*****5:00 p.m. BOARD OF REVIEW*****

BEMIDJI CITY COUNCIL

Work Session Agenda

Monday, April 22, 2019

City Hall
Chambers
6:00 P.M.

1. CALL TO ORDER / ROLL CALL

2. REVIEW BEMIDJI ICE ARENA STUDY

3. ADJOURNMENT

COUNCIL AGENDA ITEM

Bemidji — First City On The Mississippi

Meeting Date: April 22, 2019

Action Requested: Review Bemidji Ice Arena Study

Prepared By: Marcia Larson, Parks and Recreation Director

Reviewed By: Nate Mathews, City Manager

Background

The City Council in May of 2018, approved a professional services contract with 292 Design group to conduct an Ice Feasibility Study. The impetus of the study was the Neilson Reise Arena and determining the role of the City in providing ice arena facilities/activities to the community.

Tom Betti, 292 Design Group and Jeff King, Ballard King along with staff conducted input meeting with ice facilities owners and users groups in August. Following the meetings, Tom Betti and Jeff King attended the Council meeting on August 6, 2018 to provide an update on the study, market analysis, and the public input meetings.

The market analysis, building program, concept drawings, operational analysis, and cost estimates were developed following the input meetings and through discussions with staff and consultants.

The attached feasibility study explores the Bemidji area ice arena market and addresses ice arena options for the City to review and decide which option best fits the City's stance on providing ice related activities for the residence.

As the study indicates, the majority of the mechanical and building systems in the Neilson Reise Arena have exceeded their useful life. This is further complicated by the increasing operational costs and phase out of the refrigerant R-22. The Bemidji community is unique in that there are four arenas owned and operated by three separate entities and decisions regarding the Neilson Reise and role of the City in providing ice related activities will affect the Sanford Center, Bemidji Community Arena and Nymore Arena and the owners of those facilities.

Consultants Tom Betti of 292 Design Group and Jeff King of Ballard King will be at the Council Work Session to present the Ice Study and answer subsequent questions.

Bemidji Ice Arena Study

Bemidji, Minnesota

January 23, 2018

Bemidji
First City On The Mississippi

CONTENTS

The consultant team for this study included:

- *292 Design Group*
- *Ballard*King and Associates*
- *RJM Construction*
- *B32 Engineering-updating Neilson-Riese Study*
- *Nelson-Rudie and Associates-updating Neilson-Riese Study*

Bemidji First City On The Mississippi

Thank you to city staff, stakeholders and community members for their input and feedback. Their contributions were invaluable.

Purpose of Study

The feasibility study explores the Bemidji Area ice arena market and addresses ice arena options for the City to review and decide which option best fits the City's stance on providing ice related activities for the residence. The market analysis, stakeholder meetings, building program, concept drawings, operational analysis, and cost estimates were derived from a iterative process with city staff, Ballard King – a recreation and operations consultant and RJM Construction.

EXECUTIVE SUMMARY

Background

292 Design Group and Ballard*King and Associates were hired to conduct a needs assessment and feasibility study for the renovation and/or replacement the Neilson-Reise Ice Rink in Bemidji, MN. The objective of the study was to determine the condition of the rink, assess the overall ice market and explore the feasibility of renovating or replacing the Neilson-Reise Ice Rink.

Market Analysis

The Bemidji primary service area population is increasing at modest rate of 3.3% with the population projected to reach 140,533 people by the year 2023. The demographic profile of the community indicates that the age group distribution is somewhat mixed in the primary service area. There is a lower concentration of the 18-24, 25-44 and 45-54 age groups than the national level and higher concentration of Under 5, 5-17, and over 55 age groups than the national level. The median age of the primary service area is 4.1 years older than the national level of 38.3 years. The median household income is lower (15%) than the national level of $58,100. Another factor is that the housing/dwelling expense in the primary service area is 24% lower than the national level. This suggests that the ratio between HH income and housing expenses is about normal. Age and household income are two determining factors that drive participation in sports and wellness activities. The demographic profile suggests that there will be continued support and demand for recreation activities and programs in the future.

There are a number of other ice rink providers in the service area to meet the demand for ice hockey and ice sports in the area.

Statistics from the National Sporting Goods Association (NSGA) were overlaid on to the demographic profile of the service areas to determine the market potential for ice activities. The market analysis concluded that this was a sufficient market to support replacing the Neilson-Reise Ice Rink. The market analysis also concluded that there was not enough ice market available to sustain a fifth sheet of ice in Bemidji. There will be significant pressure and potential oversaturation if BCAC moves forward with constructing a second sheet of ice at the BCAC Rink.

Operations

An operation analysis was conducted to examine operational costs and revenues for adding an additional sheet of ice to the Sanford Center. The operating pro-forma that was developed represents a conservative approach to estimating expenses and revenues and was completed based on the best information available and a basic understanding of the current operation. Fees and charges utilized for this study were based on the current with a slight increase to reflect anticipated fees in the future.

The results of the operations analysis indicate that the proposed expansion of the Sanford Center will not recover 100% of its operating costs through revenue. The operating pro-forma did not include debt service since the funding for this project is yet to be determined. The consulting team was tasked with exploring several different operating models as part of the feasibility study including:

1. Renovate the Neilson-Reise Rink. The operating cost and revenues would be very similar to how the rink is currently performing.

2. Add a sheet of ice and expand the Sanford Center with a 200x85 foot ice surface, five locker rooms, lobby area, concession stand, storage, spectator seating for 360 people and administrative support spaces.

3. Within the expansion of Sanford option there are four different operating scenarios that were studied including:

    a. Transitioning the existing ice programs at Neilson Reise to the Sanford Center location (status quo option).
    b. Transitioning the existing ice programs at Neilson Reise without Youth Hockey rentals except the Mite Hockey Program (Mite only option)
    c. Transitioning the existing ice programs at Neilson Reise except no Youth Hockey (No Youth Hockey option).
    d. Transitioning the existing ice programs and adding new recreation programming opportunities (No Youth Hockey with Recreation option)

Stakeholder Meetings

A series of nine stakeholder meetings were conducted to assess input from the various hockey and skating groups in the area. One of the objectives of the stakeholder meetings was to determine and validate the need for ice time in the area. The groups that were involved in the stakeholder meetings were:

- Bemidji State University
- Bemidji Community Arena Corporation
- Bemidji Figure Skating Club
- Bemidji State University Recreation
- Curling Club
- Bemidji Youth Hockey Association
- Adult Hockey
- School District
- Sanford Center – Venue Works

Expense

The following table outlines the expense and revenue comparisons, including recovery rate estimates, for the four different options.

	Status Quo	Mites Only	No Youth Hockey	No YH w/Rec
Expenditure	$ 290,979	$ 290,979	$ 290,979	$ 305,259
Revenue	$ 246,960	$ 210,660	$ 188,160	$ 219,060
Difference	$ 44,019	$ 80,319	$ 102,819	$ 86,199
Recovery Rate Estimate	85%	72%	65%	72%

Building Concept

During the process of meeting with stakeholders and having a better understanding of the Bemidji ice market, it was determined that there are two alternatives for the city to evaluate:

1. Renovate Neilson-Reise. The updated Neilson-Reise Study is attached to this study in Appendix B.

2. Add a new ice arena to Sanford Center. To develop this concept, a thorough program was developed to identify the spaces that would be required in a new ice arena. Then a concept site plan and floor plan were developed, along with a cost estimate. These can be found on pages 66-67.

Conclusion

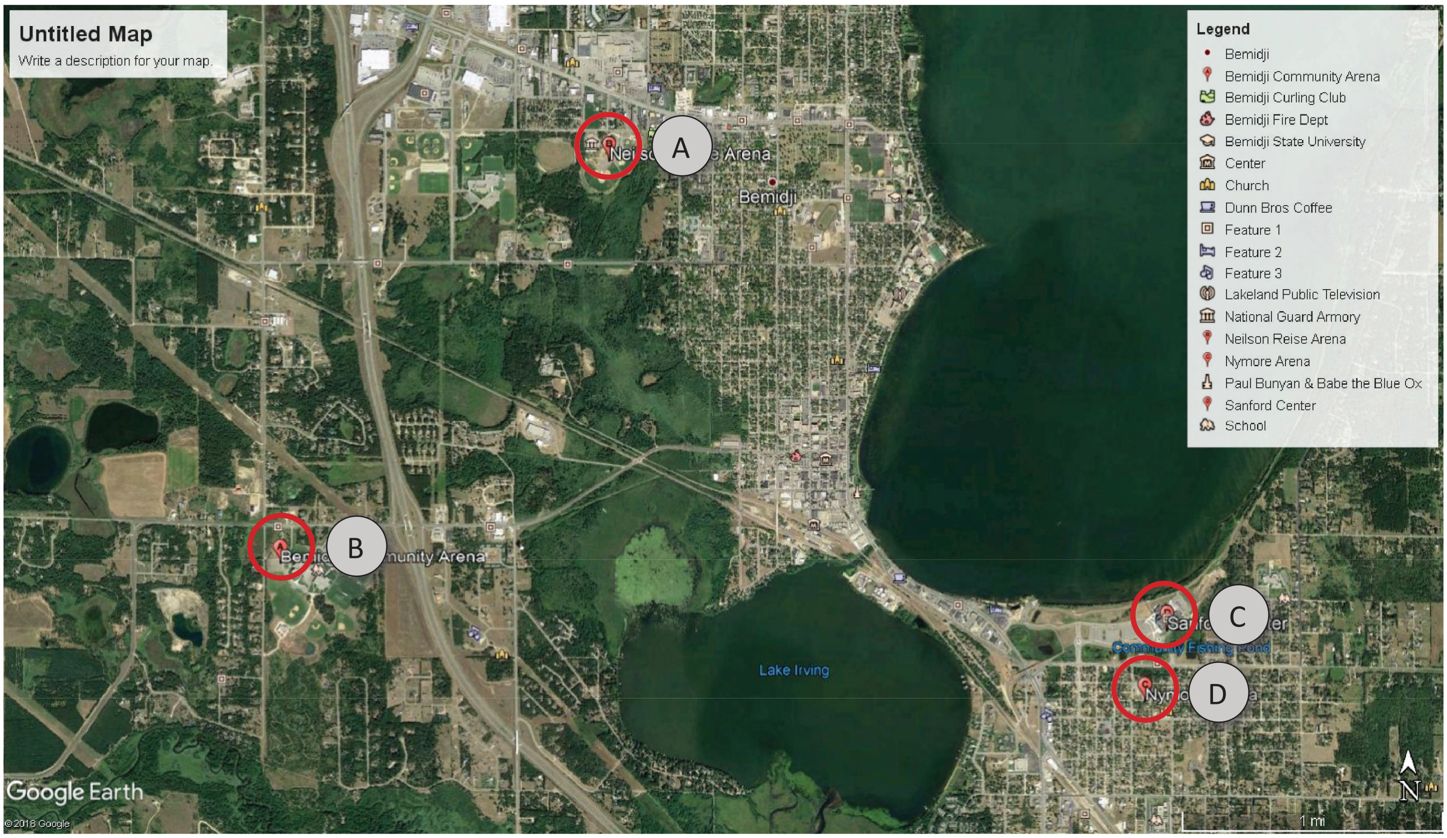
The market analysis concluded that the Bemidji market area cannot financially sustain a fifth ice sheet in the community at this time. Although the youth hockey association reports an increase in their numbers there is a limit to growth in hockey. Through the market analysis process, it was determined that there is a need for an additional 250 hours of ice time per season above the current ice schedule. This represents about 15% of the prime-time ice available if a fifth sheet of ice were present in the Bemidji market. This is not adequate to financially sustain an ice rink operation. It will take several years of continued program growth to reach a point of financial support a fifth sheet of ice. BCAC has announced their plans to expand their facility and construction has begun on their expansion project. The result of this decision is that the ice market will be over-saturated with ice sheets in Bemidji, at least for the foreseeable future.

Not to be overlooked is the financial impact and cost for hockey registration in the future. Having more ice time, regardless of location, will result in higher player registration fees. Beltrami County is one of the poorest counties in Minnesota based on household income levels and adding costs to the individual families for higher youth hockey fees has the potential to force some families out of hockey. To put this in perspective, adding 250 hours of ice usage will cost the Youth Hockey Association about $37,500 (based on a rate of $150/hour). The average increase in fees per player would climb about $100 per player based on the number of players currently registered in the youth hockey program.

The City of Bemidji has a couple of steps in the decision-making process. The first decision that must be made surrounds the question if the City of Bemidji wants to continue being in the ice rink business. With the anticipated expansion of BCAC the ice market needs will be largely met with the BCAC expansion. If the City were to divest themselves from ice rink operations this seems to be the appropriate time and opportunity.

If the decision from the City is to continue in the ice rink business, then it must decide to renovate the existing Neilson-Reise Rink or re-locate the rink to the Sanford Center. The consulting team recommends the expansion of the Sanford Center as the best option given capital cost and potential for operational efficiencies. Additionally, having another sheet of ice at Sanford Center provides easier accommodations for the BSU hockey program, enhancement to youth hockey tournaments offered throughout the skating season and attracting larger (non-ice) events to the area. This option will also force the City of Bemidji to expand its community/ recreation program to back fill the ice time loss resulting from the BCAC expansion.

BEMIDJI ICE ARENA LOCATIONS



A: Neilson-Reise Ice Arena: 1 Ice Sheet

B: Bemidji Community Arena (BCAC): 1 Ice Sheet, plus started construction on a second ice sheet at the time of the report

C: Sanford Center: 1 Ice Sheet

D: Nymore Arena: 1 Ice Sheet

Market Assessment

Ballard*King & Associates (B*K) has been hired to perform a market analysis and feasibility study for Bemidji, MN.

The following is a summary of the demographic characteristics within an area identified as Immediate, Primary and Secondary Service Areas for Bemidji, MN. The Immediate Service Area is a 10-mile radius from Bemidji. The Primary Service Area is a 60-mile radius and the Secondary Service Area is a 120-mile radius.

B*K accesses demographic information from Environmental Systems Research Institute (ESRI) who utilizes 2010 Census data and their demographers for 2018-2023 projections. In addition to demographics, ESRI also provides data on housings, recreation, and entertainment spending and adult participation in activities. B*K also uses information produced by the National Sporting Goods Association (NSGA) to overlay onto the demographic profile to determine potential participation in various activities.

Service Areas

The information provided includes the basic demographics and data for the Immediate Service Area with comparison data for the Primary and Secondary Service Area as well as the State of Minnesota and the United States.

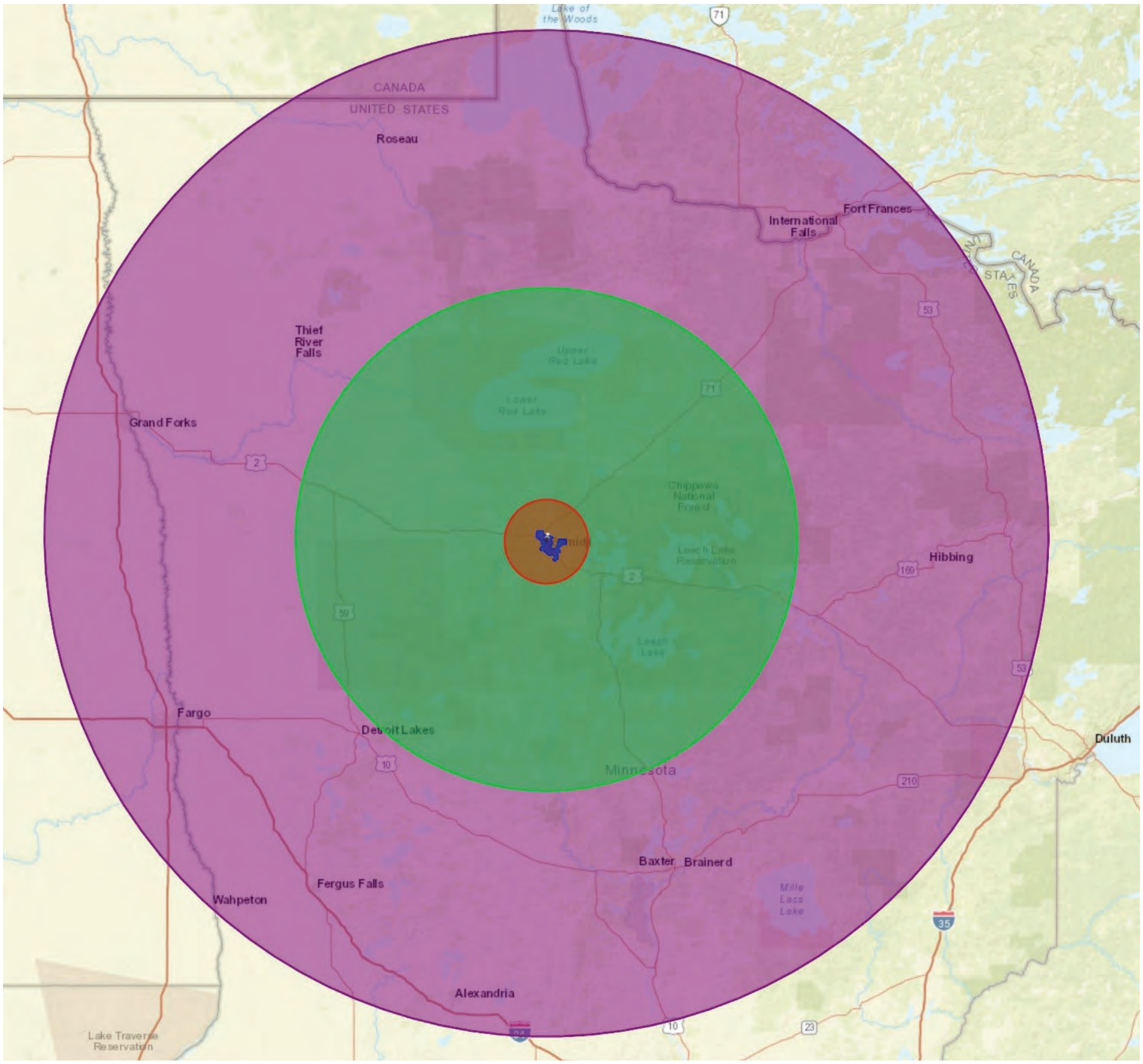
Primary Service Areas are defined as the distance people will travel on a regular basis (a minimum of once a week) to utilize recreation facilities. Use by individuals outside of this area will be much more limited and will focus more on special activities or events.

Service areas can flex or contract based upon a facility's proximity to major thoroughfares. Other factors impacting the use as it relates to driving distance are the presence of alternative service providers in the service area. Alternative service providers can influence membership, daily admissions and the associated penetration rates for programs and services.

Service areas can vary in size with the types of components in the facility.

DEMOGRAPHIC & MARKET ANALYSIS

Map A–Service Area Maps



- Blue Boundary – City limits of Bemidji
- Red Circle – 10-mile radius
- Green Circle – 60-mile radius
- Purple Circle – 120-mile radius

Demographic Summary

	Bemidji, MN	Immediate Service Area	Primary Service Area	Secondary Service Area
Population:				
2010 Census	13,955[1]	30,571[2]	129,571[3]	894,652[4]
2018 Estimate	14,449	32,510	135,956	967,849
2023 Estimate	14,820	33,795	140,533	1,016,171
Households:				
2010 Census	5,565	11,857	51,829	370,799
2018 Estimate	5,795	12,673	54,410	401,613
2023 Estimate	5,976	13,211	56,270	422,066
Families:				
2010 Census	2,707	7,296	34,392	232,521
2018 Estimate	2,887	7,715	35,682	246,582
2023 Estimate	2,954	8,006	36,724	256,696
Average Household Size:				
2010 Census	2.19	2.41	2.44	2.34
2018 Estimate	2.19	2.41	2.44	2.35
2023 Estimate	2.19	2.41	2.44	2.35
Ethnicity (2018 Estimate):				
Hispanic	2.9%	3.0%	2.2%	3.0%
White	79.1%	89.5%	79.7%	89.5%
Black	1.5%	2.4%	0.5%	2.4%
American Indian	12.9%	3.6%	15.5%	3.6%
Asian	1.3%	1.3%	0.2%	1.3%
Pacific Islander	0.1%	0.1%	0.0%	0.1%
Other	0.4%	0.8%	0.3%	0.8%
Multiple	4.7%	2.4%	3.4%	2.4%
Median Age:				
2010 Census	27.6	32.6	41.1	39.1
2018 Estimate	29.6	34.1	42.4	40.0
2023 Estimate	30.5	35.5	43.3	40.6
Median Income:				
2018 Estimate	$39,186	$51,545	$49,293	$53,238
2023 Estimate	$41,535	$55,191	$53,585	$58,527

Note: There are three Reservations within the 60-mile radius.

[1] From the 2000-2010 Census, the Bemidji experienced an 8.8% increase in population.
[2] From the 2000-2010 Census, the Immediate Service Area experienced a 14.6% increase in population.
[3] From the 2000-2010 Census, the Primary Service Area experienced a 6.2% increase in population.
[4] From the 2000-2010 Census, the Secondary Service Area experienced a 6.6% increase in population.

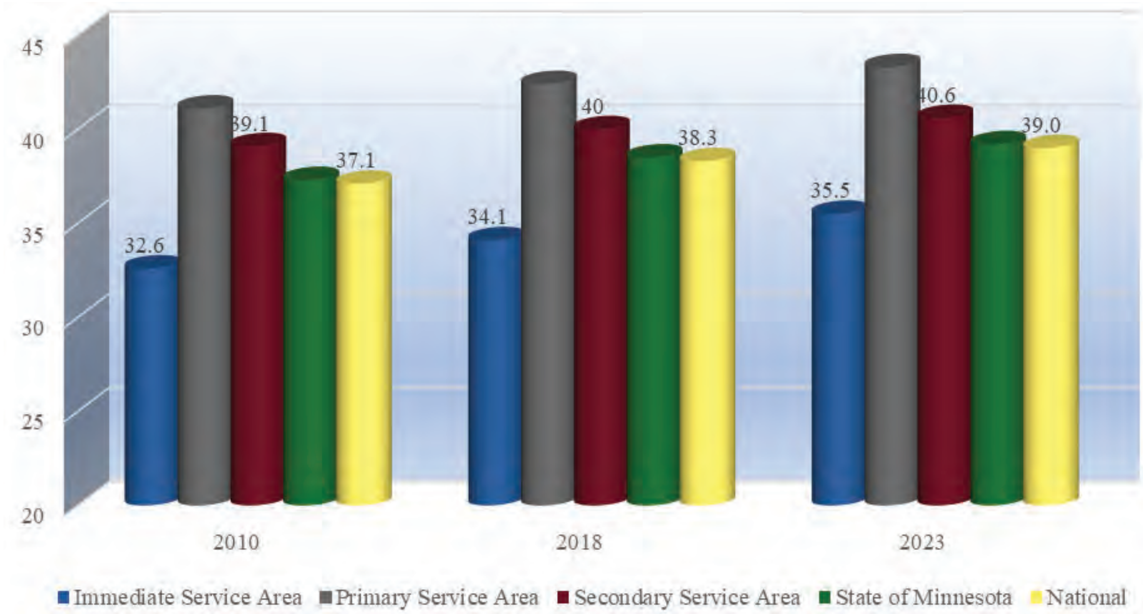
Age and Income

The median age and household income levels are compared with the national number as both of these factors are secondary determiners of participation in recreation activities. The lower the median age, the higher the participation rates are for most activities. The level of participation also increases as the median income level goes up.

Table A – Median Age

	2010 Census	2018 Projection	2023 Projection
Immediate Service Area	32.6	34.1	35.5
Primary Service Area	41.1	42.4	43.3
Secondary Service Area	39.1	40.0	40.6
State of Minnesota	37.3	38.5	39.2
Nationally	37.1	38.3	39.0

Chart A – Median Age



The median age in the Immediate is smaller than the Primary and Secondary Service Area, State of Minnesota and the National number. The Primary and Secondary Service Areas have a greater media age. A lower median age typically points to the presence of families with children.

The following chart provides the number of households and percentage of households in the Primary and Secondary Service Area with children.

	Number of Households w/ Children	Percentage of Households w/ Children
Immediate Service Area	3,528	29.8%
Primary Service Area	15,015	29.0%
Secondary Service Area	103,495	27.9%
State of Minnesota	658,591	31.6%

The information contained in Table B helps further outline the presence of families with children. As a point of comparison in the 2010 Census, 33.4% of households nationally had children present.

Table B – Median Age by County

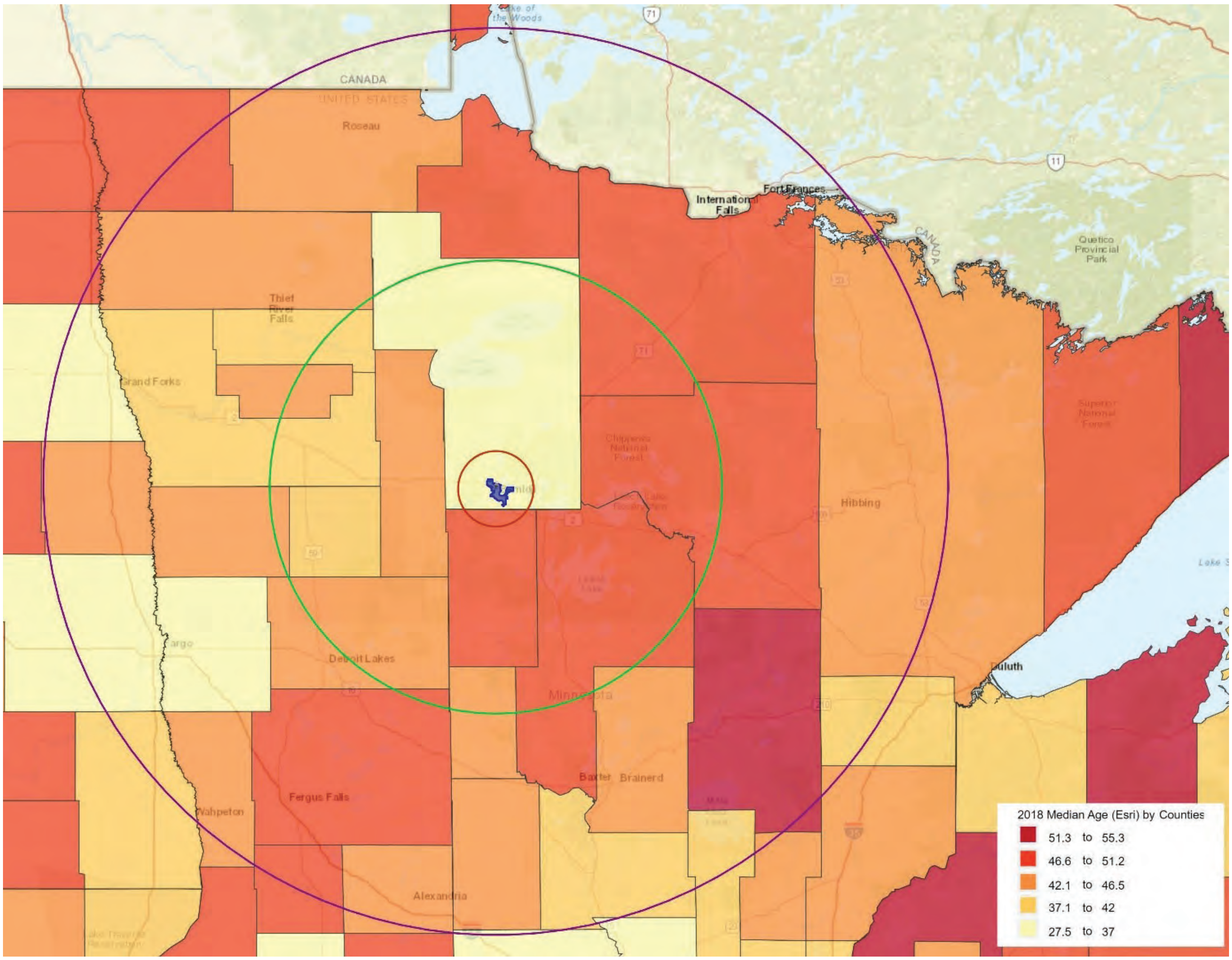
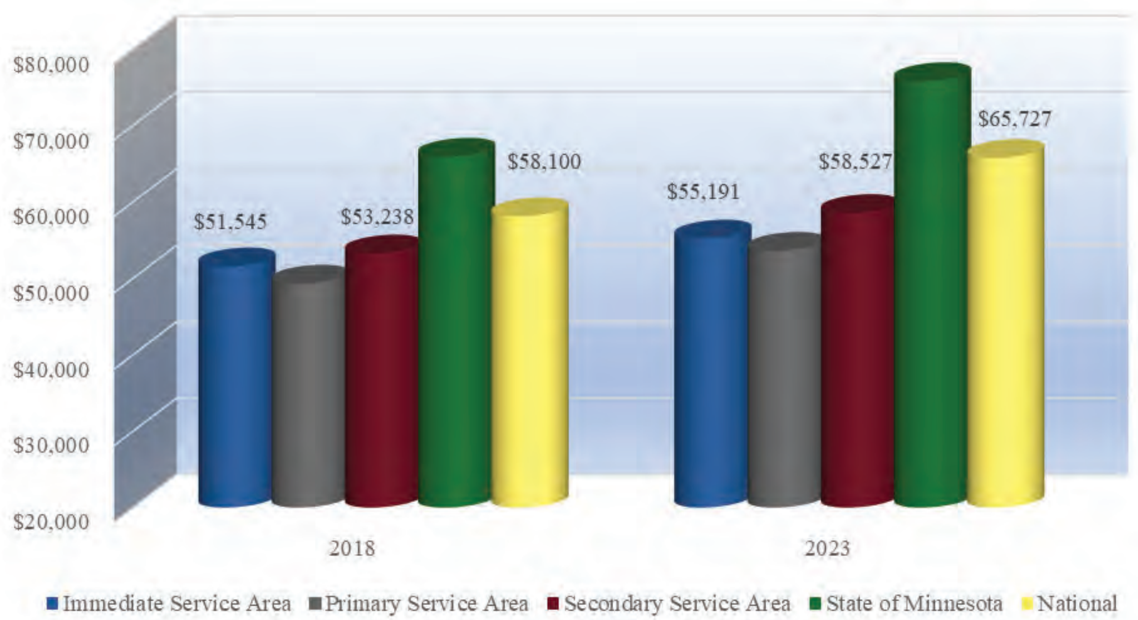


Table C – Median Household Income

	2018 Projection	2023 Projection
Immediate Service Area	$51,545	$55,191
Primary Service Area	$49,293	$53,585
Secondary Service Area	$53,238	$58,527
State of Minnesota	$65,887	$75,765
Nationally	$58,100	$65,727

Chart B – Median Household Income



Based on 2018 projections for median household income the following narrative describes the service areas:

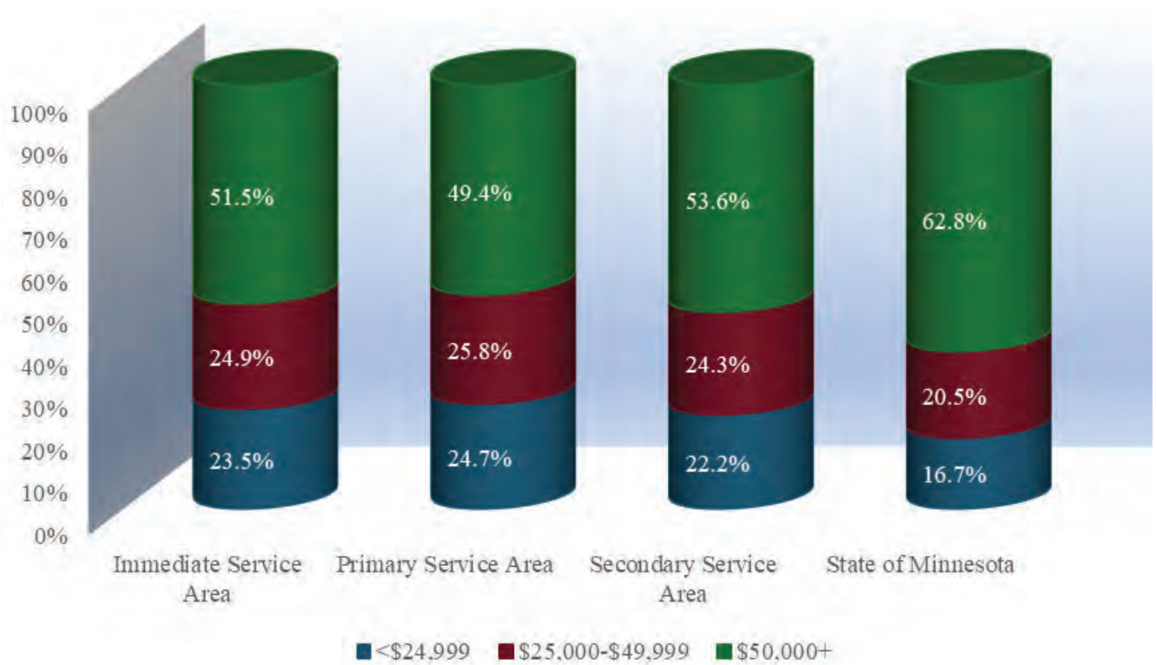
In the Immediate Service Area, the percentage of households with median income over $50,000 per year is 51.5% compared to 55.9% on a national level. Furthermore, the percentage of the households in the service area with median income less than $25,000 per year is 23.5% compared to a level of 21.5% nationally.

In the Primary Service Area, the percentage of households with median income over $50,000 per year is 49.4% compared to 55.9% on a national level. Furthermore, the percentage of the households in the service area with median income less than $25,000 per year is 24.7% compared to a level of 21.5% nationally.

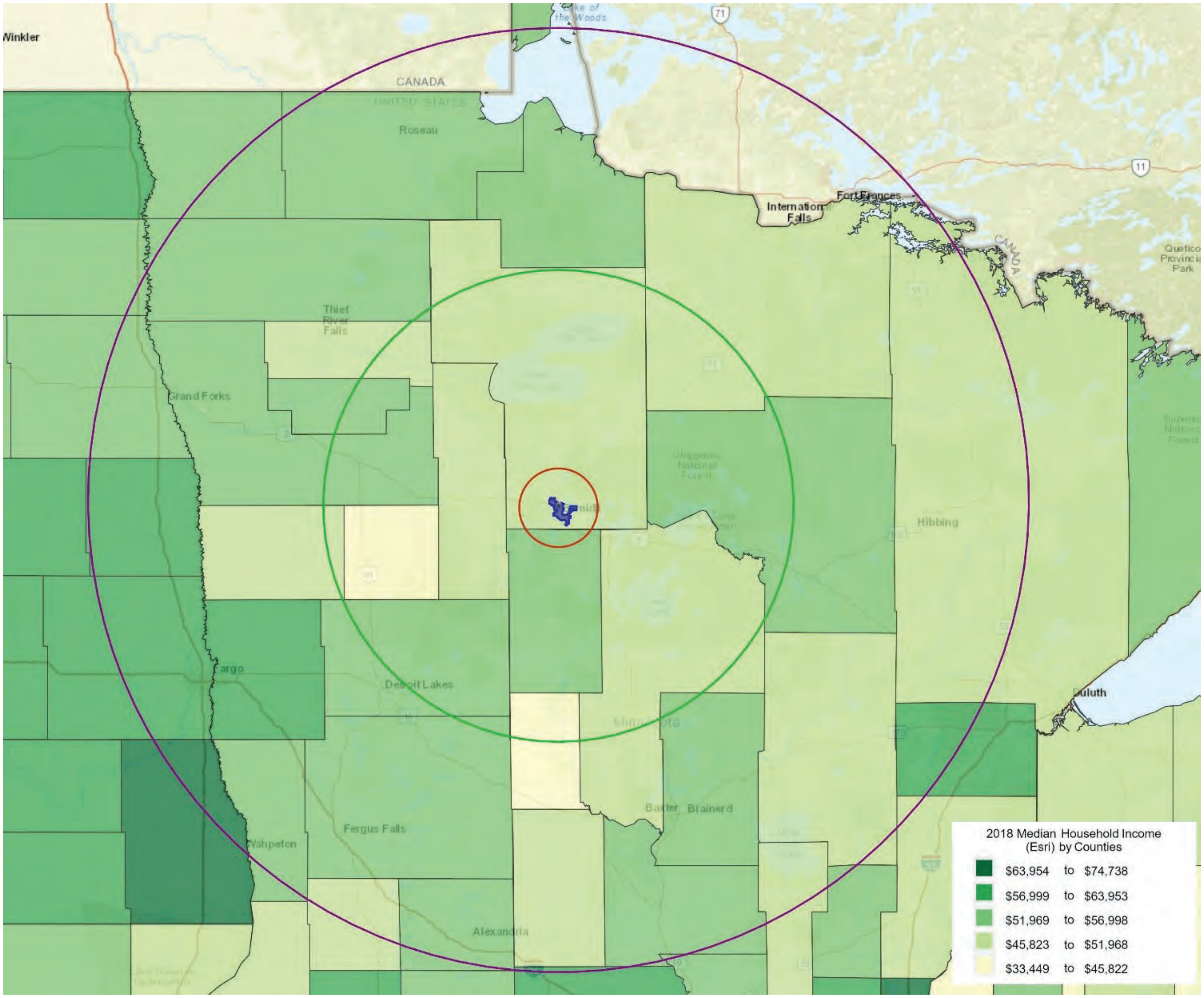
In the Secondary Service Area, the percentage of households with median income over $50,000 per year is 53.6% compared to 55.9% on a national level. Furthermore, the percentage of the households in the service area with median income less than $25,000 per year is 22.2% compared to a level of 21.5% nationally.

While there is no perfect indicator of use of an indoor recreation facility, the percentage of households with more than $50,000 median income is a key indicator. Therefore, those numbers are significant and balanced with the overall cost of living.

Chart C – Median Household Income Distribution



Map C – Household Income by Census Tract



In addition to taking a look at Median Age and Median Income, it is important to examine Household Budget Expenditures. In particular, reviewing housing information; shelter, utilities, fuel and public services along with entertainment & recreation can provide a snapshot into the cost of living and spending patterns in the services areas. The table below looks at that information and compares the service areas.

Table D – Household Budget Expenditures[5]

Immediate Service Area	**SPI**	**Average Amount Spent**	**Percent**
Housing	84	$18,253.69	30.6%
Shelter	*84*	*$14,053.99*	*23.6%*
Utilities, Fuel, Public Service	*85*	*$4,199.69*	*7.0%*
Entertainment & Recreation	84	$2,691.79	4.5%

Primary Service Area	**SPI**	**Average Amount Spent**	**Percent**
Housing	76	$16,494.35	29.2%
Shelter	*72*	*$12,158.61*	*21.5%*
Utilities, Fuel, Public Service	*87*	*$4,335.75*	*7.7%*
Entertainment & Recreation	84	$2,705.89	4.8%

Secondary Service Area	**SPI**	**Average Amount Spent**	**Percent**
Housing	84	$18,370.33	29.7%
Shelter	*82*	*$13,770.73*	*22.3%*
Utilities, Fuel, Public Service	*93*	*$4,599.61*	*7.4%*
Entertainment & Recreation	90	$2,896.53	4.7%

State of Minnesota	**SPI**	**Average Amount Spent**	**Percent**
Housing	107	$23,218.27	30.2%
Shelter	*106*	*$17,805.96*	*23.1%*
Utilities, Fuel, Public Service	*109*	*$5,412.31*	*7.0%*
Entertainment & Recreation	109	$3,512.61	4.6%

SPI: Spending Potential Index as compared to the National number of 100.

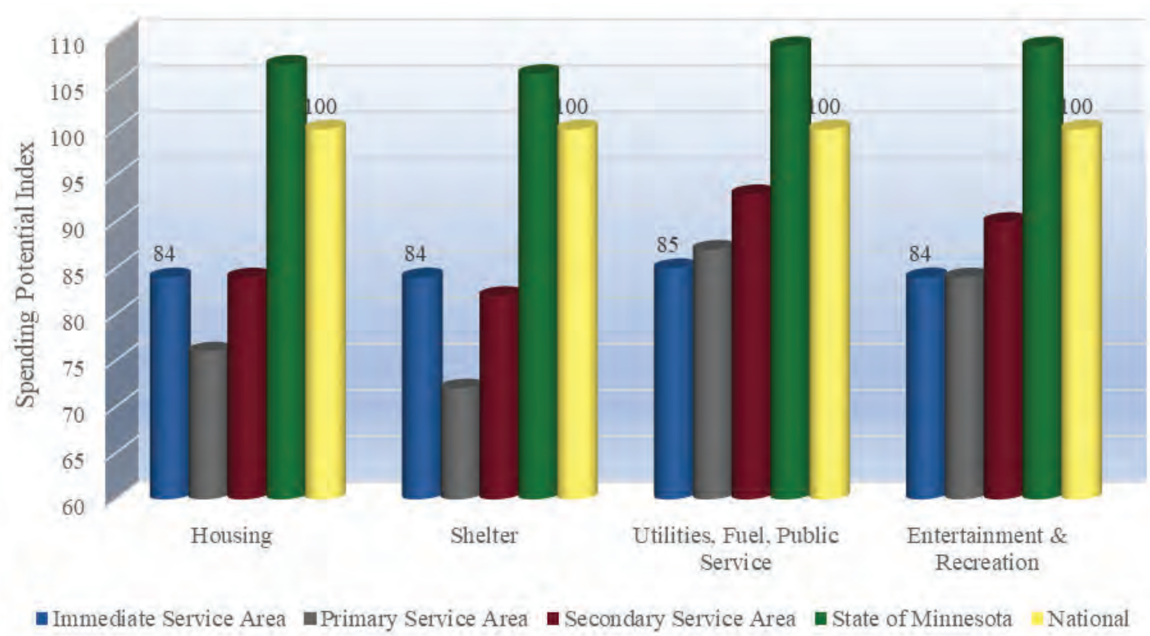
Average Amount Spent: The average amount spent per household.

Percent: Percent of the total 100% of household expenditures.

Note: Shelter along with Utilities, Fuel, Public Services are a portion of the Housing percentage.

[5] Consumer Spending data are derived from the 2004 and 2005 Consumer Expenditure Surveys, Bureau of Labor Statistics. ESRI forecasts for 2018 and 2023.

Chart D – Household Budget Expenditures Spending Potential Index



The total number of housing units in the Immediate Service Area is 13,501 and 87.8% are occupied, or 11,857 housing units. The total vacancy rate for the service area is 12.2%. Of the available units:

- For Rent 1.8%
- Rented, not Occupied 0.1%
- For Sale 1.0%
- Sold, not Occupied 0.1%
- For Seasonal Use 6.9%
- Other Vacant 2.2%

The total number of housing units in the Primary Service Area is 80,239 and 64.6% are occupied, or 51,829 housing units. The total vacancy rate for the service area is 35.4%. Of the available units:

- For Rent 1.2%
- Rented, not Occupied 0.1%
- For Sale 1.1%
- Sold, not Occupied 0.2%
- For Seasonal Use 29.8%
- Other Vacant 2.9%

The total number of housing units in the Secondary Service Area is 483,963 and 76.6% are occupied, or 370,799 housing units. The total vacancy rate for the service area is 23.4%. Of the available units:

- For Rent 1.9%
- Rented, not Occupied 0.1%
- For Sale 1.2%
- Sold, not Occupied 0.2%
- For Seasonal Use 17.5%
- Other Vacant 2.3%

Recreation Expenditures Spending Potential Index: Finally, through the demographic provider that B*K utilizes for the market analysis portion of the report, we can examine the overall propensity for households to spend dollars on recreation activities. The following comparisons are possible.

Table E – Recreational Expenditures Spending Potential Index[6]

Immediate Service Area	SPI	Average Spent
Fees for Participant Sports	84	$94.40
Fees for Recreational Lessons	77	$105.92
Social, Recreation, Club Membership	80	$181.89
Exercise Equipment/Game Tables	83	$147.98
Other Sports Equipment	85	$6.51

Primary Service Area	SPI	Average Spent
Fees for Participant Sports	69	$41.17
Fees for Recreational Lessons	70	$79.24
Social, Recreation, Club Membership	59	$82.23
Exercise Equipment/Game Tables	68	$39.06
Other Sports Equipment	95	$7.32

Secondary Service Area	SPI	Average Spent
Fees for Participant Sports	79	$89.79
Fees for Recreational Lessons	71	$97.70
Social, Recreation, Club Membership	75	$169.14
Exercise Equipment/Game Tables	79	$45.71
Other Sports Equipment	99	$7.66

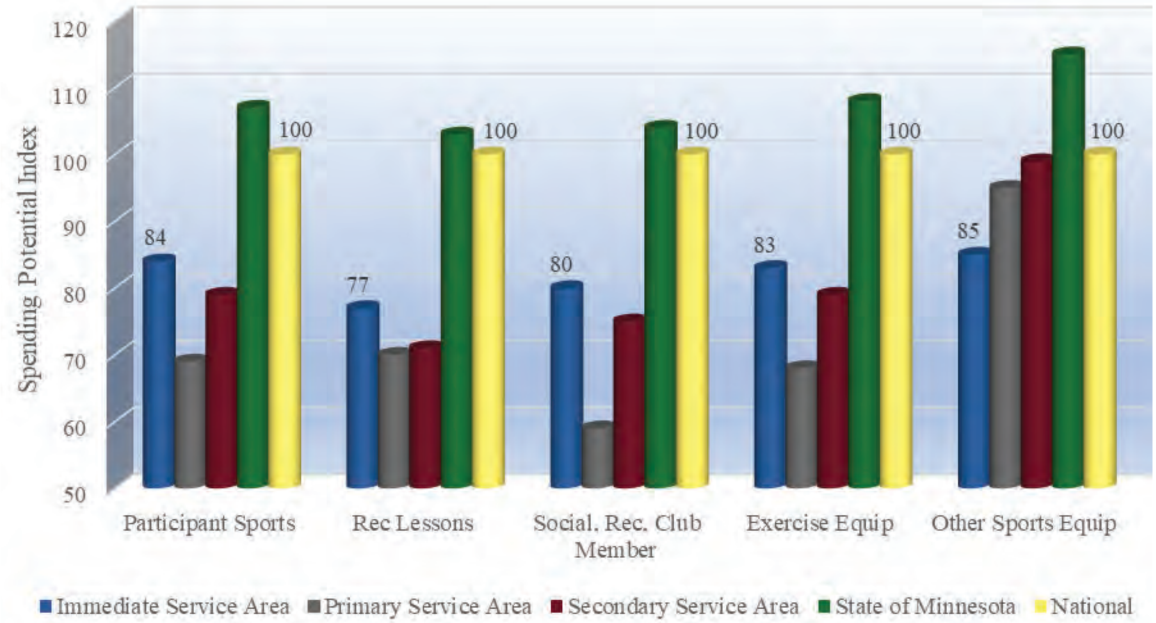
State of Minnesota	SPI	Average Spent
Fees for Participant Sports	107	$120.60
Fees for Recreational Lessons	103	$143.01
Social, Recreation, Club Membership	104	$235.67
Exercise Equipment/Game Tables	108	$62.24
Other Sports Equipment	115	$8.85

SPI: Spending Potential Index as compared to the National number of 100.

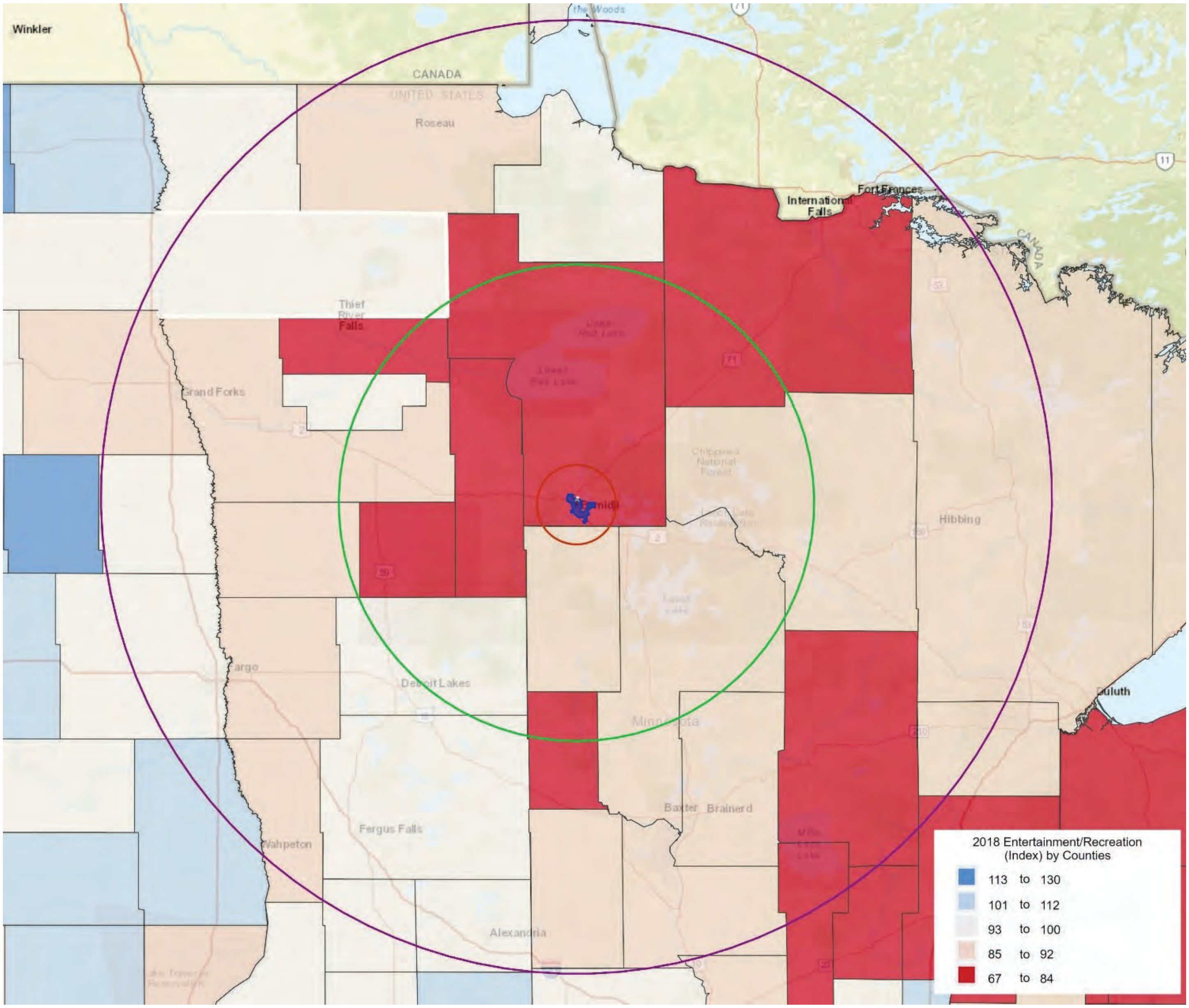
Average Amount Spent: The average amount spent for the service or item in a year.

6 Consumer Spending data are derived from the 2006 and 2007 Consumer Expenditure Surveys, Bureau of Labor Statistics.

Chart E – Recreation Spending Potential Index



Map D – Recreation Spending Potential Index by Census Tract



Population Distribution by Age: Utilizing census information for the Immediate, Primary Service Secondary Service Area, the following comparisons are possible.

Table F – 2018 Immediate Service Area Age Distribution

(ESRI estimates)

Ages	Population	% of Total	Nat. Population	Difference
0-5	2,080	6.4%	6.0%	+0.4%
5-17	5,157	15.9%	16.3%	-0.4%
18-24	4,667	14.4%	9.7%	+4.7%
25-44	8,314	25.5%	26.4%	-0.9%
45-54	3,279	10.1%	13.0%	-2.9%
55-64	3,865	11.9%	12.9%	-1.0%
65-74	2,915	9.0%	9.2%	-0.2%
75+	2,236	6.9%	6.4%	+0.5%

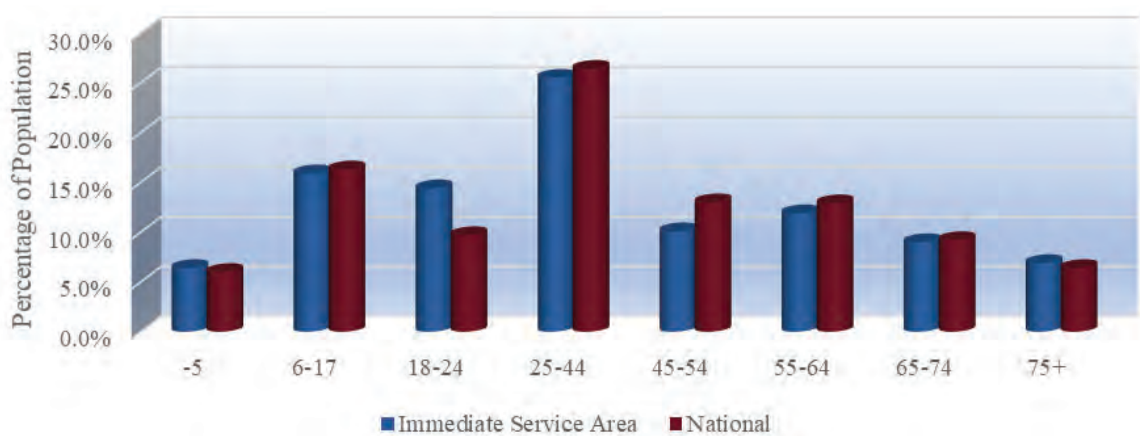
Population: 2018 census estimates in the different age groups in Immediate Service Area.

% of Total: Percentage of the Immediate Service Area population in the age group.

National Population: Percentage of the national population in the age group

Difference: Percentage difference between Immediate Service Area population and the national population

Chart F – 2018 Immediate Service Area Age Group Distribution



The demographic makeup of Immediate Service Area, when compared to the characteristics of the national population, indicates that there are some differences with a larger population in the 0-5, 18-24 and 75+ age groups. A smaller population in the age groups 6-17, 25-44,45-54,55-64 and 65-74. The greatest positive variance is in the 18-24 age group with +4.7%, while the greatest negative variance is in the 45-54 age group with-2.9%.

Table G – 2018 Primary Service Area Age Distribution

(ESRI estimates)

Ages	Population	% of Total	Nat. Population	Difference
0-5	8,629	6.3%	6.0%	+0.3%
5-17	22,150	16.4%	16.3%	+0.1%
18-24	11,461	8.5%	9.7%	-1.2%
25-44	29,193	21.4%	26.4%	-5.0%
45-54	15,624	11.5%	13.0%	-1.5%
55-64	20,267	14.9%	12.9%	+2.0%
65-74	17,092	12.5%	9.2%	+3.3%
75+	11,540	8.5%	6.4%	+2.1%

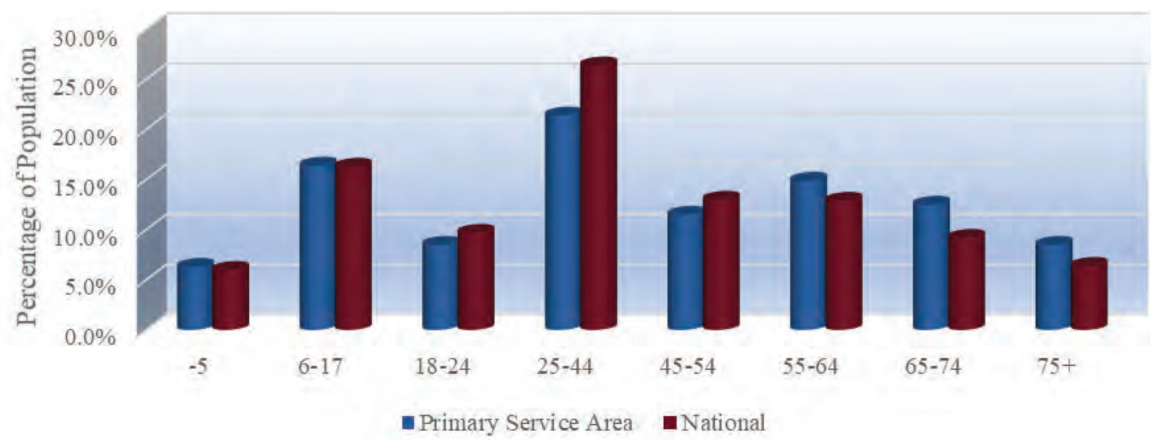
Population: 2018 census estimates in the different age groups in Primary Service Area.

% of Total: Percentage of the Primary Service Area population in the age group.

National Population: Percentage of the national population in the age group

Difference: Percentage difference between Primary Service Area population and the national population

Chart G – 2018 Primary Service Area Age Group Distribution



The demographic makeup of Primary Service Area, when compared to the characteristics of the national population, indicates that there are some differences with a larger population in the 0-17 and 55+ age groups. A smaller population in the 18-54 age groups. The greatest positive variance is in the 65-74 age group with +3.3%, while the greatest negative variance is in the 25-44 age group with-5.0%.

Table H – 2018 Secondary Service Area Age Distribution

(ESRI estimates)

Ages	Population	% of Total	Nat. Population	Difference
0-5	57,942	6.0%	6.0%	0.0%
5-17	147,917	15.4%	16.3%	-0.9%
18-24	150,489	15.5%	9.7%	+5.8%
25-44	221,601	23.0%	26.4%	-3.4%
45-54	130,352	13.5%	13.0%	+0.5%
55-64	126,386	13.1%	12.9%	+0.2%
65-74	75,318	7.8%	9.2%	-1.4%
75+	46,454	4.8%	6.4%	-1.6%

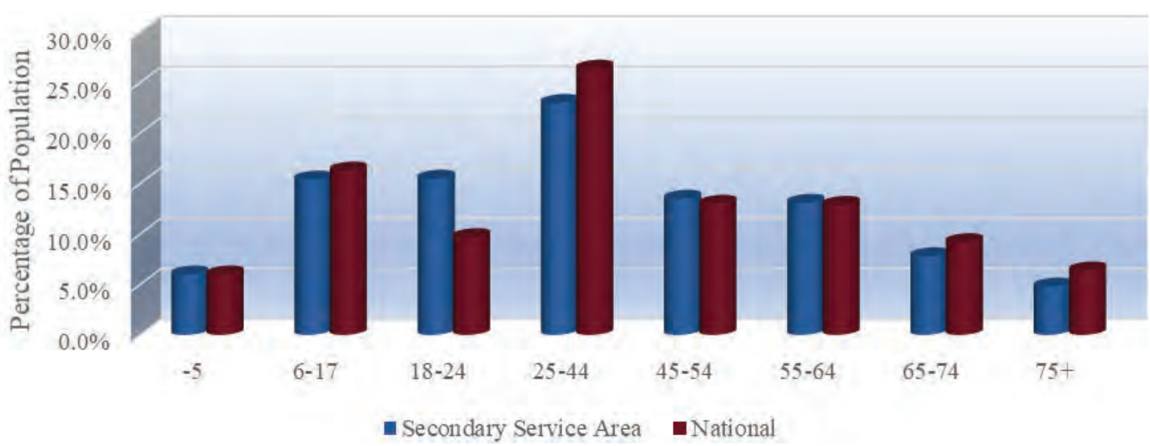
Population: 2018 census estimates in the different age groups in Secondary Service Area.

% of Total: Percentage of the Secondary Service Area population in the age group.

National Population: Percentage of the national population in the age group

Difference: Percentage difference between Secondary Service Area population and the national population

Chart H – 2018 Secondary Service Area Age Group Distribution



The demographic makeup of the Secondary Service Area, when compared to the characteristics of the national population, indicates that there are some differences with a larger population in the age groups 18-24, 45-54 and 55-64. A smaller population in the age groups, 6-17, 25-44, and 65+. The greatest positive variance is in the 18-24 age group with +5.8%, while the greatest negative variance is in the 18-24 and 25-44 age groups with-3.4%.

Population Distribution Comparison by Age: Utilizing census information from the Immediate, Primary Service Area and Secondary Service Area, the following comparisons are possible.

Table I – 2018 Immediate Service Area Population Estimates

(U.S. Census Information and ESRI)

Ages	2010 Census	2018 Projection	2023 Projection	Percent Change	Percent Change Nat'l
-5	2,116	2,080	2,160	+2.1%	+2.5%
5-17	4,876	5,157	5,343	+9.6%	+0.9%
18-24	5,205	4,667	4,713	-9.5%	+0.7%
25-44	6,980	8,314	8,637	+23.7%	+12.5%
45-54	3,909	3,279	3,286	-15.9%	-9.5%
55-64	3,533	3,865	3,566	+0.9%	+17.2%
65-74	1,984	2,915	3,408	+71.8%	+65.8%
75+	1,971	2,236	2,681	+36.0%	+40.2%

Chart I – Immediate Service Area Population Growth

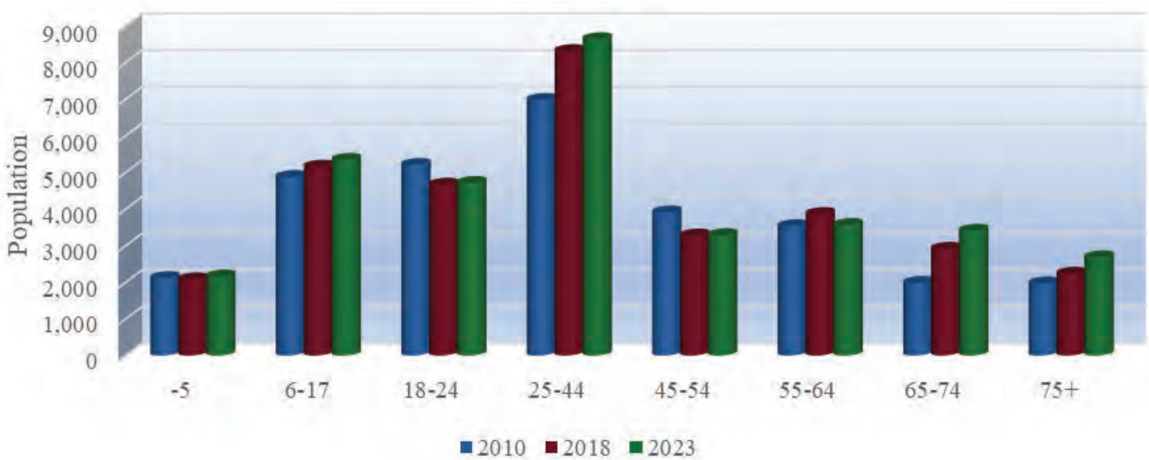


Table-H illustrates the growth or decline in age group numbers from the 2010 census until the year 2023. It is projected all age categories, except 18-24 and 45-54, will see an increase in population. The population of the United States as a whole is aging, and it is not unusual to find negative growth numbers in the younger age groups and significant net gains in the 45 plus age groupings in communities which are relatively stable in their population numbers.

Table J – 2018 Primary Service Area Population Estimates

(U.S. Census Information and ESRI)

Ages	2010 Census	2018 Projection	2023 Projection	Percent Change	Percent Change Nat'l
-5	9,015	8,629	8,670	-3.8%	+2.5%
5-17	22,343	22,150	23,117	+3.5%	+0.9%
18-24	11,914	11,461	11,164	-6.3%	+0.7%
25-44	26,835	29,193	29,910	+11.5%	+12.5%
45-54	18,642	15,624	14,846	-20.4%	-9.5%
55-64	18,110	20,267	19,342	+6.8%	+17.2%
65-74	12,867	17,092	19,658	+52.8%	+65.8%
75+	9,844	11,540	13,822	+40.4%	+40.2%

Chart J – Primary Service Area Population Growth

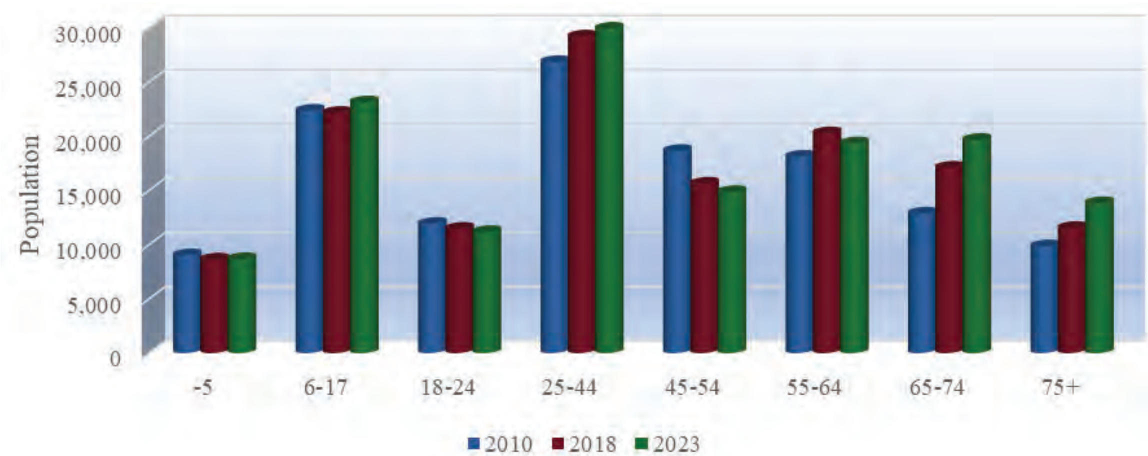


Table-H illustrates the growth or decline in age group numbers from the 2010 census until the year 2023. It is projected age categories 6-17, 25-44, 55-64, 65-74 and 75+ will see an increase in population. The population of the United States as a whole is aging, and it is not unusual to find negative growth numbers in the younger age groups and significant net gains in the 45 plus age groupings in communities which are relatively stable in their population numbers.

Table K – 2018 Secondary Service Area Population Estimates

(U.S. Census Information and ESRI)

Ages	2010 Census	2018 Projection	2023 Projection	Percent Change	Percent Change Nat'l
-5	57,609	57,942	60,145	+4.4%	+2.5%
5-17	145,699	147,917	157,615	+8.2%	+0.9%
18-24	142,479	150,489	144,345	+1.3%	+0.7%
25-44	212,057	221,601	239,839	+13.1%	+12.5%
45-54	130,613	130,352	119,811	-8.3%	-9.5%
55-64	94,039	126,386	136,688	+45.4%	+17.2%
65-74	58,231	75,318	94,594	+62.4%	+65.8%
75+	42,692	46,454	51,198	+19.9%	+40.2%

Chart K – Secondary Service Area Population Growth

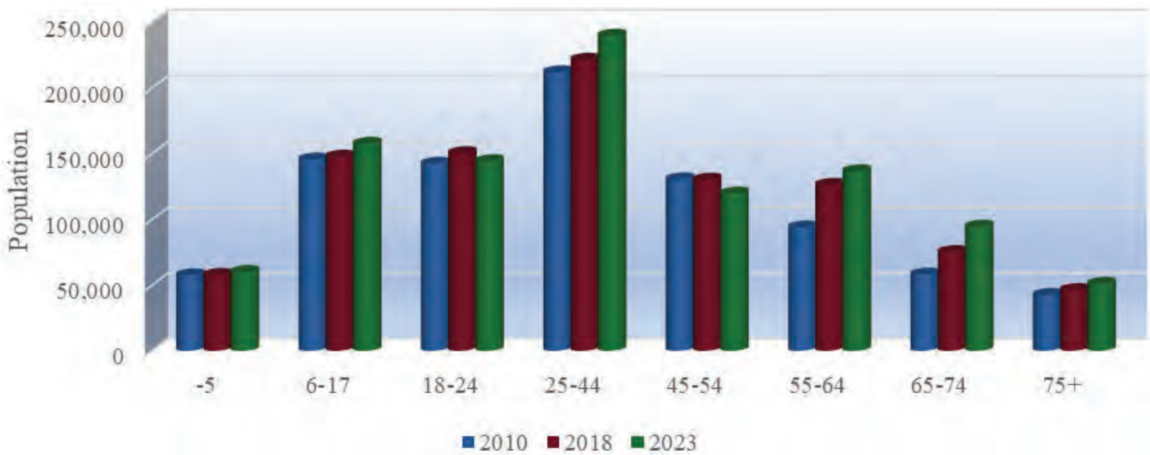


Table-I illustrates the growth or decline in age group numbers from the 2010 census until the year 2023. It is projected all age categories, except 45-54, will see an increase in population. The population of the United States as a whole is aging, and it is not unusual to find negative growth numbers in the younger age groups and significant net gains in the 45 plus age groupings in communities which are relatively stable in their population numbers

DEMOGRAPHIC & MARKET ANALYSIS

Below is listed the distribution of the population by race and ethnicity for the Immediate, Primary and Secondary Service Area for 2018 population projections. Those numbers were developed from 2010 Census Data.

Table L – Immediate Service Area Ethnic Population and Median Age 2018

(U.S. Census Bureau and ESRI)

Ethnicity	Total Population	Median Age	% of Population	% of MN Population
Hispanic	836	19.5	2.6%	5.5%

Table M – Immediate Service Area by Race and Median Age 2018

(U.S. Census Bureau and ESRI)

Race	Total Population	Median Age	% of Population	% of MN Population
White	27,243	37.1	83.8%	82.2%
Black	347	23.9	1.1%	6.4%
American Indian	3,154	25.5	9.7%	1.2%
Asian	308	25.2	1.0%	5.1%
Pacific Islander	14	27.5	0.0%	0.1%
Other	136	26.5	0.4%	2.2%
Multiple	1,310	15.9	4.0%	2.8%

2018 Immediate Service Area Total Population: 32,510 Residents

Chart L – 2018 Immediate Service Area Population by Non-White Race

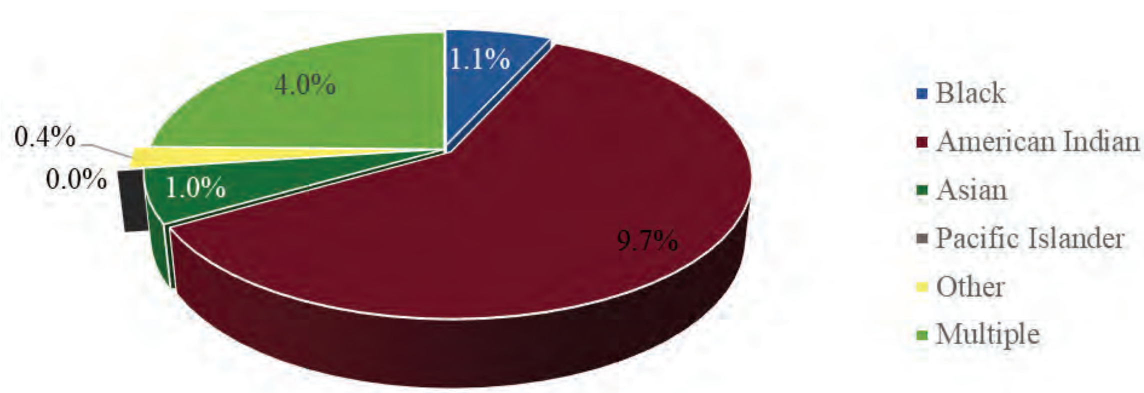


Table N – Primary Service Area Ethnic Population and Median Age 2018

(U.S. Census Bureau and ESRI)

Ethnicity	Total Population	Median Age	% of Population	% of MN Population
Hispanic	2,978	18.1	2.2%	5.5%

Table O – Primary Service Area by Race and Median Age 2018

(U.S. Census Bureau and ESRI)

Race	Total Population	Median Age	% of Population	% of MN Population
White	108,305	47.5	79.7%	82.2%
Black	702	23.6	0.5%	6.4%
American Indian	21,065	27.1	15.5%	1.2%
Asian	693	28.6	0.5%	5.1%
Pacific Islander	32	28.8	0.0%	0.1%
Other	474	27.2	0.3%	2.2%
Multiple	4,687	18.6	3.4%	2.8%

2018 Primary Service Area Total Population: 135,956 Residents

Chart M – 2018 Primary Service Area Population by Non-White Race

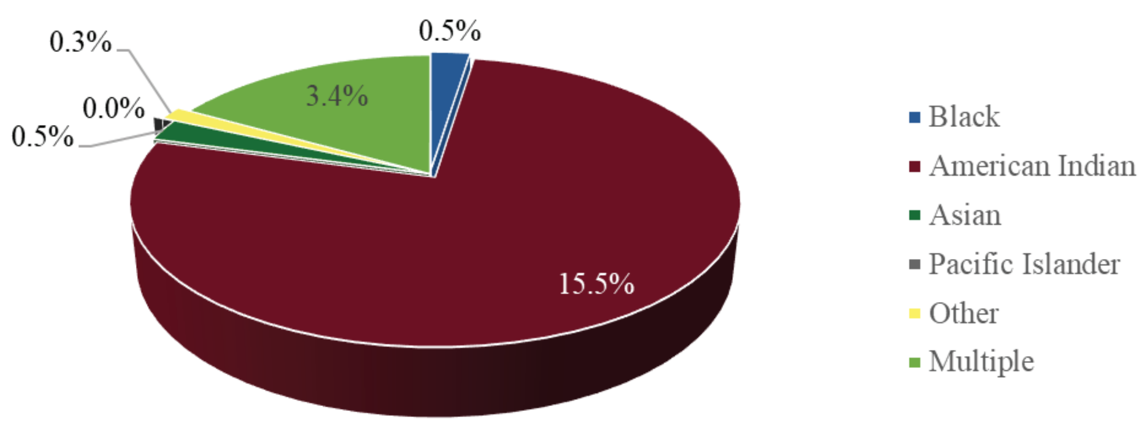


Table N – Primary Service Area Ethnic Population and Median Age 2018

(U.S. Census Bureau and ESRI)

Ethnicity	Total Population	Median Age	% of Population	% of MN Population
Hispanic	28,904	22.3	3.0%	5.5%

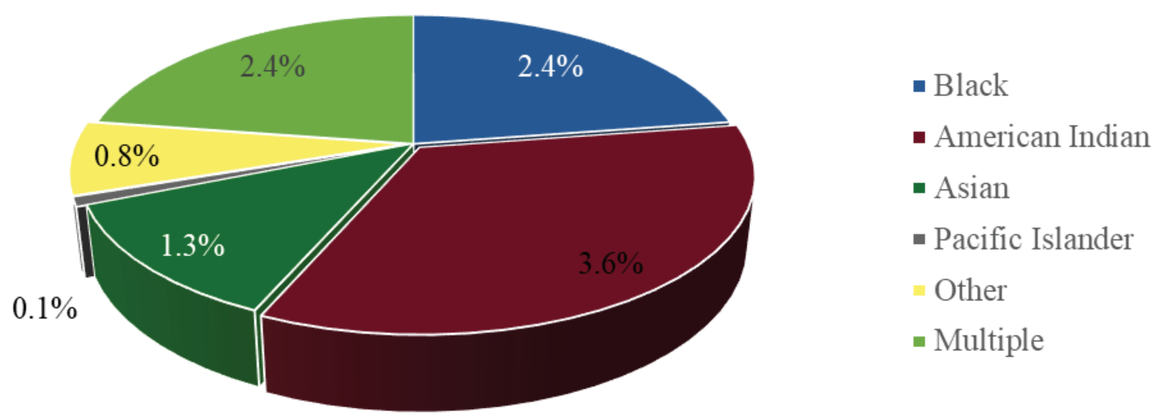
Table O – Primary Service Area by Race and Median Age 2018

(U.S. Census Bureau and ESRI)

Race	Total Population	Median Age	% of Population	% of MN Population
White	866,339	42.6	89.5%	82.2%
Black	22,879	24.4	2.4%	6.4%
American Indian	24,809	27.8	3.6%	1.2%
Asian	12,841	29.0	1.3%	5.1%
Pacific Islander	505	27.4	0.1%	0.1%
Other	7,556	27.0	0.8%	2.2%
Multiple	22,920	17.7	2.4%	2.8%

2018 Secondary Service Area Total Population: 967,849 Residents

Chart N – 2018 Secondary Service Area Population by Non-White Race



Tapestry Segmentation

Tapestry segmentation represents the 4th generation of market segmentation systems that began 30 years ago. The 65-segment Tapestry Segmentation system classifies U.S. neighborhoods based on their socioeconomic and demographic compositions. While the demographic landscape of the U.S. has changed significantly since the 2000 Census, the tapestry segmentation has remained stable as neighborhoods have evolved.

There is value including this information for Bemidji. The data assists the organization in understanding the consumers/constituents in their service area and supply them with the right products and services.

The Tapestry segmentation system classifies U.S. neighborhoods into 65 unique market segments. Neighborhoods are sorted by more than 60 attributes including; income, employment, home value, housing types, education, household composition, age and other key determinates of consumer behavior.

The following pages and tables outline the top 5 tapestry segments in each of the service areas and provide a brief description of each. This information combined with the key indicators and demographic analysis of each service area help further describe the markets that the Secondary Service Area looks to serve with programs, services, and special events.

For comparison purposes the following are the top 10 Tapestry segments, along with percentage in the United States:

1.	Green Acres (6A)	3.2%
2.	Southern Satellites (10A)	3.2%
3.	Savvy Suburbanites (1D)	3.0%
4.	Salt of the Earth (6B)	2.9%
5.	Soccer Moms (4A)	2.8%
		15.1%
6.	Middleburg (4C)	2.8%
7.	Midlife Constants (5E)	2.5%
8.	Comfortable Empty Nesters (5A)	2.5%
9.	Heartland Communities (6F)	2.4%
10.	Old and Newcomers (8F)	2.3%
		12.5%

Table R – Immediate Service Area Tapestry Segment Comparison

(ESRI estimates)

	Primary Service Area		*Demographics*	
	Percent	Cumulative Percent	Median Age	Median HH Income
Middleburg (4C)	17.6%	17.6%	35.3	$55,000
Old and Newcomers (8F)	13.6%	31.2%	38.5	$39,000
Green Acres (6A)	13.4%	44.6%	43.0	$72,000
Set to Impress (11D)	11.2%	55.8%	33.1	$29,000
Retirement Communities (9E)	8.8%	64.6%	52.0	$35,000

Middleburg (4C) – This group is conservative and family-oriented. A younger market that is growing. Prefers to buy American for a good price. Participate in sports and outdoor activities.

Old and Newcomers (8F) – Singles living on a budget. Just beginning careers or taking college/adult education classes. Strong supporters of environmental organizations.

Green Acres (6A) – Lifestyle that features self-reliance. Enjoy maintaining home/yard, being outside and playing sports. Most households no longer have children. Conservative and cautious.

Set to Impress (11D) – Residents living alone but continue to have close family ties. Very conscious of the image. Enjoy popular music and quick meals. High use of internet and social media.

Retirement Communities (9E) – This group stays up-to-date with the latest news, take pride in being financially responsible. Enjoy cooking and are health conscious.

Chart O – Immediate Service Area Tapestry Segment Representation by Percentage

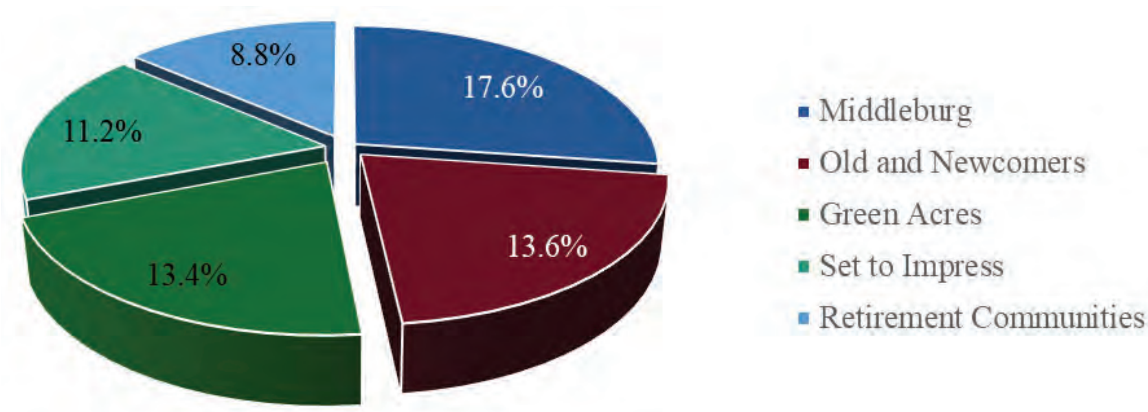


Table S – Primary Service Area Tapestry Segment Comparison

(ESRI estimates)

	Primary Service Area		*Demographics*	
	Percent	Cumulative Percent	Median Age	Median HH Income
Rural Resort Dwellers (6E)	22.9%	22.9%	52.4	$46,000
Prairie Living (6D)	13.8%	36.7%	43.4	$51,000
The Great Outdoors (6C)	11.0%	47.7%	46.3	$53,000
Heartland Communities (6F)	8.0%	55.7%	41.5	$39,000
Small Town Simplicity (12C)	6.3%	62.0%	40.0	$27,000

Rural Resort Dwellers (6E) – This group is centered around resort areas. Retirement is near but many postpone to maintain their lifestyle. Passionate about their hobbies, hunting and fishing.

Prairie Living (6D) – The most rural market, predominantly self-employed farmers. Faith is important to these married-couple families. Choose outdoor activities when they find time to relax.

The Great Outdoors (6C) – Living a modest lifestyle, these empty nesters are very do-it-yourself oriented and cost conscious. Enjoy outdoor activities such as hiking and hunting.

Heartland Communities (6F) – This group embraces a slow pace of life. Actively participate in outdoor activities and the community. Buy American and are traditional. Stick to brands they trust.

Small Town Simplicity (12C) – This group consists of young families and seniors. Both emphasize convenience. Many are at or below poverty level. Conservative and community-oriented.

Chart P – Primary Service Area Tapestry Segment Representation by Percentage

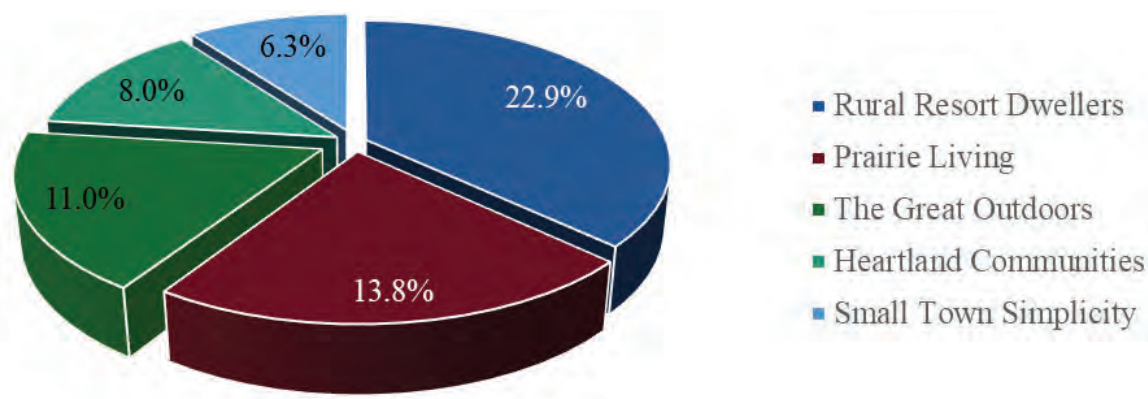


Table T – Secondary Service Area Tapestry Segment Comparison

(ESRI estimates)

	Primary Service Area		*Demographics*	
	Percent	Cumulative Percent	Median Age	Median HH Income
Rural Resort Dwellers (6E)	12.8%	12.8%	52.4	$46,000
Prairie Living (6D)	10.1%	22.9%	43.4	$51,000
Heartland Communities (6F)	8.1%	31.0%	41.5	$39,000
Small Town Simplicity (12C)	5.5%	36.5%	40.0	$27,000
Old and Newcomers (8F)	5.5%	42.0%	38.5	$39,000

Rural Resort Dwellers (6E) – This group is centered around resort areas. Retirement is near but many postpone to maintain their lifestyle. Passionate about their hobbies, hunting and fishing.

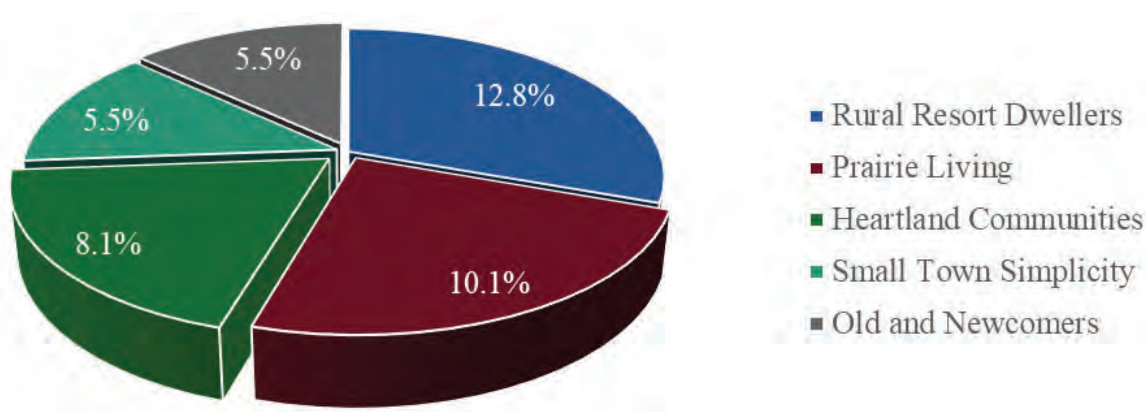
Prairie Living (6D) – The most rural market, predominantly self-employed farmers. Faith is important to these married-couple families. Choose outdoor activities when they find time to relax.

Heartland Communities (6F) – This group embraces a slow pace of life. Actively participate in outdoor activities and the community. Buy American and are traditional. Stick to brands they trust.

Small Town Simplicity (12C) – This group consists of young families and seniors. Both emphasize convenience. Many are at or below poverty level. Conservative and community-oriented.

Old and Newcomers (8F) – Singles living on a budget. Just beginning careers or taking college/adult education classes. Strong supporters of environmental organizations.

Chart Q – Secondary Service Area Tapestry Segment Representation by Percentage



Demographic Summary

The following summarizes the demographic characteristics of the service areas.

- The population within the Primary Service Area is adequate to support an ice sports, but the presence of alternative service providers must be acknowledged and accounted for. This is especially true if BCAC adds another sheet of ice to their facility.

- The median age for the Immediate Service area is significantly younger than the National number while the Primary Service and Secondary Service Areas are slightly older than the National number. The larger proportion of growth in the 25-44-year old catgory by 2023 suggests a higher concentration of families with children. Age is one determining factor that drives participation in all ice sports.

- The primary service area experienced a increase in population since the 2010 Census. This trend is expected to continue over the next 5 years with population in the immediate service area expected to grow about 3.8% to a population of 33,795. This demographic trends points to growing population and should expect some increase in ice sports participation.

- The median household income within the Primary Service Area is significantly lower (11%) than the national level. Furthermore, the percent of households with income over $50,000 is about 51.5% compared to a national level of 59.5%. Household income is another determining factor that drives participation in ice sports.

- The percent of households with children in the immediate service area is 29.8% compared to the national level of 33.4%.

- The Spending Potential Index for housing in the immediate service area is 16% lower than the national level while the median HH Income is 11% lower than the national level. This suggests a normal level of disposable income.

- The Tapestry segments identified in the Immediate Service Area point to an active community, which is also supported by the presence of other service providers in the area.

- Based on the population, age group distribution, household income levels the overall market conditions for the recreation and sports activities in the primary service area are favorable.

Participation, Trends & Providers

In addition to analyzing the demographic realities of the service areas, it is possible to project possible participation in recreation and sport activities.

Participation Numbers: On an annual basis, the National Sporting Goods Association (NSGA) conducts an in-depth study and survey of how Americans spend their leisure time. This information provides the data necessary to overlay rate of participation onto the Secondary Service Area to determine market potential. The information contained in this section of the report, utilizes the NSGA's most recent survey. For that data was collected in 2017 and the report was issued in June of 2018.

B*K takes the national average and combines that with participation percentages of the Secondary Service Area based upon age distribution, median income, region and National number. Those four percentages are then averaged together to create a unique participation percentage for the service area. This participation percentage when applied to the population of the Secondary Service Area then provides an idea of the market potential for various activities.

Community Recreation Related Activities Participation: These activities could take place at an indoor community recreation center space.

Table A – Participation Rates for Immediate Service Area

	Age	Income	Region	Nation	Average
Aerobics	14.7%	15.7%	17.6%	15.2%	15.8%
Baseball	4.1%	3.6%	4.0%	4.1%	4.0%
Basketball	8.6%	8.0%	8.4%	8.3%	8.3%
Bicycle Riding	11.9%	12.1%	13.6%	12.3%	12.5%
Exercise Walking	34.2%	36.0%	41.9%	35.4%	36.9%
Exercise w/ Equipment	18.7%	19.7%	23.1%	18.8%	20.1%
Football (Flag)	2.2%	2.6%	2.6%	2.2%	2.4%
Football (Tackle)	2.6%	2.3%	2.7%	2.5%	2.5%
Ice Hockey	1.1%	0.9%	1.3%	1.1%	1.1%
Ice Skating	3.1%	3.2%	4.3%	3.0%	3.4%
Lacrosse	1.0%	1.0%	0.9%	1.0%	1.0%
Mixed Martial Arts	2.1%	1.9%	2.2%	2.0%	2.0%
Pilates	0.3%	2.0%	1.3%	1.9%	1.4%
Running/Jogging	15.0%	15.9%	17.2%	14.8%	15.7%
Soccer	4.9%	5.0%	3.7%	4.9%	4.6%
Softball	3.3%	3.1%	4.5%	3.3%	3.5%
Swimming	15.8%	16.6%	19.3%	16.2%	17.0%
Tennis	4.1%	4.3%	3.2%	4.2%	4.0%
Volleyball	3.6%	3.7%	3.6%	3.6%	3.6%
Weight Lifting	12.4%	12.2%	15.5%	12.4%	13.1%
Workout at Clubs	12.9%	13.0%	13.6%	12.7%	13.0%
Yoga	10.2%	9.6%	9.8%	10.0%	9.9%
Did Not Participate	22.9%	25.4%	21.2%	22.8%	23.1%

Age: Participation based on individuals ages 7 & up of Immediate Service Area.

Income: Participation based on the 2018 estimated median household income in Immediate Service Area.

Region: Participation based on regional statistics (South Atlantic).

National: Participation based on national statistics.

Average: Average of the four columns.

Note: "Did Not Participate" refers to all 55 activities tracked by the NSGA.

Table B – Participation Rates for Primary Service Area

	Age	Income	Region	Nation	Average
Aerobics	14.7%	12.9%	17.6%	15.2%	15.1%
Baseball	3.7%	2.5%	4.0%	4.1%	3.6%
Basketball	7.5%	6.9%	8.4%	8.3%	7.8%
Bicycle Riding	11.9%	10.0%	13.6%	12.3%	12.0%
Exercise Walking	36.3%	34.0%	41.9%	35.4%	36.9%
Exercise w/ Equipment	18.7%	17.6%	23.1%	18.8%	19.6%
Football (Flag)	1.9%	2.1%	2.6%	2.2%	2.2%
Football (Tackle)	2.3%	2.3%	2.7%	2.5%	2.5%
Ice Hockey	1.0%	0.4%	1.3%	1.1%	1.0%
Ice Skating	2.7%	2.5%	4.3%	3.0%	3.1%
Lacrosse	0.9%	0.5%	0.9%	1.0%	0.8%
Mixed Martial Arts	1.9%	0.5%	2.2%	2.0%	1.7%
Pilates	0.3%	2.0%	1.3%	1.9%	1.4%
Running/Jogging	13.3%	12.5%	17.2%	14.8%	14.5%
Soccer	4.5%	3.4%	3.7%	4.9%	4.1%
Softball	3.0%	2.5%	4.5%	3.3%	3.3%
Swimming	15.9%	14.7%	19.3%	16.2%	16.5%
Tennis	3.8%	2.7%	3.2%	4.2%	3.5%
Volleyball	3.2%	2.4%	3.6%	3.6%	3.2%
Weight Lifting	11.7%	11.3%	15.5%	12.4%	12.7%
Workout at Clubs	12.3%	10.6%	13.6%	12.7%	12.3%
Yoga	9.3%	8.7%	9.8%	10.0%	9.5%
Did Not Participate	23.5%	25.0%	21.2%	22.8%	23.1%

Age: Participation based on individuals ages 7 & up of Primary Service Area.

Income: Participation based on the 2018 estimated median household income in Primary Service Area.

Region: Participation based on regional statistics (South Atlantic).

National: Participation based on national statistics.

Average: Average of the four columns.

Note: "Did Not Participate" refers to all 55 activities tracked by the NSGA.

Table C – Participation Rates for Secondary Service Area

	Age	Income	Region	Nation	Average
Aerobics	14.8%	15.7%	17.6%	15.2%	15.8%
Baseball	4.1%	3.6%	4.0%	4.1%	3.9%
Basketball	8.6%	8.0%	8.4%	8.3%	8.3%
Bicycle Riding	12.2%	12.1%	13.6%	12.3%	12.5%
Exercise Walking	34.4%	36.0%	41.9%	35.4%	36.9%
Exercise w/ Equipment	18.9%	19.7%	23.1%	18.8%	20.1%
Football (flag)	2.2%	2.6%	2.6%	2.2%	2.4%
Football (tackle)	2.6%	2.3%	2.7%	2.5%	2.5%
Hockey (ice)	1.1%	0.9%	1.3%	1.1%	1.1%
Ice/Figure Skating	3.1%	3.2%	4.3%	3.0%	3.4%
Lacrosse	1.0%	1.0%	0.9%	1.0%	1.0%
Martial Arts/MMA	2.1%	1.9%	2.2%	2.0%	2.0%
Pilates	0.3%	2.0%	1.3%	1.9%	1.4%
Running/Jogging	15.2%	15.9%	17.2%	14.8%	15.8%
Soccer	4.9%	5.0%	3.7%	4.9%	4.6%
Softball	3.3%	3.1%	4.5%	3.3%	3.5%
Swimming	16.0%	16.6%	19.3%	16.2%	17.0%
Tennis	4.2%	4.3%	3.2%	4.2%	4.0%
Volleyball	3.6%	3.7%	3.6%	3.6%	3.6%
Weight Lifting	12.6%	12.2%	15.5%	12.4%	13.2%
Workout at Clubs	12.9%	13.0%	13.6%	12.7%	13.0%
Yoga	10.2%	9.6%	9.8%	10.0%	9.9%
Did Not Participate	22.9%	25.4%	21.2%	22.8%	23.1%

Age: Participation based on individuals ages 7 & up of Secondary Service Area.

Income: Participation based on the 2018 estimated median household income in Secondary Service Area.

Region: Participation based on regional statistics (South Atlantic).

National: Participation based on national statistics.

Average: Average of the four columns.

Note: "Did Not Participate" refers to all 55 activities tracked by the NSGA.

Anticipated Participation Number: Utilizing the average percentage from Table-A above plus the 2010 census information and census estimates for 2018 and 2023 (over age 7) the following comparisons are available.

Table D – Participation Growth or Decline in Immediate Service Area

	Average	2010 Population	2018 Population	2023 Population	Difference
Aerobics	15.8%	4,367	4,672	4,861	494
Baseball	4.0%	1,092	1,168	1,215	123
Basketball	8.3%	2,299	2,459	2,559	260
Bicycle Riding	12.5%	3,447	3,687	3,837	390
Exercise Walking	36.9%	10,190	10,901	11,343	1,152
Exercise w/ Equipment	20.1%	5,549	5,936	6,177	628
Football (flag)	2.4%	660	706	735	75
Football (tackle)	2.5%	700	749	779	79
Hockey (ice)	1.1%	307	329	342	35
Ice/Figure Skating	3.4%	937	1,003	1,043	106
Lacrosse	1.0%	270	288	300	30
Martial Arts/MMA	2.0%	566	606	630	64
Pilates	1.4%	381	408	424	43
Running/Jogging	15.7%	4,342	4,645	4,833	491
Soccer	4.6%	1,281	1,371	1,426	145
Softball	3.5%	979	1,048	1,090	111
Swimming	17.0%	4,693	5,020	5,224	531
Tennis	4.0%	1,094	1,171	1,218	124
Volleyball	3.6%	1,003	1,073	1,117	113
Weight Lifting	13.1%	3,628	3,881	4,038	410
Workout at Clubs	13.0%	3,605	3,856	4,012	408
Yoga	9.9%	2,737	2,928	3,046	309
Did Not Participate	23.1%	6,379	6,824	7,100	721

Note: These figures do not necessarily translate into attendance figures for various activities or programs. The "Did Not Participate: statistic refers to all 55 activities outlined in the NSGA 2017 Survey Instrument.

Table E – Participation Growth or Decline in Primary Service Area

	Average	2010 Population	2018 Population	2023 Population	Difference
Aerobics	15.1%	17,676	18,696	19,383	1,707
Baseball	3.6%	4,196	4,438	4,601	405
Basketball	7.8%	9,109	9,635	9,989	880
Bicycle Riding	12.0%	13,980	14,787	15,330	1,350
Exercise Walking	36.9%	43,166	45,659	47,335	4,169
Exercise w/ Equipment	19.6%	22,882	24,203	25,092	2,210
Football (flag)	2.2%	2,578	2,727	2,827	249
Football (tackle)	2.5%	2,868	3,034	3,145	277
Hockey (ice)	1.0%	1,118	1,183	1,226	108
Ice/Figure Skating	3.1%	3,667	3,879	4,022	354
Lacrosse	0.8%	964	1,019	1,057	93
Martial Arts/MMA	1.7%	1,932	2,044	2,119	187
Pilates	1.4%	1,606	1,699	1,761	155
Running/Jogging	14.5%	16,916	17,893	18,550	1,634
Soccer	4.1%	4,811	5,089	5,276	465
Softball	3.3%	3,903	4,129	4,280	377
Swimming	16.5%	19,319	20,434	21,184	1,866
Tennis	3.5%	4,063	4,297	4,455	392
Volleyball	3.2%	3,748	3,964	4,109	362
Weight Lifting	12.7%	14,890	15,750	16,328	1,438
Workout at Clubs	12.3%	14,381	15,211	15,770	1,389
Yoga	9.5%	11,066	11,705	12,135	1,069
Did Not Participate	23.1%	27,047	28,608	29,659	2,612

Note: These figures do not necessarily translate into attendance figures for various activities or programs. The "Did Not Participate: statistic refers to all 55 activities outlined in the NSGA 2017 Survey Instrument.

Table F – Participation Growth or Decline in Secondary Service Area

	Average	2010 Population	2018 Population	2023 Population	Difference
Aerobics	15.8%	127,290	138,614	145,699	18,408
Baseball	3.9%	31,701	34,521	36,285	4,584
Basketball	8.3%	4,767	5,624	12,534	7,767
Bicycle Riding	12.5%	100,839	109,809	115,421	14,583
Exercise Walking	36.9%	296,880	323,292	339,814	42,934
Exercise w/ Equipment	20.1%	161,731	176,119	185,120	23,389
Football (flag)	2.4%	19,201	20,909	21,977	2,777
Football (tackle)	2.5%	20,314	22,121	23,252	2,938
Hockey (ice)	1.1%	8,933	9,728	10,225	1,292
Ice/Figure Skating	3.4%	27,341	29,773	31,295	3,954
Lacrosse	1.0%	7,844	8,542	8,978	1,134
Martial Arts/MMA	2.0%	16,466	17,931	18,848	2,381
Pilates	1.4%	11,089	12,075	12,693	1,604
Running/Jogging	15.8%	126,730	138,004	145,057	18,327
Soccer	4.6%	37,168	40,474	42,543	5,375
Softball	3.5%	28,534	31,073	32,661	4,127
Swimming	17.0%	136,914	149,094	156,714	19,800
Tennis	4.0%	31,924	34,764	36,541	4,617
Volleyball	3.6%	29,182	31,778	33,403	4,220
Weight Lifting	13.2%	105,928	115,351	121,247	15,319
Workout at Clubs	13.0%	104,865	114,195	120,031	15,165
Yoga	9.9%	79,666	86,753	91,187	11,521
Did Not Participate	23.1%	185,519	202,024	212,349	26,829

Note: These figures do not necessarily translate into attendance figures for various activities or programs. The "Did Not Participate: statistic refers to all 55 activities outlined in the NSGA 2017 Survey Instrument.

Participation by Ethnicity and Race: The table below compares the overall rate of participation nationally with the rate for Hispanics and African Americans. Utilizing information provided by the National Sporting Goods Association's 2017 survey, the following comparisons are possible.

Table G – Comparison of National, African American and Hispanic Participation Rates

Indoor Activity	Immediate Service Area	National Participation	African American Participation	Hispanic Participation
Aerobics	15.8%	15.2%	14.5%	11.4%
Baseball	4.0%	4.1%	2.6%	3.4%
Basketball	8.3%	8.3%	12.2%	7.9%
Bicycle Riding	12.5%	12.3%	8.0%	10.2%
Exercise Walking	36.9%	35.4%	29.4%	25.6%
Exercise w/ Equipment	20.1%	18.8%	15.8%	15.0%
Football (flag)	2.4%	2.2%	3.0%	2.0%
Football (tackle)	2.5%	2.5%	3.9%	1.4%
Hockey (ice)	1.1%	1.1%	0.3%	0.5%
Ice/Figure Skating	3.4%	3.0%	1.0%	1.4%
Lacrosse	1.0%	1.0%	0.6%	0.9%
Martial Arts/MMA	2.0%	2.0%	1.6%	1.8%
Pilates	1.4%	1.9%	1.9%	1.8%
Running/Jogging	15.7%	14.8%	14.0%	14.9%
Soccer	4.6%	4.9%	2.8%	6.2%
Softball	3.5%	3.3%	2.8%	2.1%
Swimming	17.0%	16.2%	10.2%	12.9%
Tennis	4.0%	4.2%	3.2%	3.6%
Volleyball	3.6%	3.6%	3.4%	3.2%
Weight Lifting	13.1%	12.4%	13.2%	10.5%
Workout at Clubs	13.0%	12.7%	12.0%	11.2%
Yoga	9.9%	10.0%	8.5%	9.0%
Did Not Participate	23.1%	22.8%	26.6%	26.6%

Secondary Service Part: The unique participation percentage developed for Immediate Service Area.

National Rate: The national percentage of individuals who participate in the given area.

African American Rate: The percentage of African-Americans who participate in the given activity.

Hispanic Rate: The percentage of Hispanics who participate in the given activity.

There is Hispanic population of 1.7% in Immediate Service Area. As such these numbers don't play a factor with regards to overall participation.

Table H – Comparison of National, African American and Hispanic Participation Rates

Indoor Activity	Primary Service Area	National Participation	African American Participation	Hispanic Participation
Aerobics	15.1%	15.2%	14.5%	11.4%
Baseball	3.6%	4.1%	2.6%	3.4%
Basketball	7.8%	8.3%	12.2%	7.9%
Bicycle Riding	12.0%	12.3%	8.0%	10.2%
Exercise Walking	36.9%	35.4%	29.4%	25.6%
Exercise w/ Equipment	19.6%	18.8%	15.8%	15.0%
Football (flag)	2.2%	2.2%	3.0%	2.0%
Football (tackle)	2.5%	2.5%	3.9%	1.4%
Hockey (ice)	1.0%	1.1%	0.3%	0.5%
Ice/Figure Skating	3.1%	3.0%	1.0%	1.4%
Lacrosse	0.8%	1.0%	0.6%	0.9%
Martial Arts/MMA	1.7%	2.0%	1.6%	1.8%
Pilates	1.4%	1.9%	1.9%	1.8%
Running/Jogging	14.5%	14.8%	14.0%	14.9%
Soccer	4.1%	4.9%	2.8%	6.2%
Softball	3.3%	3.3%	2.8%	2.1%
Swimming	16.5%	16.2%	10.2%	12.9%
Tennis	3.5%	4.2%	3.2%	3.6%
Volleyball	3.2%	3.6%	3.4%	3.2%
Weight Lifting	12.7%	12.4%	13.2%	10.5%
Workout at Clubs	12.3%	12.7%	12.0%	11.2%
Yoga	9.5%	10.0%	8.5%	9.0%
Did Not Participate	23.1%	22.8%	26.6%	26.6%

Secondary Service Part:	The unique participation percentage developed for Primary Service Area.
National Rate:	The national percentage of individuals who participate in the given area.
African American Rate:	The percentage of African-Americans who participate in the given activity.
Hispanic Rate:	The percentage of Hispanics who participate in the given activity.

There is Hispanic population of 1.4% in Primary Service Area. As such these numbers don't play a factor with regards to overall participation.

Table I – Comparison of National, African American and Hispanic Participation Rates

Indoor Activity	Secondary Service Area	National Participation	African American Participation	Hispanic Participation
Aerobics	15.8%	15.2%	14.5%	11.4%
Baseball	3.9%	4.1%	2.6%	3.4%
Basketball	8.3%	8.3%	12.2%	7.9%
Bicycle Riding	12.5%	12.3%	8.0%	10.2%
Exercise Walking	36.9%	35.4%	29.4%	25.6%
Exercise w/ Equipment	20.1%	18.8%	15.8%	15.0%
Football (flag)	2.4%	2.2%	3.0%	2.0%
Football (tackle)	2.5%	2.5%	3.9%	1.4%
Hockey (ice)	1.1%	1.1%	0.3%	0.5%
Ice/Figure Skating	3.4%	3.0%	1.0%	1.4%
Lacrosse	1.0%	1.0%	0.6%	0.9%
Martial Arts/MMA	2.0%	2.0%	1.6%	1.8%
Pilates	1.4%	1.9%	1.9%	1.8%
Running/Jogging	15.8%	14.8%	14.0%	14.9%
Soccer	4.6%	4.9%	2.8%	6.2%
Softball	3.5%	3.3%	2.8%	2.1%
Swimming	17.0%	16.2%	10.2%	12.9%
Tennis	4.0%	4.2%	3.2%	3.6%
Volleyball	3.6%	3.6%	3.4%	3.2%
Weight Lifting	13.2%	12.4%	13.2%	10.5%
Workout at Clubs	13.0%	12.7%	12.0%	11.2%
Yoga	9.9%	10.0%	8.5%	9.0%
Did Not Participate	23.1%	22.8%	26.6%	26.6%

Secondary Service Part:	The unique participation percentage developed for Secondary Service Area.
National Rate:	The national percentage of individuals who participate in the given area.
African American Rate:	The percentage of African-Americans who participate in the given activity.
Hispanic Rate:	The percentage of Hispanics who participate in the given activity.

There is Hispanic population of 1.4% in Secondary Service Area. As such these numbers don't play a factor with regards to overall participation.

Summary of Sports Participation: The following chart summarizes participation for indoor activities utilizing information from the 2017 National Sporting Goods Association survey.

Table J – Sports Participation Summary

Sport	Nat'l Rank[1]	Nat'l Participation (in millions)
Exercise Walking	1	104.5
Exercising w/ Equipment	2	55.6
Swimming	3	47.9
Aerobic Exercising	4	44.9
Running/Jogging	5	43.9
Hiking	6	43.8
Camping	7	42.1
Workout @ Club	8	37.4
Bicycle Riding	9	36.5
Weight Lifting	10	36.4
Yoga	13	29.6
Basketball	14	24.8
Soccer	20	14.3
Tennis	22	12.3
Baseball	23	12.1
Volleyball	24	10.7
Table Tennis	25	10.2
Softball	27	9.8
Ice/Figure Skating	31	8.8
Football (tackle)	34	7.5
Football (flag)	35	6.5
Martial Arts MMA	37	6.0
Pilates	40	5.7
Ice Hockey	50	3.3
Lacrosse	52	2.9

Nat'l Rank: Popularity of sport based on national survey.

Nat'l Particpation: Population that participate in this sport on national survey.

[7] This rank is based upon the 55 activities reported on by NSGA in their 2017 survey instrument.

Participation by Age Group: Within the NSGA survey, participation is broken down by age groups. As such B*K can identify the top 3 age groups participating in the activities reflected in this report.

Table K – Participation by Age Group

Activity	Largest	Second Largest	Third Largest
Aerobics	35-44	25-34	45-54
Baseball	12-17	7-11	25-34
Basketball	12-17	25-34	18-24
Bicycle Riding	7-11	45-54	55-64/35-44
Billiards/Pool	25-34	35-44	18-24
Exercise Walking	55-64	45-54	65-74
Exercise w/ Equipment	45-54	35-44	25-34/55-64
Football (flag)	7-11	12-17	25-34
Football (tackle)	12-17	25-34	18-24
Hockey (ice)	25-34	12-17	7-11
Ice/Figure Skating	7-11	12-17	18-24
Lacrosse	12-17	7-11	25-34
Martial Arts MMA	7-11	25-34	18-24/35-44
Pilates	25-34	35-44	45-54
Running/Jogging	25-34	35-44	18-24
Soccer	7-11	12-17	25-34
Softball	12-17	25-34	7-11
Swimming	35-44	45-54	12-17
Tables Tennis	25-34	18-24	35-44
Tennis	25-34	35-44	45-54
Volleyball	12-17	25-34	18-24
Weight Lifting	25-34	35-44	45-54
Workout at Clubs	25-34	35-44	45-54
Yoga	25-34	35-44	45-54
Did Not Participate	45-54	55-64	65-74

Largest: Age group with the highest rate of participation.

Second Largest: Age group with the second highest rate of participation.

Third Largest: Age group with the third highest rate of participation.

Market Potential Index for Adult Participation: In addition to examining the participation numbers for various indoor activities through the NSGA 2017 Survey and the Spending Potential Index for Entertainment & Recreation, B*K can access information about Sports & Leisure Market Potential. The following information illustrates participation rates for adults in various activities.

Table L – Market Potential Index for Adult Participation in Activities in Immediate Service Area

Adults participated in:	Expected Number of Adults	Percent of Population	MPI
Aerobics	1,939	7.7%	98
Baseball	930	3.7%	89
Basketball	2,239	8.9%	107
Bicycle Riding	2,507	9.9%	98
Exercise Walking	6,143	24.3%	100
Football	1,078	4.3%	97
Ice/Figure Skating	711	2.8%	94
Pilates	628	2.5%	89
Running/Jogging	3,113	12.3%	95
Softball	738	2.9%	106
Swimming	4,236	16.8%	103
Tennis	728	2.9%	83
Volleyball	973	3.5%	105
Weight Lifting	2,582	10.2%	97
Yoga	1,835	7.3%	89

Expected # of Adults: Number of adults, 18 years of age and older, participating in the activity in Immediate Service Area

Percent of Population: Percent of the service area that participates in the activity.

MPI: Market potential index as compared to the national number of 100.

This table indicates that the overall propensity for adults to participate in the activities listed is greater than the national number of 100 in all instances. In many cases when a participation number is lower than the National number, secondary factors include a lack of facilities or an inability to pay for services and programs.

Table M – Market Potential Index for Adult Participation in Activities in Primary Service Area

Adults participated in:	Expected Number of Adults	Percent of Population	MPI
Aerobics	7,699	7.3%	93
Baseball	3,846	3.7%	88
Basketball	7,206	6.9%	83
Bicycle Riding	10,454	9.9%	98
Exercise Walking	26,263	25.0%	103
Football	4,308	4.1%	93
Ice/Figure Skating	2,487	2.4%	79
Pilates	2,222	2.1%	76
Running/Jogging	9,779	9.3%	72
Softball	2,499	2.4%	86
Swimming	16,593	15.8%	97
Tennis	2,665	2.5%	73
Volleyball	3,055	2.9%	88
Weight Lifting	9,560	9.1%	87
Yoga	5,925	5.6%	69

Expected # of Adults: Number of adults, 18 years of age and older, participating in the activity in Primary Service Area

Percent of Population: Percent of the service area that participates in the activity.

MPI: Market potential index as compared to the national number of 100.

This table indicates that the overall propensity for adults to participate in the activities listed is greater than the national number of 100 in all instances. In many cases when a participation number is lower than the National number, secondary factors include a lack of facilities or an inability to pay for services and programs.

Table N – Market Potential Index for Adult Participation in Activities in Secondary Service Area

Adults participated in:	Expected Number of Adults	Percent of Population	MPI
Aerobics	58,706	7.7%	98
Baseball	31,343	4.1%	99
Basketball	60,616	7.9%	96
Bicycle Riding	79,901	10.5%	103
Exercise Walking	188,343	24.7%	102
Football	35,038	4.6%	105
Ice/Figure Skating	20,778	2.7%	91
Pilates	18,404	2.4%	86
Running/Jogging	85,472	11.2%	87
Softball	19,994	2.6%	95
Swimming	123,703	16.2%	100
Tennis	22,019	2.9%	83
Volleyball	24,992	3.3%	100
Weight Lifting	75,513	9.9%	94
Yoga	50,999	6.7%	82

Sports Participation Trends: Below are listed several sports activities and the percentage of growth or decline that each has experienced nationally over the last ten years (2008-2017).

Table O – National Activity Trend (in millions)

Increasing in Popularity

	2008 Participation	2017 Participation	Percent Change
Yoga	10.7	30.3	183.2%
Lacrosse	1.2	2.9	141.7%
Hockey (ice)	2.1	3.4	61.9%
Running/Jogging	30.4	44.9	47.7%
Wrestling	2.1	3.0	42.9%
Aerobic Exercising	34.8	45.6	31.0%
Exercise Walking	89.8	105.7	17.7%
Weight Lifting	33.2	35.6	7.2%
Basketball	24.1	24.8	2.9%
Workout @ Club	36.8	37.8	2.7%
Tennis	12.3	12.6	2.4%
Soccer	13.8	14.0	1.4%

Decreasing in Popularity

	2008 Participation	2017 Participation	Percent Change
Bicycle Riding	37.4	36.2	-3.2%
Ice/Figure Skating	8.2	7.7	-6.1%
Volleyball	12.0	10.7	-10.8%
Swimming	52.3	45.6	-12.8%
Baseball	14.0	12.2	-12.9%
Football (tackle)	9.2	7.9	-14.1%
Golf	22.7	18.5	-18.5%
Softball	12.4	9.6	-22.3%

2017 Participation: The number of participants per year in the activity (in millions) in the United States.

2008 Participation: The number of participants per year in the activity (in millions) in the United States.

Percent Change: The percent change in the level of participation from 2005 to 2014.

Ice Hockey Market and Activity Trends

Growth in ice hockey has experienced continued growth in recent years. According to USA Hockey, the number of youth players registered in the U.S. increased about 12% between the 2010-201 and 2016-2017 seasons. Registration in Minnesota lagged behind the national growth recording a registration growth of about 5.25% over that same time period. Closer analysis indicated that the 11-12 age group has experienced a decline in registration according to Minnesota registrations. This is a concern only because this outlier will play out as this age category ages out and enters the adult ages. It should be noted that the strength of youth hockey can be found in the entry level age categories and these categories have shown steady growth over the years. It should be noted that USA Hockey has implemented sweeping changes in the youngest age group by introducing the ADM training model designed to inject fun back into the game of hockey while teaching fundamentals. Another distinguishing characteristic of the ADM program is that it utilizes 1/2 ice for games and multi-station areas for practice. These changes allow for more players on the ice at one time which in turn reduces the cost to the participants.

Of note is that the Bemidji Youth Hockey Association registration growth has exceed the growth rate recorded in the State of Minnesota.

USA Hockey Registration in Minnesota

Year	MN Registration	19+	17 &18	15&16	13&14	11&12	9&10	7&8	U6
2016/17	57,179	9,218	2,107	3,744	7,287	8,200	8,621	8,718	9,284
2015/16	57,107	9,740	2,092	3,677	7,213	8,245	8,529	8,399	9,212
2014/15	55,450	9,578	1,936	3,326	7,063	8,217	8,223	8,138	8,673
2013/14	54,507	8,995	1,938	3,470	7,137	8,169	8,367	8,071	8,360
2012/13	53,935	8,599	1,925	3,465	7,125	8,218	8,456	7,996	8,125
2011/12	54,951	8,596	1,963	3,382	7,227	8,419	8,527	8,380	8,457
2010/11	54,325	7,730	1,848	3,599	7,094	8,560	8,587	8,407	8,500
Difference	2,854	1,488	259	145	193	-360	34	311	784
% Change	5.25%	19.20%	14.00%	4.02%	2.72%	-4.20%	0.40%	3.69%	9.22%

A contributing factor that could impact the leveling off of ice hockey can be found in the diversified demographic in the service area. Ice hockey does not have a strong participation history within some of the prominent race demographics in the service area. However, from a population perspective the demographic analysis results indicate an increase of .4% in the under 5 age category by the year 2023

Another contributing factor that is a challenge for hockey is the relatively high cost for participation. Ice hockey is an expensive sport for participants that requires a significant outlay of capital for registration fees, tournaments, equipment and travel costs. Although the cost to participate in hockey in Bemidji is relatively cheap when compared to other parts of the country, the average registration fee in Bemidji was reported to be in the range of $250-$500 per player. In addition, each player is responsible for a $400 fund raising fee that caps out at $800 per family. It is not uncommon to see registration fees range from $2,000 to $5,000 per player in other parts of the country. When adding tournament fees, equipment and travel cost to the registration fees the cost to play youth hockey in Bemidji could reach $1,500-$2,000 per season.

Nationally, figure skating programs have seen a slight increase in participation recently. United States Figure Skating (USFS) reports that participation in the basic skills program increased 3% over the previous year (2013-2014). Basic Skills participation grew to over 122,000 participants through over 1,000 certified programs across the country. The average number of basic skills participants at each certified rink is 120 participants. As with hockey, the cost to participant in figure skating, after completing a learn to skate program, is much higher than many sports. Cost of ice time, availability of ice, cost of instruction and equipment cost are typically contributing factors in the participation numbers. USFS has diversified its Basic Skill program offering to expand the skating opportunity for the beginner by including pre-school skating, adult, hockey, speed skating, free skate, synchronized skating, theater on ice, artistry in motion, pairs, ice dance and Special Olympics. There are over 575 registered synchronized skating teams and 46 Theater on Ice teams registered in the US. It should be noted that the popularity in synchronized skating continues to grow and there is no one participation in synchronized skating in Bemidji. The number of participants in the figure skating program, especially the competitive aspect of skating in Bemidji is relatively low. Part of the challenge facing ice skating in Bemidji is that it relies on volunteers to organize the program and the work load of promoting and developing a vibrant skating program falls on the shoulders of a couple of individuals.

Many ice rinks are known as either a hockey or figure skating rink, especially in the private sector. It is generally difficult to serve both markets adequately and generally the youth/adult hockey market is the largest and most financially lucrative. The multiple rinks operating in Bemidji are a good illustration of this. The Neilson Reise Rink provides a diversified program where as the BCAC caters exclusively to the youth hockey market, Nymore is a combination of youth hockey and high school hockey while Sanford focus is BSU while supplementing youth hockey and supporting tournaments. The ice time rate structure at Sanford tends to drive customers to the other rinks in the market. It is incumbent on public rinks to provide public access time for public skating, learn to skate programs and often provide programming for other specialty uses such as broomball, curling or short track speed skating as well.

When factoring the demographic realities of the Primary Service Area, trends in ice sports and demand for ice time, it is clear that the need for four sheets of ice in the community is adequate to meet most of the ice time demand in Bemidji. Replacing or renovating the Neilson Reise Rink is needed to meet the ice time demands in the community.

Stakeholder Meetings

A series of nine stakeholder meetings were conducted to assess input from the various hockey and skating groups in the area, including the operators of the BCAC, Nymore and Sanford Center facilities. One of the objectives of the stakeholder meetings were to determine and validate the need for ice time in the area. The following notes summarize the stakeholder meetings.

Bemidji State University

Bemidji State University (BSU) would like to see another rink located at the Sanford Center. Having a second rink at Sanford would provide ice time when non-ice events mandate a schedule change in the at the Sanford Center. It is not uncommon to have 35-45 scheduling conflicts for the BSU teams per season at Sanford. Another benefit in having another ice surface located at Sanford is the BSU hockey teams could utilize their locker room at Sanford and walk to the second rink when a scheduling conflict arises.

A second sheet of ice at Sanford will expand Hockey Tournament opportunities while enhancing the experience for players and spectators. The location the Sanford Center to area hotels and restaurants is another benefit of locating a second sheet of ice at the Sanford Center. Having two sheets of ice at Sanford will expand the opportunity for hockey camps for BSU.

Having another rink located at Sanford doubles the floor capacity for non-ice trade show, exhibitions or conference space.

BSU ice times needs are being met and there are no unmet demands or need for additional ice beyond what the current inventory of ice rinks provides.

Bemidji Community Arena Corporation BCAC

The Bemidji Community Area Corporation (BCAC) is a separate entity from the Bemidji Youth Hockey Association and focuses on operating the BCBA Ice Rink only. The serve as the landlord of the ice rink and the youth hockey association is the primary tenant. The business model of BCAC is driven by the funding requirements of a Mighty Duck Grant from the State of Minnesota. BCAC operates the rink on a solvent basis and any shortfall becomes the responsibility of the Bemidji Youth Hockey Association. BCAC would like to have the second sheet of ice up and operating in 14 months.

Part of the need to build more ice in Bemidji is being driven by the aging inventory of ice rinks in Bemidji. The Nymore Ice Arena was built in the 50's and Neilson Reise Ice Arena was built in the late 60's. There is speculation that both these rinks are one mechanical failure from closing down permanently. Although there does not appear to be a sufficient market to sustain 5 sheets of ice in the community, BCAC is trying to position itself for meeting the community needs for ice hockey if on of the older rinks in the community goes down. In the meantime, a fifth sheet if ice allows some growth of existing programs and more ice time for existing teams. However, this expansion of ice time must be measured against the impact on the individual fees to register for youth hockey.

Current BCAC rink has seating for 1,200 people and is adequate for hosting High School hockey games. There are plans to add four designated locker room for High School, dry land training area and 4 public locker rooms along with another sheet of ice as a second phase to the project.

BFSC

The Bemidji Figure Skating Club (BFSC) is certified U.S. Figure Skating Club that provides figure skating and learn to skate opportunities in the community. There are also U.S Figure Skating Clubs in Duluth, Grand Forks and Fargo. The Club has about 25-30 active members and the learn to skate program generates about 20-100 participants depending on the season. The BFSC does not offer Synchronized Skating. Without question, the fee elasticity figure skaters are willing to pay for ice time is rather narrow. A $20 increase in fees would impact overall registration numbers.

Representatives reported that participation numbers are dropping and the cost for ice time is becoming a bigger obstacle, especial as the skater base to pay for ice time is shrinking. The current ice schedule meets the figure skating needs except for hosting a couple more test sessions over the course of the year. It should be noted that the BFSC rents a majority of its ice at the Neilson Reise Ice Arena because Nymore is too cold, Sanford is too expensive and BCAC will not rent them ice.

BSU Recreation

BSU is renting the Neilson Reise Ice Arena mid-Jan until mid-March for their intermural program. It should be noted that many of the hours rented are considered non-prime, usually late-night rentals. The hockey numbers have been steady while some other intermural activities are decreasing in numbers. The BSU representative did not feel a $15 increase in ice rates will impact their program. It should be noted that BSU has studied the costs to build an outdoor rink on campus.

Curling Club

The local Curling Club operates the other half of the Neilson Reise Ice Arena through a lease with the City. There are six sheets of curling ice and the club operates from late September through April. The curling has 250 members and participation has been consistent over the few years. The Club expects to see an increase in participation because of the exposure curling received during the Winter Olympics. The Club also offers junior curling and over curling as part of the school physical fitness curriculum.

BYHA

The Bemidji Youth Hockey Association (BYHA) reported that participation in hockey has continued to grow. In fact, the growth BYHA is seeing in hockey exceeds the growth rate for the State of Minnesota. BYHA has had 350 in the club and may be seeing the highest participation ever. The lowest point was back in 2010 when only 230 players were registered. Learn to play numbers have been consistent over the past 3 years and this program is helping to drive the increase in participation. The success of the High School and BSU impacts participation numbers. Retention has been good at the lower levels. Keeping the schedule consistent for the U6and U8 groups at Neilson Reise has helped.

Representatives indicated that BYHA needed about 817 hours of ice time and only rented about 676 hours. The hours of unmet demand coupled with the expected increase in participation results in about 248 hours per season. However, there is a sensitivity to the increase in fees to cover the additional 248 hours of ice time ($37,800). The current ice agreements provide 832 hours at BCAC, 400 hours at Nymore, 273 hours at Neilson Reise and 66 hours at Sanford. Registration fees range from $250 per player to $500 per player depending on level. In addition, there is a $400 fundraising commitment required that maxs out at $800 per family above the registration fees.
BYHA has concerns about the impact of adding $140,000,00 per year for fixed cost that will push the BYHA contribution to $210,000 for a second sheet of ice at BCAC. BYHA representatives were curious about the possibility for a covered outdoor sheet of ice.

Adult Hockey

There are several adult hockey groups that rent ice time from Neilson Reise Ice Arena. All the groups represented only skate during the regular hockey season. There is a history of scheduling ice that has a pecking order and it is difficult for new groups to access reasonable ice time. All the groups mentioned that they lose numbers when they can't get consistent ice times.
Rates per player range from $10 per night to $17 per night depending on the rink. Between the groups there is an unmet demand for about 50 hours of ice per season. Another sheet of ice at Sanford would benefit hockey tournaments and having a new facility with adequate locker rooms will help the program.
It should be noted that a few of the Adult rental groups donate any profit from their programs back into the community and to BYHA.

Bemidji School District

Nymore Ice Arena was built in 1950's and is use to service the High School hockey practices. Games are scheduled at BCAC that costs the School District about $30,000 per season. It is convenience for the High School to use BCAC because of its location. The School District uses Nymore for storage in the summer months. There are no plans to renovate Nymore and the School District plans to continue operating the ice rink until the ice system breaks down beyond repair. Currently the School District is subsidizing youth hockey about $48,000 per season. It should be noted that renovation to the Nymore Ice Arena was not part of the new High School tax referendum. The School District does not have the capital funding to support the BCAC expansion and is challenged to commit to finishing locker rooms and a second sheet of ice without a tax initiative.

Sanford Center – Venue Works

The Sanford Center was constructed to support BSU hockey through a partnership with the City of Bemidji to build the main rink. Although the facility was built to meet the seating requirements for WCHA hockey games, attendance at hockey games is down significantly from when BSU was part of the WCHA Conference. WHCA games attracted 3,800-4,200 fans per game and now the games draw 1,600-1,800 spectators. The lower attendance has reduced overall revenue at Sanford significantly. According to Sanford management, the center used to generate $20,000 in sales from one day and now it takes the entire weekend to reach that sales figure. In addition to BSU hockey games, the Sanford Center hosts concerts and large events. Most non-ice events are scheduled well in advance but there are some events that impact the practice schedule for BSU and consequently other ice user groups that get bumped from their ice time to accommodate BSU. The schedule conflicts only happen about 5 times per season and the Bemidji Figure Skating Club seems to get impacted the most. Having a second sheet of ice located at the Sanford Center would provide many benefits including easier access for BSU to access practice ice when events are scheduled, the opportunity to expand non-ice bookings, improved venue for youth hockey tournaments and provides some operational efficiencies given the existing management structure and staffing levels at the Sanford Center. It is noted that Sanford ice time fees are the highest in the market but the fee structure is being driven by the actual cost to operate the Sanford Center and to minimizing the financial impact to the City for tax support.

DEMOGRAPHIC & MARKET ANALYSIS

Key Findings and Options

When reviewing the demographic information, assessment of existing ice time demand and input from stakeholder groups the following section represents some key findings and options for moving forward.

There is not enough additional demand, population growth or interest in hockey for the community to sustain having five sheets of ice unless a funding source can be allocated to covering the heavy subsidy anticipated by operating a fifth sheet of ice. Based on information collected during the stakeholder meetings with ice users, there were about 250 hours of unmet ice time demand identified. Clearly, 250 hours of use is not adequate to sustain another sheet of ice in the community. To put this in perspective, there are about 1,650 hours of prime-time ice available over a 30-week season and the demand identified during the stakeholder meetings only represent about 15% of the 1,650 hours available.

Another factor that must be considered is the financial impact on the individual hockey players' families. Having more ice time will result in higher player registration fees. It must be remembered that Beltrami County is one of the poorest counties in Minnesota based on household income levels. To put this in perspective, adding 250 hours of ice usage will cost the Youth Hockey Association about $37,500 (based on a rate of $150/hour). The average increase in fees per player would climb about $100 per player based on the number of players registered in the youth hockey program.

One of the interesting developments in the Ice Arena landscape in Bemidji is being driven by BCAC. BCAC recently broke ground on plans to build another sheet of ice for the community. The driving factor for building another sheet of ice is the belief that Nymore has far exceeded its useful life and will experience a major mechanical breakdown at some point. Although the Nymore refrigeration system is old it is operating with the original ammonia refrigeration system. Of note is that many ice rinks are going back to ammonia ice systems as Freon R-22, which is commonly used in the ice arena industry, is being phased out of production and forcing many rinks into a refrigeration system conversion. The School District indicated it has no plans to close Nymore.

The size of the community and growth potential for increasing participation in hockey and figure skating is not large enough to support five sheets of ice in the service area. The end result of adding a fifth sheet of ice to the existing inventory will be a fragmentation of the ice market that will put financial stress on the other ice rink operators in the City.

City of Bemidji Options:

Renovate the Neilson Reise Rink

The City of Bemidji is the only rink in the community that is offering a balanced program, meaning a combination of public skating, youth hockey, figure skating, adult hockey, skating lessons and special events. While the Neilson Reise Rink requires some tax support for operations, the community is benefiting from the programming aspect. The role that Neilson Reise plays in the community cannot be understated and its place in the ice market business provides community access.

Renovating the Neilson Reise Rink will disrupt a significant portion of the hockey season during the construction process. Removing the old ice system and flooring, installing new systems, expanding locker rooms, Updating the building ancillary HVAC system (dehumidification was updated in 2014), updating the lobby and concession area will take six to eight months to complete. This closure during construction will place some hardship on the community users of the City's ice rink. Renovation costs will be substantial and at the completion of the process the City will have a brand new, 1960's arena. However, the new ice plant and facility upgrades will enhance the user experience at Neilson Reise.

Replace Neilson Reise at the Sanford Center

An option to build a replacement rink at the Sanford Center allows the City to construct a replacement rink with no interruption to the ice schedule and user groups because the Neilson Reise Rink could continue operating during the construction phase. A new facility would have larger locker rooms, adequate lobby space and spectator seating. There is some operation efficiency gained by adding a second sheet of ice to the Sanford Center that takes advantage of the existing staffing and general support staff available at the Sanford Center. Providing a community rink at the Sanford Center will actually reduce the amount of City resources required. and could possibly re-purpose Neilson

Reise Rink for another recreation or community use. This option provides an exit strategy for the City to get out of the ice business if the City is interested.

This option also provides the opportunity for the Sanford Center to expand their band width for hosting events, trade shows, conferences and exhibitions. The additional square footages that expands the footprint of the Sanford Center will increase the size and magnitude of events that Bemidji could host.

Having another ice surface at the Sanford Center location allows more convenience to the BSU hockey program when scheduling conflicts at the Sanford Center displaces the team. Being able to use their locker room and walk to the second ice sheet improves convenience for the BSU teams. Although there are many favorable factors with locating the replacement rink at Sanford it must be remembered that in the eyes of the end user the Sanford Center management ability to be accommodating and supportive is a major concern. Clearly Neilson Reise Rink is recognized as the community rink in Bemidji by virtue of its ice schedule and accommodating management approach. The Sanford Center Management team must work to overcome their image in the community and work hard to be accommodating if the Sanford expansion is to be successful.

Do nothing option

The City could shut down Neilson Reise Rink and get out of the ice arena business. The expansion of the BCAC rink creates the market capacity that could absorb the displaced programs currently operating at the City rink and existing rental groups. However, it must be remembered that the mission and primary focus of BCAC is to serve the youth hockey community.

A subset to this option is for the City to continue operating Neilson Reise without making any renovations or upgrades to the facility. At some point there will be a mechanical failure that will either force the City to renovate or create the opportunity to phase out of the ice business.

Operations Analysis

Operations

The operations analysis represents a conservative approach to estimating expenses and revenues and was completed based on the best information available and a basic understanding of the project. This pro-forma does not imply any particular operator but rather an estimate of operating costs and revenues for a stand-alone facility. Fees and charges utilized for this study reflect a philosophy designed to meet a reasonable cost recovery rate and future operations cost and are subject to review, change, and approval by the joint powers committee. There is no guarantee that the expense and revenue projections outlined in the operations analysis will be met as there are many variables that affect such estimates that either cannot be accurately measured or are subject to change during the actual budgetary process or partnership.

Expenditures

Expenditures have been formulated on the costs that were designated by Ballard*King and Associates to be included in the operating budget for the facility. The figures are based on the size of the center, the specific components of the facility, and the hours of operation. All expenses were calculated to the high side and the actual cost may be less based on the final design, operational philosophy, and programming considerations adopted by the facility.

The consulting team was tasked with exploring several different operating models as part of the feasibility study including:

1. Renovate the Neilson Reise Rink. The operating cost and revenues would be very similar to how the rink is currently performing.
2. Add a sheet of ice and expand the Sanford Center with a 200x85 foot ice surface, five locker rooms, lobby area, concession stand, storage, spectator seating for 360 people and administrative support spaces.
3. Within the expansion of Sanford option there are four different operating scenarios that were studied including:

a. Transitioning the existing ice programs at Neilson Reise to the Sanford Center location (status quo option).

b. Transitioning the existing ice programs at Neilson Reise without Youth Hockey rentals except the Mite Hockey Program (Mite only option).

c. Transitioning the existing ice programs at Neilson Reise except no Youth Hockey (No Youth Hockey option).

d. Transitioning the existing ice programs and adding new recreation programming opportunities (No Youth Hockey with Recreation option).

Full-Time Staffing Levels – All Options

Facility Manager	$0
Ice Coordinator	$45,000
Maintenance Coordinator	$0
Maintenance Worker	$0
Administrative Assistant	$0
Sub-Total	$45,000
Benefits (30%)	$13,500
Total Full-Time Staff	$58,500

Part-Time Staffing Levels – All Options

	Rate	Hours	Weeks	Total
Welcome Desk	$12.00	0	51	$0
B'Day Attendant	$12.00	0	50	$0
Skate Attendant	$12.00	12	32	$4,608
Ice Attendant	$15.00	59	32	$28,320
Building Attendant	$12.00	0	51	$0
Total				$32,928
Benefits (12%)				$3,951
Total Part Time				$36,879

Expense Summary – Budget column is the same for Status Quo, Mite Only, and No Youth Hockey options

Category	Budget	W/Recreation
Personnel (includes benefits)		
Full-time	$ 58,500	$ 58,500
Part-time	$ 36,879	$ 51,159
Total	$ 95,379	$ 109,659
Utilities (Gas/Elect.-$2 SF x 40,000 SF less 15% for circulation)	$ 75,500	$ 75,500
Water/Sanitary	$ 20,000	$ 20,000
Communications (Phone/Radios)	$ 4,000	$ 4,000
Training	$ 2,000	$ 2,000
Dues and Subscriptions	$ 600	$ 600
Uniforms	$ 750	$ 750
Bank Charges (charge cards/EFT fees/software fees)	$ 2,500	$ 2,500
Insurance-General Liability	$ 10,000	$ 10,000
Custodial Supplies	$ 6,500	$ 6,500
Supplies-Office	$ 2,500	$ 2,500
Contract Services (HVAC/Control System/Ice System)	$ 15,000	$ 15,000
ASCAP/Fire Alarm/Office Equipment/Software)		
Maint/Repair Supplies	$ 12,000	$ 12,000
Printing	$ 5,000	$ 5,000
Trash	$ -	$ -
Fuel	$ 5,000	$ 5,000
Building Repair	$ 2,500	$ 2,500
Recreation Equipment and Supplies	$ 2,750	$ 2,750
Food Supplies	$ -	$ -
Chemicals and Supplies	$ 5,000	$ 5,000
Postage and Freight	$ 2,000	$ 2,000
Advertising and Promotion	$ 20,000	$ 20,000
Items for Resale	$ -	$ -
Misc	$ 2,000	$ 2,000
Total	$ 195,600	$ 195,600
Capital		
Replacement fund	$ -	$ -
Grand Total	**$ 290,979**	**$ 305,259**

Revenues

The following revenue projections were formulated from information on the specifics of the project and the demographics of the service area as well as comparing them to national statistics, other similar facilities and the competition for recreation services in the area. Actual figures will vary based on the size and make-up of the components selected during final design, market stratification, philosophy of operation, fees and charges policy, and priority of use. All revenues were calculated conservatively as a result. It should be noted that no revenues from any potential project partner have been included at this point.

Revenue Summary

Fees	Status Quo	Mites Only	No Youth Hockey	No YH w/Recreation
Daily Admissions	$ 16,640	$ 16,640	$ 16,640	$ 16,640
Punch Pass	$ 3,120	$ 3,120	$ 3,120	$ 3,120
Ice Rentals	$ 213,200	$ 176,900	$ 154,400	$ 154,400
Total	$ 232,960	$ 196,660	$ 174,160	$ 174,160
Programs				
Ice	$ 5,000	$ 5,000	$ 5,000	$ 35,900
Total	$ 5,000	$ 5,000	$ 5,000	$ 35,900
Other				
Resale Items	$ -	$ -	$ -	$ -
Special Events	$ 3,000	$ 3,000	$ 3,000	$ 3,000
Vending	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Other	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Total	$ 9,000	$ 9,000	$ 9,000	$ 9,000
Grand Total	$ 246,960	$ 210,660	$ 188,160	$ 219,060

Expenditure – Revenue Comparison

	Status Quo	Mites Only	No Youth Hockey	No YH w/Rec
Expenditure	**$ 290,979**	**$ 290,979**	**$ 290,979**	**$ 305,259**
Revenue	**$ 246,960**	**$ 210,660**	**$ 188,160**	**$ 219,060**
Difference	**$ 44,019**	**$ 80,319**	**$ 102,819**	**$ 86,199**
Recovery Rate Estimate	**85%**	**72%**	**65%**	**72%**

This operational pro-forma was completed based on the best information available and a basic understanding of the project. However, there is no guarantee that the expense and revenue projections outlined above will be met as there are many variables that affect such estimates that either cannot be accurately measured or are not consistent in their influence on the budgetary process.

Future years: Expenditures – Revenue Comparison: Operation expenditures are expected to increase by approximately 3% a year through the first 3 to 5 years of operation. Revenue growth is expected to increase by 4% to 8% a year through the first three years and then level off with only a slight growth (3% or less) the next two years. Expenses for the first year of operation should be slightly lower than projected with the facility being under warranty and new. Revenue growth in the first three years is attributed to increased market penetration and in the remaining years to continued population growth. In most recreation facilities, the first three years show tremendous growth from increasing the market share of patrons who use such facilities, but at the end of this time period revenue growth begins to flatten out. It is not uncommon to see the amount of tax support to balance the center budget increase as the facility ages.

Program Fees and Revenue Worksheet

Rentals for Status Quo Option

Revenues	Rate/Hr.	Number of Hrs	Weeks	Total
Youth Hockey	$150	14	28	$58,800
Hockey Tournament	$150	30	4	$18,000
Adult Hockey	$150	8	36	$43,200
BSU	$125	5	24	$15,000
Broomball	$125	2	28	$7,000
FSC	$50	6	48	$14,400
Summer Ice	$125	20	16	$40,000
Misc Rentals	$150	4	28	$16,800
Total				$ 213,200

With Mite Hockey Option

Revenues	Rate/Hr.	Number of Hrs	Weeks	Total
Youth Hockey	$150	6	25	$22,500
Hockey Tournament	$150	30	4	$18,000
Adult Hockey	$150	8	36	$43,200
BSU	$125	5	24	$15,000
Broomball	$125	2	28	$7,000
FSC	$50	6	48	$14,400
Summer Ice	$125	20	16	$40,000
Misc Rentals	$150	4	28	$16,800
Total				$ 176,900

No Youth Hockey Option

Revenues	Rate/Hr.	Number of Hrs	Weeks	Total
Youth Hockey	$150	0	28	$0
Hockey Tournament	$150	30	4	$18,000
Adult Hockey	$150	8	36	$43,200
BSU	$125	5	24	$15,000
Broomball	$125	2	28	$7,000
FSC	$50	6	48	$14,400
Summer Ice	$125	20	16	$40,000
Misc Rentals	$150	4	28	$16,800
Total				$ 154,400

No Youth Hockey with Recreation Option

Revenues	Rate/Hr.	Number of Hrs	Weeks	Total
Youth Hockey	$150	0	28	$0
Hockey Tournament	$150	30	4	$18,000
Adult Hockey	$150	8	36	$43,200
BSU	$125	5	24	$15,000
Broomball	$125	2	28	$7,000
FSC	$50	6	48	$14,400
Summer Ice	$125	20	16	$40,000
Misc Rentals	$150	4	28	$16,800
Total				$ 154,400

Admissions – All Options

Daily Fees	Fees	Number	Revenue
Adult	$6.00	10	$60
Youth/Teen	$5.00	35	$175
Senior	$5.00	5	$25
Total		50	$260
			x 64 days/year
Grand Total			$16,640

Punch Pass (10 Punch)	Fees	Number	Revenue
Adult	$48	15	$720
Youth/Teen	$40	50	$2,000
Senior	$40	10	$400
Total		75	$3,120

Part-Time Staff Worksheets

All Options

Rink Attendant	Days	Time	Total Hours	Employees	Days	Total Hrs. Week
32 weeks	Mon-Fri	6:00am-5:00pm	11	0	5	0
		5pm-10pm	5	1	5	25
		10pm-Midnight	3	0	5	0
	Saturday	6:00am-Noon	6	1	1	6
		Noon-6pm	6	1	1	6
		6pm-9pm	3	1	1	3
		9pm-Midnight	3	1	1	3
	Sunday	8:00am-Noon	4	1	1	4
		Noon-6pm	6	1	1	6
		6pm-9pm	3	2	1	6
Total						59

Skate Attendant	Days	Time	Total Hours	Employees	Days	Total Hrs. Week
	Saturday	6am-2pm	8	0	1	0
		2pm-4pm	2	3	1	6
		4pm-10pm				
	Sunday	10am-1pm	3	0	1	0
		2pm-4pm	2	3	1	6
Total						12

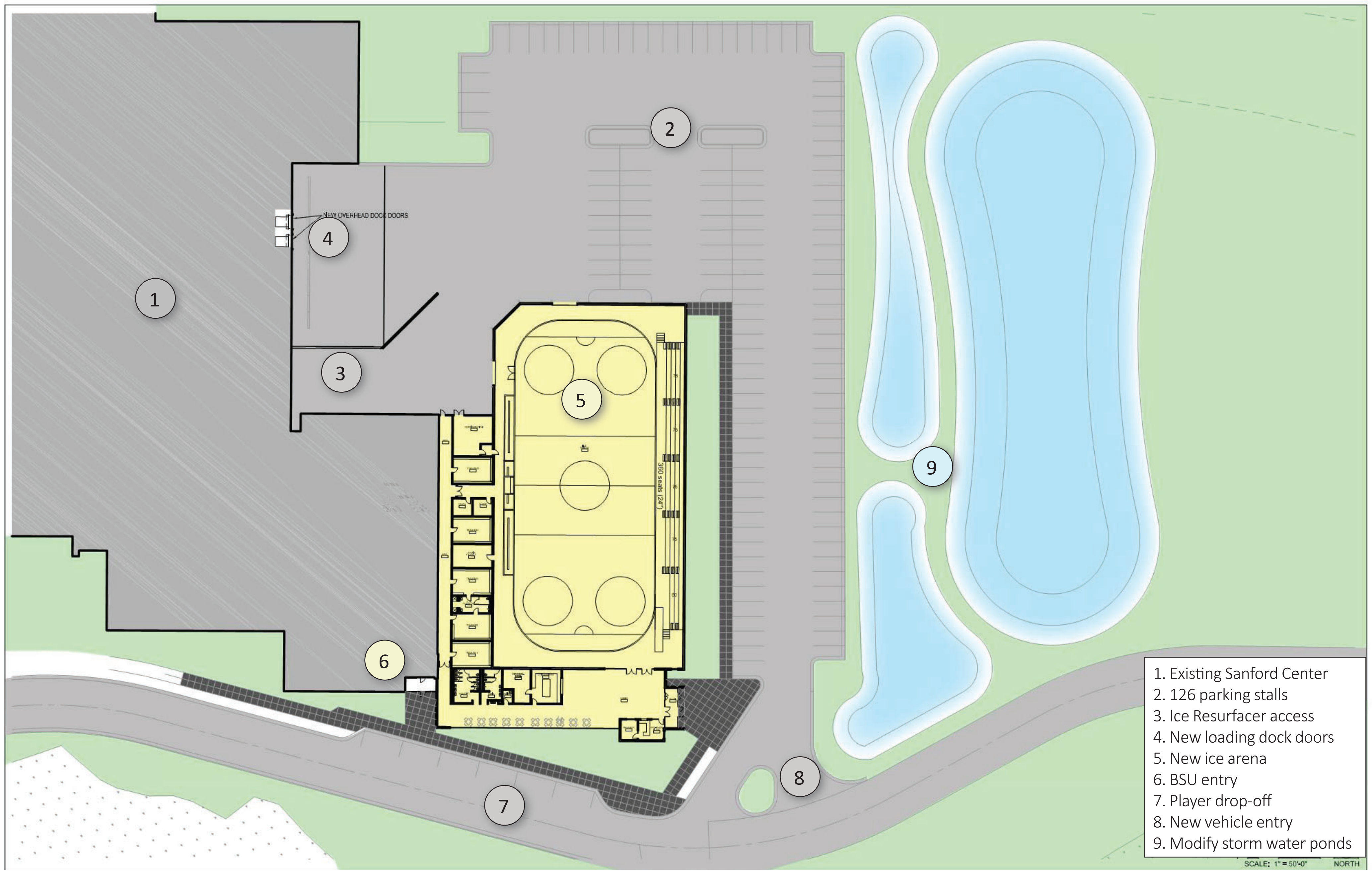
Recreation Option Only

Ice Programs	Position	Staff	Rate/Game	Game/Wk	Weeks	Total
Hockey	Official	2	$30.00	8	16	$ 7,680
	Scorer	1	$10.00	8	20	$ 1,600
LTS	Instruct	2	$25.00	5	20	$ 5,000
Total						$14,280

The following program was developed with input from city staff, Ballard*King, and 292 Design Group, who has experience programming and designing ice arenas. The program represents a practice ice arena concept, which provides the basic necessities of today's ice arena.

Bemidji Ice Arena — Revised 10/9/2018
New Ice Arena: Preliminary Building Program — 10/5/2018

Rink and Associated Areas	SF	#	Subtotal SF
Ice Sheet	17602	1	17,602
Deck Area	5400	1	5,400
Seating 300	2300	1	2,300
Sub-Total			***25,302***
Mechanical / Electrical / Storage			
Ice Mechanical Room (Refrigeration)	600	1	600
Resurfacer Room	1200	0	0
Storage/Mechanical / Electrical / Sprinkler Room	325	1	325
Elevator Equipment Room	75	0	0
Sub-Total			***925***
Locker Facilities & Associated Areas			
Team Rooms	400	5	2,000
Toilet/Shower	240	1	240
Coaches Room	120	2	240
Referee Room	125	1	125
Toilets (Unisex)	65	2	130
Sub-Total			***2,735***
Skating Support Spaces			
Dryland Training	5000	0	0
Janitor & Storage	120	1	120
Skate Changing Area (Included in deck area)	0	1	0
Sub-Total			***120***
Administrative & Public Spaces			
Lobby (incl. concess. seating, vending, trophy cases & vestibule)	2800	1	2,800
Pro-Shop / Ticketing	190	1	190
Manager Office	120	1	120
Concessions w/ prep & storage	680	1	680
Public Toilet Rooms (Men: Main Lobby)	250	1	250
Public Toilet Rooms (Women: Main Lobby)	330	1	330
Janitor	50	1	50
Sub-Total			***4,420***
Sub-Total Program Areas			**33,502**
Walls/Shafts			**5,025**
Circulation	1500	1	**1,500**
SUB-TOTAL			**40,027**



Sanford Center

ICE ARENA EXPANSION

The concept site plan shows the impact of adding a second ice arena to the existing Sanford Center. By adding an ice arena to Sanford Center, it takes advantage of the existing management and operations system that is already in place. It allows for the expansion of Sanford Center events by creating additional dry-floor space and hockey tournament opportunities.

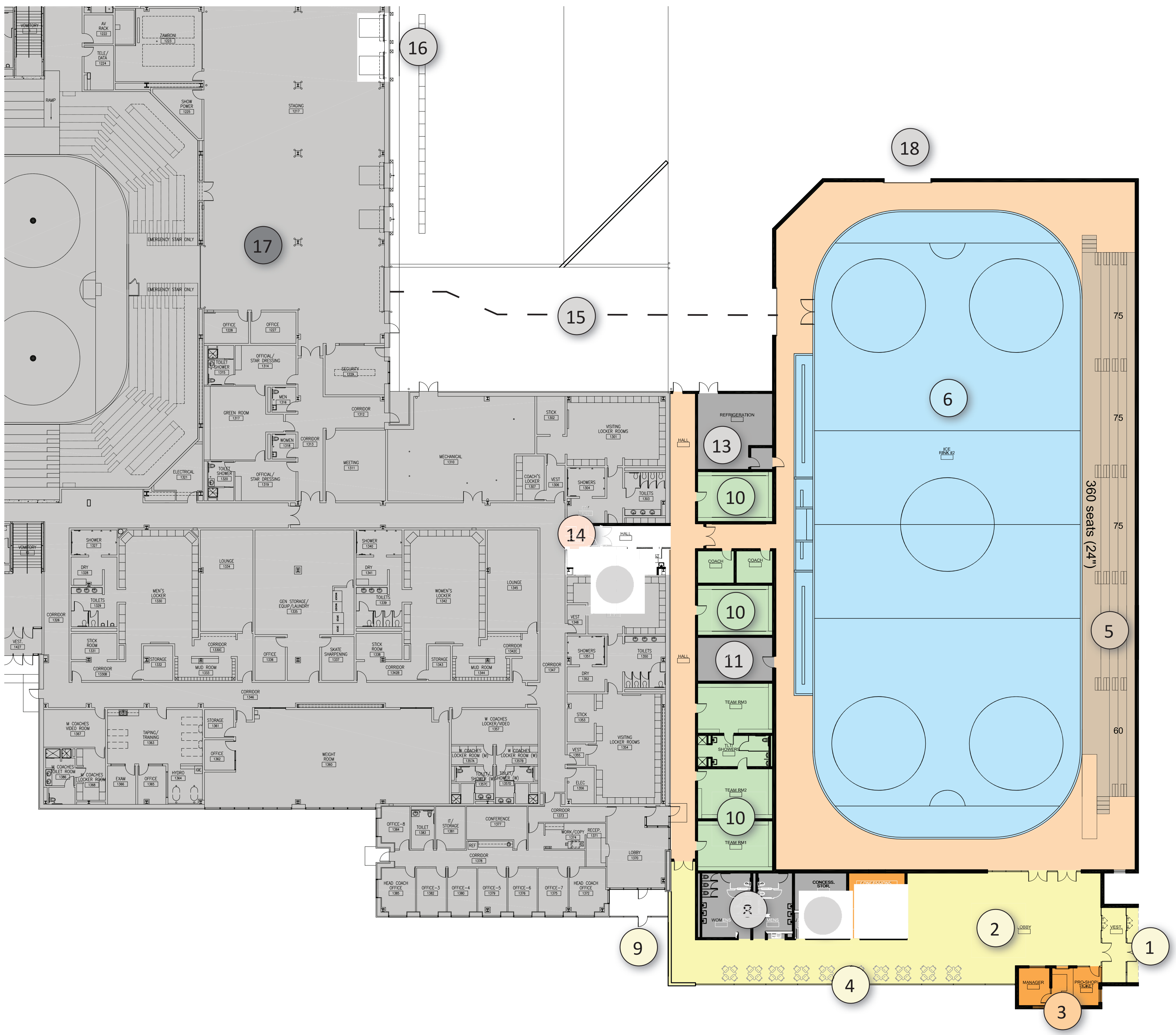
Site plan highlights are as follows:

- The new ice arena would utilize the back parking lot for day to day use
- Two new loading docks would be added to maintain ease of access to the back of the house of Sanford Center
- Ice resurfacer access would come from the existing Sanford Center
- BSU would maintain separate access to their entrance
- Player drop-off would be provided at the front of the new ice arena
- A separate entry to the ice arena is accessible from the parking lot

Project Cost: $10,472,519*

Construction Costs:	$9,279,563
Owner and Soft Costs:	$1,192,956

*A detailed cost estimate can be found in Appendix A



Sanford Center

ICE ARENA EXPANSION

The ice arena concept is based on the facility program and maximizing site access, parking, and connection to the existing Sanford Center.

List of Features:

1. Player/Spectator Entry
2. Lobby
3. Management Office
4. Window wall to bring in natural light and creates a visual entry marker for the arena
5. Seating for 300 spectators
6. NHL sized ice sheet (85x100)
7. Concessions
8. Restroom facilities
9. Separate BSU Entry
10. Youth team rooms
11. Storage
12. Referee Room
13. Separate refrigeration room
14. Connection to existing Sanford Center
15. Ice Resurfacer access
16. New loading docks
17. Existing Sanford Center
18. Garage door access


ICE ARENA
BSU ENTRY
292DesignGroup
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ICE ARENA
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APPENDIX A

Contents:

December 4, 2018

Tom Betti
292 Design Group
3533 E Lake Street
Minneapolis, MN 5546

Re: Bemidji Ice Arena

Dear Tom,

RJM Construction is pleased to present a preliminary budget estimate for the Bemidji Ice Arena Addition project located in Bemidji, Minnesota. Together with the City of Bemidji and 292 Design Group, we can work as a team to deliver the project goals of cost, schedule and quality. Our preliminary budget estimate is based upon drawings dated October 10th, 2018.

Construction Costs:	**$9,279,563**
Owner Costs:	**$1,192,956**
Preliminary Estimate Total:	**$10,472,519**

CLARIFICATIONS:

No. 1: Soil corrections, moisture mitigation and hazardous materials and abatement have all been excluded.

No. 2: We have assumed a construction start date of no later than the 1st Quarter of 2020.

Thank you for the opportunity to provide this estimate. Our team is experienced and competent in your market; this applied knowledge will assist the team in obtaining the best possible project value. Please feel free to contact RJM if you have any questions or need additional information.

Sincerely,

Bobby McCulloch
Estimator

830 Boone Avenue North
Golden Valley, Minnesota 55427 952-837-8600 RJMConstruction.com

CONSTRUCTION

ESTIMATE SUMMARY

ESTIMATE DATE:	December 4, 2018
PROJECT:	**Bemidji Ice Arena**
ARCHITECT:	292 Design Group
DRAWING DATE:	October 10, 2018

DESCRIPTION	Notes	Base Estimate	$/sf 37,185
Construction Costs			
Demolition/Building Tie-In Allowance	Allowance	$75,000	$2.02
Concrete		$359,832	$9.68
Masonry		$439,961	$11.83
Precast Concrete	$35/SF - Medium Level Panel	$1,137,192	$30.58
Structural Steel & Misc Metals		$557,866	$15.00
Rough Carpentry		$54,590	$1.47
Millwork	Locker Room Benches and Hooks, Stainless Steel Countertops	$89,703	$2.41
Roofing	Fully Adhered 60-mil EPDM	$394,785	$10.62
Metal Wall Panels	RTU Screening	$11,880	$0.32
Thermal Barriers		$44,708	$1.20
Joint Sealants		$15,046	$0.40
Doors Frames Hardware		$60,061	$1.62
Overhead Doors	Semi-High Speed Insulated Doors	$20,000	$0.54
Glass & Glazing		$206,146	$5.54
Gypsum Board		$66,716	$1.79
Tile		$2,880	$0.08
Acoustical Ceilings		$44,064	$1.18
Sport Flooring		$169,104	$4.55
Moisture Mitigation System	None	$0	$0.00
Paint & Wallcovering		$118,476	$3.19
Specialties		$26,347	$0.71
Operable Partitions	None	$0	$0.00
Lockers	Included in Specialties	$0	$0.00
Kitchen Appliances	None	$0	$0.00
Loading Dock Equipment	Includes Structural Modifications and Demolition, etc.	$75,412	$2.03
Window Treatments	Allowance	$15,000	$0.40
Ice Refrigeration System	Ammonia Refrigeration and Concrete Floor	$1,200,000	$32.27
Dasher Board System	Aluminum Framed with Tempered Glass	$185,000	$4.98
Elevators	None	$0	$0.00
Fire Protection		$92,963	$2.50
Plumbing	New Service	$305,935	$8.23
HVAC		$352,044	$9.47
Electrical	New Service	$556,643	$14.97
Phone & Data	None	$0	$0.00
Audio Visual	None	$0	$0.00
Fire Alarm		$27,889	$0.75
Security Systems	None	$0	$0.00
Earthwork		$284,667	$7.66
Storm Water Retention Rework	Allowance	$75,000	$2.02
Site Paving		$57,568	$1.55

ESTIMATE DATE:	December 4, 2018
PROJECT:	**Bemidji Ice Arena**
ARCHITECT:	292 Design Group
DRAWING DATE:	October 10, 2018

Site Concrete		$46,026	$1.24
Landscaping	Allowance	$50,000	$1.34
Site Utilities	Allowance	$100,000	$2.69
Survey		$25,464	$0.68
General Conditions		$382,390	$10.28
General Requirements		$101,272	$2.72
Temp Walls		$2,090	$0.06
Temp Fencing		$19,855	$0.53
Daily and Final Cleaning		$25,983	$0.70
General Liability Insurance		$82,588	$2.22
Builders Risk Insurance		$25,704	$0.69
Building Permit		$92,894	$2.50
Bond/Sub Bonds		$61,724	$1.66
Subtotal Construction Costs		***$8,138,468***	***$218.86***
Escalation	3.00%	$244,154	$6.57
Design Contingency	3.00%	$251,479	$6.76
Construction Contingency	5.00%	$419,131	$11.27
Contractor's Fee	2.50%	$226,331	$6.09
Total Construction Estimate		***$9,279,563***	***$249.55***

Owner Costs			
SAC/WAC Fees	Allowance	$50,000	$1.34
Concession Equipment	Allowance	$10,000	$0.27
Owner Equipment	Allowance	$50,000	$1.34
Scoreboards	Allowance	$15,000	$0.40
Aluminum Bleachers	Allowance	$100,000	$2.69
Phone and Data	Allowance	$5,000	$0.13
Audio Visual	Allowance	$20,000	$0.54
Security Systems	Allowance	$5,000	$0.13
Owner Moving Expense		$0	$0.00
Owner Signage	Allowance	$10,000	$0.27
Subtotal Owner Costs		***$265,000***	***$7.13***
Design Fees			
Arch. And Engineer Design Fees	7.00%	$649,569	$17.47
Subtotal Design Fees		***$649,569***	***$17.47***
Contingency			
Owner Contingency	3.00%	$278,387	$7.49
Subtotal Contingency		***$278,387***	***$7.49***
Total Project Estimate		***$10,472,519***	***$281.63***

APPENDIX B

Contents:

Updated Original Neilson Reise Arena Evaluation Study

Updated September 28, 2018

Evaluation Study

Neilson Reise Arena

For:

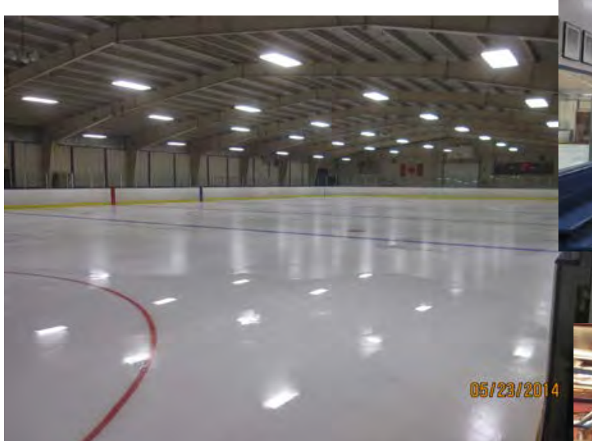
City of Bemidji
317 4th Street NW
Bemidji, MN 56601

Updated September 28, 2018

August 7, 2014

Submitted By:

Stevens
2211 O'Neil Road
Hudson, WI 54016
800.822.7670



File No. 900.14.201

In Association With:
292 Design Group
Nelson Rudie & Associates

Table of Contents

Executive Summary

Neilson Reise Arena was constructed in 1967. The facility is well used and maintains the ice sheet year round. Over the years some significant improvements have been made to the ice arena including:

- 1967 - Original curling and skating facility constructed.
- 1979 - Locker room addition was added.
- 1981 - Ice Resurfacer room was added.
- 1986-1987 - Refrigeration system was replaced.
- 2005 – Ice rink floor replaced.
- 2005 - Lobby remodeled.

The facility has been well maintained, however, the 47 year old, pre-engineered metal building is showing signs of deterioration. The majority of the mechanical and building systems are original and have exceeded their expected life. The main concerns are the condition of the roof and mechanical systems. Some leaks in the roof are starting to occur and condensation is affecting the ice quality, wall and roof systems and energy use. Also, the existing refrigeration system was manufactured in 1972 (42 years-old) and was installed in the facility around 1987 and has well exceeded its 25-year expected life. The ice system uses R-22 refrigerant which is scheduled to be phased out by 2020 due to its adverse environmental affects. As the phase-out date approaches, the cost of R-22 increases.

Stevens was retained by the City of Bemidji to prepare an evaluation of the existing facility. The recommendations and costs are summarized in the tables that follow and are broken down in to phase priorities. The costs, presented in the tables, are estimated total project costs for 2015. They are intended to be used for budget purposes and are, therefore, higher than would be expected if the project was competitively bid.

Table A. Phase 1 – Recommended Mechanical System Improvements

Item	Cost
1. Additional HVAC Upgrades	$67,850
Total estimated project cost	**$67,850**

Table B. Phase 2 or 3 – Recommended Building System Improvements

Item	Cost
Roof replacement Option 3 – Spray foam insulation	$308,560
Wall improvement Option 2 – Rigid foam metal panel	$610,576
Total estimated project cost	**$919,136**

Table C. Phase 2 or 3 – Ice System Replacement - Recommendations and Cost Estimates

Item	Cost
1. Ice system replacement (ammonia system, dashers, waste heat)	$2,218,695
2. Refrigeration room improvements (General Construction)	$65,170
3. Demand control ventilation	$0
4. Ice equipment room ventilation	$67,850
Total estimated project cost	**$2,351,715**

Table D. Phase 4 – Other Improvements or Considerations

Item	Cost
New lobby addition (6,000 SF)	$1,274,400 to $1,557,600
New Arena (32,000 SF)	$6,944,300 to $8,136,100

Implementing the recommendations in this study is, not only a necessity in some cases, but will provide a strong operational and structural foundation for the facility over the next 25 to 30 years or more.

Updated September 28, 2018

Section 1
Project Information

Contact Information

Facility Address:
Neilson Reise Arena
1115 23rd St NW
Bemidji, Minnesota 56601

Type of Facility: Ice Arena
Square Footage: NA
Seating Capacity: NA

Facility Manager:
Evan

P. 218.759.4861 (arena)

Client Contact:
Marcia Larson
Parks and Recreation Director
1351 5th St NW
Bemidji, Minnesota 56601
P. 218.333.1860
marcia.larson@ci.bemidji.mn.us

Consulting Engineering Firms:

Stevens
2211 O'Neil Road
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P. 651.436.2075
F. 715.386.5879
Scott A. Ward, P.E.
sward@stevensengineers.com

292 Design Group
3533 E Lake Street
Minneapolis, MN 55406
P. 763.533.3813
F. 763.367.7601
Tom Betti
tbetti@292designgroup.com

Nelson Rudie & Associates
9100 49th Avenue North
Minneapolis, MN 55428
P. 763.367.7600
F. 763.367.7601
Michael D. Woehrle, P.E.
Michael.Woehrle@nelsonrudie.com

Electric Utility:

Gas Utility:

Certification

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Minnesota.

Scott A. Ward, P.E.
STEVENS

40921
Registration Number

8.7.14
Date

Section 2

Project Overview

PROJECT OVERVIEW

Background

The Neilson Reise Arena began with the construction of the curling rink and skating rink in 1967. The ice arena includes an ice arena, team rooms, concessions and an office. The facility is has a long standing tradition of providing ice-related activities for the Bemidji Community and is home to Youth Hockey, Bemidji State University Practices, and Figure Skating. The facility also hosts open skating, hockey training and camps, along with a variety of youth and adult hockey events. The facility maintains the ice sheet year round.

Over the years some significant improvements have been made to the ice arena including:

- 1967 - Original curling and skating facility constructed.
- 1979 - Locker room addition was added.
- 1981 - Ice Resurfacer room was added.
- 1986-1987 - Refrigeration system was replaced.
- 2005 – Ice rink floor replaced.
- 2005 - Lobby remodeled.

The facility has been well maintained, however, the 47 year old, pre-engineered metal building is showing signs of deterioration. The majority of the mechanical and building systems are original and have exceeded their expected life. One main concern is the refrigeration system. The existing refrigeration system was manufactured by Holmsten Ice Rinks in 1972 (42 years-old) and was installed in the facility around 1987 and has well exceeded its 25-year expected life. Improvements to the refrigeration system were performed in 2005 when the sand-based ice rink floor was replaced. The dasher board system was also manufactured and installed by Holmsten Ice Rinks and has exceeded to expected life.

In addition, the ice system uses R-22 refrigerant which is scheduled to be phased out by 2020 due to its adverse environmental affects. As the phase-out date approaches, the cost of R-22 increases. A key part of this study will be evaluating possible refrigerant options and finding the best fit for this facility and the City. For example, CO_2 has a long history as a refrigerant but not until 2000 has it gained momentum and popularity in the ice rink industry as a natural, environmentally friendly, alternative refrigerant. The analysis of the existing refrigeration room (both size and building material construction) will also be a key component of the study.

Neilson – Reise Ice Arena in one of four ice arenas that serve the Bemidji Community, the other three rinks are:

- Bemidji Community Arena
- Sanford Center
- Nymore Arena

Purpose

As part of a continued effort to: improve the operations and financial success of the Neilson Reise Arena; address concerns over the aging facility and systems; to plan for future improvements to the facility; and to continue to provide high quality ice for its user groups; Stevens and a specialized team of consultants were retained by the City of Bemidji to prepare an engineering study of the facility. The primary objectives of this study are as follows:

- To provide recommendations and a scope of work for future improvement project(s).
- Identify and evaluate the best system options for replacing the existing R-22 based ice system that will maximize performance and energy efficiency and provide superior ice quality for the next 25+ years.
- Provide accurate conceptual cost estimates to assist the City in making informed decisions on future project(s).
- Recommend improvements that maximize energy efficiency while incorporating sustainable design practices that reduce the use of fossil fuels, the production of greenhouse gas emissions, and reduce total energy use of the systems and facility.

It is recommended that the findings presented in this report be used to plan for improvements to the facility including the building and mechanical systems and future replacement of the ice system and related improvements. The information in this report should also be used to assist in identifying possible rebates or grant programs from utility or energy companies or departments, state and federal agencies, or other sources.

Scope of Services

The scope of the study included the following systems and areas of the ice arena facility. The curling rink was not part of this study.

- Evaluate existing refrigeration and dehumidification systems.
- Evaluate building systems, specifically the roof and walls. Evaluation will be a visual evaluation along with recommended replacement options. Evaluate restrooms, team rooms, existing ice equipment room upgrades and visual review of existing refrigeration room for code compliance.
- Identify potential building upgrades to allow the building to meet the needs of current users. Potential upgrades include new lobby, team rooms, repurpose existing lobby, concession stand, skate check area, community rooms, office space.
- Provide professional opinion of overall condition of existing facility, expected life span of structure if left in current condition.
- Provide cost to build a new ice arena at the existing site, or a new arena at a different site.
- Evaluate the existing facility's ability to support proposed refrigeration and mechanical improvements.

Report Organization

The report is organized starting with observations on the existing building, mechanical and ice systems followed by recommendation for improvements. Supporting documentation including cost estimates, schedules, etc. are provided in the Appendices.

Section 3
Building Systems

EXISTING BUILDING SYSTEMS

General

The existing ice arena consists of a major structure that houses the skating rink and curling club which is a pre-engineered steel roof framed building constructed in 1967.

Over the years improvements have been made to the facility including:

- Locker room addition was added in 1979
- Ice Resurfacer room was added in 1981
- Refrigeration system was replaced in 1986-1987
- Lobby was remodeled in 2005

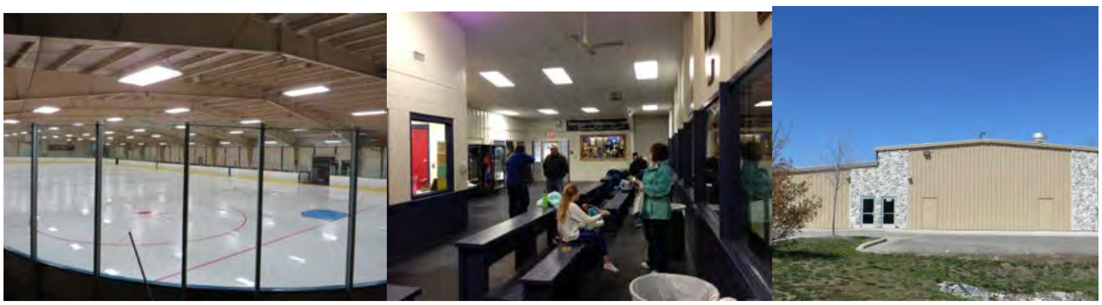
The facility is entered through a common entry that serves both the ice arena and curling club. The entry has a ramped surface to get up to the lobby level. Once inside the lobby there are wooded bleachers that allow for views of the ice rink to the south. The manager's office is located along the north wall of the lobby, along with restrooms, concessions, and coaches/skating club locker room. To enter into the ice arena from the lobby, there are stairs located on each end of the lobby that access bleachers and locker rooms on the east side of the arena. The west side stairs provide access to the ice resurfacer, refrigeration room, and ice rink.

Observations of Existing Conditions – Building Systems

The design team toured the facility with the facility's management personnel and have the following observations and comments.

- The facility is visually in good condition and has been well maintained considering the age and the heavy use the facility receives.
- The ice arena has a very low roof/ceiling compared to new community ice arenas.
- The exterior walls are in good shape on the exterior skin, the interior skin is dented and in need of some upgrades.
- Concessions area is undersized, and in a location that causes congestion with access to the restrooms.
- The Manager's Office and office space in general is undersized.
- The locker rooms don't appear to have any sort of ventilation. Also, there are no showers available for users.
- The existing roof system is starting to leak in a few areas.
- The metal wall panels at the exterior walls have condensation and/or leaking issues.

- The ice-resurfacer room and refrigeration room utilize a large amount of structural wood sheathing, wood sheathing and framing is not allowed by today's building codes.
- The refrigeration room is not separated from the ice arena by a fire wall/smoke barrier.
- A description and evaluation of the mechanical, electrical, and ice systems are included in the following sections.



Picture Window 1: (left to right): Interior of arena, interior of lobby, exterior entry.

Evaluation and Recommendations – Existing Building Systems

General

The evaluation process consisted of a kick-off meeting on May 23, 2014 with representatives from the City of Bemidji to discuss overall project goals that are listed at the beginning of the study. We recommend the City plan and budget for the capital improvements for the existing building systems at the facility as outlined in this Section.

Rink Roof

The east rink roof system is the original roof system that was installed in 1967 and is getting to the end of its useful life. Given the age of the roof it has held up fairly well. Over the years advances and understanding of arena roof and wall systems has evolved in how to deal with temperature, humidity, and seasons of operation. Rinks today are running all year long without removing the ice, or if the ice is removed for only a brief period of time. Even if they are not running year around the ice is going in earlier in the season and coming out later. This extension of the ice season has increased the thermal and moisture stresses on an ice arena. Because of this better roof and wall systems and approaches have been developed.

For reroofing the project a variety of options exist.

First Option:

Remove the existing metal roof panels and insulation and provide a new mechanically seamed metal roof system. Install new 10" fiberglass insulation with a perforated Low-E barrier.

Picture Window 2 (left to right): Interior photo showing insulation damage at ceiling, overall interior

Pros:
Provides a new watertight roof system.

Cons:
Condensation will develop within this system and cause dripping onto the ice surface. The reason condensation will form is the inside surface of the metal deck, which acts like a vapor barrier, will be very close to the outside air temperature. So when the arena dew point temperature exceeds the outside air temperature condensation will form.

The Stevens Design Team does not recommend this system because of the condensation issues. This system is being replaced in ice arenas constantly. It is a good system if the arena was only operational in the winter seasons from late November to mid March. Even running during these times there could be periods of times when condensation forms because of unseasonably warm weather.

Second Option:
Leave the existing roof and insulation system in place and provide an adhesive applied EPDM or TPO roof membrane over the existing metal roof. There are also some spray applied membrane systems that could be utilized for this application. Install a Low-E barrier just below the new insulation system to protect it from flying pucks and help create a more energy efficient arena by reflecting heat away from the ice surface.

Pros:
Inexpensive solution. This system will seal the roof from leaks.

Cons:
Similar to Option One this solution will not prevent condensation from forming on the underside of the metal deck because it does not solve the issue of roof deck temperature.

Third Option:
Leave the existing metal roof deck in place and remove the existing fiberglass. Spray apply foam insulation to the underside of the metal deck and apply a thermal barrier top coat over the foam to protect it from fire. Install a Low-E barrier just below the new insulation system to protect it from flying pucks and help create a more energy efficient arena by reflecting heat away from the ice surface. Note,

the existing fiberglass insulation must be removed in order for the metal deck temperature to stay at a temperature that will minimize the chance of condensation forming on the deck.

Pros:
Maintains the temperature of the underside of the metal deck above freezing, therefore eliminating the chance for condensation to develop do to outside temperature variations. Also, this approach eliminates areas and pockets that can harbor mold growth. The amount of maintenance required on the ice surface is minimized by eliminating the time required to take out the bumps and ridges formed from condensation dripping on the ice surface. The existing roof structure is protected from deterioration and rust do to condensation within the roof structure. The dehumidification system can work more efficiently because it is not also trying to remove the moisture in the facility caused by condensation.

Cons:
This roof system is expensive. Also, the existing roof structure will need to be analyzed to verify that it can support the additional load of the new roof materials. Based on past experience the weight of saturated fiberglass insulation exceeds the weight of the spray foam system, so most code officials approve this approach.

Based on the site visit and preliminary analysis, the Stevens Team would recommend Option Three. But given the unknowns with the structural capacity of the existing roof structure and given the potential cost of this system, detailed plans and specifications need to be developed to help in determining the most appropriate solution for the arena. Based on the systems outlined above the following budgets have been established for each system.

<u>Exterior walls</u>
The exterior walls of the ice arena consist of steel girt framing with metal panels on the exterior, fiberglass insulation in the cavity space and a metal liner on the interior face. The existing wall has frost buildup on the exterior face of the walls during some of the winter months and condensation within the panels in the summer months. This is common with this type of system.

The moisture in the wall is typically a result of condensation from the warm moist summer air penetrating through the gaps, cracks, and holes in the metal panel and condensing when it hits a cold surface (dew point) within the wall. The opposite occurs in the winter months where warmer moist air from within the arena condenses in the wall when it hits a colder surface in the interior of the wall cavity. So depending on the season the point of condensation within the wall changes, or to put it another way the vapor barrier needs to be on the exterior of the wall in the summer and in the interior in the winter.

To solve this problem an insulation system is required that has an integral vapor barrier, rigid insulation has this property.

Picture Window 3 (left to right): Interior of metal panel liner, interior of resurfacer room (2 pictures)

<u>Wall Solution</u>

First Option:
Remove the existing metal interior wall panels and insulation and provide new interior perforated metal wall panels with fiberglass insulation.

Pros:
Provides a new interior finish and is the least expensive option.

Cons:
Condensation and frost will develop within this system. The reason condensation will form is the inside surface of the metal panel, which acts like a vapor barrier, will be very close to the outside air temperature. So when the arena dew point temperature exceeds the outside air temperature condensation and frost will form depending on the time of year. A perforated metal wall panel is recommended to allow the dehumidification system to dry out the insulation when it gets wet from condensation during the winter months.

The Stevens Design Team does not recommend this system because of the condensation issues. This system is being replaced in ice arenas constantly. It is a good system if the arena was only operational in the winter seasons from late November to mid March. Even running during these times there could be periods of times when condensation forms because of unseasonably warm weather.

Second Option:
The most appropriate way to remedy the wall condensation and frost issue is to install a rigid foam metal panel system on the exterior face of the existing wall construction. This new panel would be clipped to the existing steel girts. The bottom edge of the panel will need to be sealed against the floor or stem wall. By placing the foamed panel at the exterior it prevents moisture and water vapor from migrating into the wall assembly.

Pros:
Maintains the temperature at the inside face of the metal panel above the dew point, therefore eliminating the chance for condensation to develop do to outside temperature variations. Also, this approach eliminates areas and pockets that can harbor mold growth. The existing wall structure is

protected from deterioration and rust by eliminating condensation within the wall system. The dehumidification system can work more efficiently because it is not also trying to remove the moisture in the facility caused by condensation.

Cons:
This wall system is expensive. Sound can be an issue because of the hard interior metal finish causes the interior to echo. This can be controlled by installed an interior perforated metal panel liner with mineral wool insulation to act as a sound absorber.

Based on the site visit and preliminary analysis, the Stevens Team would recommend Option Two. Based on the systems outlined above the following budgets have been established for each system.

<u>Existing Refrigeration Room</u>
With the introduction of a new refrigeration system utilizing ammonia as the primary refrigerant the existing refrigeration room that serves the current ice arena will need code upgrades. If an ammonia based system is not used, the vestibule construction can be eliminated from the budget outlined below. The upgrades include a 1-hour rated wall and roof construction, along with an interior vestibule for the interior entry to the room. Also, additional electrical and mechanical items will be required; refer to the respective section for a description of the upgrades required for the electrical and mechanical systems.

Picture Window 4 (left to right): interior of refrigeration room

<u>New Lobby Addition</u>
The existing lobby, concessions area, and bathrooms lack adequate space and compliant ADA access. The existing ramp that accesses the ice arena is to long without intermediate landings as required by ADA. An opportunity exists to add a new lobby along with associated support spaces; this upgrade will better serve the existing users of the ice arena. The proposed addition would include the following:

- Lobby Space
- Concessions
- Concession Storage
- Referee Room
- 2 Locker Rooms with Showers and Toilet Facilities
- Restrooms
- Managers Office
- Skate rental area

This addition could be added onto the east side of the existing arena and would create a new entry identity to the facility. The concept design of this addition is beyond the scope of this study but for planning purposes an addition that includes the above spaces would be approximately 6,000 square feet.

Picture Window 5 (left to right): non-compliant ice arena access, non-compliant access arena from lobby

<u>New Ice Arena</u>

When putting together a study such as this a question is always asked: How much is it to build a new ice arena? This is a difficult question to answer because of the many variables that come into play. These variables include ice arena size, seating capacity, type of refrigeration system, mechanical systems, and site parameters just to name a few. The best way is to provide a cost per square foot estimate based on historical low and high ranges of construction cost. The costs per square foot are based on traditional community ice arenas and the following assumptions and building program:

- Assumes site is pad ready
- Utilities are readily available
- 32,000 SF Precast building shell with long span joists, clear height of 24' minimum
- Quality mechanical and electrical systems
- Ammonia Refrigeration
- Concrete block interior partitions
- Seating for 400
- 4 Team Rooms
- Lobby Space
- Concessions
- Concession Storage
- Referee Room
- Restrooms
- Managers Office
- Skate rental area

If this is a direction the City is interested in pursuing, The Stevens Design Team highly recommends a more detailed study be performed to refine a building program, identify a site and size for the arena, and to refine the cost estimate.

Cost Estimates – Existing Building Systems and New Arena

The costs of the recommended improvements are summarized below and are total project costs. A more detailed description of the cost estimate is located in the Appendix.

Table 1. Building System Improvements Cost Estimate Summary

Item	Cost
Roof Options	
Option 1	$358,686
Option 2	$316,540
Option 3	$308,560
Wall Improvement Options	
Option 1	$182,316
Option 2	$610,576
Refrigeration Room Improvements	$133,020
New lobby addition (6,000 SF)	$1,274,400 to $1,557,600
New Arena (32,000 SF)	$6,944,300 to $8,136,100

Updated September 28, 2018

Section 4
Mechanical and Electrical Systems

EXISTING MECHANICAL AND ELECTRICAL SYSTEMS

General

In general, the existing mechanical (HVAC and dehumidification systems) and electrical systems are original to the building construction and have exceeded their useful and expected life. The electrical systems were not included in the scope of this study but are discussed in relation to the mechanical and ice systems.

Observations of Existing Conditions – Mechanical Systems

The design team toured the facility with the facility's management personnel and have the following observations and comments.

- The arena is operated with year round ice.
- The arena uses a natural gas powered ice resurfacer which off gasses the products of combustion into the arena.
- The arena envelope has numerous cracks in the envelope which allow humidity to infiltrate into the building.
- The arena is heated with gravity vented gas fired unit heaters. The heaters have flues which are open to the exterior of the building. This allows a path for humid outside air to infiltrate into the building. It also allows moisture to condense and accumulate on the inside of the unit heater causing issues with the life and operation of the unit heaters.
- The ice arena portion of the building is dehumidified with a Rink-Drier brand dehumidifier manufactured by Holmsten Ice Rinks. The dehumidification unit is nearly 50 years old and no longer functions properly.
- The arena is ventilated with a wall mounted exhaust fan and intake louvers with manual volume dampers. This ventilation system allows hot, humid air to be directly introduced into the arena during the summer and untreated cold winter air to enter the arena during the winter. Both conditions are undesirable and can lead to poor arena conditions.

Existing Arena Dehumidification System

The ice arena portion of the building is dehumidified with a Rink-Drier brand dehumidifier manufactured by Holmsten Ice Rinks. The dehumidification unit is nearly 50 years old and no longer functions properly. The unit uses low temperature refrigerant from the ice plant to dehumidify the arena. The system is not designed to dehumidify the outside air and it does not have heating components for heating the arena. The unit has well exceeded its expected service life and should be scheduled for replacement.

Picture Window 6: Dehumidification unit to be removed

Arena Ventilation System

The arena is ventilated with a wall mounted exhaust fan and intake louvers with manual volume dampers. This ventilation system allows hot, humid air to be directly introduced into the arena during the summer and untreated cold winter air to enter the arena during the winter. Both conditions are undesirable and can lead to poor arena conditions.

Our initial review of the system produced the following concerns.

1. The amount of outdoor air introduced into the facility is determined by the building operators. If the outdoor air damper is accidently left open the arena can easily be overwhelmed with humidity or the arena can become extremely cold in the winter season.
2. The arena does not have carbon monoxide or other toxic gas sensors. The levels of carbon monoxide are regulated by the state with required documentation logs. This is currently being completed using hand sensors. Adding building mounted sensors with associated alarms would help protect the facility from high contaminant levels.
3. The system is a refrigerant based system. The effectiveness of the system decreases as the arena temperature drops. We recommend that a desiccant based dehumidification be considered for the facility.

Picture Window 7 (l to r): Intake louver & gas fired heater, vapor barrier penetration, mold & rust

Existing Arena Unit Heaters

The arena is heated with gas fired unit heaters which are suspended in the arena. We have the following concerns about the heaters.

- The heaters are natural draft heaters which have flues extending up through the roof. The flues are an open penetration of the building envelope with outdoor air conditions inside the flue. During summer use of the arena the temperature of the flue inside the arena is often colder than the dew point temperature of the outside air. When this condition occurs water will condense out of the outside air and collect in the flue system. Over the course of a summer this continually occurs and can greatly reduce the life of the unit heater. It also adds increased humidity load on the arena dehumidification system. We recommend that the facility consider adding a heating section to the new dehumidification system which would eliminate the gas fired heaters.

- Some of the heaters are pointed out over the ice surface. This adds cooling demand on the ice plant reducing the quality of the ice and increasing energy bills.

Existing Arena Envelope Issues

During our survey of the ice arena facility we noted numerous areas where the building vapor barrier has been compromised. This leads to condensation in the building insulation system, mold growth in the insulation system, deterioration of the building deck and structural steel, water dripping on the ice and other humidity related issues. We recommend that the arena envelope be closely reviewed and any penetrations of the building vapor barrier be repaired.

Arena Team and Locker Rooms Mechanical Systems

- The Arena team rooms are being heated with a high efficiency gas fired furnace coupled with an air to air energy recovery unit. The unit appears to be in good working order and was recently replaced. (Don't know age of unit.)


Picture Window 8 (l to r): team room furnace, team room energy recovery unit

Existing Refrigeration Machine Room
The refrigeration machinery room is ventilated with a wall mounted exhaust fan and an intake louver open to the room. The existing installation does not comply with new refrigeration room ventilation requirements. The system will need to be replaced with a new ventilation system when the refrigeration plant is upgraded.

Current building codes require a one hour fire separation between the refrigeration room and other occupancies. During our survey we noticed several penetrations of the enclosure that should be properly fire rated

Existing Building Fire Protection System
The existing building is not protected with an automatic fire protection system. Discussions will need to occur with the Building Officials to determine if the existing building will need to be upgraded with a new fire protection system.

Recommendations – Existing Mechanical Systems

General
We recommend the City plan and budget for the capital improvements for the existing mechanical systems at the facility as outlined in this Section.

Recommendation 1:
Mechanical Recommendation 1 – Disconnect the Existing Dehumidification System and replace with a new gas fired Dehumidification system.

The existing gas fired, desiccant based dehumidification unit is improperly sized to dehumidify and ventilate the Arena on a year round basis. We recommend that the unit be replaced with a new gas fired, desiccant based dehumidification unit that is sized to dehumidify and ventilate the rink on a year round basis. The system should be designed to provide current code mandated ventilation air to the facility. This new unit will properly maintain the humidity levels in the building. The new Rink dehumidification system will include a gas fired heating section and 100% outside air capabilities. The existing desiccant dehumidification unit and gas-fired unit heaters will be removed from the building.
During the design process of the arena we will investigate the use of several energy saving technologies

that can be applied to the system including using waste heat from the ice plant to regenerate the desiccant wheel, using waste heat from the ice plant to heat the building, and using air to air energy recovery wheels to reduce the energy use of the facility. We will also review the use of CO_2 monitoring to reduce the amount of outside air introduced into the building. This dramatically reduces the heating and dehumidification needs of the building. Preliminary design concepts for the system include locating the unit on grade outside the building. New ductwork will be run down one side of the arena to distribute warm dry air throughout the arena.

A letter was provided prior to the completion of this report to assist the City is replacing this unit in the summer of 2014. This letter is included in Appendix A.

Recommendation 2

Mechanical Recommendation 2 – Add Demand Control Ventilation Controls to the Arena Ventilation System.

The second item that we recommend considering is demand control ventilation for the arena ventilation systems. Demand control ventilation actively controls the amount of outside air introduced into the arena based on the level of carbon dioxide, CO_2, and carbon monoxide, CO, in the arena. CO_2 is given off when people exhale. As the occupant load in the building increases the level of CO_2 increases. When the level of CO_2 reaches a first set point the outside air damper on the make-up air unit will modulate open to flush the contaminates from the building. Carbon monoxide is given off when internal combustion engines are operated in the facility. We recommend that new CO sensors be integrated into the control sequence to flush CO from the building. The sequence of operation will be similar to the CO_2 control system with outside air systems sequencing on to flush contaminants from the building.

Cost Estimates – Existing Mechanical Systems

The costs of the recommended improvements are summarized below and are total project costs. A more detailed description of the cost estimate is located in the Appendix. The control system recommended under Recommendation #2 has a typical pay back of less than three years.

Table 2. Mechanical System Improvements Cost Estimate Summary

Item	Cost
Recommendation 1 (Completed in 2014)	$0
Recommendation 2 (Competed in 2014)	$0
Ice Equipment Room Ventilation System	$67,850

Section 5
Ice Systems

EXISTING ICE SYSTEM

General

The existing ice arena is served by a *direct-type* ice system that includes a refrigeration system, NHL sized ice sheet and dasher board system. R-22 refrigerant is used as the primary refrigerant that is circulated through the ice rink floor. The existing refrigeration system was manufactured by Holmsten Ice Rinks in 1972 (42-years old) and was installed in the facility around 1987 (27-years ago) and has reached its original expected life. This study includes an in-depth evaluation for the improvement or replacement of the existing ice system.

This section of the study discusses the existing ice systems, general design parameters to consider, options available, and recommendations for improving or replacing the existing ice system. Estimated costs for each recommendation are also provided in this section and the Appendix.

Definitions for the two types of ice systems used in ice rink facilities and several other common terms discussed throughout the study are provided below:

Ice System: A term that collectively refers to the refrigeration system, ice rink floor system, waste heat recovery systems and dasher board systems.

Direct System: A *direct* refrigeration system circulates the primary refrigerant (e.g. R-22) directly through the ice rink floor. There is no secondary solution or refrigerant. **This is the type of system installed at Neilson Reise Arena.**

Indirect System: An *indirect* refrigeration system uses two refrigerants. A primary refrigerant (e.g. R-22) remains confined in the refrigeration room and a secondary refrigerant (e.g. glycol or calcium chloride) is circulated in the rink floor. The heat exchange between the primary and secondary refrigerants takes place in the refrigeration room.

HCFC: Hydrochlorofluorocarbon (e.g. R-22, etc.). **Neilson Reise Arena's refrigerant.**

HFC: Hyrdrofluorocarbon (e.g. R134a, R404A, R407C, R410, R507, etc.)

Natural Refrigerants: Natural occurring refrigerants such as ammonia (R717), carbon dioxide (CO_2, R744) and hydrocarbons.

Synthetic Refrigerants: Artificial refrigerants such as HCFC and HFC type refrigerants.

Ice Systems - Observations of Existing Conditions

The design team toured the facility with the facility's management personnel and have the following observations and comments.

- This refrigeration system was installed in 1987 (27-years ago) but was manufactured in 1972 (42-years old). The ice rink floor was replaced in 2005. The dasher boards are at least 27 years old if not older.

- Ice operational season: 12 months. The ice was removed this summer for the first time in 12 years.

- Overall, the systems related to the ice system have been very well maintained by the facility's operational and maintenance personnel.

- *Refrigeration System.* The arena is served by a *direct* refrigeration system manufactured by Holmsten Ice Rinks. The majority of the components include two (2) York compressors, one (1) low pressure receiver, two (2) pumper drum vessels, and one (1) motor control center. The 42-year old (27 years in operation) refrigeration system is at the end of its expected life of 25 years. The system is in fair condition for its age. It is becoming more difficult to maintain with its outdated electrical and control systems, discontinued compressors units, etc. Some improvements have been performed on the refrigeration package over the years like reinsulating sections of the piping systems, etc.

  The existing cooling tower is an evaporative condenser type system, manufactured by Evapco and original to the system. This system uses air and water to dissipate heat for the refrigeration processes.

- *Waste heat recovery system(s).* The facility does an excellent job (more than many ice arenas) at recovering waste heat from the refrigeration system and reusing it throughout the facility. The waste heat recovery systems serve the existing subfloor heating (front prevention system) beneath the ice rink floor, snow melt pit, air handling unit and preheating domestic hot water (the old water heaters are used as storage tanks).

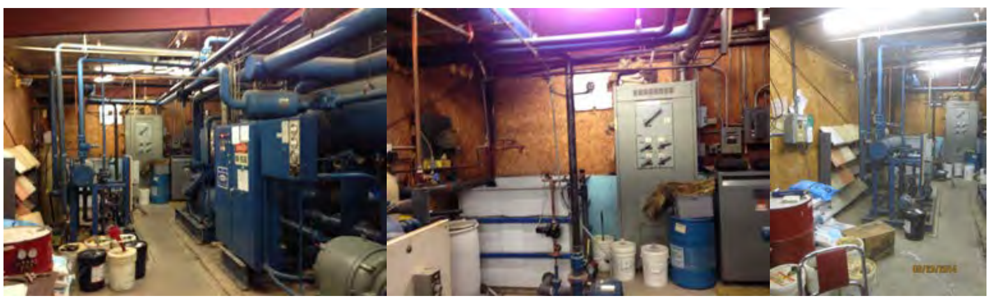
  The subfloor heating system is reportedly in good working order eliminating the concern of frost heave or build-up beneath the ice rink floor. This piping system beneath the rink floor was replaced in 2005 when the rink floor was replaced. Frost heave, due to frost build-up beneath the ice rink floor, is a common concern and problem with the older Holmsten *direct* systems. There are no visible or reported signs of frost heave, such as cracked perimeter concrete or building walls.

- *Ice rink floor.* The rink floor was replaced in 2005 (9-years old) with the same type of sand floor design as the original floor. The existing floor is standard NHL size (200'x85'x28' radii) and the standard Holmsten Ice Rink design consisting of: 6 inch subfloor sand layer and heating system; 3 inches of floor insulation; ½ schedule 40 steel tubing installed at 4 inches on-center with welded connections; and 5 inches of reinforced concrete. It is very typical for the rink floors in a Holmsten Ice Rink System to be the first components to fail as was the case at this facility and led to its replacement in 2005.

- *Ice equipment room.* The existing ice equipment room is located in the northwest corner of the facility and is approximately (18'x40') 720 square feet in size. The two exterior walls allow for the use of various types of refrigerants. There are electrical components and systems located in the room that are unrelated to the ice system such as a distribution panel, junction boxes, transformers, etc.

- *Life safety systems.* The refrigeration room is equipped with an R-22 leak detection system. We did not recall seeing an emergency power shunt trip for the refrigeration system or an energizer switch for the emergency ventilation system on the exterior of the mechanical room door(s) as required per code. It was not noted when pressure relief valves on the systems were last replaced. Replacement is required every 5 years. There is an existing mechanical ventilation system in the refrigeration room as required by code.

- *Dasher board system.* The existing dasher board system was manufactured and installed at the time the building was constructed. The 24-year old system was manufactured by Holmsten Ice Rinks and is a steel frame system with acrylic shielding. The life expectancy of a typical dasher board system like this is approximately 20-25 years.



Picture Window 9 (left to right): Existing direct refrigeration system; water tank and electrical gear, waste heat recovery system.

Recommendations – Ice System

General

In addition to evaluating the feasibility of expanding the facility, one of the main focuses of this study is the planning and budgeting for the replacement of the 42-year old (27-years of use) refrigeration system, the 27-year old dasher board system and possibly the rink floor. Holmsten Ice Rink's *direct*-type ice system is one of the most efficient systems designed for ice rink applications. However, because of the following factors, this type of system is no longer a viable type of system to use in today's ice arena facilities:

- Requires a large quantity of refrigerant (6,000 pounds vs. 400 to 1,000 pounds on a modern *indirect* system).
- Refrigerant is circulated through the ice rink floor, potentially exposing spectators to refrigerant if a leak occurs.
- R-22 is currently on a phase out schedule mandated by the EPA and will no longer be produced after 2020.

- The rink floor already failed and was replaced so the condition of the floor is not a concern.

Outlined below are several improvement options ranging from doing nothing and operating as-is to a total replacement of the ice system. Options 3-87 require changing from a *direct* system to an *indirect* system with the exception of using CO2 refrigerant. *Indirect* systems require a secondary heat exchange process making them less energy efficient than *direct* systems.

The following options will be discussed in this section:

Option 1: Do nothing. Continue to maintain existing systems.

Option 2: Make improvements to the existing *direct* system(s).

Option 3: Convert to an *indirect*, industrial grade, R-22 or other hydrofluorocarbons (HFCs) based system using the existing refrigeration equipment.

Option 4: New *indirect*, commercial grade, HFC based system.

Option 5: New *indirect*, industrial grade, HFC based system.

Option 6: New *indirect*, industrial grade, ammonia based system.

Option 7: New *indirect*, carbon dioxide (CO2) based system.

Option 8: New *direct*, carbon dioxide (CO2) based system.

One option that is not discussed in this report but may be an option in the future is installing a common refrigeration system serve both the skating and curling facilities. A common refrigeration has the least capital costs overall and operates with the greatest efficiency. A new refrigeration system for the skating rink could be sized to accommodate the curling rink in the future.

Before the system options are discussed in more detail, a general discussion of seven (7) major factors or design considerations that the design team feels are most important to consider when evaluating ice system options is presented below. A general understanding of these factors, we believe, will aid the City in making the best possible selection for improving or replacing the existing ice systems. In a historically slow-changing industry, the somewhat recent updated environmental regulations and increasing energy costs have brought new innovations and technology to the ice rink industry.

1. *Selection of Primary Refrigerant:* **R-22** has been the most popular refrigerant used in ice rink applications in recent history. However, with the signing of the Montreal Protocol, the United States Environmental Protection Agency (EPA) implemented the final rule of Section 604 of the Clean Air Act in July 1992, limiting the production and consumption of a set of chemicals known to deplete the stratospheric ozone layer as measured by their ozone depleting potential (ODP). R-22, which also has a high global warming potential (GWP), is one of these targeted chemicals.

   Regulations on R-22 started taking effect in 2010 and will continue to significantly reduce the allowances to produce and import R-22 through 2020 when production and importation in the U.S. will be halted all together. The U.S. EPA has proposed to significantly reduce allowances by 11-17% per year through 2014.

In addition to the current regulations on refrigerants that affect the ozone, there is now pressure to consider phasing-out refrigerants that contribute to global warming, as measured by their global warming potential (GWP). This affects mainly hydrofluorocarbons (HFCs) like those used in blended refrigerants such as R-507A, R407C, R-404A etc. The European Union has been on the leading edge of this change. The European Parliament passed legislation called the "F Gas Directive" that became effective in 2007, that requires very strict inspection of systems for leakage, rigorous record keeping, and mandatory training and certification on systems using HFCs. Most recently, the European Union has tightened these restrictions with an informal agreement in December, 2013. The changes include increasing taxes on HFC's and providing incentives for using natural refrigerants.

Currently, the ice rink industry is caught in a transition period for refrigerants as new environmental regulations are implemented. Careful consideration and evaluation of the current refrigerant options should be made. The replacement refrigerants for HCFC refrigerants (i.e. **R-22**, etc.) are fairly new with a limited history and performance data in this application. The almost certain future regulations of HFC refrigerants (i.e. **R-507, R407C**, etc.), which are used in many of the R-22 replacement refrigerants, should be considered.

Large global companies, such as Coca Cola, are leading the charge to ban HFCs and use natural refrigerants such as **CO2**, hydrocarbons and **ammonia**. Between 2004 and 2012, twenty four ice skating facilities in Europe have switched over to using CO2 as the secondary refrigerant with ammonia as the primary. The first CO2-based ice system in North America, and the first *direct* CO2-based system in the world, opened in 2011 in Quebec, Canada with a second rink opening in Montreal in 2012.

Some other factors that should be considered when comparing primary refrigerants are listed below.

Location: it is important to consider local temperatures and weather patterns when selecting refrigerants. For example, CO2 is more likely to be affected by ambient conditions than other refrigerants. CO2 is most efficient in colder climates. The following is a partial list of CO2 ice rinks that are currently in operation or under construction world-wide. Note that most if not all are located north of Montreal or Quebec, Canada:

Indirect CO2 Systems
Dollard-des-Ormeaux Civic Centre, Canada, 2012
Stade de la Cite des Jeunes – Riviere-du-Loup, Qc, Canada. Complete Nov. 2013
Lacroix-Dutil Sport Complex – St-Georges, Qc, Canada. Complete Nov. 2013
Curling Roberval – Roberval, Qc, Canada. 3 sheets. Complete Nov. 2013
Rosaire-Belanger Sports Center – Riviere-Bleue, Qc, Canada. Complete Nov 2013
Cynthia-Coull Arena – Longueuil, Qc, Canada. Complete Nov. 2013

Direct CO2 Systems
Arena Marcel Dutil, Les Costeaux, Qc, Canada. 1 Sheet. 2010.
Concordia College, Montreal, Canada. 1 sheet, 600 seats. Recently completed.
St-Gedeon-de-Beauce Arena, Canada.
Isatis Sport Chambly, Chambly, Qc, Canada. 3 sheets, Completed July 2012.
McDonald Center, Eagle River, Alaska – start-up in fall of 2014

30+ direct CO2 or Ammonia/CO2 systems in Europe
CO2 ice rink systems started in the year 2000 in Europe.

Efficiency: Compared to HFCs, ammonia and CO2 refrigerants are significantly more efficient, providing greater capacity at less horsepower. The winner between ammonia and CO2 is less clear. It has been shown that CO2 is most efficient in colder climates. As the ambient temperature rises above CO2's critical temperature of 86 F, the capacity and performance of the system drops mainly due to the change from subcritical operation (condensing with gas cooler) to transcritical (no condensing takes place). It has been determined that, in general, the efficiency of CO2 based ice systems is greater than HCFC-based systems.

A technical paper presented at the 2013 Industrial Refrigeration Conference and Exhibition presented by the International Institute of Ammonia Refrigeration (IIAR) concluded that an indirect ammonia/glycol ice system with waste heat recovery is the best solution from an energy perspective when compared to a transcritical CO2 system and an ammonia/glycol system without waste heat recovery systems.

In contrast, a September 2012 Master of Science Thesis paper on "Carbon Dioxide in Ice Rink Refrigeration" by Tuyet Nguyen at the KTH School of Industrial Engineering and Management, Stockholm, Sweden showed through simulation that *direct* CO2 systems in ice rink applications is 30% lower in energy consumption than an *indirect* ammonia/brine system and 46% lower than and *indirect* CO2/brine system. CO2 systems also had the highest energy savings in regards to waste heat recovery potential. The study also concluded that the overall life cycle of a direct CO2 system is approximately 13% lower than an *indirect* ammonia/brine system. Finally, it was noted that a direct CO2 system has the high potential to be the next generation refrigeration system in ice rink applications but the transcritical working may restrict it to cooler climates.

In both cases, significant modeling was performed with numerous scenarios. It is likely that, as the rapid development of CO2 in the supermarket industry continues and further development of CO2 transcritical (both subcritical and supercritical states of operation) technology progress, greater system efficiencies will be realized in the near future.

Environment: Both ammonia and CO2 are naturally occurring refrigerants with zero ozone depleting potentials (ODP). The global warming potential (GWP) is zero for ammonia and one for CO2.

System Charge: The following table lists approximate system charges for the proposed ice systems with various refrigerants. One main restriction when using CO2 direct systems is current industry codes restrict the amount of refrigerant in a system based on arena volume or space. Depending on the size of the facility, a direct CO2 system may not meet code requirements.

Table 3. Typical System Charge for Single Ice Sheet

Refrigerant	Charge (pounds)
Ammonia (indirect)	400-600
HFC (indirect)	600-1,200
CO2 (indirect)	500-600
CO2 (direct)	4,000–5,000

Composition: While ammonia and CO2 are natural or "pure" refrigerants, the HFC refrigerants replacing R-22 are "blended" refrigerants, meaning they are a mixture of several different, individual refrigerants. Since refrigerants have different properties, each one reacts differently to changes in its properties, such as pressure and velocity. When a leak occurs, varying amounts of each refrigerant may leak out, throwing the original mixture out of balance and potentially forcing the replacement of the entire charge, rather than simply adding the amount that was lost.

Safety: HFC refrigerants have the least safety concerns of the refrigerants that are discussed in this report, although they can be difficult to detect without a leak detection system. Ammonia on the other hand, is considered a high health hazard because it is corrosive to the skin, eyes and lungs. Exposure of 300 parts per million (ppm) is immediately dangerous to life and health. It can be explosive if released in an enclosed space with a source of ignition or if the vessel is exposed to fire. It is fortunate that ammonia has a low odor threshold (20 ppm) forcing people to seek relief at much lower concentrations, and because if its efficient composition, the system charge can be significantly reduced. Ammonia has mild flammability. There are also safety devices and systems available to help detect, signal, and prevent dangerous situations.

CO2 is a non-toxic, non-flammable and non-explosive gas. The one disadvantage of using CO2 in ice rink applications is the operating pressures are between pressures of 300 and 1800 psi compared to ammonia and HFC-based systems that operate at maximum pressures of 300-350 psi. The following is table comparing CO2 and ammonia safety limitations.

Table 4. Refrigerant Safety Limitations

Parameter	Ammonia	CO2
TLV (Threshold Limit Value)	25 ppm	5,000 ppm
STEL (Short Term Exposure Limit)	35 ppm	30,000 ppm
Revised IDLH (Immediate Dangerous to Life and Health)	500 ppm	40,000 ppm
LFL (Lower Flammability Limits)	15%	Non-flammable
GROUP (ASHRAE, 1992)	B2 Toxic	A1 Non-Toxic

Cost: The increasing environmental regulations are certainly impacting the price of R-22. As the industry experienced in March of 2012 when the price suddenly jumped overnight from $7 per pound to $13 per pound. Replacement or "drop-in" refrigerants for R-22 are currently on the market and becoming more available at a cost of approximately $15 to $18 per pound. Ammonia and CO2 are currently $1.50 per pound.

Additional Regulations:
Regulations on HFC refrigerants would be similar to the existing R-22 system. Ammonia is probably among the most regulated refrigerants. For example:

- Facilities containing 500 pounds of ammonia or more must be reported to the local emergency planning committee. **A new system at Neilson Reise will operate with less than 500 pounds.**

- Facilities containing over a threshold quantity (TQ) must submit a risk management plan to the U.S. Environmental Protection Agency. Typically TQ around 10,000 pounds.
- Losses of over 100 pounds must be reported to the National Response Center within 15 minutes.

Since CO2 is very new to the ice rink industry in North America, it will likely be regulated similar to an ammonia-based system. This assumption was used in this evaluation and in determining cost estimates.

Reporting a Release of R-22

With the existing aging R-22 direct refrigeration system at the facility it is important to understand the reporting requirement if a release occurs. There are requirements for governments, local authorities and facilities to report hazardous and toxic chemicals. For accidental releases of refrigerant a report must be filed under the Emergency Planning and Community Right-To-Know Act (EPCRA). For an ice system, the reporting trigger leak for CFC (e.g. R-12) or HCFC (e.g. R-22) type refrigerant is 35 percent annually. The Environmental Protection Agency, under the Clean Air Act (Section 608), also requires a report for the release of HCFC type refrigerants.

There are government regulations for repairing leaks in a refrigeration system. If during the course of a 12-month period, an appliance is leaking refrigerants beyond the trigger rate, the owner must take action to repair it. In general, the owner needs to make suitable repairs to the appliance within 30 days of finding out about the leak. Or, make plans to retrofit or retire the appliance within 30 days, and act on the plan within a year of the plan date.

Other Considerations

It is recommended that prior to making a change in the type of refrigerant that is used, that the proposed changes be reviewed in detail with the Owner's insurance carrier, the fire marshal, fire department and other interested parties.

2. *Selection of Secondary Refrigerants:* There are two main secondary refrigerants that are used for ice arena applications, **calcium chloride** (often referred to as "brine") and **ethylene glycol**. In some cases, although fairly rare, **propylene glycol** is used. A diluted **ammonia** solution is being used in Europe with increased frequency. A comparison of the secondary refrigerants provided below.

   Efficiency: The efficiency of the secondary refrigerant is determined by a number of factors including thermal conductivity, specific heat, fluid flow characteristics, surface area, etc. Calcium chloride is a salt and water mixture. The chemical properties of the calcium chloride solution allow it to be pumped easier and to transfer heat at a higher rate than glycol. Therefore, the refrigeration equipment can be reduced in size. This leads to an overall system efficiency of 8% of 12% greater than ethylene glycol. Propylene glycol is less efficient than ethylene.

   Environment: Since calcium chloride is a mixture of salt and water it poses little harm to the environment if a leak or spill occurs.

   Ethylene glycol on the other hand will remain in high concentrations in the soils for long periods of time. Propylene glycol is less toxic than ethylene glycol. It is a food-based glycol that is much more environmentally friendly than ethylene glycol.

Corrosiveness: The disadvantage of using calcium chloride is that it can become corrosive when exposed to air. Systems using calcium chloride require more monitoring and maintenance. Once mixed with ammonia refrigerant, the corrosiveness increases substantially and potentially turns into a hazardous chemical. There are inhibitors that are mixed with the solution to aid in corrosion prevention and many rinks in North America have used this solution for 50+ years. Glycol on the other hand is not corrosive.

Typically, the types of heat exchangers available for use with CO2 systems are limited because of the higher operating pressures and usually require a glycol solution.
Cost: At a mixture of 21% concentration, calcium chloride is approximately $1.00 per gallon compared to glycol, 35% concentration at $9.00 per gallon. A new indirect ice system for this facility will require approximately 4,000 gallons of a secondary refrigerant.

Monitoring: A more extensive monitoring program will be required with calcium chloride than with glycol and generally requires sampling and testing once or twice a year.

3. *Quality of Materials and Equipment:* Balancing the initial cost of materials and equipment with energy savings can be difficult during the budgeting process of the project. For example, the phrases "commercial grade" and "industrial grade" systems, used throughout the report, refer to quality and operational efficiency differences in the refrigeration system.

   Commercial grade systems are similar to supermarket type refrigeration systems, built on a rack package, and have a lower life expectancy (15-20 years). These systems typically use copper and PVC pipe in place of steel; disposable type compressors in place of rebuildable ones; direct expansion type heat exchangers in place of flooded type systems; etc.

   Industrial grade systems are typically stick built on site, have a longer life expectancy (25-35 years), and are generally more efficient to operate.

   For the **ice rink floor**, there are several different types of piping arrangements and designs to consider. For example, the traditional design of rink floor piping systems used clamped connections using hose clamps to connect the poly rink piping to a steel header system. Around 1995, the industry replaced the hose clamp connections with heat fused connections, similar to what the natural gas companies' use for their pipelines. Fusion weld technology has eliminated the need or use of corrosive materials in the rink floor and provided the opportunity for a virtually seamless piping system that can extend the life of the rink floor from 25 years to over 40 years.

   Another important choice is the selection between the use of steel pipe or polyethylene pipe. Polyethylene pipe is significantly less cost but does not transfer heat as efficiently. For most community based rinks, polyethylene pipe is the most cost effective pipe material. For larger venues, steel pipe systems are preferred.

4. *System Design:* A thorough design of the ice system is critical in maximizing its efficiency. Examples of design elements that should be thoroughly evaluated during the design phase include:

- *Lowering condensing temperatures.* Lowering the condensing temperature of the refrigeration system increases its efficiency but decreases the amount of waste heat that is generated.

- *Liquid cooler.* A liquid cooler is a large cooling system that is installed outside the ice arena and takes advantage of cold air temperatures and is most applicable in colder climates. Brine is circulated through the unit when the air temperature is lower than the ice temperature set point.

- *Compressor options.* Depending on the refrigerant selection, there is typically more than one option for the type of compressor that could be used including semi-hermetic, open drive or reciprocating, screw, etc. Continuous advances in technology are increasing the number of options available for ice rink applications.
- *Floating head pressure.* Allowing the head pressure of the system to vary based on ambient temperatures can provide a significant energy savings over a fixed setting. However, this results in less waste heat being available from the system and, in one recent study, has been shown to have an overall negative effect on energy savings. *Variable frequency drives.* The use of variable frequency drives on pumps and compressors can be beneficial not only for energy savings but control of ice temperatures as well.

- *Variable frequency drives.* The use of variable frequency drives on pumps and compressors can be beneficial not only for energy savings but control of ice temperatures as well.

- *Controls.* System control options range from very basic to a complete integrated building or energy management system.

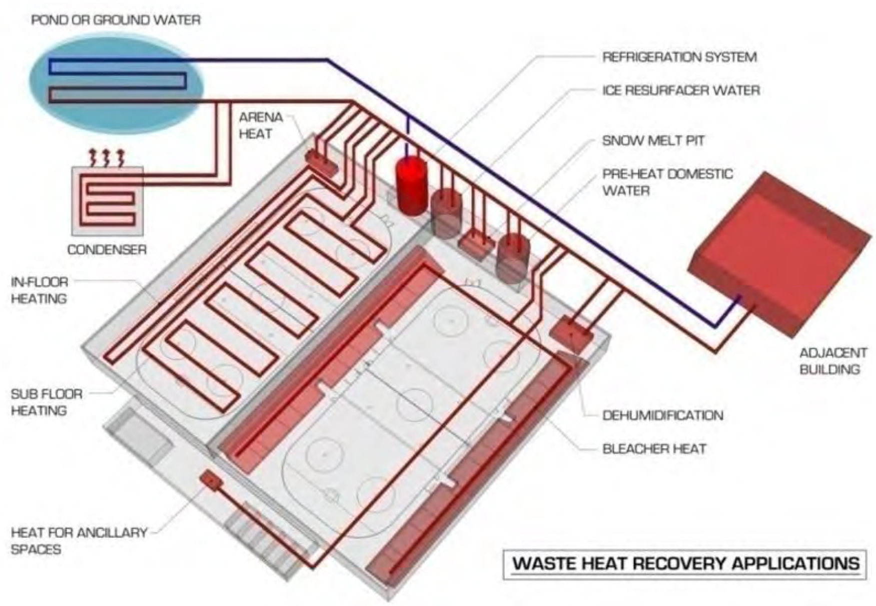
Finding the balance between system and equipment options is key to a successful and efficient design.

5. *Energy Source:* As energy costs rise, alternative sources of energy, such as geothermal, natural gas, or co-generation, may look more attractive. Electricity still remains the most practical energy source for these types of systems. Stevens has designed several geothermal systems and can provide information on these systems if desired.

6. *Waste Heat Recovery:* Refrigeration systems generate a large amount of heat that is typically wasted into the atmosphere. A refrigeration system for a single ice sheet can typically generate enough waste heat to serve the subfloor heating system, snowmelt pit, the dehumidification system, and potentially preheat domestic water source or in-coming air. Historically, ice rink facilities have only captured and reused approximately 25% of the waste heat generated. It has now become normal design practice in the ice rink industry to capture 90% or more of the waste heat and reuse this “free energy” throughout the facility. While all ice rinks have a demand for heat during most, if not all of the season; the heat recovery systems are especially beneficial for arenas where the greatest heat is required for the longest period of time (e.g. northern U.S. and Canada). At least one recent major study shows that systems that recover waste heat and use it throughout the facility will operate much more efficiently than systems that do not.

Table 5. Estimated of Total Waste Heat Available

Units - MBH	Winter	Spring/Fall	Summer
1 sheet	410	550	700
2 sheets	800	1100	1500



Some uses for waste heat include:

Snow Melt Pit Operations (basic heat recovery): This is a very common use of the waste heat. In this option, waste heat is captured from the refrigeration process through the use of a heat exchanger which will reject the heat into a solution of glycol and water. The glycol solution is then pumped to a coil located in the snow melt pit. This process will eliminate or greatly reduce the use of other sources of heat such as natural gas or electric boiler systems.

This system will also eliminate the need to melt snow with hot water from the domestic water system which is often installed as a band-aid for an underperforming or broken system. A boiler can be connected to the waste heat system to provide snow melting when the ice plant is turned off.

Subfloor Heating System (basic heat recovery - frost prevention system): This is another very common use of waste heat. In this option, waste heat is captured from the refrigeration process through the use of a heat exchanger which will reject the heat into a solution of glycol and water. The glycol solution is then pumped through a system of pipes located beneath the ice sheet and insulation system. The subfloor heating system prevents the ground from freezing below the ice rink floor. Frost heave is a common problem with the *direct* Holmsten Ice Rink systems, especially for the earlier installations where the piping systems used thin walled pipe and hose clamps and had a high failure rate.

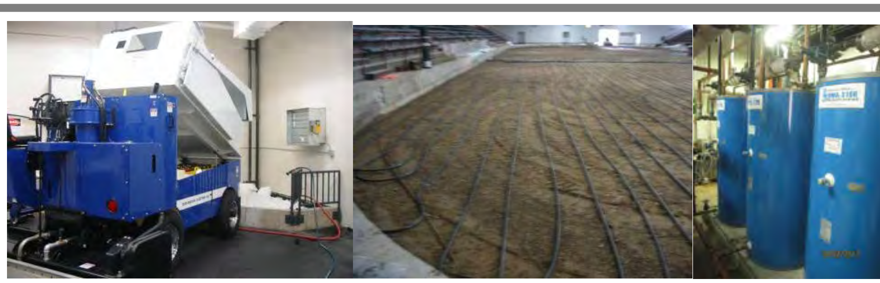
Domestic Hot Water Preheat (enhanced heat recovery): In this option high temperature waste heat is captured from the refrigeration process through the use of heat recovery water heaters. The water heaters are specifically designed to capture heat from the refrigeration systems. The system has proven to greatly reduce the domestic water heating needs of the facility.

Resurfacer Water Preheat (enhanced heat recovery): Most ice arena facilities have water heaters dedicated to providing the ice resurfacers with hot water for flooding and resurfacing the ice sheet. A waste heat recovery system could be installed that is similar to the domestic hot water preheat system described above.

Building Heat (enhanced heat recovery): Waste heat can be used to offset the heating needs of the building. Ice arenas require heat on nearly a constant basis. In this option waste heat is captured from the refrigeration process through the use of a heat exchanger which will reject the heat into a solution of glycol and water. The glycol solution is then pumped over to a heating coil located in an air handler unit. The air handler can run whenever the refrigeration system is operational. This process is attractive because it presents a nearly constant use for the waste heat.

This option is viable for most refrigerant systems and becomes even more viable for the CO2-based refrigeration system. The CO2-based refrigeration system operates at very high pressures and the heat rejected from the system will be at correspondingly higher temperatures. It is much less expensive to use the waste heat when it is at the higher temperatures provided by the CO2-based refrigeration system. However, waste heat from CO2 systems can be limiting when ambient air temperatures are higher.

Exterior Snow Melting System: Waste heat can also be used for exterior snow melting use. Piping can be installed in sidewalks or ramps and waste heat from the ice plant can be used to keep the surfaces clean of snow and dry. This can be a good use of the waste heat but its use is limited to a small percentage of the total hours available in a year.



Picture Window 10. (Left to right): snow melt pit, subflooring heating, preheating water

During the design phases of each project; the facility's layout and potential use for waste heat from the refrigeration system should be evaluated in depth to determine the benefit of each system.

7. *Sustainability:* Sustainability goes hand-in-hand with all the items in this list of considerations. Energy savings, through smart design practices, translates directly into the reduction of green house gas emissions such as carbon dioxide. There is an opportunity for the City to lower the carbon

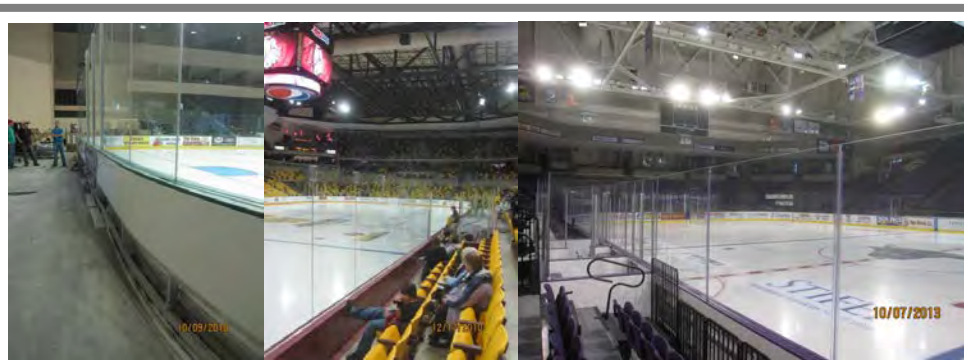
footprint of the ice arena by reducing or eliminating the use of HCFC refrigerants and increasing the use of waste heat from the refrigeration system.

Other recommended improvements to the existing ice and refrigeration system.

- *Install waste heat recovery systems.* See previous discussion on options.

- *Replace dasher board system.* The useful life of a dasher board system depends on the quality of construction, maintenance, timeliness of the repairs, and the amount of moisture in the ice arena, and therefore, can be difficult to determine. Generally, the useful and safe life ranges between 15-20 years. In some cases, dasher board systems are replaced because of new technology and options that are available such as:
  - Seamless or supportless glass systems. These systems are installed in most NHL rinks and many college and community rinks. However, these systems are more rigid than the traditional supported or posted systems;
  - Framing systems. Options include steel or aluminum framing systems. Steel is the traditional material and is considered to be more durable. However, aluminum systems have improved tremendously providing a corrosion resistant and lighter weight system. Aluminum is the preferred system when frequent assembling and disassembling is required;
  - Tempered glass shielding providing clearer viewing and reducing maintenance over acrylic shielding. Tempered glass shielding is currently about the same cost as acrylic shielding; and
  - Lift out panels for indoor soccer nets on the ends of the rink or for access to the rink floor during dry floor activities.

  Many advancements have been made in dasher board system technology over the past 10 years. Not only should the new system be designed to improve spectator viewing and installation and take-down efforts, but more importantly, to improve player safety.
  - Acrylic shielding system. The new acrylic shielding systems have been designed to better resist scratching and discoloring and provide the greatest flexibility of all the shielding systems. These systems are currently being installed in most NHL rinks and will eventually be installed in many college facilities. Framing systems. Since the dasher board system in this facility will remain in place, either steel or aluminum framed system will work well.
  - Flexible glass or frame systems should be considered to aid in reducing injuries especially at the ends and radii of the rink.
  - Soft caprail. This is fairly new product that was recently introduced by one manufacturer and is marketed to reduce head injuries. The product has a life span of approximately 5 years.
  - Recessed kickplate in place of the traditional kick plate that protrudes out ½ inch from the face of the dasher panel.



Picture Window 11(left to right): flexible frame and glass system, seamless tempered glass, acrylic shielding

- *Flood water systems for resurfacing:*
  - *Water Quality.* Water quality has a direct relationship with energy use, performance and aesthetics. Purer water takes less energy to freeze, is more dense and therefore, provides greater structural integrity. The denser the ice, the faster it plays. The players want to be on the surface and not in the ice so ice density is very important. It's possible to lessen the thickness of the ice by a quarter inch or more with using clean water. This in turn saves energy. The Department of Energy found that for every 1-inch of ice thickness required, the refrigeration system demand increases by 8 to 15 percent. Typical ice thickness is 1.5 inches.
  - *Water Temperature*. There is a general rule of thumb that states for every one degree (F) rise in ice surface temperature, there is an energy savings of 4 to 6 percent on the refrigeration system. Ice temperatures can typically be raised by 2 to 4 F higher using treated water over untreated water for a total overall energy savings of 8 to 12 percent depending on programming, weather, length of season, etc. The traditional standard temperature for flood water is 120-165 F. However, some facilities use temperatures as low as 80-90 F.
  - *Water Treatment*. A common water treatment system that is used in ice arena facilities today (mainly collegiate and NHL facilities) is based on a reverse osmosis (RO) process. Typical water hardness readings between 50-80 ppm (3 to 5 grains) are desired. For water with readings higher than this, treatment is recommended. The City's water quality reports should be reviewed for a possible application at Sullivan Arena.

<u>Ice System Replacement Options - Recommendations</u>
The following improvement and replacement options were evaluated in this study.

Option 1: *Do Nothing – Maintain Existing Systems.* The City may elect to keep operating the existing refrigeration system. The existing *direct* refrigeration ice system, manufactured and installed by Holmsten Ice Rinks; was commonly installed in arenas during the 1970's and 80's. The design of this *direct* ice system is unique and has proven to perform very well and operate very efficiently. However, this type of system is outdated and numerous concerns exist with the basic system design and current code regulations. These concerns include:

Some of the potential downsides, or risks, involved in continuing to operate the existing system for too much longer are as follows:

- *On-going Maintenance and Equipment Costs:* The equipment and parts on the refrigeration system will continue to require replacement in the near term. It's similar to driving a vehicle with high miles; the longer it runs, the more costly it becomes to repair and the lower the return on investment. Parts for the existing York compressors are no longer manufactured and becoming extremely difficult to find and costly to purchase. Some valve manufacturers (like Sporlan) no longer manufacture some of the valves used on the system. Major improvements to the existing refrigeration system will soon be required to extend its safe and useful life.

- *Safety:* The *direct* ice system circulates R-22 refrigerant in the ice rink floor, which is located in the occupied space of the facility, potentially exposing hundreds of spectators, skaters, and workers to leaking refrigerant as the floor system ages. However, the rink floor is fairly new so leaks are less of a concern at this time.

- *Dependability:* The risk of problems occurring with the refrigeration system, and therefore, the risk of losing the ice sheet, increases as the system ages.

- *Cost and future availability of refrigerant:* As the system ages, the risk of a major release of refrigerant increases. A single *direct* system contains approximately 6,000 pounds of R-22 refrigerant with a replacement costs (refrigerant only) currently ranging from $60,000 to $120,000. As the phase-out date for R-22 approaches, the cost will continue to increase. Since 2005, the cost of R-22 refrigerant has risen 850%. Depending on the availability of R-22 when this occurs, the City may be forced to install a new blended refrigerant which will require additional modifications to the system.

- *Environmental:* The existing system uses a large volume of R-22 refrigerant (approximately 6,000 lbs) with a high global warming potential (GWP) rating. R-22 refrigerant is scheduled to be phased out of production in the near future.

Option 2*: Make Improvements to the Existing Systems.* Holmsten Ice Rinks provided good quality vessels (e.g. high pressure receiver, pumper drums, etc.) with their systems. This opens up the option of renovating the existing refrigeration system to extend its useful, dependable, and safe life. This option has successfully been performed at several facilities such as Gustavus Adolphus College, University of Minnesota-Duluth and others.

If the existing refrigeration system(s) is going to remain in place, whether in its current operation as a *direct* system, or converted into an *indirect* ice system, we recommend the following improvements be performed on the existing refrigeration system.

- *Replace relief valves on all vessels:* Relief valves are required on all high pressure vessels and should be replaced every five years. These are important safety devices and should be maintained on a regular basis. This work will include installing pressure reliefs on the pumper drums which were not typically installed.

- *Replace and install monitoring devices on the refrigeration system:* Quality monitoring devices such as pressure, temperature and pressure gauges are extremely important in monitoring and troubleshooting the system. These devices will allow the facility's staff to more accurately assess and adjust the performance of various systems and to pinpoint problem areas.

- *Investigate the integrity of the existing steel vessels and piping systems:* Corrosion along the bottom of the low pressure receiver is common in these systems and is visible by staining on the jacket or covering of the insulation systems. The extent of any corrosion cannot be determined without removing the insulation. The recommended repair includes: removing several sections of the existing insulation on the system; conducting a visual inspection of the vessels and piping; and conducting a non-destructive ultra sound tests of the steel. If high levels of corrosion are found, the entire insulation system should be removed; the surface of the vessels and piping should be sanded, primed, painted; and then the entire system should be re-insulated.

  If the steel vessels and piping systems are found to be in good shape, this system could last another 15 or more years with the other recommended improvements completed and with continued proper maintenance.

If extensive corrosion is found, the vessels should be repaired and recertified and/or replaced and piping should be replaced before reinsulating. Poor insulation can aid in pre-mature corrosion and loss of efficiency.

- *Replace dump solenoids on each pumper:* The coils in the existing solenoid valves (typically Sporlan) have a tendency to dry out. Solenoid valves manufactured by Hanson or Parker seem to work better for this application and reportedly have fewer problems. Replace one valve on each pumper drum.

- *Replace vent solenoids on each pumper with same materials:* Inspect and replace the existing valve (typically a Sporlan MA50) with same model. This valve cannot be replaced with a higher quality valve as manufactured by Hanson due to the inadequate space.

- *Replace compressors:* Parts for the existing York compressor can be difficult to find since they are no longer in production. These compressors can be rebuilt and reused for well over 30 years. However, if the compressors need replacement, they should be replaced by compressors that can be used in a future refrigeration system.

Option 3: *Convert existing direct system to an indirect, industrial grade, R-22 or other hydrofluorocarbons (HFCs) based system using the existing refrigeration equipment.* Only recently has this option proven feasible for converting Holmsten refrigeration packages from *direct* to *indirect* systems while using the existing refrigeration equipment.

The option includes converting the existing refrigeration system to an *indirect* system by installing a new heat exchanger and rink pumps. This option includes reusing the existing low pressure receiver, pumper drums and piping, and main motor control center. The existing system would be updated as recommended in Option 1. The existing ice rink floor would require replacement under this option.

This option will substantially reduce the charge of R-22 in the system to approximately 1,000 pounds. A reduction from 6,000 to 10,000 pounds of R-22 down to 1,000 pounds of R-22 will noticeably reduce the facility's carbon footprint. The City could store the extra R-22 refrigerant for future use.

Option 4: New *indirect*, commercial grade, HFC based system. Replace all ice system components with a new commercial grade, direct expansion chiller, blended HFC refrigerant, semi-hermetic compressors, pumps, and concrete rink floor.

Option 5: *New indirect, industrial grade, HFC system.* This option includes replacing the entire refrigeration system and concrete ice rink floor with an industrial grade flooded chiller, new blended HFC refrigerant, reciprocating compressors, pumps, and concrete rink floor. This system is similar the construction of the existing ice system for Rink 2 at Dempsey-Anderson Ice Arena.

Option 6: New *indirect*, industrial grade, ammonia based system. This option is the same as Option 5 but replaces the use of a new blended HFC type refrigerant with ammonia refrigerant. This option typically requires more extensive modifications to the refrigeration room to meet safety and code requirements.

Picture Window 12(left to right):
Option 3 – Convert to indirect using existing equipment – University of Minnesota-Duluth
Option 4 – Commercial grade refrigeration system.
Options 5 & 6 – Industrial grade, “stick-built”, refrigeration system.

Options 7 and 8: *New indirect or direct, carbon dioxide (CO2) based system.* Continuing the discussion from the refrigerant discussion earlier in the report, the use of CO2 refrigerant will likely be the next substantial “innovation” in the ice rink industry. Currently European countries are using CO2 as a secondary refrigerant in twenty four ice rink applications. Several rinks in Canada just recently installed *direct* CO2 system. CO2 applications in the U.S are rapidly increasing mainly in the supermarket industry. However the selection of equipment is limited and the regulatory codes are still under development.

The use of carbon dioxide as the primary refrigerant changes the type of refrigeration equipment presented in previous options. CO2 systems will be provided on equipment or skid packages as shown in the photographs in this section. The existing ice equipment room will likely be able to accommodate a system with the required capacity for this facility but space requirements need to be confirmed.

Because this is a new technology and application, there is fairly limited information on the systems. The cost estimates should be updated as the desired project date approaches.

The most efficient CO2 system is the *direct* system where CO2 is circulated throughout the rink floor. This type of system has been successfully installed, in the past year, in a facility in Montreal, Canada. The rink floor is constructed with stainless steel tubing with mechanical connections at 4 inches on center. The main concern and relatively unknown is the cost and durability of the rink floor materials. The alternate stainless steel pipe is poly coated copper piping as is used in many of Europe’s CO2 based ice rinks.

In addition to its efficiency, the waste heat that is generated from these systems ranges from 140-170 F as compared to an HFC or ammonia system where the majority of the useable waste heat is at temperatures of 80-85 F. The higher temperature waste heat allows the heat recovery systems to be sized up to 20% smaller than standard systems.

It is recommended that a CO2 refrigerant based ice systems be seriously considered. If the City is interested in pursuing the use of CO2 refrigerant, we encourage a site visit to at least one facility that is currently using this type of system along with in-depth discussion with the facility's management and operation personnel and manufacturer's representatives. Possible locations include:

- Quebec and Montreal Canada – CO2 based ice systems
- Sweden – direct Ammonia/CO2 ice systems and CO2 equipment manufacturers.
- Eagle River, Alaska – First CO2 ice system to be in operation November, 2014.

Presented in the table at the end of this section are cost estimates for a *direct* CO2 system for a single rink application Option 7.

<u>Ice Rink Floor - Recommendations</u>

The ice rink floor is only 9-years old. In Options 3-7 the ice system would be converted from a direct to an indirect system. This requires the rink floor to be replaced. Option 8 (CO2 direct) may allow the rink floor to be reused. Stevens is currently exploring this as an option for rink owners that have newer direct rink floors like the City of Bemidji.

<u>Cost Estimates – Existing Ice System</u>

The costs of the recommended improvements are summarized below and are total project costs. A more detailed description of the cost estimate is located in the Appendix.

Table 6. Ice System Improvements/Replacement Options Cost Estimate Summary

Item	**Cost**
Option 2 – Improve existing system	$427,082
Option 3 – Convert existing R-22 to indirect system	N/A
Option 4 – New HFC commercial grade indirect system	$1,974,435
Option 5 – New HFC industrial grade indirect system	$2,184,770
Option 6 – New ammonia industrial grade indirect syst	$2,218,695
Option 7 – New CO2 indirect system	$2,252,260
Option 8 – New CO2 direct system	$2,524,020ss

Section 6
Site

SITE

General

The Neilson – Reise Ice Arena is located at 1115 23rd Street Northwest in Bemidji, MN.

Observations

We walked the site to get an understanding of the existing site conditions. The ice arena and curling club shares a parking lot with the City Park located to the East and South of the existing ice arena. Currently the curling club and ice arena share an entry between the two facilities. The parking lot is relatively new and in excellent condition. The City Park includes a community building with restrooms and concessions and also provides access to an outdoor hockey rink located just to the east.

Arial Photo of Site

The site is relatively flat and is not very conducive to water drainage away from the facility. The exterior should be visually expected periodically for any excessive settlement or drainage compromises to minimize the chance of water migrating back into the building. If this happens the soils below the refrigerated ice slab could become saturated. If the soils get saturated the potential for movement of the ice slab and building structure is greatly increase do to potential frost heaving.

Overall, the site is well maintained and utilizes the available site very well by sharing the parking infrastructure. No immediate improvements to the site are anticipated.

Appendix A

Dehumidification Replacement Letter

Nelson-Rudie & Associates, Inc.
Structural - Mechanical – Electrical
Consulting Engineers

July 7, 2014

Mr. Scott Ward, P.E.
Stevens
2211 O'Neil Road
Hudson, WI 54016

Re: Neilson-Reise Arena Ice and Curling Rink
Bemidji, Minnesota
Condition Study
NRA Project No.: 14-056

Dear Scott:

We recently toured the Neilson-Reise Arena Ice and Curling Rink located in Bemidji Minnesota to review the condition of the existing mechanical systems. During our site visit we were requested to prepare preliminary recommendations for the ice rink dehumidification systems. The following items were noted pertaining to the existing arena dehumidification system:

1. Existing Conditions
   a. The arena is operated with year round ice.
   b. The arena uses a natural gas powered ice resurfacer which off gasses the products of combustion into the arena.
   c. The arena envelope has numerous cracks in the envelope which allow humidity to infiltrate into the building.
   d. The arena is heated with gravity vented gas fired unit heaters. The heaters have flues which are open to the exterior of the building. This allows a path for humid outside air to infiltrate into the building. It also allows moisture to condense and accumulate on the inside of the unit heater causing issues with the life and operation of the unit heaters.
   e. The ice arena portion of the building is dehumidified with a Rink-Drier brand dehumidifier manufactured by Holmsten Ice Rinks. The dehumidification unit is nearly 50 years old and no longer functions properly. It has well exceeded it's expected service life and should be scheduled for replacement.

Scott F. Rudie, P.E
John R. Brison, P.E.
Joseph M. Pearce, P.E.
Frederic A. Decourt, P.E.
Andrew N. Erdmann, P.E.
Jeffrey A. Piehl, P.E., P.Eng., LEED AP BD+C
Michael D. Woehrle, P.E., P.Eng., LEED AP BD+C

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www.nelsonrudie.com

f. The arena is ventilated with a wall mounted exhaust fan and intake louvers with manual volume dampers. This ventilation system allows hot, humid air to be directly introduced into the arena during the summer and untreated cold winter to enter the arena during the winter. Both conditions are undesirable and can lead to poor arena conditions.

2. We recommend the following improvements be considered for the Ice Arena portion of the building.

   a. Remove the existing dehumidification unit and replace it with a new high temperature, desiccant based dehumidification unit. The unit should be sized to adequately dehumidify the arena on a year round basis. The least expensive dehumidification option would include a dehumidification system with minimal outside air and no building heating system. We estimate the cost for this type of system to be approximately $175,000.

   b. Consider removing the arena exhaust fan and intake louvers and properly sealing the existing openings. Arena ventilation air for occupant breathing and contaminant removal should be introduced into the building through the new dehumidification system. This will allow the outside air to be heated and dehumidified before it is introduced into the arena. This will increase the cost of the first cost of the project but it will improve conditions in the arena. All outside air will be introduced through the dehumidification unit. The humidity will be removed from the air before it ever enters the building. This is highly preferable to the current installation which uses wall intake air louvers for the ventilation air. We estimate that adding the ventilation system with controls to the unit will increase the cost by approximately $20,000. We strongly suggest this option be implemented.

   c. Consider removing the gas fired unit heaters and replacing them with a gas heating section designed into the new dehumidification system. This option will remove the flue opening through the roof. It will also result in warmer air being distributed into the arena which will feel less drafty than untreated air being introduced into the arena. We estimate that this option will increase the cost by approximately $25,000.

   d. Provide new controls that will allow the dehumidification to automatically dehumidify the arena, heat the arena, and modulate the outside air to prevent contaminants from accumulating in the building. This option will increase the project cost by approximately $5,000.

   e. Consider tightening up the envelope of the building. This would include adding weather stripping to doors, sealing cracks, replacing dampers and other issues that may be identified in the building envelope. Tom suggested we carry $10,000 for thjis item.

Please review the above data with the arena staff and let us know if any additional data is needed. Lead time on the equipment is normally 10 to 12 weeks so getting a system installed for this summer will be difficult. We understand that the arena is having humidity problems and will be happy to work with the Owner to get a solution implemented as soon as possible.

Yours very truly,

Michael D. Woehrle, P.E., P.Eng., LEED AP

Enclosure

Appendix B
Investigation Methods, Documentation, Codes and References

Investigation Methods and Documents

Various methods were used to evaluate the existing facility including:

Visual Observations and Meetings: Site visits and meetings were conducted on the following dates: May 23, 2014. Stevens has previously designed improvements to the facility and has been on-site numerous times prior.

Interviews: During the on-site visit, in-depth discussions were conducted with the facility's management and operational staff to document existing issues with the facility and discuss historical problems with its systems.

Research: Where applicable, additional research was conducted to provide accurate and detailed information regarding improvements or systems recommendations.

Documents: The following documents were received and reviewed for the evaluation:

Existing Drawings:

- Partial Original Drawings – 1967
- 1972 ice rink floor plans
- 1981 addition plans
- 1986 – Refrigeration and rink floor plans
- 1987 addition – plumbing plans
- 2005 remodel plans
- 2005 ice rink floor replacement

Reports, Studies, Memos:

- None

Codes, Standards, and Guidelines Applicable to the Project

The following Codes generally apply to projects of this scope and may or may not be enforced by the City:

- 2006 Life Safety Code, as amended
- 2011 NRFA 70 National Electric Code, as amended
- 2009 Minnesota State Building Code, including Chapter 1341 Accessibility Code
- 2007 Minnesota State Fire Code (2009 International Fire Code)
- 2009 Minnesota State Mechanical Code (2006 International Mechanical Code)
- 2009 Minnesota State Plumbing Code
- 2007 NFPA 13 -Sprinkler Systems
- 2007 NFPA 72 – National Fire Alarm Code
- ASHRAE 90.1 – 2007 Energy Standard
- 2010 ADA Standards for Accessible Design as Required to Comply with Section 504 of US Rehabilitation Act of 1973 title II of Americas with Disability Act of 1990, Updated September 15, 2010
- Department of Labor & Industry – High Pressure Piping and Code for Power Piping Systems, Chapters 326 (MN Statues 1999) and Chapter 5230 (MN Rules 2001)
- ANSI/ASHRAE Standard 15-2013
- ANSI/IIAR 2-2008 (Includes Addendum A1)
- The City's CODE OF ORDINANCES were not reviewed or referenced for this evaluation.

Appendix C
Cost Estimates

Estimated Project Costs

The proposed cost estimates presented throughout this report were developed by estimating the probable construction costs based on similar types of construction projects and work performed and bid in 2009-2014 and updated for 2015 costs unless otherwise noted. The estimated costs include all materials and labor for a complete installation unless otherwise noted. Costs will vary depending on the time of year the projects are bid, the current economic climate and the size of project.

In addition to the probable construction costs of the proposed work, other associated project costs are included to provide a total estimate cost for the project. The Estimate, Design and Construction Contingency line item in each cost table is included during the preliminary phase of design projects because the exact scope of the project has not yet been determined. This percentage is typically reduced from 10% to 5% during the final design phase of the project.

The Engineering, Legal, Financial and Administrative line item in each cost table is provided to cover all work performed by the design team, geotechnical services and other material testing services, and all legal, financial and administrative responsibilities required by the City for projects of this type. These costs will vary based on project scope. A proposal will be provided to the City for all architectural and engineering services.

Escalation Factor and Method of Application

Where costs are projected beyond 2015, an escalation factor of 4% is applied. The escalation factor is based on current economic conditions and location, and is applied to midpoint of construction which is estimated to be July 1st of the applicable year.

Estimated Energy Savings

Estimated savings presented in this report are computed from the equipment and manufacturer's information provided to us and on Stevens experience with similar systems. The actual energy savings will depend on many factors including: conservation measures implemented, seasonal weather variations, energy price increases, and energy use practices of the facility's staff and users.

Building System Evaluation

The following are cost estimates for the building improvements discussed in Section 3 of the report.

Roof Options

Option One (20,800 SF of Roof Area)	Cost*
Demolition	$83,200
Standing Seam Metal Roof System and Insulation	$191,000
Estimate/Design/Construction Contingency (15%)*	$41,130
Engineering/Legal/Administrative Contingency (18%)*	$43,356
Total	$358,686

* These contingencies are added to provide a complete project budget picture.

Option Two (20,800 SF of Roof Area)	Cost*
Preparation Work	$30,000
Fully Adhered Membrane Roof	$208,000
Low-E Barrier (Completed in 2014)	$0
Estimate/Design/Construction Contingency (15%)*	$35,700
Engineering/Legal/Administrative Contingency (18%)*	$42,840
Total	$316,540

* These contingencies are added to provide a complete project budget picture.

Option Three (20,800 SF of Roof Area)	Cost*
Demolition	$50,000
Spray Foam Insulation and Top Coat	$182,000
Low-E Barrier (Completed in 2014)	$0
Estimate/Design/Construction Contingency (15%)*	$34,800
Engineering/Legal/Administrative Contingency (18%)*	$41,760
Total	$308,560

* These contingencies are added to provide a complete project budget picture.

Wall Solutions

Option One (9,200 SF of Wall Area)	Cost*
Metal Panel Demolition (9,200 SF)	$27,600
Insulation	$32,200
Interior Liner Panel	$77,280
Estimate/Design/Construction Contingency (15%)*	$20,562
Engineering/Legal/Administrative Contingency (18%)*	$24,674
Total	$182,316

* These contingencies are added to provide a complete project budget picture.

Option Two (9,200 SF of Wall Area)	Cost*
Metal Panel Demolition (9,200 SF)	$27,600
Insulated Rigid Foam Metal Panel	$322,000
Interior Liner Panel and Sound Insulation	$109,480
Estimate/Design/Construction Contingency (15%)*	$68,862
Engineering/Legal/Administrative Contingency (18%)*	$82,634
Total	$610,576

* These contingencies are added to provide a complete project budget picture.

Existing Refrigeration Room

Item	Cost*
Demolition	$6,000
New vestibule	$18,000
1 hour rating upgrade to wall and roof	$25,000
Estimate/Design/Construction Contingency (15%)*	$7,350
Engineering/Legal/Administrative Contingency (18%)*	$8,820
Total	$65,170

* These contingencies are added to provide a complete project budget picture.

Lobby Addition

New Lobby Addition (6,000)	Low Cost*	High Cost*
New Construction	$1,080,000	$1,320,000
Engineering/Legal/Administrative Contingency (18%)*	$194,400	$237,600
Total	$1,274,400	$1,557,600

* These contingencies are added to provide a complete project budget picture.

New Arena

New Ice Arena (32,000)	Low Cost*	High Cost*
New Construction	$5,760,000	$6,720,000
Allowance for repurposing existing lobby	$125,000	$175,000
Engineering/Legal/Administrative Contingency (18%)*	$1,059,300	$1,241,100
Total	$6,944,300	$8,136,100

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Mechanical System Improvements

The following are cost estimates for the mechanical systems improvements discussed in Section 4 of the report.

Item	Cost
Mechanical Recommendation #1 – new gas fired desiccant dehumidification system. (Completed in 2014)	$0
Mechanical Recommendation #2 – Add Demand Control Ventilation Controls to the Arena Ventilation System. (Completed in 2014)	$0
Demolition	$5,000
Ice Equipment Room Ventilation System	$45,000
Subtotal Estimated Construction Costs	$50,000
Estimate, Design, and Construction Contingency (15%)[1]	$7,500
Total Estimated Construction Costs	$57,500
Engineering, Legal, and Administrative (18%)[1]	$10,350
Total Estimated Project Costs	$67,850

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Ice System Improvements

The following cost estimates are based on the existing facility continuing the current programming and include improvements recommended in this study.

Option 2 – Improve the existing ice system. The following table provides cost estimates for the recommended improvements to the existing ice system. See explanation of each line in the description for Option 2 in the study narrative.

Ice System Option 2 - Minimum Improvements to Existing System

Item	Cost[1]
Replace refrigerant relief valves	$8,000
Replace monitoring devices (temp. and press.)	$4,700
Investigate integrity of vessels and piping systems	$4,700
Replace dump solenoid valves (3 total)	$8,000
Replace vent solenoid valves (3 total)	$8,000
Overhaul compressors typ maintenance (2 total)	$8,000
Replace dryer cores - typical maintenance	$3,500
Replace compressors and motors (2 total)	$111,00
Replace evaporative condenser	$70,000
R-22 refrigerant to top off system (1,000 lbs x $22)	$26,000
New life safety systems - emergency shutoff for refrig syst.	$6,000
Subtotal of estimated construction costs	$257,900
Cost adjustment for location (20%)	$51,580
Subtotal of estimated construction costs	$309,480
Estimate, design and constr. Contingency (15%)[1]	$46,422
Total estimated construction costs	$355,902
Engineering, legal, financial and administrative (20%)[1]	$71,180
Total estimated project costs	**$427,082**

Footnotes:

1. See cost estimate narrative in report.

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Item	Cost Estimate[1]					
	Single System					
	Option 3 Conversion	Option 4 New	Option 5 New	Option 6 New	Option 7 New	Option 8 New[3]
Refrigerant type	Ex R-22	New HFC	New HFC	Ammonia	CO2 indirect	CO2 direct
Grade of system	Industrial	Commercial	Industrial	Industrial	Industrial	Industrial
Removal and dispose of dasher boards		$20,000	$20,000	$20,000	$20,000	$20,000
Demolition of existing refrigeration system		$20,000	$20,000	$20,000	$20,000	$20,000
Demolition of existing conc. rink floor (NHL + 5" thick)		$75,000	$75,000	$75,000	$75,000	$75,000
Repairs to existing direct system (see Option 2 table)		N/A	N/A	N/A	N/A	N/A
New refrigeration system or equipment		$400,000	$550,000	$575,000	$600,000	$650,000
New concrete rink floor w/poly pipe +subfloor (NHL +5" thick)		$550,000	$550,000	$550,000	$550,000	$700,000
Basic waste heat recovery system (subfloor + snowmelt pit)		$75,000	$75,000	$75,000	$75,000	$75,000
Enhanced waste heat recovery system (preheat zam water, etc.)		$100,000	$100,000	$100,000	$100,000	$100,000
New life safety systems		Incl above	Incl above	Incl above	Incl above	Incl above
Ventilation system improvements or replacement in room		see mech	see mech	see mech	see mech	see mech
Miscellaneous plumbing improvements in ice equip room		$10,000	$10,000	$10,000	$10,000	$10,000
Electric service upgrade		$20,000	$25,000	$25,000	$25,000	$25,000
Lighting modifications and misc. electrical		$10,000	$10,000	$10,000	$10,000	$10,000
Dewatering allowance		$0	$0	$0	$0	$0
New dasher board system (NHL size)		$175,000	$175,000	$175,000	$175,000	$175,000
New interior vestibule and doors		N/A	N/A	$0	$0	$0
Water treatment system for resurfacer water		$0	$0	$0	$0	$0
Subtotal of estimated construction costs		$1,455,000	$1,610,000	$1,635,000	$1,660,000	$1,860,000
Cost adjustment for location (0%)		$0	$0	$0	$0	$0
Subtotal of estimated construction costs		$1,455,000	$1,610,000	$1,635,000	$1,660,000	$1,860,000
Estimate, design and constr. Contingency (15%)[1]		$218,250	$241,500	$245,250	$249,000	$279,000
Total estimated construction costs		$1,673,250	$1,851,500	$1,880,250	$1,909,000	$2,139,000
Engineering, legal, financial and administrative (18%)[1]		$301,185	$333,270	$338,445	$343,620	$385,020
Total estimated project costs		**$1,974,435**	**$2,184,770**	**$2,218,695**	**$2,252,620**	**$2,524,020**
Expected useful life - refrigeration system (yrs)		15-20	25-30	25-30	20-25	20-25
Expected useful life - rink floor (yrs)		40-50	40-50	40-50	40-50	20-25
Adjusted Costs for 2019[2]		$2,053,412	$2,272,161	$2,307,443	$2,342,725	$2,624,981
Adjusted Costs for 2020[2]		$2,135,549	$2,363,047	$2,399,741	$2,436,434	$2,729,980
Adjusted Costs for 2021[2]		$2,220,971	$2,457,569	$2,495,730	$2,533,891	$2,839,179

Footnotes:

1. See cost estimate narrative in report.

2. Applied escalation costs of 4% per year.

3. Cost savings of 994,000 to reuse existing direct floor (total project costs - NO LONGER ACCURATE

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Appendix D

Financial Assistance Programs

FINACIAL ASSISTANCE PROGRAMS

There are several financial programs that Energy utilities may have available that the City may wish it take advantage of. They include:

1. Engineering Assistance Study Program. The purpose of this program is to provide the City with the necessary business case justification to implement energy-saving opportunities. This evaluation report can be expanded to identify energy conservation opportunities, energy modeling, etc. to meet the programs requirements. Utilities companies may reimburse the City up to fund up to 75% of the cost of this study. One example where the City would benefit from this additional energy analysis is in selecting a refrigerant (ammonia, CO2, etc.) or refrigeration system to replacing the existing R-22 refrigerant or system. It is typically required that these programs be pre-approved prior to starting any work on the study.

2. Rebate Programs. Rebate programs are available through utility companies for many energy improvement measures that can be performed such as lighting replacement, motor replacement, installation of variable frequency drives, improving insulation systems, etc. Custom rebate programs are also available and may apply to the refrigeration system replacement depending on the type of system selected. Utility companies should be contacted to identify possible rebates prior to starting any improvement project relating to energy savings. Some rebates require preapproval prior to purchasing and installation.

State Appropriation Board
Programs should be reviewed for potential funding opportunities.

Sports Commission
Programs should be reviewed for potential funding opportunities.

Mighty Ducks Legislation
The Mighty Ducks legislation from the mid 1990's was revived in 2013 to include funding for air quality (ventilation, testing and resurfacers) initial program deadlines have pasted. The legislation failed by four votes. It appears that some funding will be included in the 2014 bonding bill but will likely be very limited. Stevens was intimately involved in this process and providing information to the Minnesota Amateur Sports Association to aid in their lobbying efforts.

Alternate Project Delivery Method

Another delivery and funding option the City may consider for this project is through guaranteed-savings contracts. Stevens has teamed with several Energy Service Organizations to successfully complete ice rink projects for the City of Brooklyn Park, Northfield, Eden Prairie, and New Hope. We are currently working with the Minneapolis Park and Recreation Department on a guaranteed-energy savings contract project at Parade Ice Gardens.

If the City is interested in learning more about this delivery method we would be happy to discuss it in more detail with you.