Belmont Skating Rink

Public Forum

October 11th, 2022

SUSTAINABILITY & ESTIMATED COST

Design Solutions

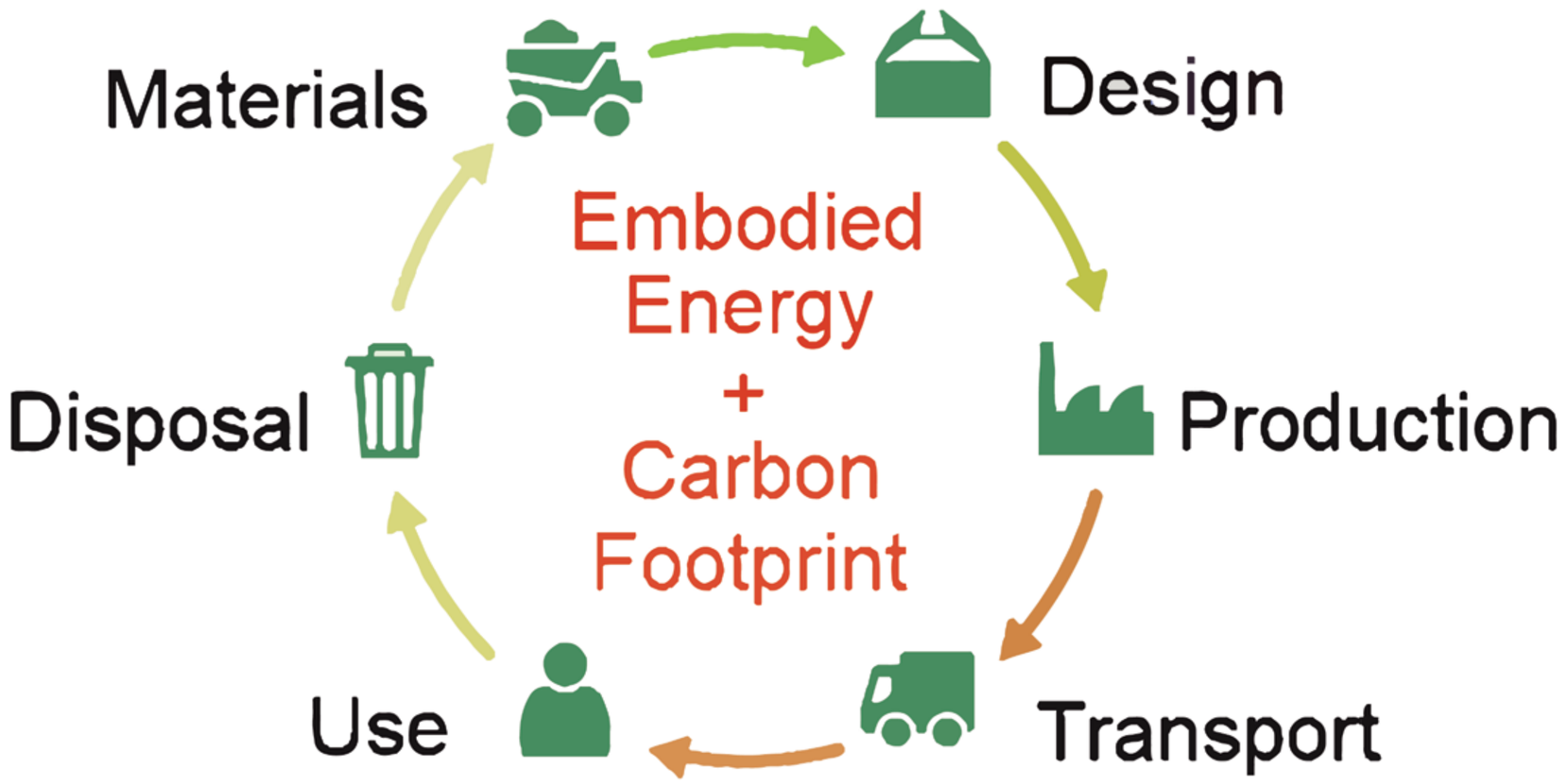
- Renovation and Expanding Skating Rink
  . Renovate, Reuse, Recycle

- Design Sustainable Skating Rink
  . All Electric
  . Energy Efficient
  . Fossil Fuel Free
  . Net-Zero Focused

- Fields remain functional

- Consider Conceptual Design of Fields

- Consider Conceptual Design of Parking



Embodied Energy

Building Renovation / Possible Re-use

- Structural steel bents

- Roof purlins

- Foundations (with modifications)

- Harvesting other materials for re-use
  . Masonry

- Recycle all unusable materials

EXISTING MATERIAL

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Existing Exterior

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INCORPORATED 1859

EXISTING MATERIAL

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Re-use Existing Bents

EXISTING MATERIAL

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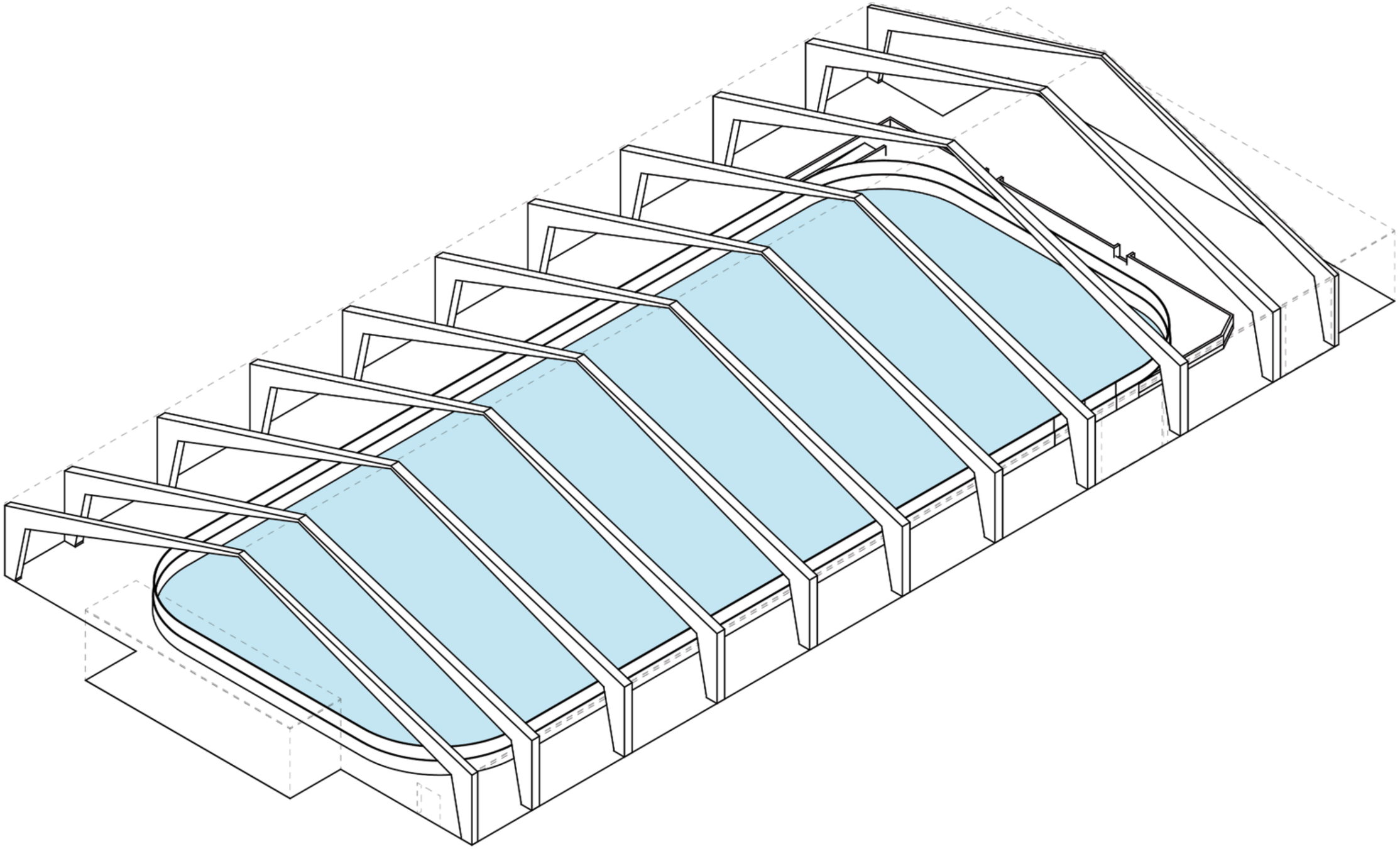
Re-use Existing Purlins



EXISTING STRUCTURE

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Bents

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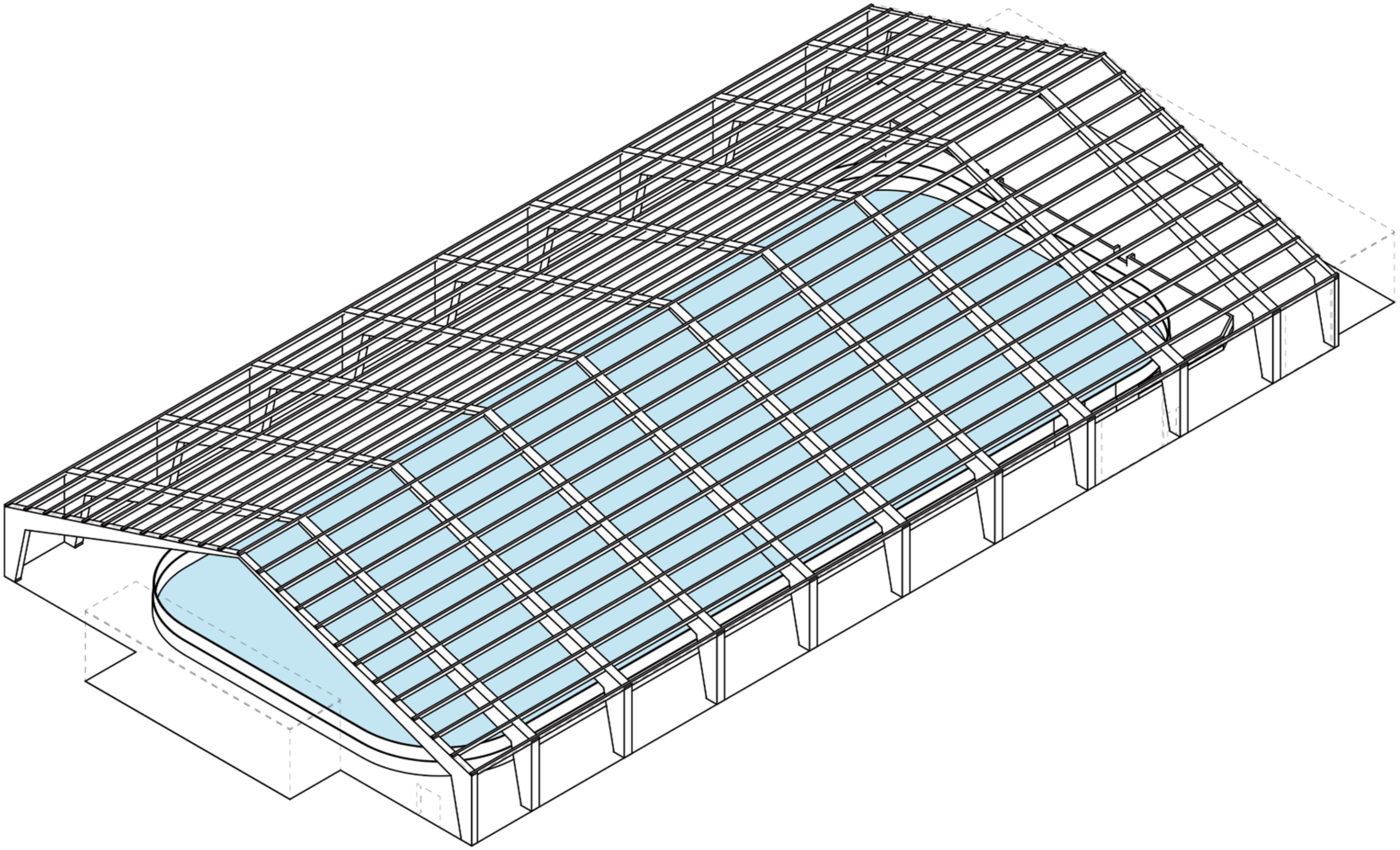
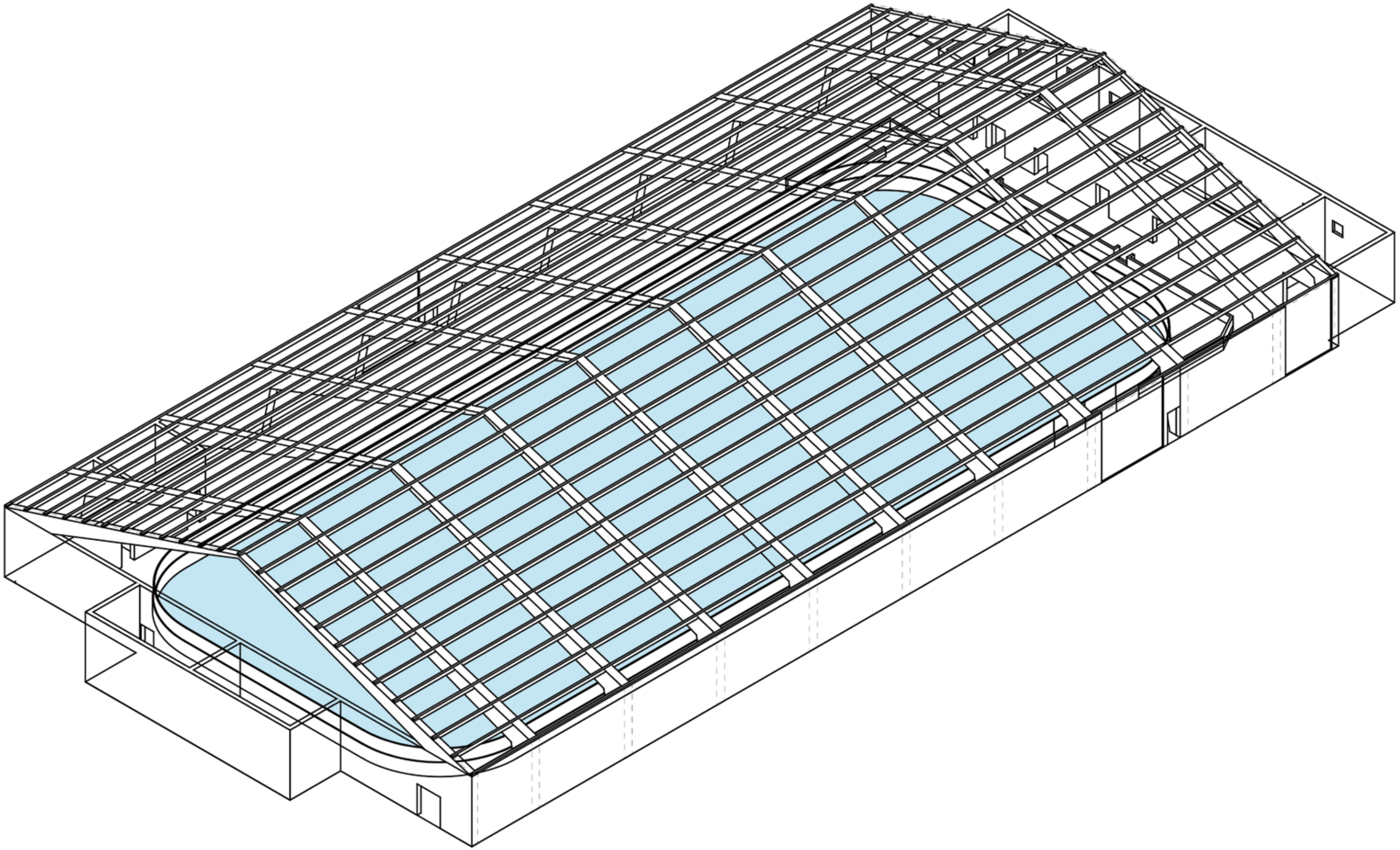


Purlins



EXISTING STRUCTURE

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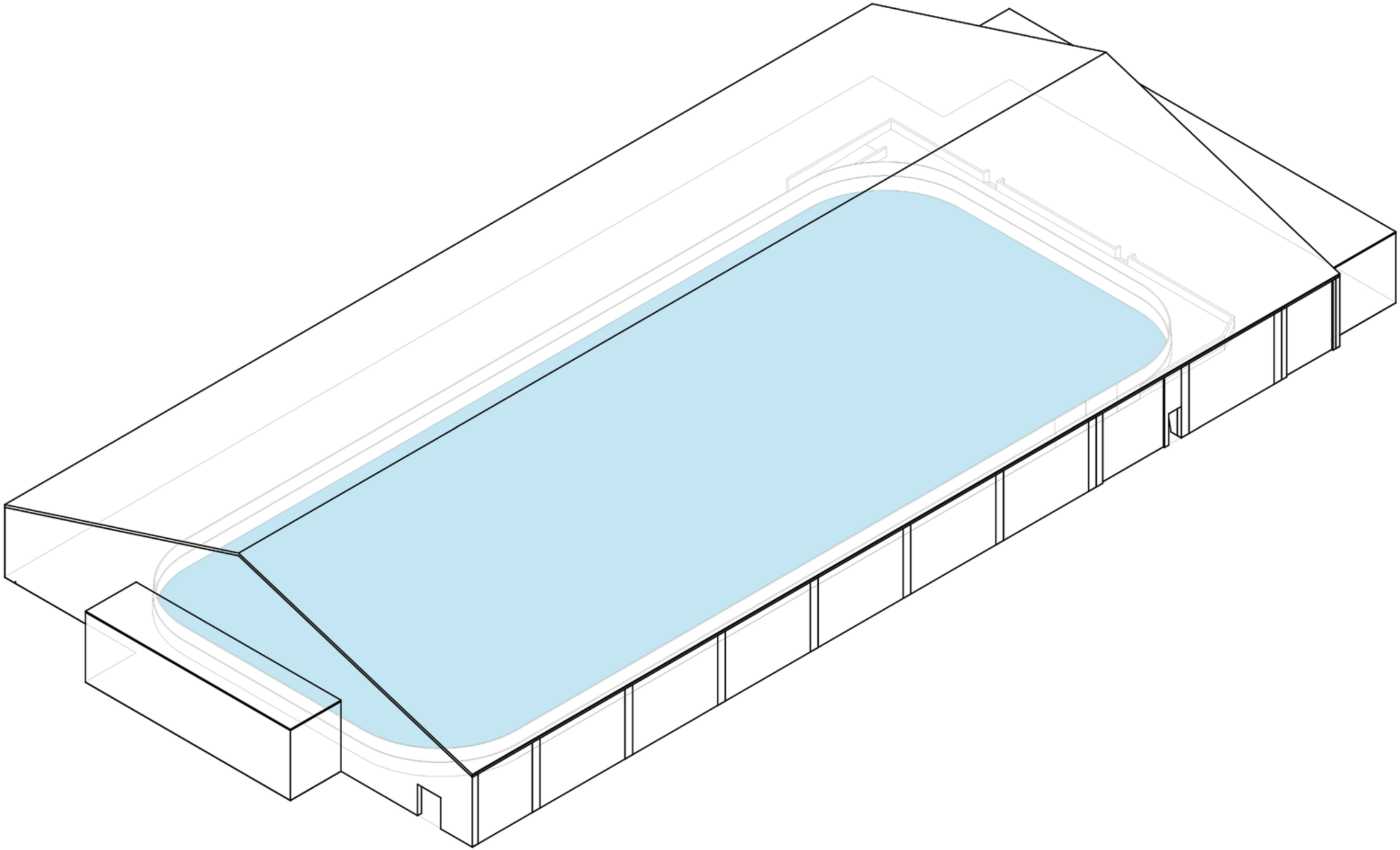
Wall Envelope



Roof

Net-Zero Energy Goal

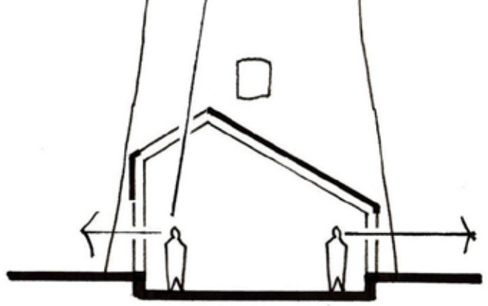
Potential for Town Wide Net Zero Approach

Energy Impacting Features - 1 of 2

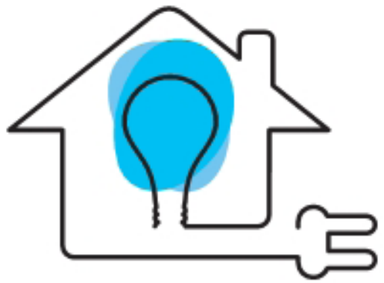
- Schematic Design: The Green Engineer
- Renovate / re-use / recycle
- Use of modular cubes to make ice
- Use waste heat to prevent ground from freezing
- Thermally insulated building envelope: floor, walls, and roof
- Natural daylight being brought into rink for lighting and views
- Capturing embodied energy of existing building components

Energy Impacting Features - 2 of 2

- Fossil fuel free building and systems
- All electric building and site
- Photovoltaic panels on roof
- Demand control ventilation via CO2 monitoring
- Use of heat pumps
- Desiccant based dehumidifiers
- Minimize impact on green space development

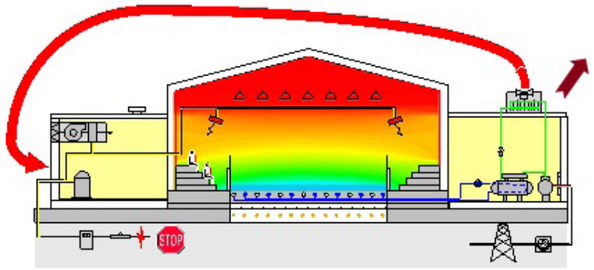


Natural daylight

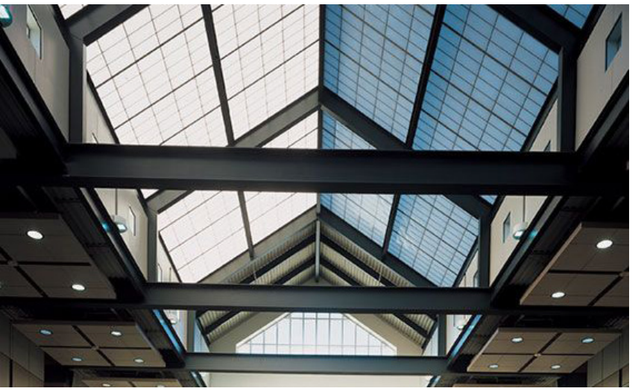


All electric building

Captured embodied energy



Reclaim waste heat



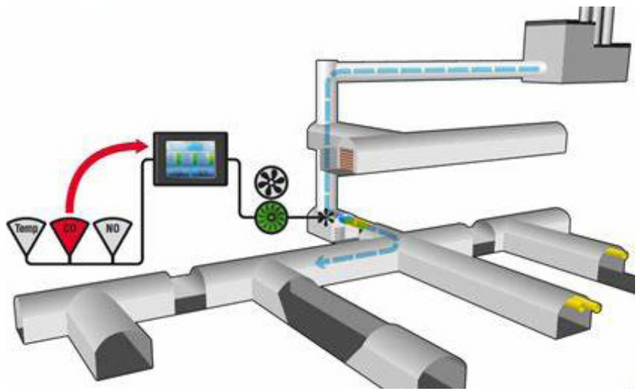
Roof light monitors

Thermally insulated envelope:
walls, floors, and roof

Low emissivity ceiling

Fossil fuel free

Photovoltaic panels



Demand controlled ventilation

Heat pumps

Desiccant based dehumidifiers

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Energy and Sustainability

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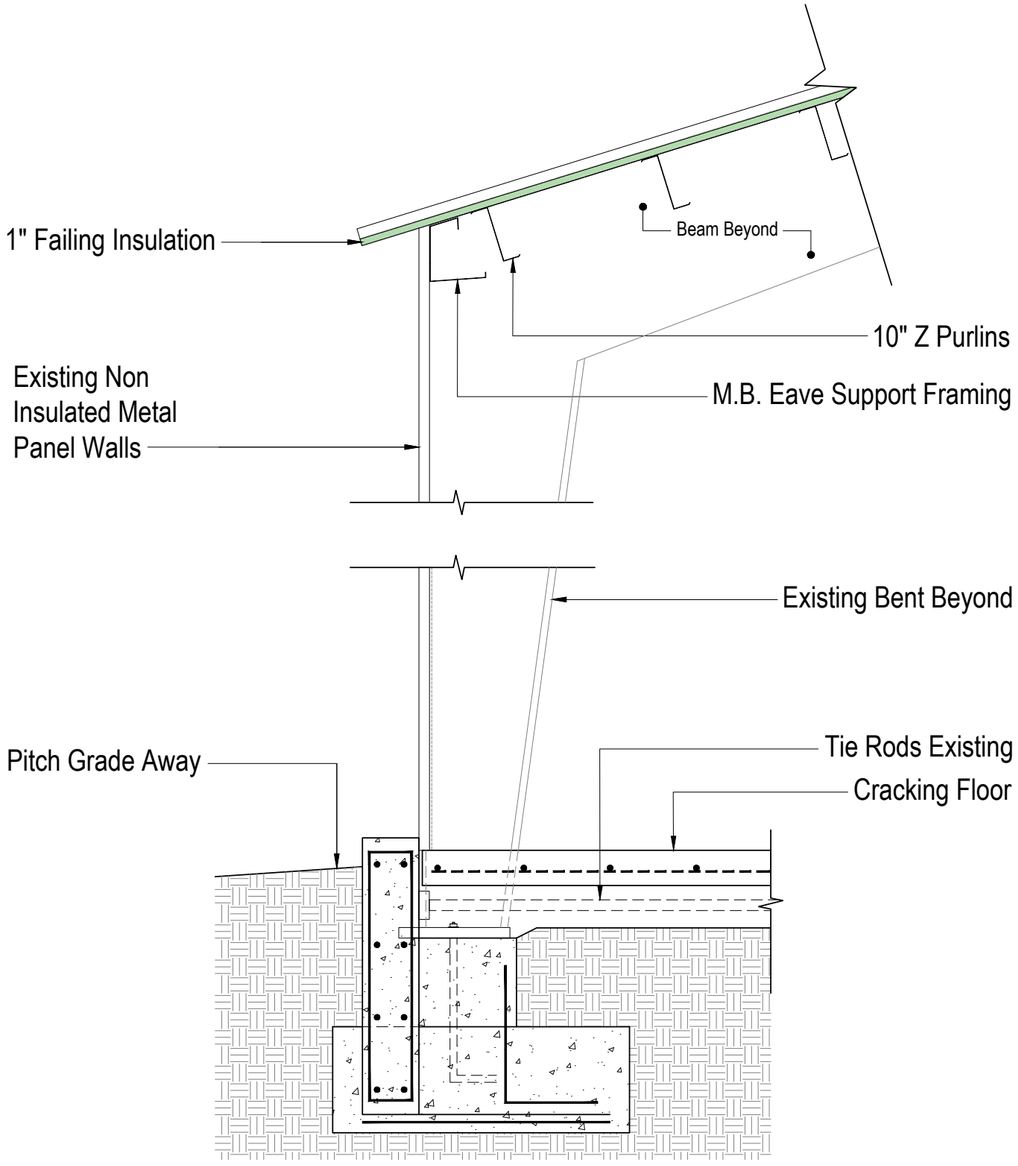
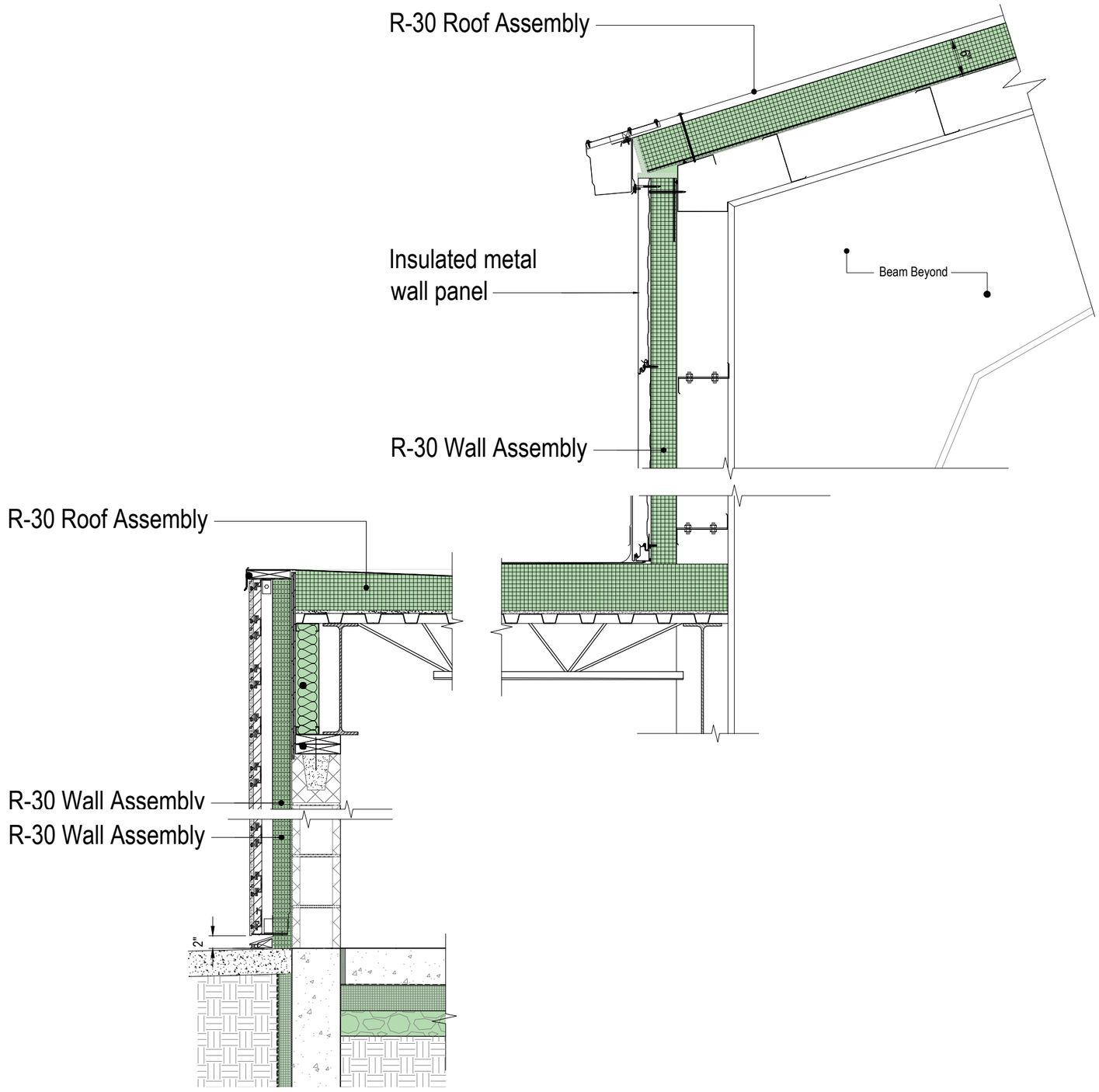


Exisiting



Proposed

Wall Section

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Building Energy Model

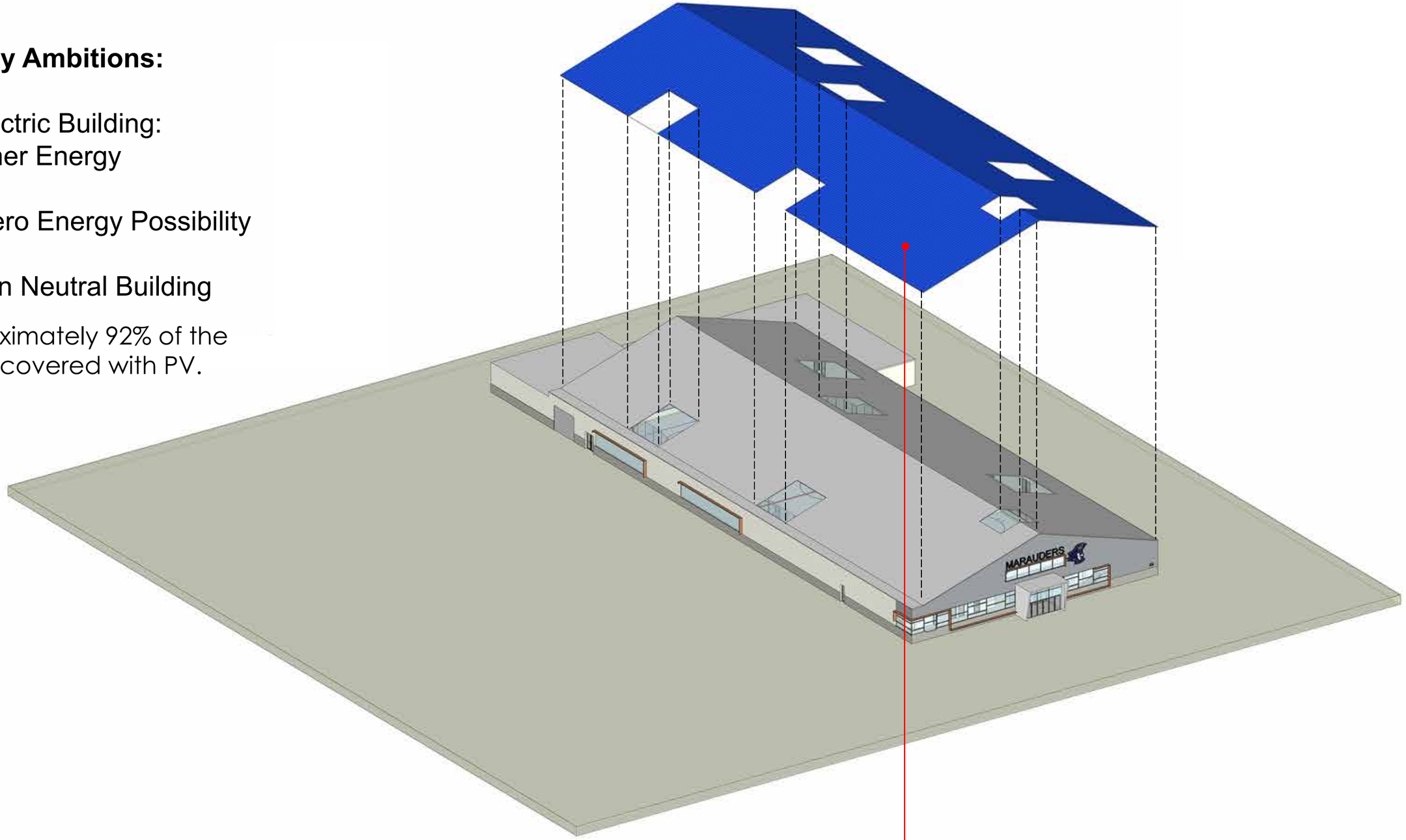
Energy Ambitions:

All Electric Building:
-Cleaner Energy

Net Zero Energy Possibility

Carbon Neutral Building

Approximately 92% of the roof is covered with PV.



ENERGY

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Energy Model Diagram

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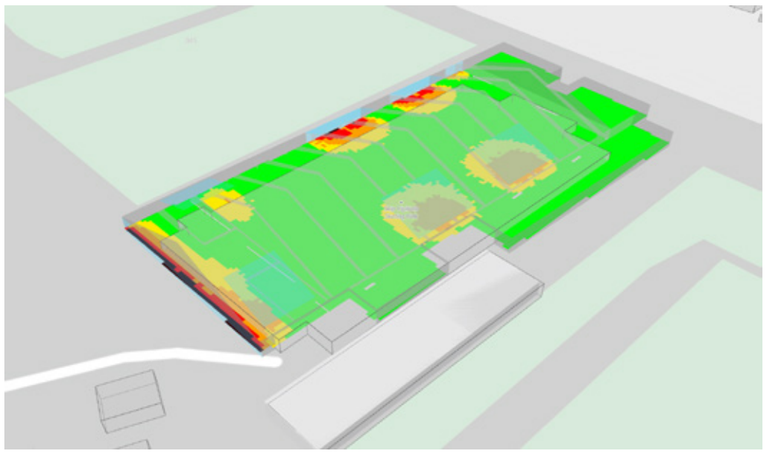
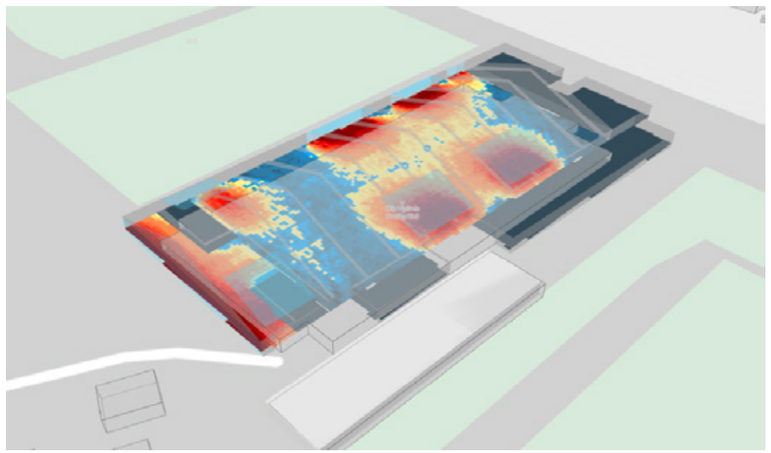
DAYLIGHT ANALYSIS (0.50 Tvis Average)
Annual Sunlight Exposure (ASE): 25%



DAYLIGHT ANALYSIS (0.50 Tvis Average)
Spatial Daylight Autonomy (sDA): 39%



DAYLIGHT ANALYSIS
Maximum Sunlit Hours/Day: 12 Hours

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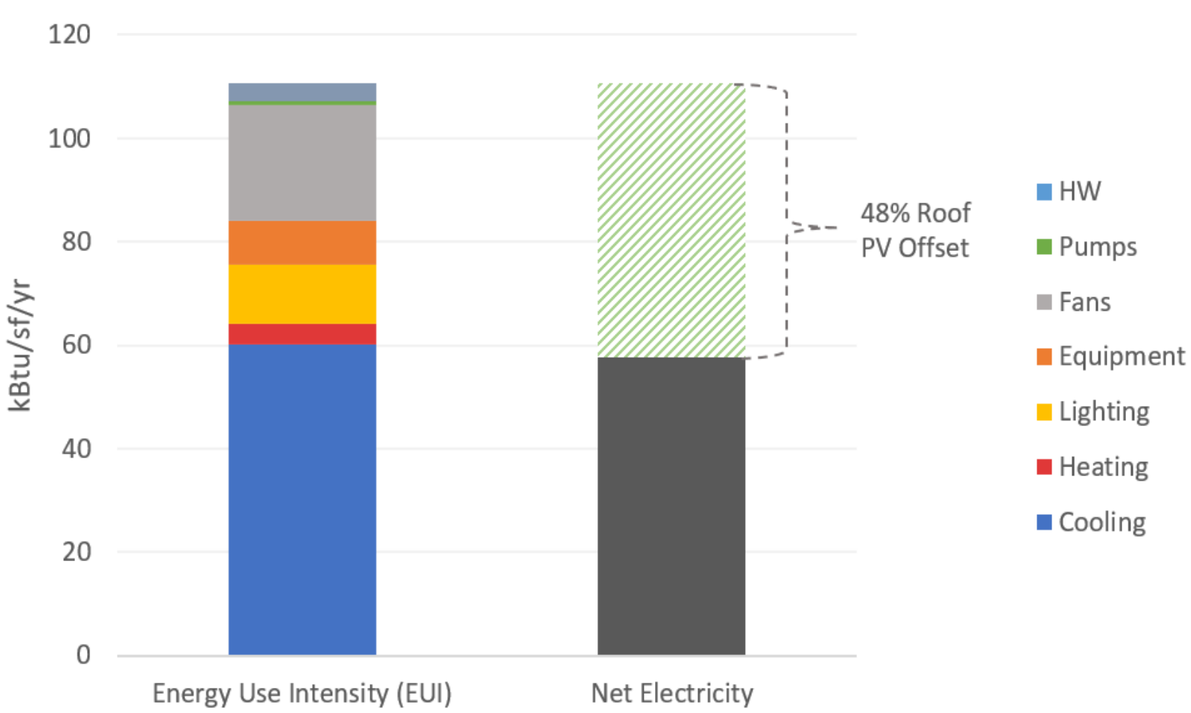
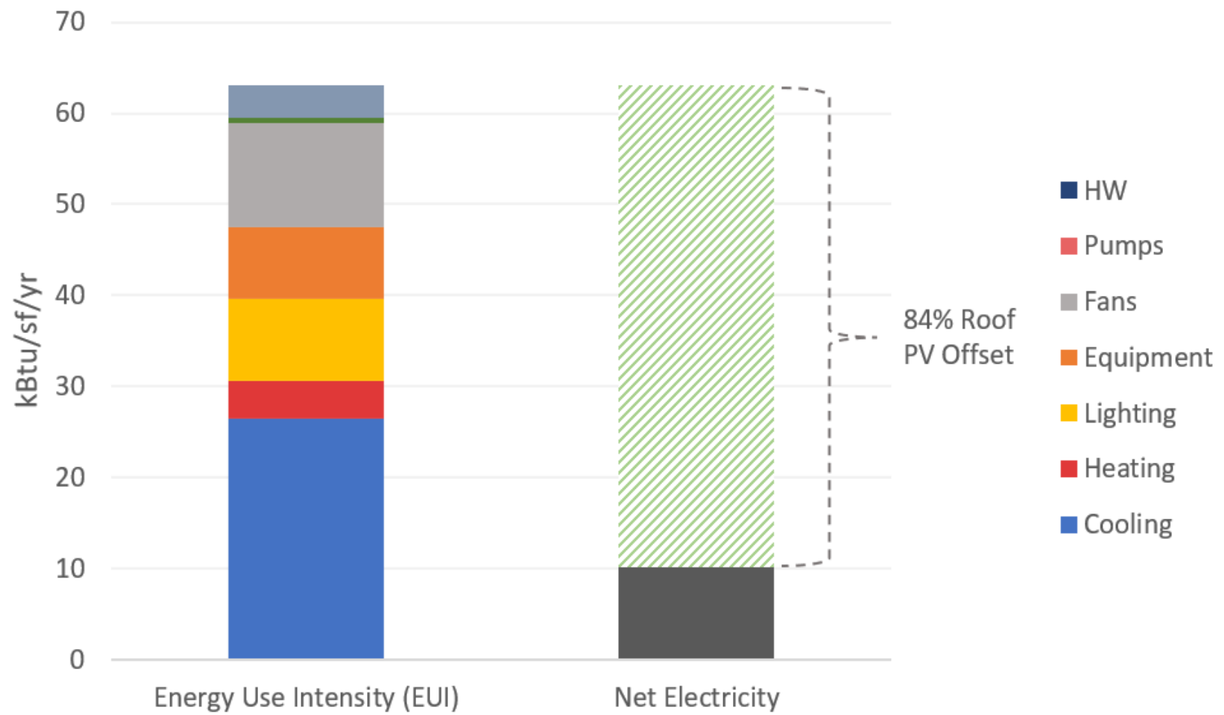
PRELIMINARY Energy Model


120
100
80
60
40
20
0
kBtu/sf/yr
48% Roof
PV Offset
HW
Pumps
Fans
Equipment
Lighting
Heating
Cooling
Energy Use Intensity (EUI)
Net Electricity


70
60
50
40
30
20
10
0
kBtu/sf/yr
84% Roof
PV Offset
HW
Pumps
Fans
Equipment
Lighting
Heating
Cooling
Energy Use Intensity (EUI)
Net Electricity

12 Month Operation Schedule

	No PV	40,000 sf Panel Area	Net Zero Option
	Proposed Whole Baseline EUI	**Proposed Whole Baseline EUI**	**Proposed Whole Baseline EUI**
Net Energy	110.6	57.8	Net Zero
Total Energy	110.6 kBtu/ft²/yr 1,468,589 kWh/yr	110.6 kBtu/ft²/yr 1,468,589 kWh/yr	110.6 kBtu/ft²/yr 1,468,589 kWh/yr
PV Offset	0 kBtu/ft²/yr 0 kWh/yr	52.8 kBtu/ft²/yr 702,083 kWh/yr	110.6 kBtu/ft²/yr 1,468,589 kWh/yr
Net Energy	110.6 kBtu/ft²/yr 1,468,589 kWh/yr	57.8 kBtu/ft²/yr 766,506 kWh/yr	Net Zero
PV Array	Not Applicable	561 kW	1,173 kW
Electricity	$205,602/yr	$107,311/yr	$0/yr
Emissions	407 Tonne CO2e/yr	212.7 Tonne CO2e/yr	Net Zero

6 Month Operation Schedule

	No PV	40,000 sf Panel Area	Net Zero Option
	Proposed Whole Baseline EUI	**Proposed Whole Baseline EUI**	**Proposed Whole Baseline EUI**
Net Energy	63.02	10.15	Net Zero
Total Energy	63.02 kBtu/ft²/yr 836,804 kWh/yr	63.02 kBtu/ft²/yr 836,804 kWh/yr	63.02 kBtu/ft²/yr 836,804 kWh/yr
PV Offset	0 kBtu/ft²/yr 0 kWh/yr	52.8 kBtu/ft²/yr 702,083 kWh/yr	63.02 kBtu/ft²/yr 836,804 kWh/yr
Net Energy	63.02 kBtu/ft²/yr 836,804 kWh/yr	10.15 kBtu/ft²/yr 134,721 kWh/yr	Net Zero
PV Array	Not Applicable	561 kW	668 kW
Electricity	$117,153/yr	$18,861/yr	$0/yr
Emissions	231.9 Tonne CO2e/yr	37.3 Tonne CO2e/yr	Net Zero

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PRELIMINARY Energy Analysis

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Preliminary Energy Summary

- Energy analysis is preliminary; very conservative model inputs
- Waste heat recycling not accounted for yet; Model will be closer to net zero once accounted for
- If the new rink operated same as current rink, building will be 90%-100% Net Zero
- 12 months of operation = 45-50%+ of electricity generated on site
- PV array will offset more than $100,000/yr in energy costs

ENERGY SUMMARY

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Estimated Cost Projections

				cost/sf
Trade Costs	$	20,485,819	$	420
GCs and Fee	$	3,309,447	$	68
Sub-total	**$**	**23,795,266**	$	488
Projected Cost Escalation of 10%	$	2,169,527	$	44
Sub-total	**$**	**25,964,793**	$	532
Design Contingency - 15%	$	3,254,290	$	67
Owners Contingency - 5%	$	1,084,763	$	22
Sub-total	**$**	**30,303,846**	$	621
Allowances			$	-
Design and OPM Fees	$	4,745,775	$	97
Parking	$	790,000	$	16
Harzardous Materials - Rink	$	1,000,000		
Harzardous Materials - White Field House	$	500,000	$	10
Sub-total	**$**	**37,339,621**	**$**	**765**
Value Engineering Deductions				
Eliminate 2 Harris Field locker rooms (2,316 sf)	$	1,158,000	$	500
Eliminate DPW Shop (993 sf)	$	496,500	$	500
Scale Back Rink Entrance Mezzanine (2,919 sf)	$	1,459,500	$	500
Eliminate White Field House Demolition	$	535,000		
Reduce scale for parking and entrance plaza	$	300,000		
Value Engineering deductions sub-total	**$**	**3,949,000**		
Total Project Cost	**$**	**33,390,621**		

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Construction Budget

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Cost Estimate

- Programing and Design was focused on for many months
- Two independent Cost Estimators worked simultaneously to generate estimates
- Figures came in nearly exact
- Two hour reconciliation meeting took place to generate one estimate
- This TPC Estimate came in too high for Building Committee to support
- Value Engineering process took place

COST SUMMARY

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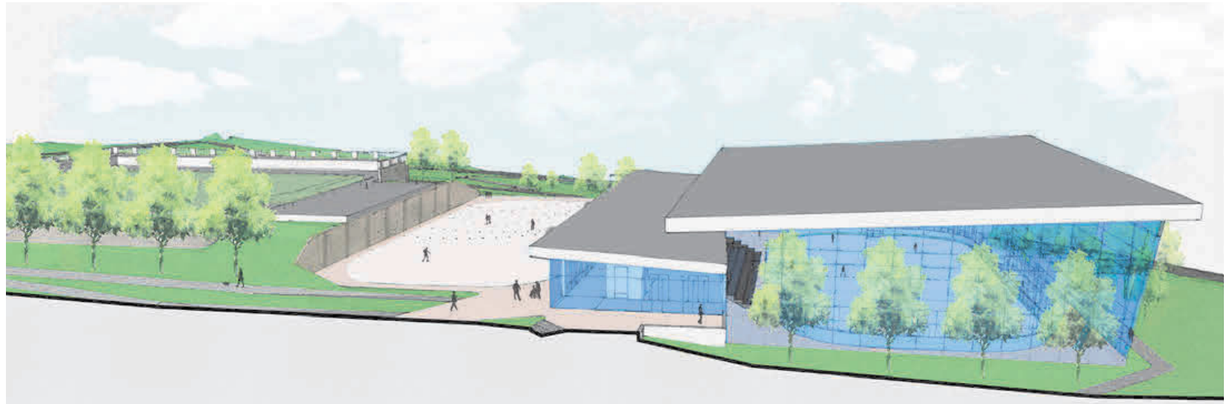

Design Option Terrace Enclosed

two values with arrows should be removed for comparison to Belmont

Description	Note	Low	High
Landscape (only associated with rinks)	(See Item 1-7, and Item 10 in Landscape Detail)	$ 8,600,000.00	$ 9,400,000.00
Italianate Garden	(See item 8 in Landscape Detail)	$ 1,650,000.00	$ 1,750,000.00
Maintenance Garden	(See item 9 in Landscape Detail)	$ 5,750,000.00	$ 5,850,000.00
Open Rink + Enclosed Rink		$ 24,800,000.00	$ 27,400,000.00
Subtotal Construction Estimate		**$ 40,800,000.00**	**$ 44,400,000.00**
Soft Costs (approx 15%)	Includes Design, Engineering, Permitting Packages, Testing, Reports	$ 6,200,000.00	$ 6,600,000.00

Total Open + Enclosed (Construction + Design Fees)	**$ 47,000,000.00**	**$ 51,000,000.00**
	- 7,400,000.00	- 7,600,000.00
	$ 39,600,000.00	**$ 43,400,000.00**

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