SHADOW STUDY

Northwest corner of Rebstock Road and Ridge Road South

Crystal Beach ON

Proposed Residential Development

Prepared by:

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architecture | interiors | design | research

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Prepared for:

M5V Developments Inc.

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1.0 OVERVIEW

1.1 INTRODUCTION:

Organica Studio + has been retained to study the effects on the proposed multi-storey residential development on the existing surrounding single-family dwellings. The existing single-family dwellings consist of single and one and half storey building heights. They are located to the South and East of the proposed site. To the North of the site is an existing community centre and to the West of the site is an existing public park. The proposed site on the West and North side will have a building height of approximately 13m. The two central buildings will have a height of approximately 11m.

1.2 STUDY PARAMETERS:

This shadow study was prepared using the following parameters;

- The main solstice/equinox for each of the four seasons for the year 2021
  - March 20, June 21, September 22, December 21
- The study was set to 1 hour increments
- The proposed building types have been modeled to the proposed heights
- The existing residential single family dwellings have been modeled up to a one and a half storeys building height
- The study conforms to the dates and times set out typically for shadow studies in southwestern Ontario municipalities
- The study was conducted using Autodesk Revit 2020 – a computer generated shadow diagram.

1.3 DESCRIPTION OF PROPOSED DEVELOPMENT:

The existing vacant parcel of land is approximately 15,035 m^2 and is available for the development of a private residential blocks. The proposed residential buildings will be located to the north and west portion of the site, with two smaller building units located centrally. The site is bordered by existing residential homes on the east side (Ridge Road South) and the South side (Rebstock Road). The proposed parking lot will abut the east and south portion of the lot. The entrance to the site will be marked by signage and the main drive aisle will contain visitor parking spaces. In total there will be parking for 194 vehicles and 20 bicycle parking spaces, with approx. 36% of the lot landscaped.

There will be two different residential blocks proposed for the site. The three (3) and a half storey block are marked as Block A – D and are located on the west and north perimeter of the site. Block B and D taper to a two (2) storey height, Block B in the east side and Block D on the south side. The three storey blocks are marked as Block E – F is located more centrally within the site (Refer to the Site Plan in Appendix A). In total there will be

154 dwelling units with a mix between three bedroom, two bedroom and single bedroom. The lot coverage or "building footprint" of the six blocks is approx. 17.5% of the property.

NEIGHBOURING PROPERTIES INCLUDE:

TO THE EAST:

To the east of the proposed development are residential homes that front Ridge Road South and have their rear yard to the subject property. The homes are up to one and half storey in building height with peaked roofs. The lots are generally deep and narrow in shape.

TO THE SOUTH:

To the south of the proposed development are residential homes that front Rebstock Road and have their rear yard to the subject property. The homes are one storey in building height with peaked roofs. The lots are generally deep and wide in shape.

TO THE WEST:

To the west is the Crystal Ridge Park, a public park which is currently being redeveloped by the town to improve onsite amenities and play spaces.

TO THE NORTH:

To the north of the proposed development is the continuation of Crystal Ridge Park and partial parking spaces for the Crystal Ridge Arena.

2.0 METHODOLOGY

The Town of Fort Erie has bylaws, which govern the development of properties. One of the criteria being analysed in this report is the requirement that the proposed development address the issue of height and the affect of the shadows upon neighbouring properties and the subject property itself. This shadow study also provides shadow diagrams for four (4) periods of the day, which is representative of different shadow patterns cast over the course of the day. We are also analysing the typical shadow patterns, which reflect the solar solstice periods over the course of the year, and represent the highest, the mid and lowest points of the sun over the year. We are providing a chart (Appendix "C"), which provides data as to shadow length, solar angle over the course of the typical day over the periods of study, as well as the sunset/sunrise times.

In Appendix "A" the site plan will illustrate the location of the proposed buildings relative to the location of existing residential homes. Appendix "B" provides the shadows created at specific times and dates as noted on

each diagram. The analysis was conducted based on the geodetic location of 42.871506 degrees North and -79.053681 degrees West. The analysis will study the affects of a building with a maximum height of 13 meters.

The diagrams provided illustrate shadow patterns for 4-5 times a day at 4 specific dates of the year. Generally speaking the analysis of the shadow diagrams identifies typical shadows, which are cast in a Spring, Summer, Fall and Winter periods.

The following analysis of the shadow plans will discuss the shadow pattern for each of the dates and times and will identify characteristics of those shadows and the anticipated impact upon the immediate site and neighbouring sites with specific concern for the existing residential homes which may be impacted by the proposed development.

3.0 SHADOW STUDY: PRE-DEVEOPMENT

After reviewing the existing site conditions, it is noted that there is no current building or structure on the site. The current site is an open field, therefore it will not provide any notable shadows onto the existing adjacent properties.

4.0 SHADOW STUDY: POST-DEVELOPMENT

4.1 SPRING SHADOWS (MARCH 20):

A summary of the spring shadow affect of the proposed development upon the subject property and surrounding area is as follows:

4.1A 9:00AM

The sun is low in the sky at 13.24 degrees azimuth. The sun rises at 7:57am this day of the year. Shadow length is approximately 41.23m.

- No affect to residential properties
- Shadow cast towards Crystal Ridge Park

4.1B 12:00PM

The sun is high in the sky at 63.78 degrees azimuth. Shadow length is approximately 13.78m.

- No affect to residential properties

- Shadow cast within property

4.1C 2:00PM

The sun is located west in the sky at 85.96 degrees azimuth. Shadow length is approximately 12.33m.

- No affect to residential properties
- Shadow cast within property

4.1D 5:00PM

The sun is located west in the sky at 118.89 degrees azimuth. Shadow length is approximately 27.12m.

- Partial affect to southwest corner of residential property #133 Ridge Road South
- Shadow cast towards parking lot on property

4.1E 6:00PM

The sun is located west in the sky at 271.11 degrees azimuth. The sun sets at 6:29pm this day of the year. Shadow length is approximately 46.83m.

- Partial affect to residential properties #133 - #153 Ridge Road South
- Shadow cast towards parking lot on property

4.2 SUMMER SHADOWS (JUNE 21):

A summary of the summer shadow affect of the proposed development upon the subject property and surrounding area is as follows:

4.2A 9:00AM

The sun is low in the sky at 24.80 degrees azimuth. The sun rises at 5:33am this day of the year. Shadow length is approximately 19.22m.

- No affect to residential properties
- Shadow cast towards Crystal Ridge Park

4.2B 12:00PM

The sun is high in the sky at 59.97 degrees azimuth. Shadow length is approximately 6.13m.

- No affect to residential properties
- Shadow cast within property

4.2C 2:00PM

The sun is located west in the sky at 78.85 degrees azimuth. Shadow length is approximately 5.06m.

- No affect on residential properties
- Shadow cast within property

4.2D 5:00PM

The sun is located west in the sky at 264.73 degrees azimuth. Shadow length is approximately 15.11m.

- Partial shadowing on property #137 Ridge Road south, No shadow on dwelling unit
- Shadow cast within property
- Shadow cast towards parking lot on property

4.2E 6:00PM

The sun is located west in the sky at 275.14 degrees azimuth. Shadow length is approximately 22.43m.

- Partial shadowing on property #137 Ridge Road south, no shadow on dwelling unit
- Shadow cast within property
- Shadow cast towards parking lot on property

4.2F 7:00PM

The sun is located west in the sky at 284.51 degrees azimuth. The sun sets at 8:58pm this day of the year. Shadow length is approximately 37.13m.

- Shadowing on property #139 Ridge Road south, partial shadowing on dwelling unit.
- Shadow cast within property
- Shadow cast towards parking lot on property

4.3 FALL SHADOWS (SEPTEMBER 22):

A summary of the fall shadow affect of the proposed development upon the subject property and surrounding area is as follows:

4.3A 9:00AM

The sun is low in the sky at 37.63 degrees azimuth. The sun rises at 7:06am this day of the year. Shadow length is approximately 35.53m.

- No affect to residential properties
- Shadow cast towards Crystal Ridge Park

4.3B 12:00PM

The sun is high in the sky at 77.99 degrees azimuth. Shadow length is approximately 13.23m.

- No affect to residential properties
- Shadow cast within property

4.3C 2:00PM

The sun is located west in the sky at 98.70 degrees azimuth. Shadow length is approximately 12.71m.

- No affect on residential properties
- Shadow cast within property

4.3D 5:00PM

The sun is located west in the sky at 246.82 degrees azimuth. Shadow length is approximately 30.64m.

- Shadowing on property #133 Ridge Road South – no affect to dwelling
- Shadow cast towards parking lot on property

4.3E 6:00PM

The sun is located west in the sky at 258.31 degrees azimuth. The sun sets at 7:15 pm this day of the year. Shadow length is approximately 56.89m.

- Affect to residential dwellings #133 - #153 Ridge Road South
- Shadow cast towards parking lot on property

4.4 WINTER SHADOWS (DECEMBER 21):

A summary of the winter shadow affect of the proposed development upon the subject property and surrounding area is as follows:

4.4A 9:00AM

The sun is located in the sky at 56.79 degrees azimuth. The sun rises at 7:53am this day of the year. Shadow length is approximately 72.93m.

- No affect to residential properties
- Shadow cast towards Crystal Ridge Park

4.4B 12:00PM

The sun is located more south in the sky at 96.08 degrees azimuth. Shadow length is approximately 29.70m.

- No affect to residential properties
- Shadow cast to Crystal Ridge Park

4.4C 2:00PM

The sun is located west in the sky at 114.77 degrees azimuth. Shadow length is approximately 36.86m.

- No affect on residential properties
- Shadow cast to Crystal Ridge Park and on property

4.4D 4:00PM

The sun is located west and low in the sky at 147.96 degrees azimuth. The sun sets at 4:41pm this day of the year. Shadow length is approximately 123.88m.

- Partial affect to residential dwellings #139 Ridge Road South
- Shadow cast east towards Crystal Ridge Arena

5.0 SHADOW IMPACT SUMMARY:

5.1 **General Comment regarding sunlight on the public and private realms:**

Currently, the Town of Fort Erie does not have any guidelines for evaluating shadowing impacts. The following criterion is taken as a reference from the City of Niagara Falls Architectural Design Review to assess the impact on the adjourning public realm;

To provide a minimum of: *5 hours of sunlight on September 21st remains on the pedestrian corridor, open spaces areas, entry corridors, retail and access streets. 3 hours elsewhere.* For this study we have also added a minimum of 5 hours of sunlight on private properties.

5.2 The major shadow effect in Spring is as follows:

- There are no shadows falling upon adjacent houses in this study period.
- Early morning shadows cast upon Crystal Ridge Park, by 10:30am there is no shadow cast from the proposed development. Crystal Ridge Park receives a minimum of 7 hours of sunlight.
- Shadows predominantly fall upon the subject property.

5.3 The major shadow effect in the Summer is as follows:

- Partial shadowing on property #137 & 139 Ridge Road south, No shadow on dwelling unit or any other residential dwellings prior to 7pm.
- Early morning shadows cast upon Crystal Ridge Park, by 9:30am there is no shadow cast from the proposed development. Crystal Ridge Park receives a minimum of 10.5 hours of sunlight.
- Shadows predominantly fall upon the subject property.
- The residential properties facing Ridge Road South will receive a minimum of 12 hours of sunlight.

5.4 The major shadow effect in the Fall is as follows:

- Affects the residential dwelling to the northeast for approximately 2 hours from the start to the finish of the shadow rotation from the west to the east between 5:00pm to 7:00pm.
- Early morning shadows cast upon Crystal Ridge Park, by 10am there is no shadow cast from the proposed development. Crystal Ridge Parks receives a minimum of 9 hours of sunlight.
- Shadows predominantly fall upon the subject property.
- As per design standards set out by municipalities in southern Ontario, residential corridors are to maintain a minimum of 5 hours of sunlight. The residential properties facing Ridge Road South will have a minimum of 9 hours of sunlight.

5.5 The shadows cast from this proposed development are largest in the winter:

- The large shadow affects one residential dwelling (#139) to the northeast for approximately 1 hour from the start to the finish of the shadow rotation from the west to the east between 3:40pm to 4:40pm. The rest of the dwellings are affected by the shadow from the fence and accessory buildings located within their property.

5.6 **General Comment Regarding Shadow Affect based upon the Shape of a Building:**

- The shadow effect of a "thinner" or "stepped" building has less impact than a "wide" building.
- The shadow of a thinner building falls "upon" a property for a shorter period of time and effectively "passes over" a building and property more quickly than a wider building and therefore has less shadow impact.
- As this proposal is effectively a stepped building which is three and half storeys in building height at it's "core" and wider at its "base" this is considered a "stepped" building with less shadow impact than a wide building.

5.7 **General Comment Regarding Buffers surrounding a Building:**

- The subject property has a proposed development of 6 blocks of a stepped shape from top to bottom, which reduces shadow affect by reducing "duration" upon neighbouring properties.

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- The majority of the seasons, the shadows cast by the stepped buildings are maintained within the property boundary, except where noted within the report.
- The properties to the east are affected by the winter shadows as noted within the report, though the effect happens within the evening hours.
- Existing trees within the residential areas to the east are currently providing shade during the summer months and have not been reflected within this report.
- The residential properties to the east are buffered by a large parking lot from the proposed development which helps to maintain the shadows within the property.
- The municipal property to the north receives minimal shadowing and will typically be affected during the winter, and predominately within the evening.

END OF REPORT

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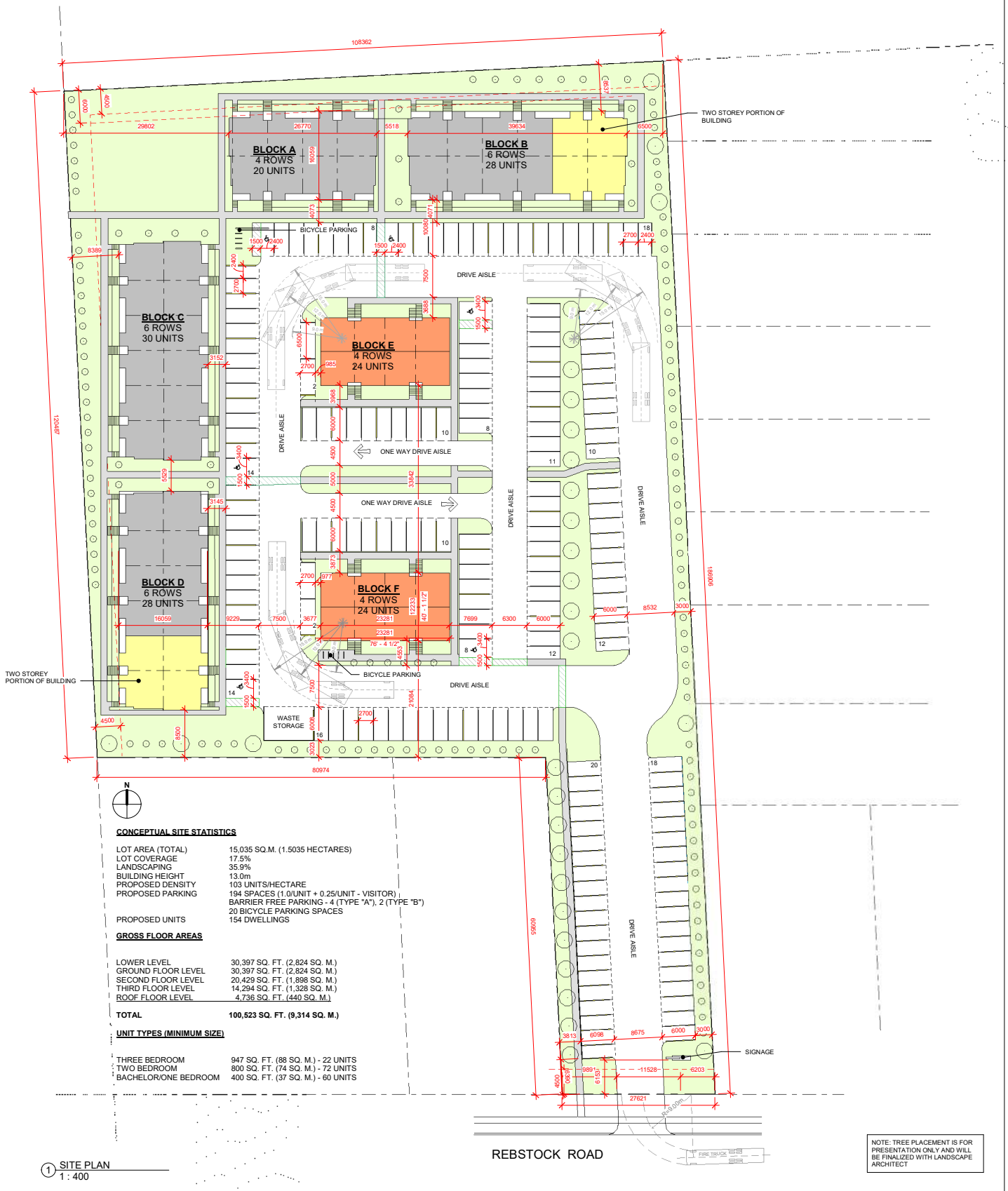
APPENDIX A



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CONCEPTUAL SITE STATISTICS

LOT AREA (TOTAL)	15,035 SQ.M. (1.5035 HECTARES)
LOT COVERAGE	17.5%
LANDSCAPING	35.9%
BUILDING HEIGHT	13.0m
PROPOSED DENSITY	103 UNITS/HECTARE
PROPOSED PARKING	194 SPACES (1.0/UNIT + 0.25/UNIT - VISITOR) BARRIER FREE PARKING - 4 (TYPE "A"), 2 (TYPE "B") 20 BICYCLE PARKING SPACES
PROPOSED UNITS	154 DWELLINGS

GROSS FLOOR AREAS

LOWER LEVEL	30,397 SQ. FT. (2,824 SQ. M.)
GROUND FLOOR LEVEL	30,397 SQ. FT. (2,824 SQ. M.)
SECOND FLOOR LEVEL	20,429 SQ. FT. (1,898 SQ. M.)
THIRD FLOOR LEVEL	14,294 SQ. FT. (1,328 SQ. M.)
ROOF FLOOR LEVEL	4,736 SQ. FT. (440 SQ. M.)
TOTAL	**100,523 SQ. FT. (9,314 SQ. M.)**

UNIT TYPES (MINIMUM SIZE)

THREE BEDROOM	947 SQ. FT. (88 SQ. M.) - 22 UNITS
TWO BEDROOM	800 SQ. FT. (74 SQ. M.) - 72 UNITS
BACHELOR/ONE BEDROOM	400 SQ. FT. (37 SQ. M.) - 60 UNITS

NOTE: TREE PLACEMENT IS FOR PRESENTATION ONLY AND WILL BE FINALIZED WITH LANDSCAPE ARCHITECT

1 SITE PLAN
1 : 400

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PROPOSED RESDENTIAL DEVELOPMENT - SITE PLAN

NORTHWEST CORNER OF REBSTOCK ROAD & RIDGE ROAD SOUTH
CRYSTAL BEACH, ON
M5V DEVELOPMENTS

20073

REV. 13 - 07.29.2021

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12/03/20

APPENDIX B

SPRING EQUINOX - 20 MARCH, 2021 - 9 AM

SPRING EQUINOX - 20 MARCH, 2021 - 12 PM

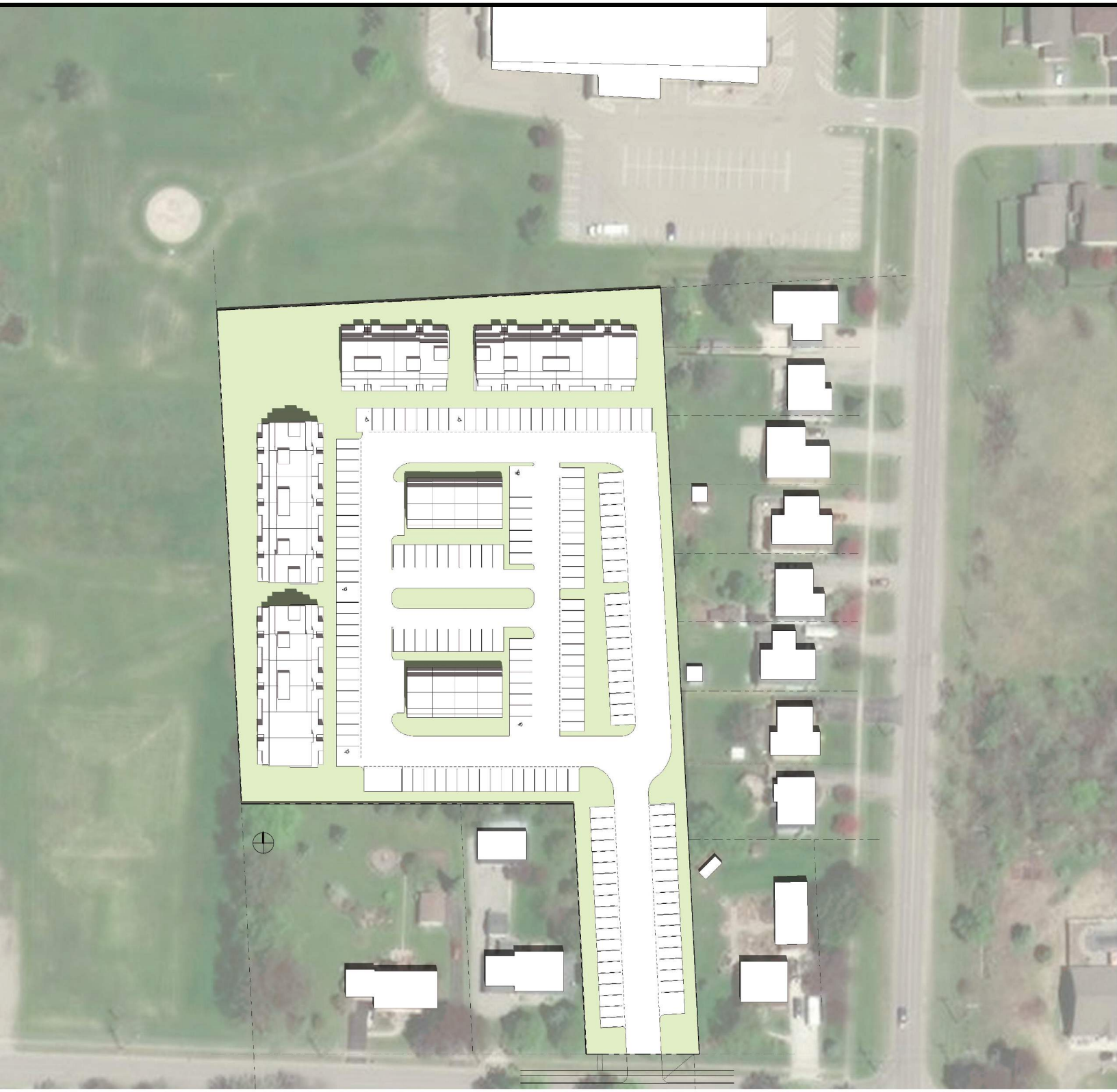
SPRING EQUINOX - 20 MARCH, 2021 - 2 PM

SPRING EQUINOX - 20 MARCH, 2021 - 5 PM

SPRING EQUINOX - 20 MARCH, 2021 - 6 PM

SUMMER SOLSTICE - 21 JUNE, 2021 - 9 AM

SUMMER SOLSTICE - 21 JUNE, 2021 - 12 PM



SUMMER SOLSTICE - 21 JUNE, 2021 - 2 PM

SUMMER SOLSTICE - 21 JUNE, 2021 - 5 PM

SUMMER SOLSTICE - 21 JUNE, 2021 - 6 PM

SUMMER SOLSTICE - 21 JUNE, 2021 - 7 PM

FALL EQUINOX - 22 SEPTEMBER, 2021 - 9 AM

FALL EQUINOX - 22 SEPTEMBER, 2021 - 12 PM

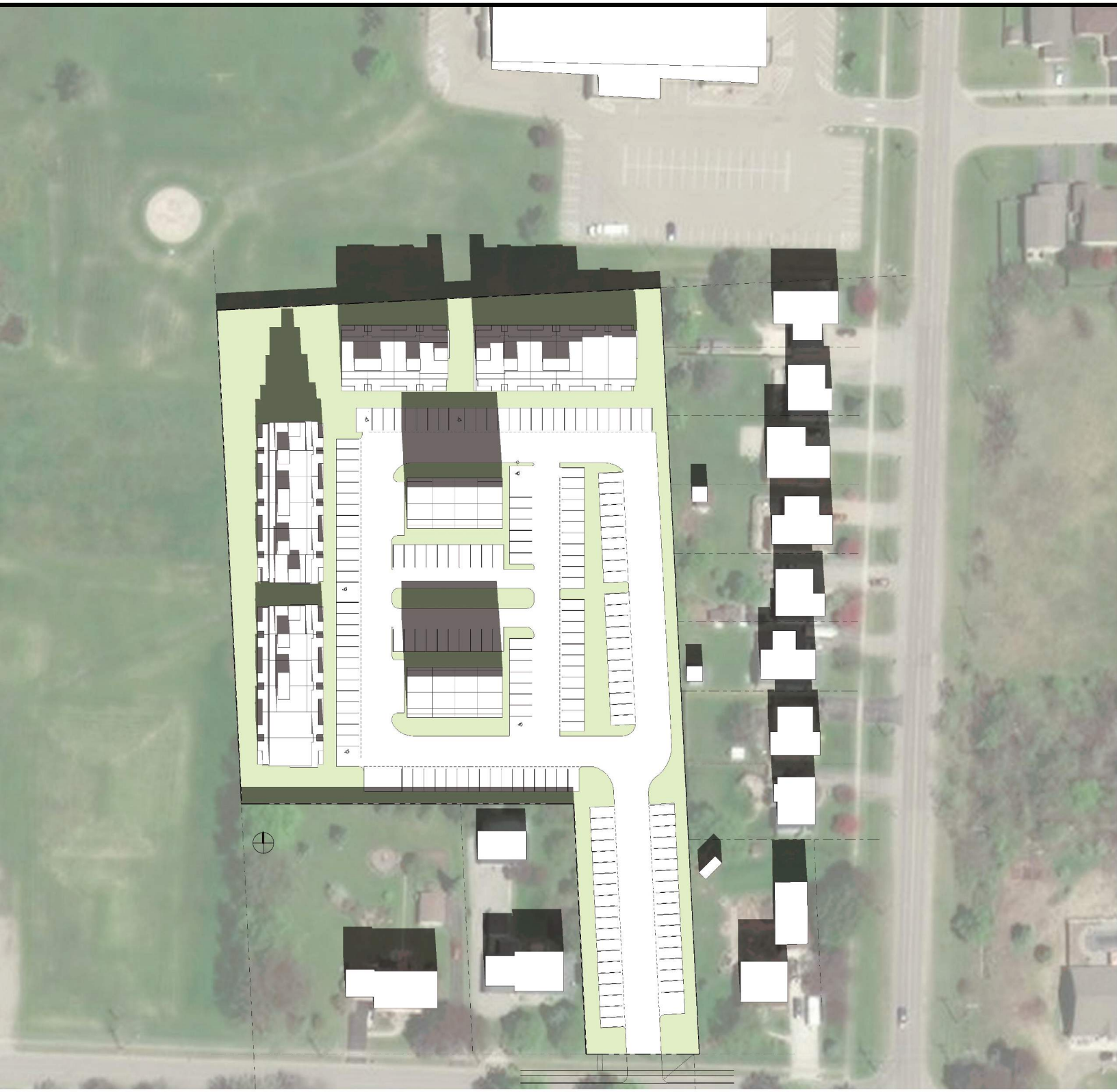
FALL EQUINOX - 22 SEPTEMBER, 2021 - 2 PM

FALL EQUINOX - 22 SEPTEMBER, 2021 - 5 PM

FALL EQUINOX - 22 SEPTEMBER, 2021 - 6 PM

WINTER SOLSTICE - 21 DECEMBER, 2021 - 9 AM

WINTER SOLSTICE - 21 DECEMBER, 2021 - 12 PM



WINTER SOLSTICE - 21 DECEMBER, 2021 - 2 PM

WINTER SOLSTICE - 21 DECEMBER, 2021 - 4 PM

APPENDIX C

SOLAR INFORMATION

DATE	TIME	SOLAR AZIMUTH DEGREES	SHADOW LENGTH (m)	Hours of Sunshine
SPRING				7:57/20:08
March 20	9:00 am	13.24	41.23	
March 20	12:00 pm	63.78	13.78	
March 20	2:00 pm	85.96	12.33	
March 20	5:00 pm	118.89	27.12	
SUMMER				5:33/20:58
June 21	9:00 am	24.80	19.22	
June 21	12:00 pm	59.97	6.13	
June 21	2:00 pm	78.85	5.06	
June 21	5:00 pm	113.20	15.11	
June 21	6:00pm	275.14	22.43	
June 21	7:00pm	284.51	37.13	
FALL				7:06/19:15
September 22	9:00 am	37.63	35.53	
September 22	12:00 pm	77.99	13.23	
September 22	2:00 pm	98.70	12.71	
September 22	5:00 pm	137.17	30.64	
September 22	6:00pm	258.31	56.89	
WINTER				7:53/16:41
December 21	9:00 am	56.79	72.93	
December 21	12:00 pm	96.08	29.70	
December 21	2:00 pm	114.77	36.87	
December 21	4:00 pm	147.96	123.88	