/STOP BUTTON FOR HYDROTHERAPY PUMP "P2A". LABEL "HYDROTHERAPY ON/OFF". PROVIDE IN A WP COVER.
P18	PROVIDE RED MUSHROOM HEAD EPO PUSHBUTTON TO SHUT OFF SLIDE PUMP. MOUNT AT TOP OF SLIDE TOWER. CONTACT SHALL BE NORMALLY CLOSED. WHEN PUSHED THE CONTACT OPENS AND TURNS OFF THE SLIDE PUMP. LABEL "LIDE EM SHUTOFF". PROVIDE IN A WP COVER.
P19	PROVIDE RED MUSHROOM HEAD EPO PUSHBUTTON TO SHUT OFF LEISURE POOL PUMPS. CONTACT SHALL BE NORMALLY CLOSED. WHEN PUSHED THE CONTACT OPENS AND TURNS OFF THE LEISURE POOL FEATURE PUMPS (P2B, P3B, P4B). LABEL "LEISURE POOL EM SHUTOFF". PROVIDE IN A WP COVER.
P20	PROVIDE RED MUSHROOM HEAD EPO PUSHBUTTON TO SHUT OFF WHIRLPOOL PUMPS. CONTACT SHALL BE NORMALLY CLOSED. WHEN PUSHED THE CONTACT OPENS AND TURNS OFF THE WHIRLPOOL CIRC PUMP (P1C) AND JET PUMP (P2C). LABEL "WHIRLPOOL EM SHUTOFF". PROVIDE IN A WP COVER.
P21	PROVIDE RED MUSHROOM HEAD EPO PUSHBUTTON TO SHUT OFF SPLASH PAD PUMPS. CONTACT SHALL BE NORMALLY CLOSED. WHEN PUSHED THE CONTACT OPENS AND TURNS OFF THE SPLASH PAD CIRC PUMP (P1D) AND ACTIVITY PUMP (P2D). LABEL "SPLASH PAD EM SHUTOFF". PROVIDE IN A WP COVER.
P22	PROVIDE PVC COATED CONDUITS AND NON METALLIC BOXES FOR ALL EXPOSED DEVICES IN THIS ROOM.
P24	WINDOW SHADE CONTROLS LOCATION FOR NATATORIUM. COORDINATE CONNECTIONS WITH MANUFACTURERS INSTALLATION INSTRUCTIONS.

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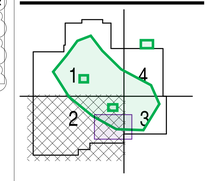
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LOUISVILLE, CO 80027

SCD Project No.: 1641

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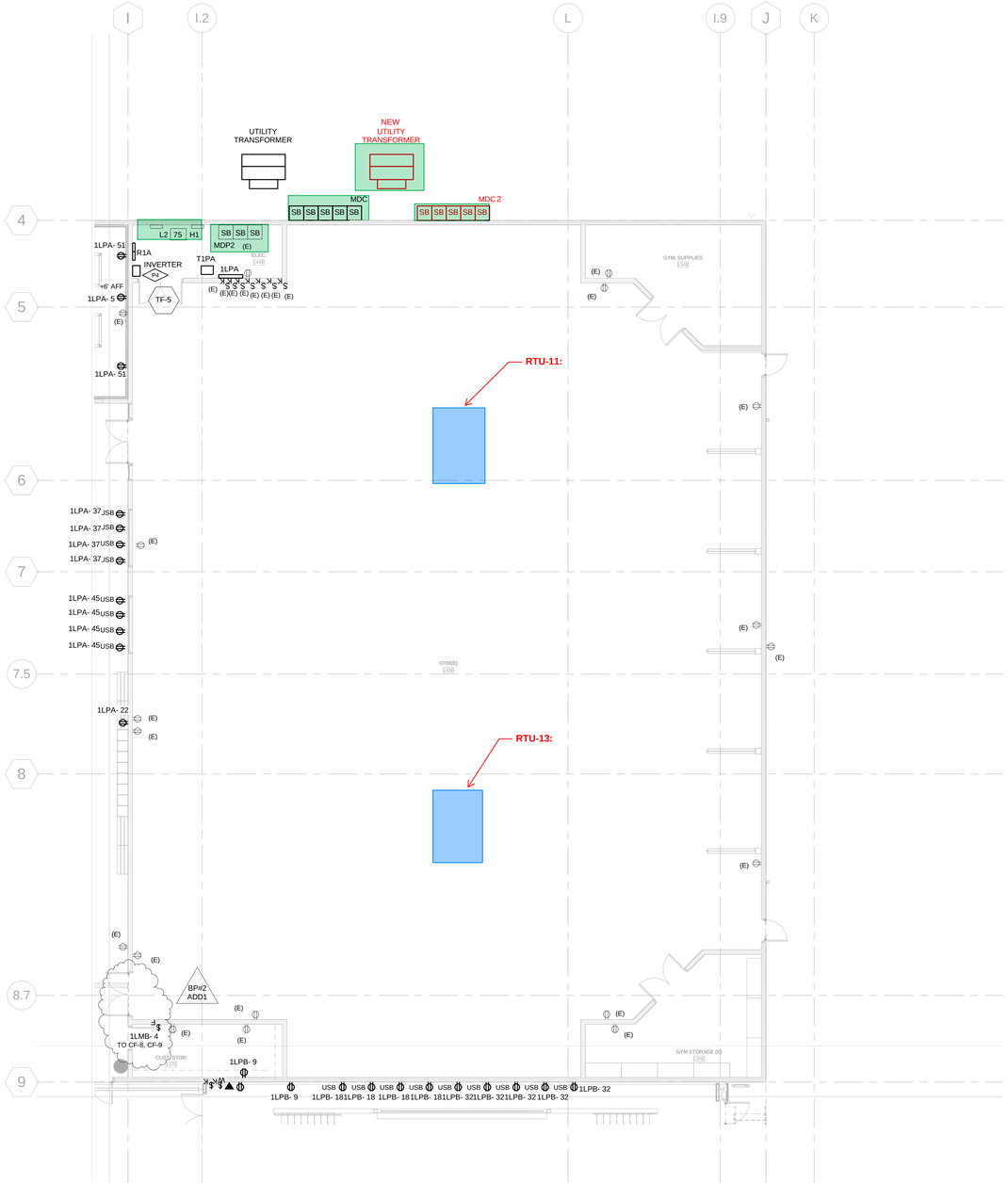
No.	Issues/Revisions:	Date
	DESIGN DEVELOPMENT	06/30/2017
	CD PROGRESS SET	08/29/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD1	BP#2 ADDENDUM #1	10/13/2017
BP2 ADD2	BP#2 ADDENDUM #2	11/10/2017



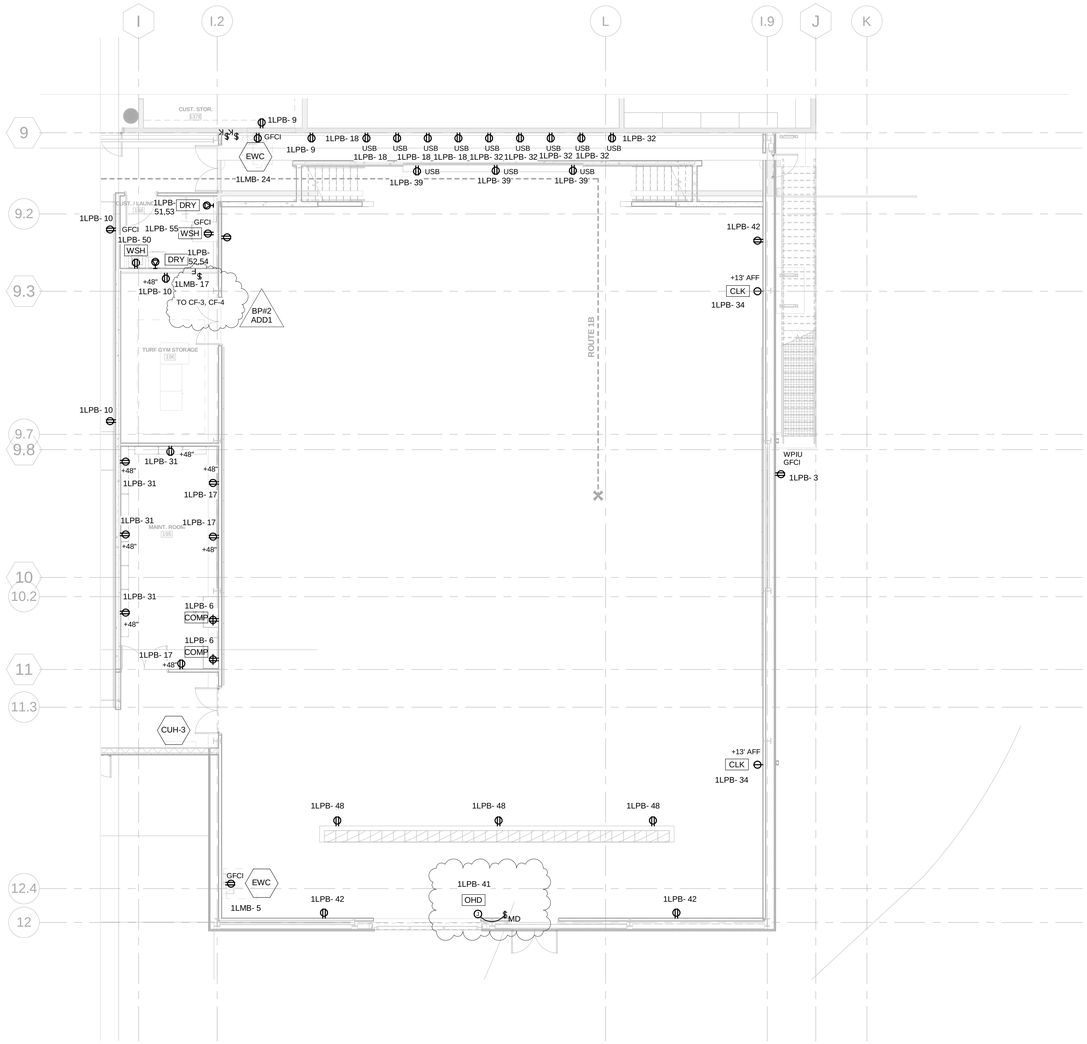
LEVEL 01 POWER PLAN SECTOR 2

E2.12

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1 LEVEL 01 POWER PLAN SECTOR 4
1/8" = 1'-0"



2 LEVEL 01 POWER PLAN SECTOR 3
1/8" = 1'-0"

Keynote Legend	
Key Value	Keynote Text

P1	PROVIDE KEY SWITCHES FOR BATTING CAGE MOTOR AND DIVIDER CURTAIN MOTOR.
P4	PROVIDE EVENLITE INVERTER #LM-52-LC-V2-WB. REFER TO DETAIL 4 SHEET E0.12 FOR SCHMATIC DETAIL FOR EPC UNITS, INVERTERS AND THE CIRCUITS THEY CONTROL.
P9	PROVIDE POWER FOR AN ADDITIONAL (1) FLOW AND (1) TAMPER SWITCH.

EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE

SINK COMBS DETHLEFS
ARCHITECTURE DESIGN
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

City of Louisville

innovative electrical systems, inc.
7550 West Yale Avenue, Suite B-130
Denver, Colorado 80227
V:303.988.8305 F:303.984.8603
www.iesystems-inc.com

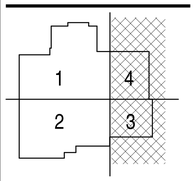
LOUSVILLE RECREATION/ SENIOR CENTER EXPANSION

LOUISVILLE, CO 80027

SCD Project No.: 1641

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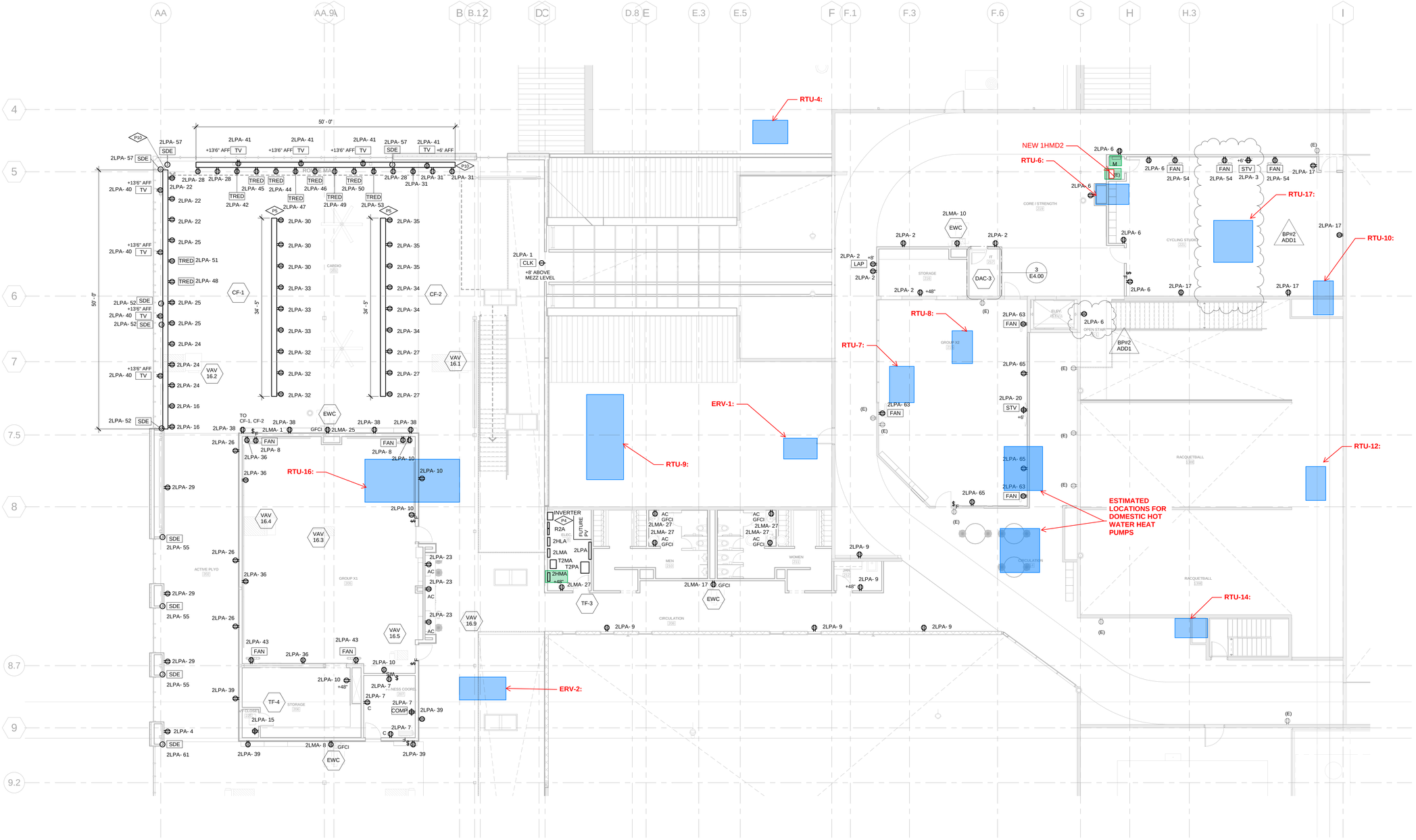
No.	Issues/Revisions:	Date
	DESIGN DEVELOPMENT	06/30/2017
	CD PROGRESS SET	08/29/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD1	BP#2 ADDENDUM #1	10/13/2017



LEVEL 01 POWER PLAN SECTOR 3 & 4

E2.13

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1 MEZZANINE POWER PLAN SECTOR 1
1/8" = 1'-0"

Keynote Legend	
Key Value	Keynote Text
P4	PROVIDE EVENLITE INVERTER #LM-52-LC-V2-WB. REFER TO DETAIL 4 SHEET E0.12 FOR SCHMATIC DETAIL FOR EPC UNITS, INVERTERS AND THE CIRCUITS THEY CONTROL.
P5	PROVIDE CRG RACEWAY FOR POWER AND DATA TO EXERCISE ROOM. RACEWAY SHALL BE LENGTH INDICATED ON PLANS AND CONTAIN THE POWER AND DATA INDICATED ON THE PLANS. CRG #T358-GR539. STUB INTO END OF WALL (2) 2" CONDUITS BACK TO IT 217 FOR LOW VOLTAGE CABELS AND (1) 3/4" CONDUIT TO ELEC 209 FOR POWER.
P10	PROVIDE CRG RACEWAY FOR POWER AND DATA TO EXERCISE ROOM. RACEWAY SHALL BE LENGTH INDICATED ON PLANS AND CONTAIN THE POWER AND DATA INDICATED ON THE PLANS. CRG #T358-GR539. STUB INTO END OF WALL (2) 2" CONDUITS BACK TO IT 217 FOR LOW VOLTAGE CABELS AND (4) 3/4" CONDUIT TO ELEC 209 FOR POWER.

EQUIPMENT LOCATION

EQUIPMENT LOCATION ON ROOF

ELECTRICAL GEAR IMPACTED BY PROJECT SCOPE

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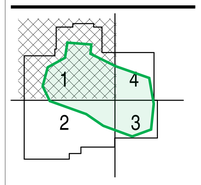
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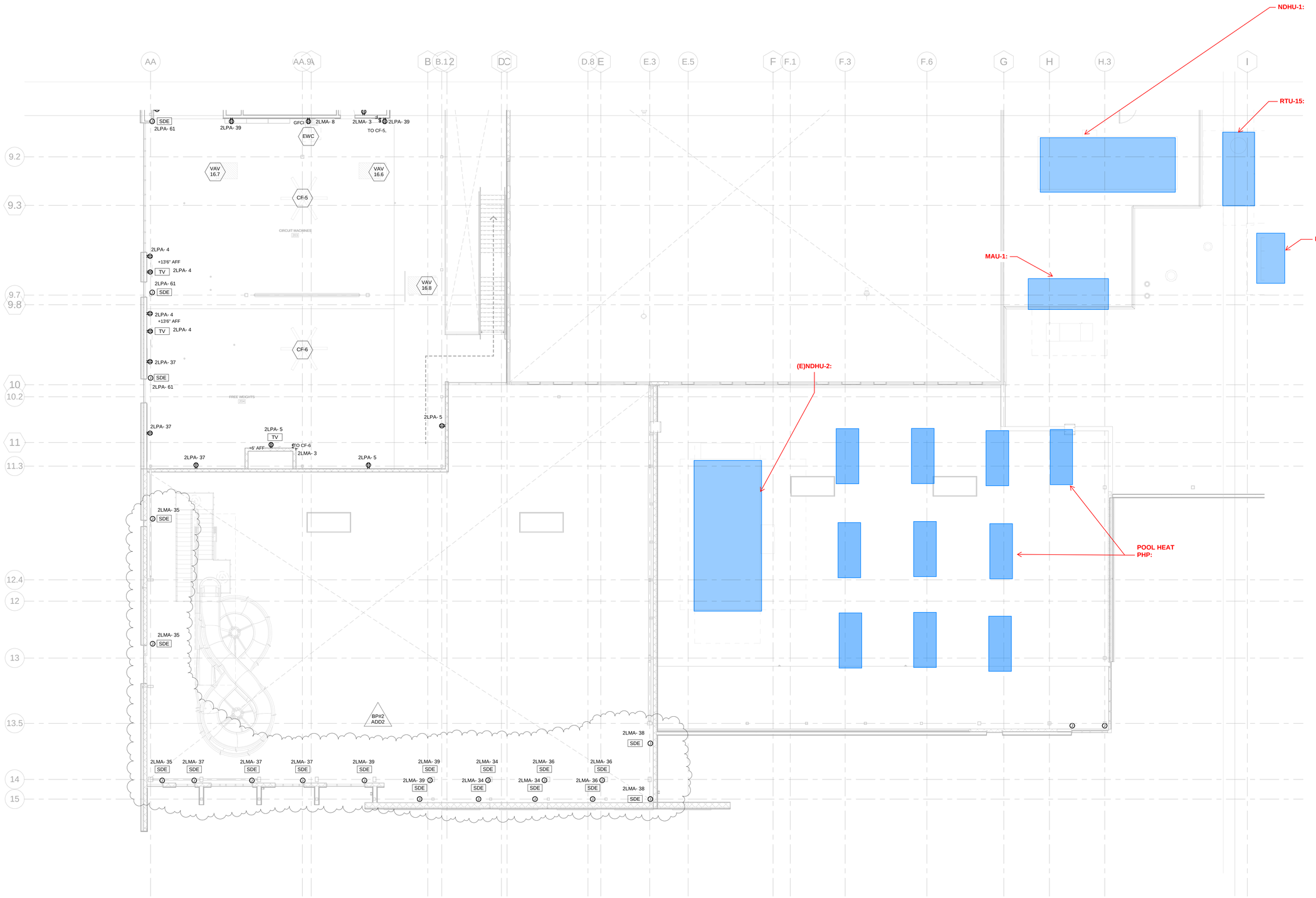
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BP1 ADD1	BP#2 ADDENDUM #1	10/13/2017



MEZZANINE POWER PLAN SECTOR 1

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1 MEZZANINE POWER PLAN SECTOR 2
1/8" = 1'-0"

Keynote Legend	
Key Value	Keynote Text

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SINK COMBS DETHLEFS
ARCHITECTURE DESIGN
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

COLORADO LICENSED
KEVIN R. SELLENGARNG
43925
11-10-17
PROFESSIONAL ENGINEER

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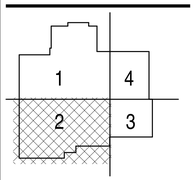
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BP2 ADD2	BP#2 ADDENDUM #2	11/10/2017



MEZZANINE POWER PLAN SECTOR 2

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Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

City of Louisville
COLORADO • SINCE 1878

McKinstry
For The Life Of Your Building

MEPS Coordination Matrix - Rec Center

Existing General (from nameplates/diags)		OPTION 1B - New Electrical (Gas Backup w/ Wheel)			OPTION 1A - New Electrical (Elec. Only w/ Wheel, Resistance Backup)			Structural					Structural Info				
BUILDING	UNIT	Equip. Selection Make	Nominal Tons	Model #	Equip. Selection Make	Nominal Tons	Model #	Unit	Existing Weight (lbs)	OPTION 1A New Weight Elec. Only w/ Wheel (lbs)	OPTION 1B New Weight Gas Backup w/ Wheel (lbs)	Ref Drawing [Martin/Martin]	Support Framing	Status	Reinf Type	Reinf Components
REC CENTER	RTU-1	DAIKIN	5	DPS037A	DAIKIN	5	DPS037A	RTU-1	619	2,346	2,432	S2.31	Unknown; assumed bar joist	NG	T1 (BAR JOIST REINF)	CHORD REINF: (2)- 7/8 IN DIA BAR x 24 FT, TOP AND BOT CHORD; TRUSS WEB REINF: L1-1/2 x 1-1/2 x 3/16 ON BOTH SIDES OF DIAG, QNTY: 10, (5 DIAG LOCATIONS); COMP STRUT (TRUSS PANEL POINT): L1-1/2 x 1-1/2 x 3/16 ON CHORD, COORD WITH AHU CURB
REC CENTER	RTU-2	DAIKIN	5	DPS037A	DAIKIN	5	DPS037A	RTU-2	619	2,346	2,432	S2.31	Unknown; assumed bar joist	NG		
REC CENTER	RTU-3	DAIKIN	6	DPS037A	DAIKIN	6	DPS037A	RTU-3	702	2,396	2,482	S2.31	Unknown; assumed bar joist	NG		
REC CENTER	RTU-4	DAIKIN	10	DPS056A	DAIKIN	10	DPS037A	RTU-4	1,015	2,421	4,304	S2.31	Unknown; assumed bar joist	NG		
REC CENTER	RTU-5	DAIKIN	4	DPS003A	DAIKIN	4	DPS003A	RTU-5	587	1,494	1,547	S2.31	Unknown; assumed bar joist	NG	T1 (BAR JOIST REINF)	CHORD REINF: (2)- 7/8 IN DIA BAR x 24 FT, TOP AND BOT CHORD; TRUSS WEB REINF: L1-1/2 x 1-1/2 x 3/16 ON BOTH SIDES OF DIAG, QNTY: 10, (5 DIAG LOCATIONS); COMP STRUT (TRUSS PANEL POINT): L1-1/2 x 1-1/2 x 3/16 ON CHORD, COORD WITH AHU CURB
REC CENTER	RTU-6	DAIKIN	3	DPS003A	DAIKIN	3	DPS003A	RTU-6	786	1,444	1,497	S2.31	Bar joist, near support, unit supported on 1 joist only	NG		
REC CENTER	RTU-7	DAIKIN	7.5	DPS037A	DAIKIN	7.5	DPS037A	RTU-7	935	2,396	2,482	S2.31	Bar joist, near support, unit supported by 3 joists	NG		
REC CENTER	RTU-8	DAIKIN	6	DPS037A	DAIKIN	6	DPS037A	RTU-8	702	2,396	2,482	S2.31	Bar joist, center of span, unit supported by 3 joists	NG		
REC CENTER	RTU-9	AAON	31	RNA-031-D-D-3-EJADB-CD2LD	AAON	31	RNA-031-D-D-3-EJADB-CD2LD	RTU-9		6,363	6,363	S2.31	Unknown; assumed bar joist; existing unit + 28 ton (mech); assume new unit is sim in size	OK		
REC CENTER	RTU-10	DAIKIN	6	DPS037A	DAIKIN	6	DPS037A	RTU-10	702	2,396	2,482	S2.31	Bar joist, near support, unit supported by 2 joists	NG	T1 (BAR JOIST REINF)	CHORD REINF: (2)- 7/8 IN DIA BAR x 24 FT, TOP AND BOT CHORD; TRUSS WEB REINF: L1-1/2 x 1-1/2 x 3/16 ON BOTH SIDES OF DIAG, QNTY: 10, (5 DIAG LOCATIONS); COMP STRUT (TRUSS PANEL POINT): L1-1/2 x 1-1/2 x 3/16 ON CHORD, COORD WITH AHU CURB
REC CENTER	RTU-11	DAIKIN	15	DPS056A	DAIKIN	15	DPS015A	RTU-11	2,022	4,239	4,339	?	?	NG		
REC CENTER	RTU-12	DAIKIN	4	DPS003A	DAIKIN	4	DPS003A	RTU-12	587	1,494	1,547	S2.31	Bar joist, near support, unit supported by 2 joists	NG	T1 (BAR JOIST REINF)	CHORD REINF: (2)- 7/8 IN DIA BAR x 24 FT, TOP AND BOT CHORD; TRUSS WEB REINF: L1-1/2 x 1-1/2 x 3/16 ON BOTH SIDES OF DIAG, QNTY: 10, (5 DIAG LOCATIONS); COMP STRUT (TRUSS PANEL POINT): L1-1/2 x 1-1/2 x 3/16 ON CHORD, COORD WITH AHU CURB
REC CENTER	RTU-13	DAIKIN	15	DPS056A	DAIKIN	15	DPS015A	RTU-13	2,022	4,239	4,339			NG		
REC CENTER	RTU-14	DAIKIN	3	DPS003A	DAIKIN	3	DPS003A	RTU-14	533	1,444	1,497	S2.31	Bar joist, center of span, unit supported by 2 joists	NG		
REC CENTER	RTU-15	AAON	20	RN-020-3-D-4X0E-5A8	AAON	20	RN-020-3-D-4X0E-5A8	RTU-15		9,760	9,760	S2.32	Unknown; assumed bar joist	NG		
REC CENTER	RTU-16	AAON	50	RNA-050-D-D-3-EJADB	AAON	50	RNA-050-D-D-3-EJADB	RTU-16		7,566	7,566	S2.31	Unknown; assumed bar joist; supported by conc pad with 7,000# allowance	OK		
REC CENTER	RTU-17	DAIKIN	7.5	DPS037A	DAIKIN	7.5	DPS037A	RTU-17	935	2,396	2,482	S2.31	Bar joist, with MC sleepers from previous retrofit; allowance for 3,000#	OK		
REC CENTER	MAU-1	Greenheck	N/A	MSX-P113-H12-MF	Greenheck	N/A	MSX-P113-H12-MF	MAU-1	1,300	1,119		S2.32	Unknown Barjoist	OK		
REC CENTER	MAU-2	Greenheck	N/A	MSX-P109-H12-MF	Greenheck	N/A	MSX-P109-H12-MF	MAU-2	900	1,108		S2.32	Unknown Barjoist	OK		
REC CENTER	NOHU-1	INNOVENT	N/A	NOHU-150-PL-26100-AC-EH-460	INNOVENT	N/A	NOHU-150-PL-26100-AC-EH-460	NOHU-1	22,500	16,500		S2.32	Unknown Barjoist	OK		
REC CENTER	NOHU-2	INNOVENT (ELECTRIC COIL ONLY)	N/A	N/A	INNOVENT (ELECTRIC COIL ONLY)	N/A	N/A	NOHU-2	21,800	16,500		S2.32	Unknown Barjoist	OK		
REC CENTER	ERV-1	Renewaire		HE2XRT	Renewaire		HE2XRT	ERV-1		784		S2.31	Unit supported on conc pad with 2,000# allowance	OK		
REC CENTER	ERV-2	Renewaire		HE2XRT	Renewaire		HE2XRT	ERV-2		784		S2.31	Existing erv?, but replacement unit assumed adequate	OK		
REC CENTER	#1	Ouraweit		650 L 200A-VE	Ouraweit		920 L 200A-VE	#1	1,847	2,808				OK		
REC CENTER	#2	Ouraweit		650 L 200A-VE	Ouraweit		920 L 200A-VE	#2	1,847	2,808				OK		
REC CENTER	#3	Ouraweit		650 L 200A-VE	Lync		Aegis A 500	DHWHP-1	N/A	2,820		S2.31		NG	T1 (BAR JOIST REINF)	CHORD REINF: (2)- 7/8 IN DIA BAR x 24 FT, TOP AND BOT CHORD; TRUSS WEB REINF: L1-1/2 x 1-1/2 x 3/16 ON BOTH SIDES OF DIAG, QNTY: 10, (5 DIAG LOCATIONS); COMP STRUT (TRUSS PANEL POINT): L1-1/2 x 1-1/2 x 3/16 ON CHORD, COORD WITH AHU CURB
					Lync		Aegis A 500	DHWHP-2	N/A	2,820		S2.31		NG	T1 (BAR JOIST REINF)	

AA · AA.9 · A · A.6 · B · B.1 · B.2 · D · C · D.8 · E · E.3 · E.5 · F · F.1 · F.3 · F.6 · G · H · H.3 · I

8'-0" · 17'-8" · 1'-10" · 1'-1" · 3'-7" · 11'-5" · 17'-0" · 16'-0" · 9'-6" · 11'-6" · 29'-8"

1 · 2 · 4 · 7 · 8 · 8.7 · 9 · 9.2

8'-8" · 30'-4" · 12'-8" · 2' · 13' · 30'-8" · 12'-0" · 10'-7"

RTU-1:
REPLACE EXISTING 5-TON GAS DX RTU (619#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 5-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (2,346#)
OPTION 2: DAIKIN 5-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (2,432#)

RTU-2:
REPLACE EXISTING 5-TON GAS DX RTU (619#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 5-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (2,346#)
OPTION 2: DAIKIN 5-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (2,432#)

RTU-3:
REPLACE EXISTING 6-TON GAS DX RTU (702#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 6-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (2,396#)
OPTION 2: DAIKIN 6-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (2,482#)

RTU-4:
REPLACE EXISTING 10-TON GAS DX RTU (1,015#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 10-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (2,421#)
OPTION 2: DAIKIN 10-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (4,304#)

RTU-5:
REPLACE EXISTING 4-TON GAS DX RTU (587#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 4-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (1,494#)
OPTION 2: DAIKIN 4-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (1,547#)

RTU-6:
REPLACE EXISTING 3-TON GAS DX RTU (786#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 3-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (1,444#)
OPTION 2: DAIKIN 3-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (1,497#)

RTU-7:
REPLACE EXISTING 7.5-TON GAS DX RTU (935#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 7.5-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (2,396#)
OPTION 2: DAIKIN 7.5-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (2,482#)

RTU-8:
REPLACE EXISTING 6-TON GAS DX RTU (702#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 6-TON W/ WHEEL AND 100% ELEC BACKUP (2,396#)
OPTION 2: DAIKIN 6-TON W/ WHEEL AND 100% GAS BACKUP (2,482#)

RTU-9:
REPLACE EXISTING 28-TON GAS DX RTU WITH NEW HEAT PUMP RTU WITH 100% GAS REHEAT.
BASIS OF DESIGN:
AAON 31-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (6,363#)

RTU-10:
REPLACE EXISTING 6-TON GAS DX RTU (702#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 6-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (2,396#)
OPTION 2: DAIKIN 6-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (2,482#)

RTU-12:
REPLACE EXISTING 4-TON GAS DX RTU (587#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 4-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (1,494#)
OPTION 2: DAIKIN 4-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (1,547#)

RTU-14:
REPLACE EXISTING 3-TON GAS DX RTU (533#) WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% REHEAT.
BASIS OF DESIGN:
OPTION 1: DAIKIN 3-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (1,444#)
OPTION 2: DAIKIN 3-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (1,497#)

RTU-16:
REPLACE EXISTING 50-TON GAS DX RTU WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% ELECTRIC REHEAT.
BASIS OF DESIGN:
AAON 50-TON HEAT PUMP W/ WHEEL AND 100% ELEC BACKUP (7,566#)

ERV-1:
REPLACE EXISTING 1800 CFM GAS ERV WITH NEW ELECTRIC-ONLY ERV.
BASIS OF DESIGN:
RENEWAIRE HE2XRT WITH AUXILIARY ELECTRIC HEAT (784#)

ERV-1:
REPLACE EXISTING 1376 CFM GAS ERV WITH NEW ELECTRIC-ONLY ERV.
BASIS OF DESIGN:
RENEWAIRE HE2XRT WITH AUXILIARY ELECTRIC HEAT (784#)

DOMESTIC HOT WATER:
OPTION 1A:
PROVIDE 2 NEW 500 MBH HEAT PUMP WATER HEATERS ON ROOF
BASIS OF DESIGN:
LYNC AEGIS A 500 (2820#)

CONTRACTOR TO LOCATE EXISTING BRIDGING LOCATIONS IN RELATION TO NEW DUCTWORK, SEE MECHANICAL DRAWINGS, NOTIFY ARCHITECT OF ANY CONFLICTS, DO NOT REMOVE ANY EXISTING BRIDGING

MC 6x 12 FLAT SLEEPERS, TYP

B/DECK [131'-0"] TYP AT GRID AA · T/STEEL [131'-0"] TYP AT GRID AA · B/DECK [131'-0"] TYP AT GRID 8.7 · T/STEEL [131'-0"] TYP AT GRID 8.7 · TYPE A TYP AT GRID AA

TYP THIS LINE PARALLEL TO GRID 5 · TYP AT STOREFRONT · TYPE D TYP AT GRID 5 · TYP AT STUD WALL · MOVEMENT JOINT, SEE ARCH DRAWINGS · TYPE B · DETAILS APPLY ONLY ABOVE SLAB EDGE EXTENT BELOW, SEE S2.21 · DETAIL APPLIES ONLY SOUTH OF SLAB EDGE EXTENT BELOW, SEE S2.21 · SEE S2.21 FOR CONNECTION AT LOW ROOF

INDICATES FAN BELOW, SEE MECH DWGS · INDICATES LOCATIONS OF BOTTOM CHORD EXTENSIONS, SEE 6/S5.05 · DECK CONN TO WF BTWN JOIST SEATS PER 2/S5.05 TYP · SKYLIGHT, SEE ARCH · RTU, SEE MECH DRAWINGS · EXTENT OF CONCRETE PAD, SEE 10/S5.31 · CMU WALL BELOW · T.O. CMU 124'-8" · T.O. CMU 126'-0" · T/(E) CMU 126'-0" VIF

5/8" SHIM · 3/4" SHIM · 7/8" SHIM · 3.0 K · 2.0 K · 7.0 K

HSS5x5x1/4 · HSS5x5x1/4 · HSS5x5x1/4 · HSS5x5x1/4 · HSS5x5x1/4 · HSS5x5x1/4

W24x62 · W12x26 · W16x26 · W16x31 · W18x40 · W14x22 · W21x44 · W18x35 · W18x40 · W21x48 · W21x55 · W12x19 · W8x15 · W12x26

ROOF PLAN - SECTOR 1

1/8" = 1'-0"

NORTH

---

v1 - 03/28/2028

STRUCTURAL NOTES:

1. REPLACEMENT ROOFTOP UNITS CONFIGURED WITH LG ADAPTER CURB TYP UNO.
2. NEW UNITS TO BE PROVIDED WITH MECH CURB.
3. CONFIGURE MC6 X 12 [FLAT] SLEEPERS AT NEW UNIT LOCATIONS.
4. [ ] DENOTES UNIT LOCATION WITH REQ'D TRUSS REINFORCING; SEE SK-1 FOR ADDITIONAL INFO; DETAILS 2, 6, 18 & 19.
5. NEW SLEEPERS TO BE WELDED TO UNDERLYING FRAMING; ROOF PATCHING NO SHOWN FOR CLARITY.
6. NO NEW ROOF OPENINGS ARE ANTICPATED WITH BASE SCOPE; IF NEW OPENING IS REQ'D SEE DETAIL.
7. FOR BAR JOIST REINF WELDING, ASSUME 3 PEOPLE FOR WELDING AND FIRE-WATCH; FIRE WATCH AT FLOOR LEVEL AND ADDITIONAL FIRE WATCH AT ROOF LEVEL.
8. STRUCTURAL SCOPE FOR ROOFTOP PV IS NOT INCLUDED. IF ROOFTOP PV IS DESIRED, FURTHER ANALYSIS WILL BE NEEDED TO VALIDATE STRUCTURAL CAPACITY OF EXISTING ROOF.

SINK COMBS DETHLEFS
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City of Louisville

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12499 WEST COLFAX AVENUE, LAKEWOOD, COLORADO 80215
MAIN 303.431.6100 MARTINMARTIN.COM

Louisville Recreation Center

LOUISVILLE, COLORADO 80027

SCD Project No.: 17.0033.S.01

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BP2 ADD1	BP #2 - ADDENDUM #1	10/13/2017

1 · 4 · 2 · 3

ROOF PLAN -SECTOR 1

S2.31

Project Style
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NDHU-1:
REPLACE EXISTING GAS-FIRED NDHU (22,500#) WITH NEW ELECTRIC-ONLY NDHU.
BASIS OF DESIGN:
INNOVENT NDHU-OU-PL-26100-AC-EH-460 (12,700#)

RTU-15:
REPLACE EXISTING 20-TON GAS DX RTU WITH NEW HEAT PUMP RTU WITH HEAT WHEEL AND 100% GAS REHEAT.
BASIS OF DESIGN:
AAON 20-TON HEAT PUMP W/ WHEEL AND 100% GAS BACKUP (3,760#)

MAU-2:
REPLACE EXISTING GAS MAU (900#) WITH NEW ELECTRIC MAU.
BASIS OF DESIGN:
GREENHECK MSX-P109-H12-MF (1,108#)

MAU-1:
REPLACE EXISTING GAS MAU (1,300#) WITH NEW ELECTRIC MAU.
BASIS OF DESIGN:
GREENHECK MSX-P115-H12-MF (1,119#)

POOL HEAT:
OPTION 1A:
PROVIDE (10) NEW 500 MBH HEAT PUMP WATER HEATERS ON ROOF
BASIS OF DESIGN:
(10) LYNC AEGIS A 500 (2820#)

(E)NDHU-2:
REMOVE GAS COIL ON EXISTING INNOVENT UNIT AND REPLACE WITH NEW ELECTRIC COIL OF SIMILAR SIZE, 400 KW OF CAPACITY

STRUCT NOTES:

1. SEE SHEET NOTES ON P1OF4 FOR ADDED INFO.

ROOF PLAN - SECTOR 2

1/8" = 1'-0"

NORTH

SINK COMBS DETHLEFS
SPORTS CONSULTANTS
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

City of Louisville

MARTIN/MARTIN CONSULTING ENGINEERS
12499 WEST COLFAX AVENUE, LAKEWOOD, COLORADO 80215
MAIN 303.431.6100 MARTINMARTIN.COM

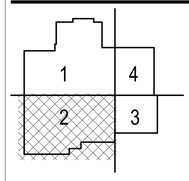
Louisville Recreation Center

LOUISVILLE, COLORADO 80027

SCD Project No.: 17.0033.S.01

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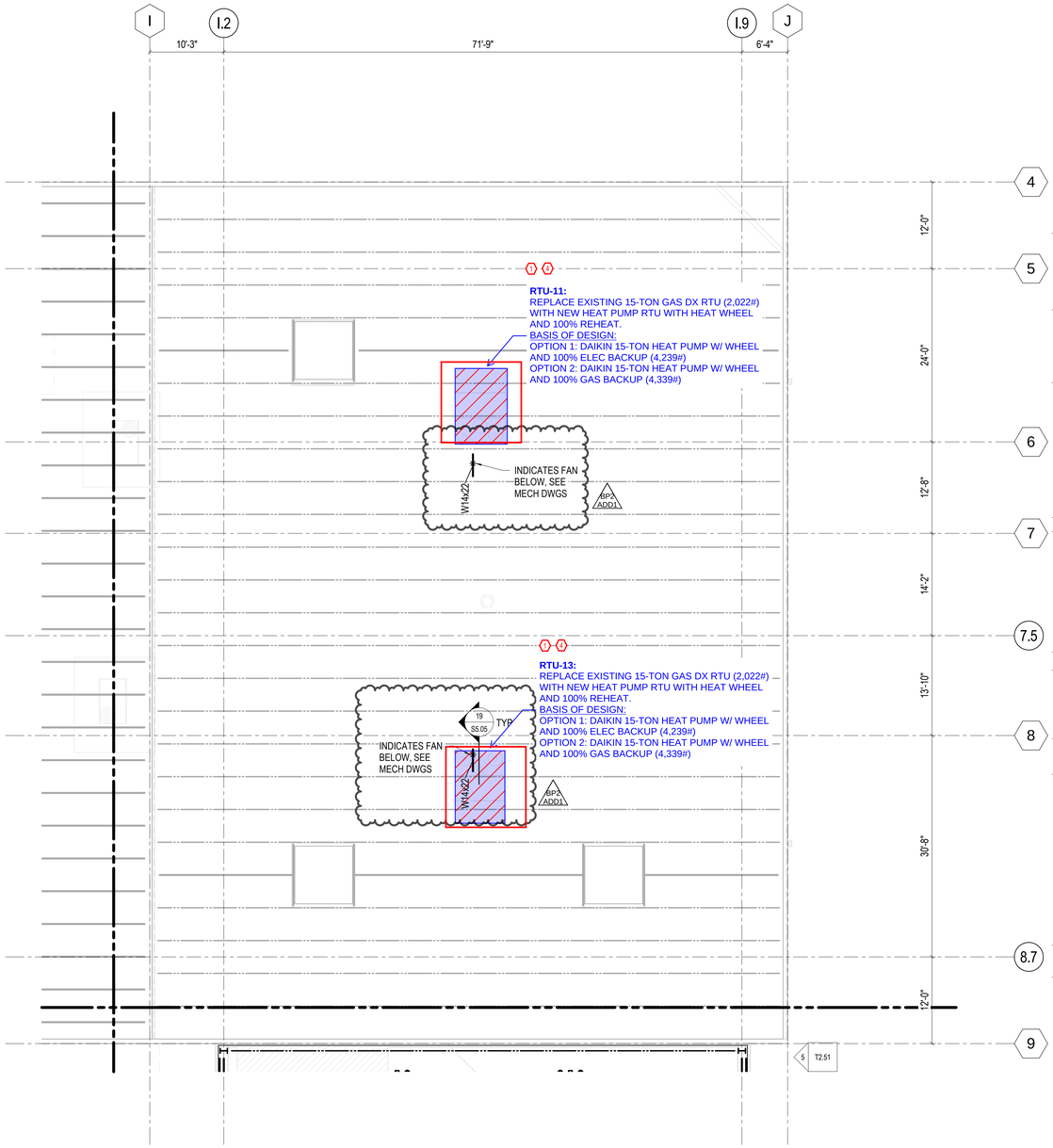
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	DESIGN DEVELOPMENT	06/30/2017
	BID PACKAGE #1 - REFERENCE	07/28/2017
	CD PROGRESS SET	08/29/2017
	BP #1 - REFERENCE	09/15/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD1	BP #2 - ADDENDUM #1	10/13/2017



ROOF PLAN -SECTOR 2

S2.32

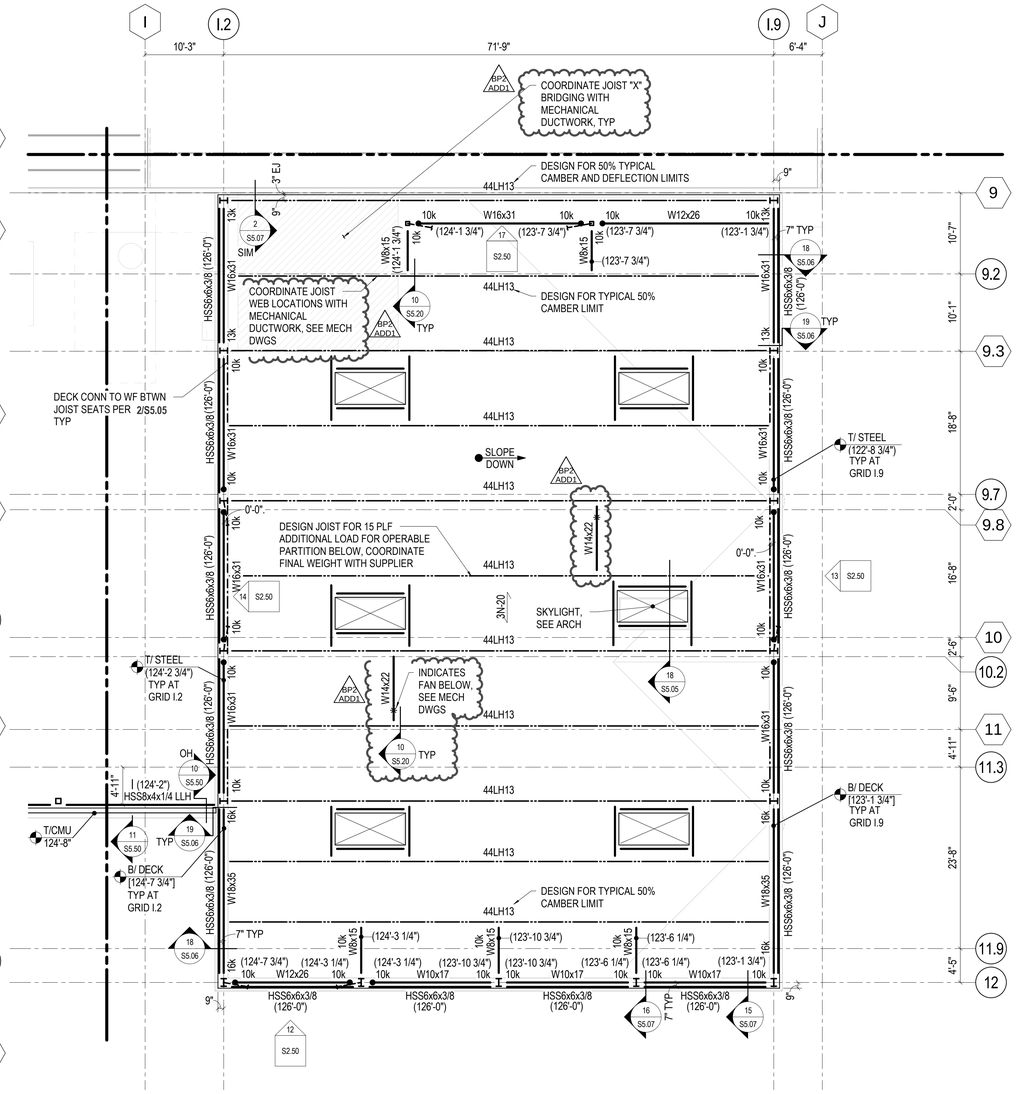
Project Status
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ROOF PLAN - SECTOR 4

1/8" = 1'-0"

NORTH



ROOF PLAN - SECTOR 3

1/8" = 1'-0"

NORTH

SINK COMBS DETHLEFS
SPORTS CONSULTANTS
475 LINCOLN STREET
SUITE 100
DENVER, CO 80203
Tel: 303-308-0200

City of Louisville

MARTIN/MARTIN CONSULTING ENGINEERS
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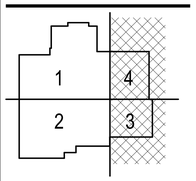
Louisville Recreation Center

LOUISVILLE, COLORADO 80027

SCD Project No.: 17.0033.S.01

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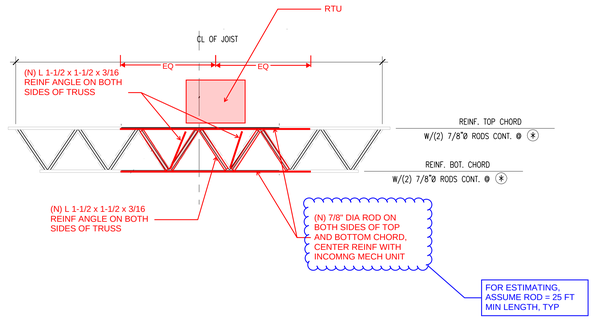
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	CD PROGRESS SET	08/29/2017
	BP #1 - REFERENCE	09/15/2017
	BID PACKAGE #2	09/29/2017
BP2 ADD1	BP #2 - ADDENDUM #1	10/13/2017



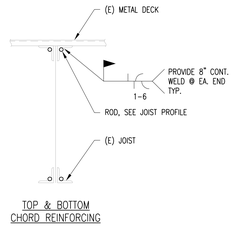
ROOF PLAN -SECTOR 3 AND 4

S2.33

Project Date:
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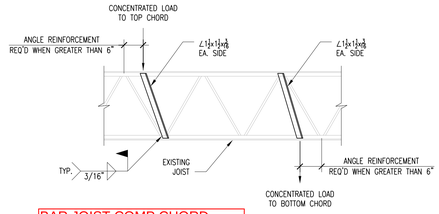
2 BAR JOIST REINF ELEVATION



TOP & BOTTOM
CHORD REINFORCING

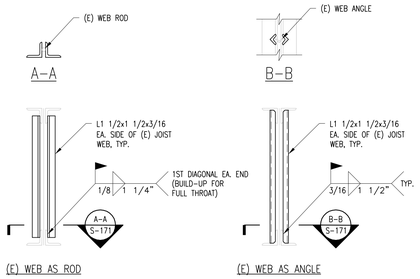
BAR JOIST CHORD REINF

18 SECTION
3/4" = 1'-0"



BAR JOIST COMP CHORD
REINF (TRUSS PANEL POINT)

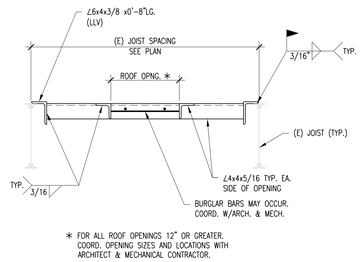
6 TYPICAL EXISTING JOIST REINFORCING DETAIL
3/4" = 1'-0"



(E) WEB AS ROD (E) WEB AS ANGLE

BAR JOIST WEB REINF

19 SECTION
3/4" = 1'-0"



* FOR ALL ROOF OPENINGS 12" OR GREATER.
COORD. OPENING SIZES AND LOCATIONS WITH
ARCHITECT & MECHANICAL CONTRACTOR.

ROOF OPENING REINF

1 TYPICAL ROOF OPENING DETAIL
3/4" = 1'-0"

Louisville Recreation Center

LOUISVILLE, COLORADO 80027

BAR JOIST
REINF DETAILS

SK - 1



Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

City of Louisville
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City of Louisville
Recreation & Senior Center
Electric Vehicle Charging Narrative

Electric Vehicle Charging Narrative

Electric Vehicle Charging Narrative

Fleet & Electric Vehicle Charging

As part of the decarbonization study, the fleet vehicles were analyzed for replacement with EV equivalents. In addition, building electrical capacities were reviewed to determine if they have enough capacity to charge the fleet vehicles and if any electrical upgrades may be needed to the buildings.

EV Fleet Conversion

Based on current technology, transitioning from internal combustion engine (ICE) vehicles to EVs can substantially lower overall carbon emissions. A caveat to consider in assessing the environmental impact of EVs is the variation of electricity generation sources in a given area. The state of Colorado relies mainly on coal and natural gas. However, the share of these fuel sources as a percentage of total generation is decreasing. Alternative energy sources such as wind and solar are increasing rapidly. By using additional onsite renewable energy sources and phasing in vehicle replacement it will be possible for Louisville's fleet to be entirely carbon free.

In the current vehicle market mainly light duty vehicles are being produced. The battery technology is still being developed for heavy-duty vehicles. The market is rapidly changing so over the course of the next 5 years new innovation should allow heavy duty vehicles to be carbon free through either advanced battery technology or other yet to be determined technology.

EVs typically have a higher initial capital cost to purchase or lease when compared to ICE vehicles, EVs can cost less in the long-term due to lower fuel costs, different maintenance requirements, and longer vehicle lives. Therefore, it is important to consider the entire lifespan of a vehicle when investing in fleet vehicles. There are also limiting factors of EVs to consider, such as range and power needs of certain fleet vehicles, as well as the near-constant changes in the electric vehicle and infrastructure technology.

Charging Infrastructure

When planning for EV charging infrastructure, it is recommended to proactively plan for the number of charging stations needed by installing more electrical equipment (e.g. transformers and conduits) than is needed for the initial purchase of EVs. It is more cost effective to install excess electrical equipment during the initial installation than having to add electrical wires each time additional stations are required. This electrical equipment installation does not include purchasing all the charging stations that can fit with that equipment, but instead having the electrical capacity to purchase charging stations to meet future capacity needs without additional construction. The city has already thought about this and this report is the result of that forward thinking.

While there are three levels of EV charging infrastructure currently available, Level 2 charging is currently the most prevalent among them and requires electrical infrastructure upgrades to extend 240 volt AC service to locations where the EVs would charge. It charges at over twice the rate of level 1, adding 12 to 80 miles of range per hour charging. Level 3 charges are also becoming more common and can add from 80 to 500 miles of range per hour. Level 3 charging typically requires a 480 volt AC service. The level 2 and 3 chargers with the increased rate of charging can justify the costs to serve the needs of fleet management in a timely manner. Costs per unit can vary within these ranges depending on the installation and labor costs, warranties for equipment, and operation and maintenance costs for the equipment. Level 2 chargers provide good value for infrastructure investment when factoring in cost and time required to charge when compared to Level 3 chargers. Level 3 chargers can make sense when high use vehicles need quick recharging, though these chargers will cost more to install and incur a higher charging cost than level 2 chargers.

Electric Vehicle Charging Narrative

For the public chargers the City may want to consider charging a some type of fee for usage. Many charging stations charge a usage fee at some dollar per kWh of charging. This can help offset the peak demand that may be incurred by the city. Another option is to charge an idle fee. This type of fee encourages people not to leave there vehicle plugged in for long period of times once the vehicle has reached full charge.

Another consideration for charging infrastructure is the daily charging schedule. Most of the buildings reviewed for this study are on a secondary general rate schedule. This rate schedule does not have time of use rates for electrical consumption or peak demand. This means depending on when and how many vehicles charge relative to the buildings peak demand, it may increase the demand charges the city pays. Xcel Energy does offer a EV charging rate plan that incentivize the intentional reduction of electricity use during peak energy demand periods, such as during hot summer days. This rate plane does require a separate service for just the charging stations. Planning for fleet recharging during off-peak periods can add up to thousands of dollars in savings.

Battery capacity

Battery technology is changing rapidly, resulting in increased charge capacity and lower operating cost per mile. Many manufactures now offer eight year/100,000 mile warranties on their EV batteries (generally covering defects and workmanship), and some offers an eight year/100,000 mile warranty on battery capacity. Auto manufacturer warranties and charge capacity have generally reduced consumer concern about battery life and range. As a result, the analysis of total ownership cost does not account for the cost of EV battery replacement, assuming that municipal vehicles will be retired at the warranty expiration.

Recreation Center Site

The recreation center has 3 vehicles. One is considered a heavy-duty vehicle and the other two are passenger vehicles. These vehicles are primarily used at the rec center. See table below.

Use Type	Make	Model	Quantity
Rec Center	Dodge	2500	1
		Caravan	1
	Ford	E350	1

We recommend installing 5 chargers and upgrading the electrical infrastructure to support them. Currently there is no direct replacement for the van or heavy duty truck (used to plow the parking lot). It is anticipated those vehicles will be available in the next 5 to 10 years. We also recommend installing publicly available chargers for the city residents. The table below shows the number of recommended chargers.

Existing Public charging stations	Existing Public Charger Level	Quantity of New Level 2 Public Charger	Quantity of New Level 3 Public Charger	Quantity of New Level 2 Fleet Charger	Quantity of New Level 3 fleet Charger
1	2	2	1	1	1

At this site the chargers were split into two groups, public and fleet. The number of fleet chargers selected to be installed here were based on the number of vehicles stored onsite plus one extra to account for visiting fleet vehicles. In addition, one of the fleet chargers was selected to be a L3 charger to allow for quick recharge of a fleet vehicle if needed. An example of such a use case maybe for the plow vehicle used to clear the parking lot.

Electric Vehicle Charging Narrative

The quantity of public chargers selected for this site was based on the remaining parking spots located in that parking strip area and proximity to the electrical services that will be in the area for the fleet chargers. More or less spots could installed or located in other areas but this will affect the cost. One L3 charger was included in the public area to allow a fast charging option for the public.



Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

City of Louisville
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City of Louisville Decarbonization Study

Louisville Recreation and Senior Center

RENEWABLES SUPPORTING ANALYSIS

LOUISVILLE, CO

AUGUST 18, 2023

Together Building a Thriving Planet



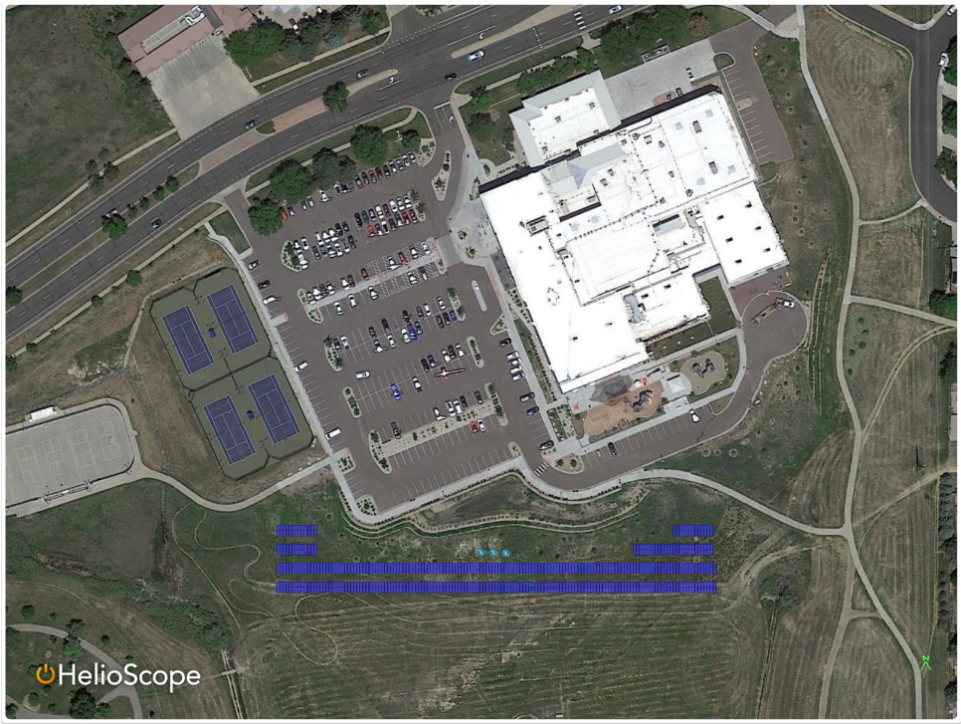
Louisville Recreation & Senior Center

The Louisville Recreation & Senior Center is a good candidate for a fixed-tilt ground mount or flat rooftop solar PV system. The roof is a 2018 remodel, aligning the membrane lifetime with the PV module lifetime. The roof area with the lowest likelihood of needing structural upgrades and the land south of the parking lot are fairly open, allowing for cohesive arrays. Either system would be advantageous to the City of Louisville's Decarbonization Plan.

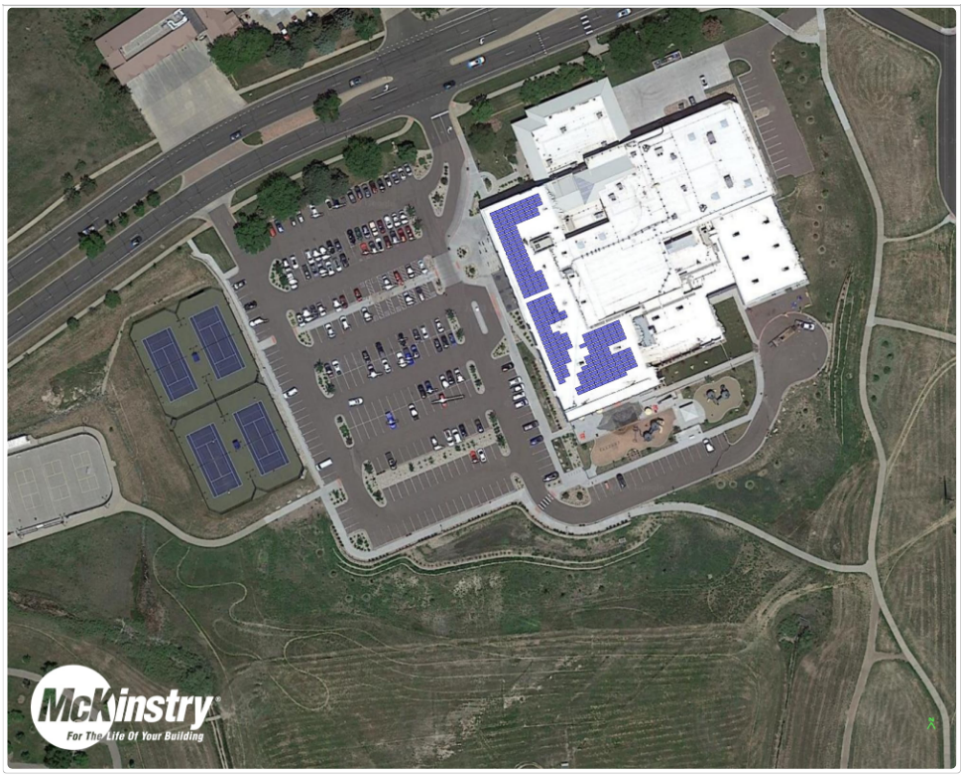
1. Proposed Solar PV System Overview

Below is a high-level summary of the proposed system specifications. Please note, specific equipment manufacturers and models may change depending on availability and market conditions at the time of construction.

SITE NAME	SITE ADDRESS	OPTION	SIZE (KW-DC)	SIZE (KW-AC)	SYSTEM TYPE	YEAR 1 PRODUCTION (kWh)
Louisville Recreation and Senior Center	900 W Via Appia Way Louisville, CO 80027	1	379.1	300.0	Fixed-tilt ground mount	620,610
		2	137.7	120.0	Flat rooftop	200,873
		3	516.8	420.0	Combo	821,483



Louisville Recreation & Senior Center



LOUISVILLE RECREATION & SENIOR CENTER EQUIPMENT AND QUANTITY SUMMARY

QUANTITY	EQUIPMENT DESCRIPTION
	Ground Mount
702	JA Solar, JAM72D30-540 (540W) – Bifacial Mono PERC Half Cell Double Glass Modules
3	CPS SCA100KTL-DO/US-480 - Inverters
1	30° Fixed-Tilt Ground Mount Racking System
1	AlsoEnergy Data Acquisition System (DAS) Package – PLCS600
1	Electrical Balance of Systems Package
	Flat Rooftop
255	JA Solar, JAM72D30-540 (540W) – Bifacial Mono PERC Half Cell Double Glass Modules
2	CPS SCA60KTL-DO/US-480 - Inverters
1	PanelClaw clawFR 10° Flat Roof Racking System • Mix of ballast and mechanical attachments
1	AlsoEnergy Data Acquisition System (DAS) Package – PLCS400*
1	Electrical Balance of Systems Package

**If both systems are implemented, they would share a PLCS600 package*

AlsoEnergy Data Acquisition System (DAS) includes the equipment/functionality listed below.

- NEMA 4 Enclosure and Data Logger
- Cellular modem
- CT Based Revenue Grade Meter
- Inverter Direct Monitoring
- 5-year service plan
- A Meteorological Station consisting of the following:
  - Cell Temp Sensor
  - Pyranometer
- Publicly accessible web-based dashboard functionality

The Electrical Balance of Systems Package includes all components to create an electrically complete ground mount or rooftop solar PV installation. This includes grounding materials, wiring, conduit, MCT, panelboards/combiners, switchgear, fuses, and disconnects. For the purposes of this decarbonization study, this scope is split between the electrical and solar PV pricing. More details provided in Section 4.

2. Production Modeling

Array layouts and system production are modeled in Helioscope, an industry-standard design and energy modeling software package with 3-dimensional modeling capabilities. Through Helioscope, we can incorporate site-specific characteristics of buildings and shade producing obstructions to determine their impacts upon system layout and production. McKinstry further applies our knowledge of codes and regulations, industry best practices, and professional judgment to ensure that designs are code-compliant and strike a balance across customer preferences, production, constructability, and price concerns.

Helioscope provides robust PV system output modeling capabilities. We use these in conjunction with Typical Meteorological Year (TMY) weather datasets, real-world equipment specifications, proprietary 3rd-party-engineered dust and snow soiling models, and professional judgment to determine a system's annual kWh production. For City of Louisville, we are using the TMY, DENVER INTL AP, NSRDB (tmy3,I) weather data set and soiling conditions from the DNV-GL NOAA Lafayette station. Full Helioscope report below.

Louisville Recreation & Senior Center

HelioScope Annual Production Report produced by Mountain Lyanda Dudley

Cohort 1 - Rec Center Ground_REV1 City of Louisville, 951 Spruce St, Louisville, CO 80027

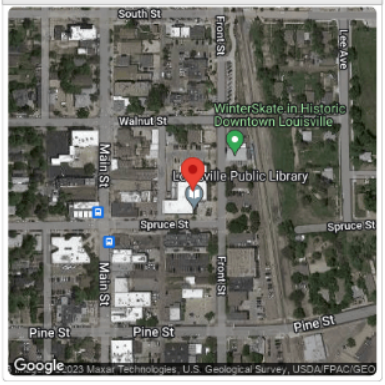
Report

Project Name	City of Louisville
Project Address	951 Spruce St, Louisville, CO 80027
Prepared By	Mountain Lyanda Dudley lyandad@mckinstry.com

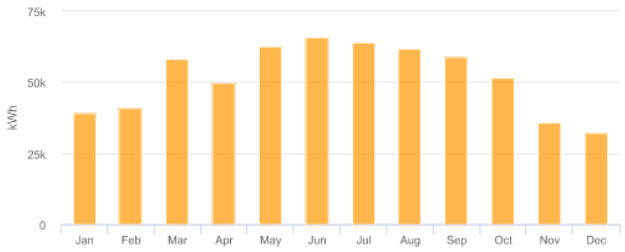
System Metrics

Design	Cohort 1 - Rec Center Ground_REV1
Module DC Nameplate	379.1 kW
Inverter AC Nameplate	300.0 kW Load Ratio: 1.26
Annual Production	620.6 MWh
Performance Ratio	82.1%
kWh/kWp	1,637.1
Weather Dataset	TMY, DENVER INTL AP, NSRDB (tmy3,)
Simulator Version	5aee66451a-bd835f4a09-97ab2b5119-59c665659f

Project Location

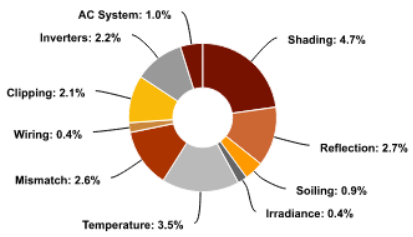


Monthly Production



Month	GHI (kWh/m²)	POA (kWh/m²)	Shaded (kWh/m²)	Nameplate (kWh)	Grid (kWh)
January	77.6	134.8	117.7	42,490.1	39,238.6
February	88.7	131.0	122.4	44,205.9	41,037.8
March	144.4	183.1	179.4	65,506.2	58,133.6
April	143.6	157.1	152.8	56,133.6	49,685.2
May	196.1	196.6	191.4	71,020.5	62,550.5
June	218.0	209.1	204.2	76,622.0	65,803.9
July	208.2	203.3	198.3	74,302.4	64,051.7
August	185.7	197.1	192.5	72,240.1	61,829.1
September	155.3	186.0	182.1	68,354.4	58,748.1
October	114.2	160.4	155.0	58,403.8	51,543.3
November	73.9	119.1	105.8	38,919.8	35,833.8
December	64.4	115.6	98.1	35,375.8	32,154.0

Sources of System Loss



Louisville Recreation & Senior Center

HelioScope **Annual Production Report** produced by Mountain Lyanda Dudley

Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,670.2	
	POA Irradiance	1,993.2	19.3%
	Shaded Irradiance	1,899.7	-4.7%
	Irradiance after Reflection	1,849.0	-2.7%
	Irradiance after Soiling	1,832.9	-0.9%
	Total Collector Irradiance	**1,832.9**	**0.0%**
Energy (kWh)	Nameplate	703,574.7	
	Output at Irradiance Levels	700,542.8	-0.4%
	Output at Cell Temperature Derate	676,064.2	-3.5%
	Output After Mismatch	658,175.4	-2.6%
	Optimal DC Output	655,305.3	-0.4%
	Constrained DC Output	641,283.9	-2.1%
	Inverter Output	626,878.3	-2.3%
	Energy to Grid	**620,609.5**	**-1.0%**
Temperature Metrics			
	Avg. Operating Ambient Temp		15.0 °C
	Avg. Operating Cell Temp		25.0 °C
Simulation Metrics			
	Operating Hours		4513
	Solved Hours		4513

Condition Set

Description	Ground 30 deg											
Weather Dataset	TMY, DENVER INTL AP, NSRDB (tmy3, I)											
Solar Angle Location	Project Lat/Lng											
Transposition Model	Perez Model											
Temperature Model	Diffusion Model											
Temperature Model Parameters	Rack Type						U_{const}			U_{wind}		
	Fixed Tilt						29			0		
	Flush Mount						15			0		
	East-West						29			0		
	Carport						29			0		
Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	3.5	3.5	2.5	1.5	0.5	-0.5	-0.5	-0.5	-0.5	-0.5	1.5	3.5
Irradiation Variance	3.5%											
Cell Temperature Spread	3° C											
Module Binning Range	0% to 2.5%											
AC System Derate	1.00%											

Trackers	Maximum Angle		Backtracking
	30°		Disabled
Module Characterizations	Module	Uploaded By	Characterization
	JAM72D30-540/MB (JA Solar)	HelioScope	Spec Sheet Characterization, PAN
Component Characterizations	Device	Uploaded By	Characterization
	CPS SCA50KTL-DO/US-480 (Sept17) (Chint)	HelioScope	Spec Sheet
	CPS SCA100KTL-DO/US-480 (Chint Power Systems)	HelioScope	Default Characterization
	CPS SCA60KTL-DO/480 (Chint)	HelioScope	Spec Sheet

Components

Component	Name	Count
Inverters	CPS SCA100KTL-DO/US-480 (Chint Power Systems)	3 (300.0 kW)
Strings	10 AWG (Copper)	27 (9,457.5 ft)
Module	JA Solar, JAM72D30-540/MB (540W)	702 (379.1 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	-	Along Racking
Wiring Zone 2	-	-	Along Racking
Wiring Zone 3	-	-	Along Racking
Wiring Zone 4	-	26-26	Along Racking
Wiring Zone 5	-	-	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Ground Mount	Fixed Tilt	Portrait (Vertical)	30°	180°	10.0 ft	2x13	27	702	379.1 kW

Louisville Recreation & Senior Center

HelioScope Annual Production Report produced by Mountain Lyanda Dudley

Cohort 1 - Rec Center Roof_REV2 City of Louisville, 951 Spruce St, Louisville, CO 80027

Report

Project Name	City of Louisville
Project Address	951 Spruce St, Louisville, CO 80027
Prepared By	Mountain Lyanda Dudley lyandad@mckinstry.com

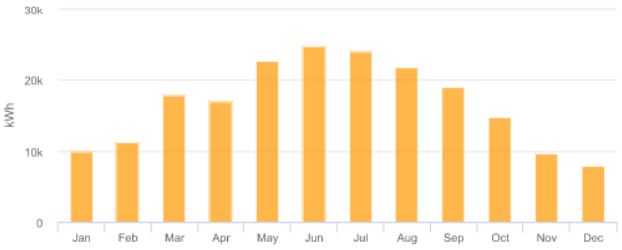
System Metrics

Design	Cohort 1 - Rec Center Roof_REV2
Module DC Nameplate	137.7 kW
Inverter AC Nameplate	120.0 kW Load Ratio: 1.15
Annual Production	200.9 MWh
Performance Ratio	80.2%
kWh/kWp	1,458.8
Weather Dataset	TMY, DENVER INTL AP, NSRDB (tmy3,)
Simulator Version	5aee66451a-bd835f4a09-97ab2b5119-59c665659f

Project Location

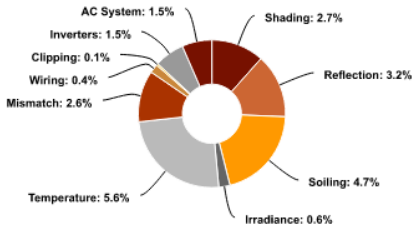


Monthly Production



Month	GHI (kWh/m²)	POA (kWh/m²)	Shaded (kWh/m²)	Nameplate (kWh)	Grid (kWh)
January	77.6	97.6	90.2	10,536.7	9,938.9
February	88.7	104.5	100.3	11,966.0	11,291.9
March	144.4	160.7	157.4	19,566.6	17,880.0
April	143.6	152.0	149.6	18,805.4	17,035.1
May	196.1	201.4	198.7	25,866.8	22,668.9
June	218.0	221.1	218.4	29,387.0	24,764.1
July	208.2	213.3	210.4	28,265.7	23,928.8
August	185.7	194.9	192.2	25,823.0	21,850.9
September	155.3	169.3	166.1	22,212.5	19,078.4
October	114.2	131.5	127.9	16,504.5	14,833.0
November	73.9	89.8	84.4	10,326.5	9,666.0
December	64.4	82.0	74.5	8,482.3	7,937.3

Sources of System Loss



HelioScope Annual Production Report produced by Mountain Lyanda Dudley

Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,670.2	
	POA Irradiance	1,818.3	8.9%
	Shaded Irradiance	1,770.1	-2.7%
	Irradiance after Reflection	1,713.2	-3.2%
	Irradiance after Soiling	1,633.3	-4.7%
	Total Collector Irradiance	**1,633.3**	**0.0%**
Energy (kWh)	Nameplate	227,743.1	
	Output at Irradiance Levels	226,457.0	-0.6%
	Output at Cell Temperature Derate	213,668.4	-5.6%
	Output After Mismatch	208,139.0	-2.6%
	Optimal DC Output	207,229.2	-0.4%
	Constrained DC Output	207,040.7	-0.1%
	Inverter Output	203,932.4	-1.5%
	Energy to Grid	**200,873.4**	**-1.5%**
Temperature Metrics			
	Avg. Operating Ambient Temp		15.0 °C
	Avg. Operating Cell Temp		27.9 °C
Simulation Metrics			
	Operating Hours		4513
	Solved Hours		4513

Condition Set

Description	Roof 10 deg		
Weather Dataset	TMY, DENVER INTL AP, NSRDB (tmy3, I)		
Solar Angle Location	Project Lat/Lng		
Transposition Model	Perez Model		
Temperature Model	Diffusion Model		
Temperature Model Parameters	Rack Type	U_{const}	U_{wind}
	Fixed Tilt	20	0
	Flush Mount	15	0
	East-West	20	0
	Carport	29	0

Soiling (%)	J	F	M	A	M	J	J	A	S	O	N	D
	12	11	8	7	4	1	1	1	1	4	8	14

Irradiation Variance	3.5%		
Cell Temperature Spread	3° C		
Module Binning Range	0% to 2.5%		
AC System Derate	1.50%		
Trackers	Maximum Angle	Backtracking	
	10°	Disabled	
Module Characterizations	Module	Uploaded By	Characterization
	JAM72D30-540/MB (JA Solar)	HelioScope	Spec Sheet Characterization, PAN
Component Characterizations	Device	Uploaded By	Characterization
	CPS SCA60KTL-DO/US-480 (2021) (Chint Power Systems)	HelioScope	Spec Sheet

Components

Component	Name	Count
Inverters	CPS SCA60KTL-DO/US-480 (2021) (Chint Power Systems)	2 (120.0 kW)
Strings	10 AWG (Copper)	15 (1,381.6 ft)
Module	JA Solar, JAM72D30-540/MB (540W)	255 (137.7 kW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	-	17-17	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Landscape (Horizontal)	10°	157.66922°	1.2 ft	1x1	255	255	137.7 kW

3. Annual Utility Savings and Value of Solar Energy

To analyze utility bill savings, we utilize Energy Toolbase, an industry-standard bill modeling software package. Energy Toolbase estimates bill savings based upon a site's electric load characteristics, PV system production (imported from Helioscope or other sources), and local utility tariffs and net metering polices. Xcel Energy tariffs and Net Metering tariff adjustments used in this analysis are:

- Secondary General (SG)
- Secondary Photovoltaic Time-of-Use (SPVTOU)
- Net Metering Service (Schedule NM)

To properly calculate the annual utility savings associated with the solar PV, we need to analyze the building load after all electrification and carbon reduction measures are implemented. As noted in the Summary

Report, there are three bundles of measures – Bundle 1, Bundle 1b, and Bundle 2. Each create a slightly different building load baseline. Therefore, all scenarios are listed below. Baseline utility year is 2019 and the assumed DOE building profile is Large Office.

OPTION 1 – GROUND MOUNT ONLY

SCENARIO	ANNUAL SAVINGS	ENERGY SAVINGS	DEMAND SAVINGS
Bundle 1	$48,919	$35,128	$13,790
Bundle 1b	$49,018	$35,128	$13,889
Bundle 2	$41,469	$35,128	$6,341
Bundle 2 w/ rate switch SPVTOU	$57,248	-$13,390	$70,638

OPTION 2 – ROOF MOUNT ONLY

SCENARIO	ANNUAL SAVINGS	ENERGY SAVINGS	DEMAND SAVINGS
Bundle 1	$16,811	$11,370	$5,440
Bundle 1b	$16,635	$11,370	$5,265
Bundle 2	$14,682	$11,370	$3,312
Bundle 2 w/ rate switch SPVTOU	$18,475	-$50,418	$68,893

OPTION 3 – COMBINED GROUND AND ROOF

SCENARIO	ANNUAL SAVINGS	ENERGY SAVINGS	DEMAND SAVINGS
Bundle 1	$64,327	$46,498	$17,828
Bundle 1b	$64,390	$46,498	$17,892
Bundle 2	$54,504	$46,498	$8,006
Bundle 2 w/ rate switch SPVTOU	$76,459	$4,896	$71,563

Note that some of the Bundle 2 w/ rate switch SPVTOU savings are negative. This means Louisville would pay more on the energy portion of their bill but save more on the demand portion of their bill due to the time-of-use rate structure.

To qualify for a rate switch to SPVTOU, the building must have a minimum 30% load factor for the trailing 12 months. The only combination of measures that would qualify for this switch is Bundle 2. Note that Xcel must have 12 months of bills showing this load factor, so the system would only receive the regular Bundle 2 savings under SG for the first year before it could take advantage of the Bundle 2 w/ rate switch savings.

4. System Price and Financial Results

There are two main avenues City of Louisville can choose to finance these projects – cash purchase or tax-exempt lease purchase (TELP). As a tax-exempt entity, City of Louisville is eligible for direct pay in Year 1 at Energy Investment Tax Credit (ITC) rates. These rates are 30% for cash purchase and 25.5% for TELP.

At this early feasibility study stage of a portfolio, we focus on simple payback to get a high-level look at the project economics. Our simple payback calculation is based on Year 1 solar production, Year 1 annual utility savings, and the Solar*Rewards C&I incentive program. Should any of these projects move into the next stage of development, McKinstry would develop more detailed proformas and cash flows to include items like solar degradation, Operations & Maintenance, discount rates, and more.

McKinstry aims to recommend solar systems that will pay back in the system lifetime, between 25-30 years. All three of these options pay back before then. However, since individual systems and portfolios of projects benefit from economies of scale, Options 1 and 3 have the quickest pay back.

OPTION 1 – GROUND MOUNT ONLY

SCENARIO	SYSTEM PRICE	ANNUAL SAVINGS	UTILITY INCENTIVE	SIMPLE PAYBACK (YRS)
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$996,000	$48,919-$57,248	$23,273	12.4-13.8
TELP with IRA	$742,020			9.2-10.3
Cash Purchase with IRA	$697,200			8.7-9.7

OPTION 2 – ROOF MOUNT ONLY

SCENARIO	SYSTEM PRICE	ANNUAL SAVINGS	UTILITY INCENTIVE	SIMPLE PAYBACK (YRS)
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$505,200	$16,811-$18,475	$8,035	19.1-20.3
TELP with IRA	$376,374			14.2-15.1
Cash Purchase with IRA	$353,640			13.3-14.2

OPTION 3 – COMBINED GROUND & ROOF

SCENARIO	SYSTEM PRICE	ANNUAL SAVINGS	UTILITY INCENTIVE	SIMPLE PAYBACK (YRS)
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$1,470,400	$64,327-$76,459	$30,806	13.7-15.5
TELP with IRA	$1,095,448			10.2-11.5
Cash Purchase with IRA	$1,029,280			9.6-10.8

Please note that because there is overlap in service upgrades with other measures being proposed in this study, all PV scope from the AC panelboard to interconnection is included in the electrical scope & price, and not in the pricing below. Additionally, pricing below assumes Louisville moves forward with a system at the Library and the Police & Municipal Courts Building; there are cost efficiencies in material, installation, and construction management scopes using a portfolio approach.

Another metric that may be useful as the City of Louisville considers the best way to decarbonize is levelized cost of electricity (LCOE). This is defined as capital cost divided by the estimated system lifetime production with units of $/kWh. It can help the City of Louisville compare the value of owning onsite solar versus subscribing to renewable utility programs like Renewable Connect and Windsource. The table below shows LCOE with and without the Solar*Rewards C&I incentive.

SCENARIO	LCOE – NO UTILITY INCENTIVES ($/KWH)	LCOE – W/ UTILITY INCENTIVES ($/KWH)
OPTION 1 – GROUND MOUNT ONLY		
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$0.053	$0.027
TELP with IRA	$0.040	$0.013
Cash Purchase with IRA	$0.037	$0.011
OPTION 2 – ROOF MOUNT ONLY		
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$0.101	$0.069
TELP with IRA	$0.075	$0.043
Cash Purchase with IRA	$0.070	$0.038
OPTION 3 – COMBINED GROUND AND ROOF		
Cash Purchase or Tax-Exempt Lease Purchase (TELP)	$0.062	$0.034
TELP with IRA	$0.046	$0.019
Cash Purchase with IRA	$0.044	$0.016

5. Future Considerations and Next Steps

Should Louisville decide to move forward with the Recreation & Senior Center ground mount system, next steps would involve a geotechnical study, locates, land survey, and other due diligence items necessary to de-risk the project. One priority item to iron out is potential impact from the current zoning designation. The plot is currently zoned as “Residential Estate”. The Recreation & Senior Center was likely built under a Special Review Use Approval, meaning it is not a guarantee a solar array would be approved on this lot, especially if there is significant community pushback. Whether this would be received well should be investigated further if the site progresses. For the roof mount, next steps would involve a more detailed

structural capacity analysis and a drone survey. Racking and electrical bid sets would be developed for both sites, as well as an interconnection application to Xcel, and a subcontractor RFP to get final pricing.

6. Assumptions, Inclusions, and Exclusions

- Codes and Utility Standards:
  - NEC 2020
  - IBC 2018
  - IFC 2018
  - Xcel Energy Blue Book (7/31/2022 Version)
  - Xcel Energy DG Tech Manual (10/28/2021 Version)
- Tax-exempt
- Prevailing wage
- 10% mechanical attachment count for the rooftop
- No structural upgrades required of the roof
- Scope from AC combiner to interconnection is included in the electrical scope and pricing
- Pricing assumes a portfolio approach; Louisville will move forward with a solar PV system at both the Police & Courts Building and the Library
- Pricing includes payment & performance bond
- Terms & Conditions listed in the Xcel Energy Interconnection Agreement
- Current labor rates
- Modeling:
  - TMY, DENVER INTL AP, NSRDB (tmy3,I) weather file
  - 1.5% production gain for ground mounts with bifacial modules
  - Soiling data from DNV-GL
- Design Loads
  - Wind speed:
    - Risk Category II: 145mph
    - Exposure: C
  - Ground snow load: 30 psf
    - Risk Category II: 1.0 importance factor
- No interconnection upgrade costs
- No grounding transformers
- Major equipment warranties
  - Modules – 12 years
  - Inverters – 10 years
  - DAS – 5 years
  - AC Combiners – 5 years
  - LEDs – 5 years
- No extended warranties
- No ongoing DAS Costs
  - Any ongoing fees beyond year 5 are excluded (both Cell Service and Data Subscription Monitoring fees).
- No reroofing or roofing repairs
- No backup generation
- 4’ perimeter setback for rooftops

- Favorable soil conditions. No hard drilling or special footers/foundations required.
- No hazardous soils or materials (asbestos, PFAS, etc.). Should monitoring, mitigation, abatement, and/or disposal be required, Louisville would be responsible for this additional scope.
- Xcel Energy Solar*Rewards C&I Incentives:
    - Tier 1: <250kWac = $0.04/kWh for 20 years
    - Tier 2: 250kWac-500kWac = $0.0375/kWh for 20 years



Appendix

1. Mechanical System Matrix Options
2. Mechanical Decarbonization Scoping
3. Electrical Decarbonization Scoping
4. Structural Scoping
5. Electric Vehicle Charging Narrative
6. Renewables Scoping
7. Cost Estimating

City of Louisville
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Recreation & Senior Center Cost Estimates

These are “all-in costs” and represent the total cost of construction. These are the amounts that will need to be allocated for budget purposes. They are also Rough Order of Magnitude (ROM) numbers, with a +/-20% range. See the “Construction Pricing Context” section in the report body for more detail.

OPTION 1 (All-Electric): REC & SENIOR CENTER

Scope		Total Cost
HVAC Rooftop Units and Ductwork	$	4,253,000
Pool Water Heating and Piping	$	3,602,000
Domestic Water Heating and Piping	$	1,216,000
Electrical	$	3,154,000
Structural	$	4,560,000
Total:	$	16,785,000

OPTION 2 (Hybrid): REC & SENIOR CENTER

Scope		Total Cost
HVAC Rooftop Units and Ductwork	$	3,709,000
Pool Water Heating and Piping	$	1,860,000
Domestic Water Heating and Piping	$	599,000
Electrical	$	329,000
Structural	$	4,017,000
Total:	$	10,514,000

Electrical Add-Alts:		
Level 3 EV Charging	$	111,200
Level 2 EV Charging	$	168,800
Ground Mount PV interconnect	$	245,600
Roof PV Interconnect	$	115,600
Battery Scope	$	2,640,000