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April 9, 2021

VIA E-MAIL

San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, City Hall, Room 244
San Francisco, CA 94103
Board.of.Supervisors@sfgov.org

Re: Project Sponsor's Brief
Appeal of CEQA Exemption
2651-2653 Octavia Street – Case No. 2018-011022 PRJ

Dear President Walton and Supervisors:

The Planning Commission approved a modest addition to an existing two-family residence at 2651-2653 Octavia Street. The Project Sponsor seeks approval of the project in order to make the existing residence suitable for use as their multi-generational family home.

The Planning Department determined that the project meets all code requirements and qualifies for a Class 1 Categorical Exemption for additions to existing structures. The Planning Commission upheld that determination, which has been appealed by a group of neighbors due to unsubstantiated claims that the project could potentially impact the Golden Gate Valley Library's natural light and solar arrays. The Planning Department has thoroughly investigated all issues and determined that there would be no significant impacts to the library. The Project Sponsor respectfully requests that the Board of Supervisors deny the appeal and affirm the Planning Commission's approval of the Categorical Exemption for the following reasons:

- All south-facing windows that face the Project Sponsor's building are intentionally covered by dark grey shades that cover 50% of the windows and filter 90% of the natural sunlight because too much natural light already enters the library. Even with the intentional use of dark grey shades, there is plenty of light for patrons in the library and there is no impact to the library's historic character.

- The Sun Shade Impact Analysis Report finds that the grey shades reduce natural light in the library by -13.6% for overcast sky, -24.5% for partly cloudy sky, and -14.2% for clear sky. This intentional reduction in light is far less than the project's impact of -4% for overcast sky, -11.1% for partly cloudy sky, and -1.8% for clear sky.[1]

[1] All referenced studies can be found at the following link: https://zacks.egnyte.com/fl/GmWFU9Axzh

- Consistently during open hours, the normal condition in the library is natural light plus the use of electric lighting. The Illumination Impact Report for the library's normal environment of natural light and electric light finds that impact of the proposed project would de minimis, -1.0% reduction for overcast sky, -4.2% for partly cloudy sky, and -2.0% for clear sky.
- Even if there were significant impacts from the project, the consistent intentional use of electrical lights and dark grey sun shades in the library makes any hypothetical impacts to natural light from the project irrelevant.

- The neighbors' appeal admits that there are "not yet state or local laws on point to address protecting solar access" and impacts to adjacent solar panels are not governed by CEQA.

- The Shade Impact Analysis for the library's Solar Panels finds that the impact of the project on solarity would be de minimis, a reduction of $178 of solar energy production annually.

I. Factual Background

A Categorical Exemption for this residential addition was issued by the Planning Department in September 2019, a determination that was upheld by the Planning Commission in February 2020. The neighbors appealed the Planning Commission's ruling. Following a July 2020 hearing, the Board of Supervisors directed the Planning Department to conduct further investigations to quantify more fully whether the project may have an impact on the illumination of the library interior.

Over the next six months, the Environmental Planning Staff carried out the direction of the Board. They developed the scope of analysis, which consisted of finding the impact of natural light in the library for 2,406 unique points in the library for three sky conditions, during three times of the year, and for three different times of day. Symphysis, an independent Bioclimatic consultant, was contracted to complete the study. Environmental Planning thoroughly reviewed all of these findings.

The Project Sponsor and the Planning Department have been exhaustive in their due diligence to analyze all conceivable impacts the proposed project might have on the library. In addition to the above-mentioned analysis, three other illumination and shade studies were conducted: Shade Impact on the Solar Panels, Illumination with Normal Light Conditions (Natural + Electric), and Illumination impact of the Sun Shade Devices.

Because the statistical analysis from every shade and illumination study showed no significant impacts to the Library, the Planning Department determined no project revisions were necessary and issued a second Categorical Exemption in January 2021. In February 2021, the Planning Commission approved the project and the Categorical Exemption. On March 5, 2021

the same group of neighbors, now renamed the Friends of the GGV Library, again appealed the Planning Commission's approval of the second Categorical Exemption for the project.

II. The Project Is Categorically Exempt From Further CEQA Review

Categorical Exemptions apply to a list of classes of projects that have already been determined as a matter of law not to have a significant effect on the environment. (CEQA § 21084(a)). This project clearly falls within the Class 1 Categorical Exemption for minor additions of 10,000 square feet or less, as the project here is a 2,361-square-foot addition to an existing two-family residential structure. (CEQA Guidelines § 15301).

Thus, unless one of the limited exceptions to a Categorical Exemption applies, the project here is categorically exempt from further CEQA review. For projects that may impact historical resources, an exception is found if the project will cause a "substantial adverse change in the significance of a historical resource." (CEQA Guidelines § 15300.2(f)). An exception also applies if "the activity will have a significant effect on the environment due to unusual circumstances." (CEQA Guidelines § 15300.2(c)).

A party challenging an exemption has the burden to show a project *will* have a significant effect in order to overturn an exemption, as "it is not enough for a challenger merely to provide substantial evidence that the project *may* have a significant effect on the environment." (Berkeley Hillside Preservation v. City of Berkeley (2015) 60 Cal. 4th 1086, 1105). CEQA Guidelines Section 15384 states that "[a]rgument, speculation, unsubstantiated opinion or narrative" does not constitute acceptable evidence.

The neighbors merely assert that the project should be further investigated for potential impacts to the natural light entering the library and the effectiveness of the library's solar arrays and put forth unsupported narrative argument regarding the importance of the library and renewable energy. However, the Planning Department has already thoroughly investigated these issues, gathered facts, reviewed expert opinions, and determined that the project will not have a significant effect on the library's natural light or solar arrays. The neighbors have provided no factual evidence to refute the Planning Department's determination.

a. <u>The Project will not have a substantial adverse impact to the natural light of the Golden Gate Valley Library's reading room.</u>

The neighbors state that the exemption should be overturned solely to "investigate and then disclose" potential impacts to the natural light entering the library, which is exactly what the Planning Department has already executed with four exhaustive independent studies. Further, CEQA protects the "character defining" features of a historical resource, and the Planning Department correctly points out that natural light is not one of the "character defining" features of any of the Carnegie Libraries. Thus, even if the project were to have a substantial impact on the library's natural light, this impact would not adversely change the historical significance of the library. The neighbors' appeal admits this, stating that "character defining features are typically *material or physical features*" and their brief further explains that CEQA defines

historical impacts as "work that materially alters, in an adverse manner, those *physical characteristics that convey the resource's historical significance*." Thus, because natural light is not a character defining feature of the Library, the project's impacts to natural light are immaterial with respect CEQA.

Further, the Planning Department has already gathered substantial evidence from the Daylight Impact Analysis Report, which determined that the project will not, in fact, have a significant effect on the natural light entering the Library. Additional Illumination studies demonstrate that the library staff consistently utilizes electrical illumination and dark grey window shades during open hours that cover 50% of the windows. The analysis shows that for "best-case scenario" clear sunny days (i.e. the only time the library would not require electric lighting), the project would result in a mere 1.8% reduction in natural light. On the "worst-case scenario" partly cloudy days (when the library requires electrical lighting), the project would result in a 4% reduction in natural light. This is far less than the reduction in light caused by the library's own intentional use of window dark shades, which reduce light by -14.2% on clear sunny days and -24.5% on partly cloudy days.

While the Project Sponsor does not debate the neighbor's point that natural light to the library is important, natural light is not protected by CEQA and there is substantial evidence in the record demonstrating that the project will have no significant effect on the Library's natural light, particularly as compared to the library's intentional reduction of light by using dark grey window shades. The neighbors have not provided any facts to refute the findings of the Daylight Impact Analysis, nor did the appeal documents even acknowledge the details of the report's findings. Additional study of this issue, as requested by the neighbors, is not necessary. As such, the Planning Commission's approval of the Categorical Exemption for the project must be upheld.

b. <u>The Project will not have a significant impact on the Golden Gate Valley Library's solar arrays.</u>

The neighbors state that the Categorical Exemption should be overturned because the project will reduce the effectiveness of the library's solar arrays. As admitted by the neighbors in their appeal brief, impacts to neighboring solar panels are not protected by any state or local law, including CEQA. Thus, even if significant, an impact to solar panels is not an environmental effect recognized by CEQA that can overturn a Categorical Exemption.

Further, there is already substantial evidence in the record that the project will not have a significant effect on the Library's solar arrays. The Shading Impact Analysis specifically analyzed the project's impact to the library's solar arrays and found it minimally reduces captured radiation, a reduction of $178 of solar energy production annually.[2] The neighbors have not provided any facts to refute the findings of the Shading Impact Analysis.

[2] The neighbors' appeal states that the shading will increase by 69%, which is misleading. To clarify, 17.4% of the surface area of the east array is shaded and the project would cause an increase to 29.4%, an 11.7% increase. For the west array, 22.7% of the surface area is already shaded and the project would cause an increase to 28.4%, a 6%

Additionally, the presence of solar arrays on a neighboring property is not an "unusual circumstance" that would warrant overturning a Categorical Exemption. Solar panels are extremely common and their presence on a neighboring property is not atypical for a minor residential addition. Overturning a Categorical Exemption based upon a small reduction to the efficacy of a neighboring solar panel would have the practical effect of eliminating the Class 1 exemption for minor additions and would require full Environmental Impact Reports for many small residential projects.

Thus, because neighboring solar panels are not regulated by CEQA, there is substantial evidence in the record demonstrating that the project will have no significant effect to the library's solar arrays, and no unusual circumstances are present at the property; the Planning Commission's approval of the Categorical Exemption for the project must be upheld.

c. <u>The project is consistent with state and local laws regarding solar access.</u>

The neighbors also argue that the project will have a significant effect on the environment because the project is inconsistent with two General Plan policies that encourage the development of ordinances to promote renewable energy resources.[3] Both of the policies cited by the neighbors are aspirational and direct City agencies to take steps toward developing ordinances, but no such ordinances yet exist. The neighbors admit as much, noting in their appeal that that the "Planning Department is correct that there are not yet state or local laws on point to address protecting solar access." The approved project will not have any impact on the ability of City agencies to develop future ordinances regarding solar access and, as confirmed by the neighbor's appeal, there are currently no state or local laws addressing solar access that the project can conflict with. As such, the project does not have a significant effect on the environment and the Categorical Exemption must be upheld.

The neighbors' appeal also references the 1978 Solar Shade Act that prohibits the planting of new trees that will shade solar generation on adjacent properties, stating that this shows property owners should not be able to block a neighbor's solar panels with their building. Despite the fact this law is completely inapplicable as the Solar Shade Act regulates trees and not residential development, the Solar Shade Act only prohibits trees that "cast a shadow greater than 10 percent of the collector absorption area." (1978 Cal. Stat. ch. 1366. § 25982). Here, the Shading Impact Analysis shows that the project will only cast a shadow over 8.6% of the Library's solar arrays. Thus, even if the Solar Shade Act were applicable to residential development, the project here would not meet the shadow threshold to be regulated under the Act.

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increase in total surface area shaded. In total, the project would increase total surface area of the Library's array shaded by 8.4%.

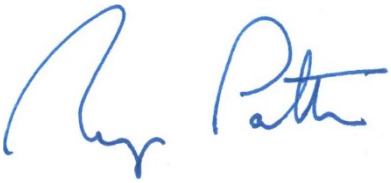
[3] The appellants cite Environmental Protection Policy 16.1 ("Develop land use policies that will encourage the use of renewable energy sources") and 16.2 ("Remove obstacles to energy conservation and renewable energy systems in zoning and building codes.")

III. Conclusion

There is substantial evidence in the record that this residential addition will not have a significant impact to the library's natural light or solar arrays. The neighbors' appeal does not provide any evidence to refute the exhaustive analysis undertaken by independent experts and relies solely on narrative argument. As such, the Planning Commission's approval of the Categorical Exemption for the development of the Project Sponsor's multi-generational family home must be upheld.

Very truly yours,

ZACKS, FREEDMAN & PATTERSON, PC



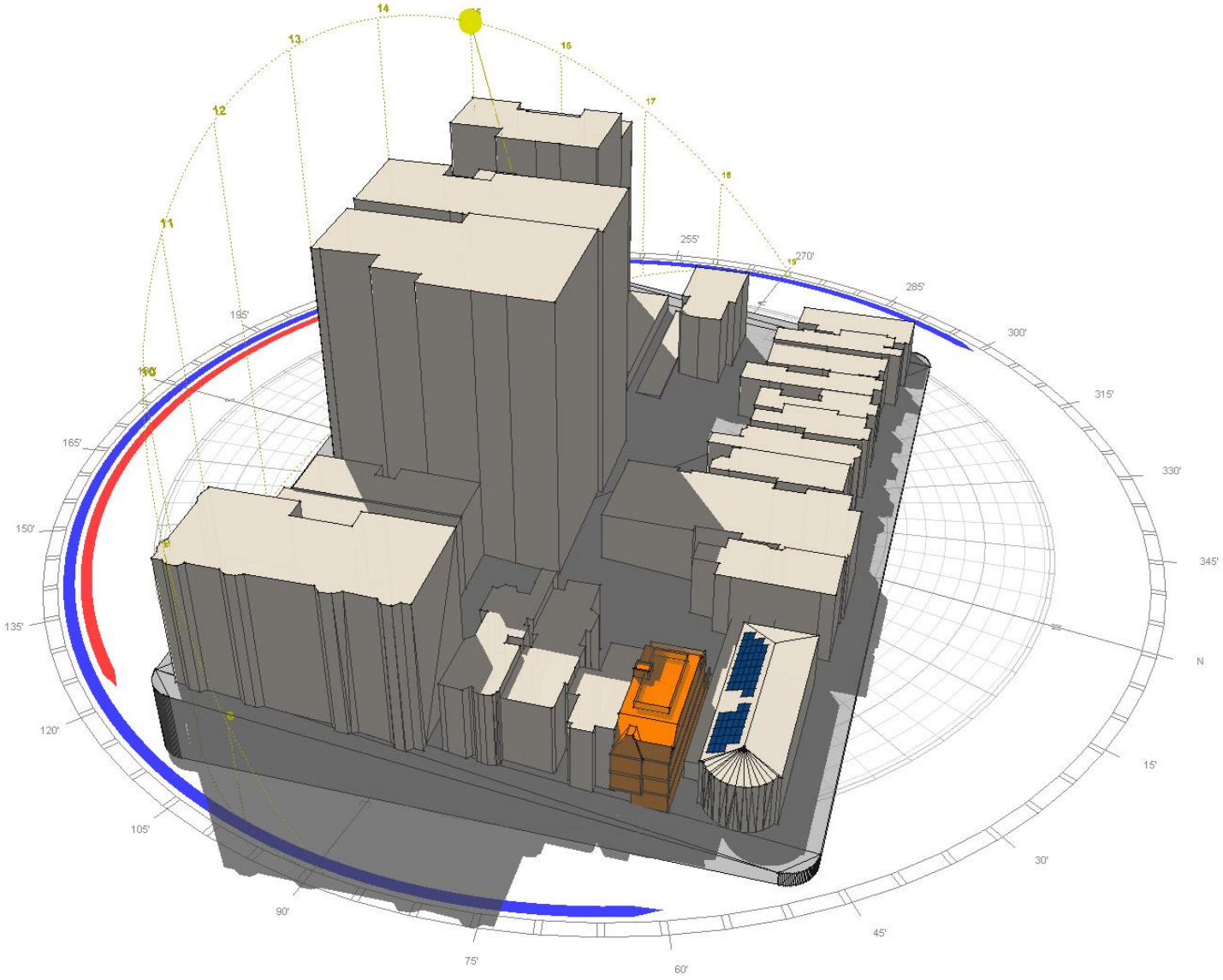
Ryan J. Patterson

cc: Kei Zushi, Senior Environmental Planner
kei.zushi@sfgov.org

SHADING IMPACT ANALYSIS REPORT

FOR **2653 OCTAVIA STREET** | DECEMBER 1ST 2019

Revised APRIL 11th 2021*



Report prepared by
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SYMPHYSIS
Bioclimatic Design Consulting
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I. INTRODUCTION & ANALYSIS SUMMARY

SYMPHYSIS was asked to perform a shading analysis to assess the shading impact of a proposed vertical and horizontal addition, located at 2651-2653 Octavia Street, upon the adjacent building's photovoltaic system located on the roof of 1801 Green Street.

After performing the analysis, SYMPHYSIS concludes that **the proposed project at 2653 Octavia Street would reduce solar radiation by an average of 5.8%** on the existing photovoltaic system at 1801 Green Street.

The report herein describes the proposed project, as well as the methodology used for the shading analysis along with its results. ■

Olivier A. Pennetier, MArch, LEED AP
SYMPHYSIS Principal
12/01/2019

CABEC
California Association of Building Energy Consultants
CERTIFIED ENERGY ANALYST
CEA# R16-19-20172

This 04/09/2021 revision separated the original Table 1 into two separate tables: Table 1 for the solar radiation results, and Table 2 for the shading percentage results. As originally presented, the *percentage reductions* in shading percentages were too easily misinterpreted for shading percentage. This version only shows the difference in shading percentage: 9% from existing conditions to proposed conditions. An appendix was also added to present the solar radiation tables for the impact calculations on the solar array .

Our services consist of professional opinions and conclusions developed in accordance with generally accepted environmental design, solar engineering and daylighting design principles and practices. Our conclusions and recommendations are based on the information provided by the clients, USGS Digital Elevation Model and publicly available Geographic Information System database.

II. PROJECT LOCATION

The proposed project is located at 2653 Octavia Street, in the Northeastern corner of the Pacific Heights neighborhood, block 0554, lot 002. ■

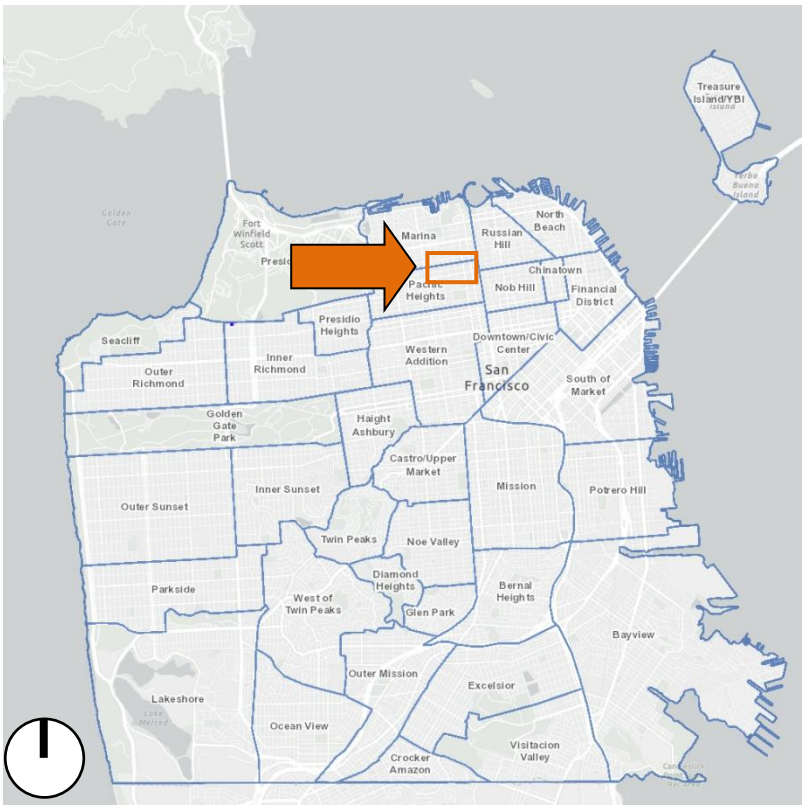


FIGURE 1: LOCATION MAP

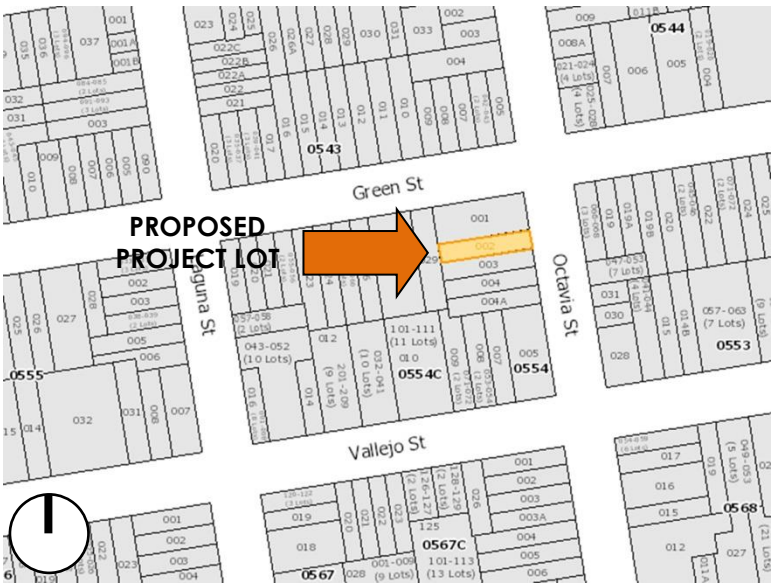


FIGURE 2: BLOCK MAP

III. PROPOSED PROJECT DESCRIPTION

The proposed design features a new fourth story addition on top of an existing 3 story single family residence. The new addition will increase the height of the building to 39'-10 ½".

The following images show the 3D massing models for the existing conditions and proposed design. ■

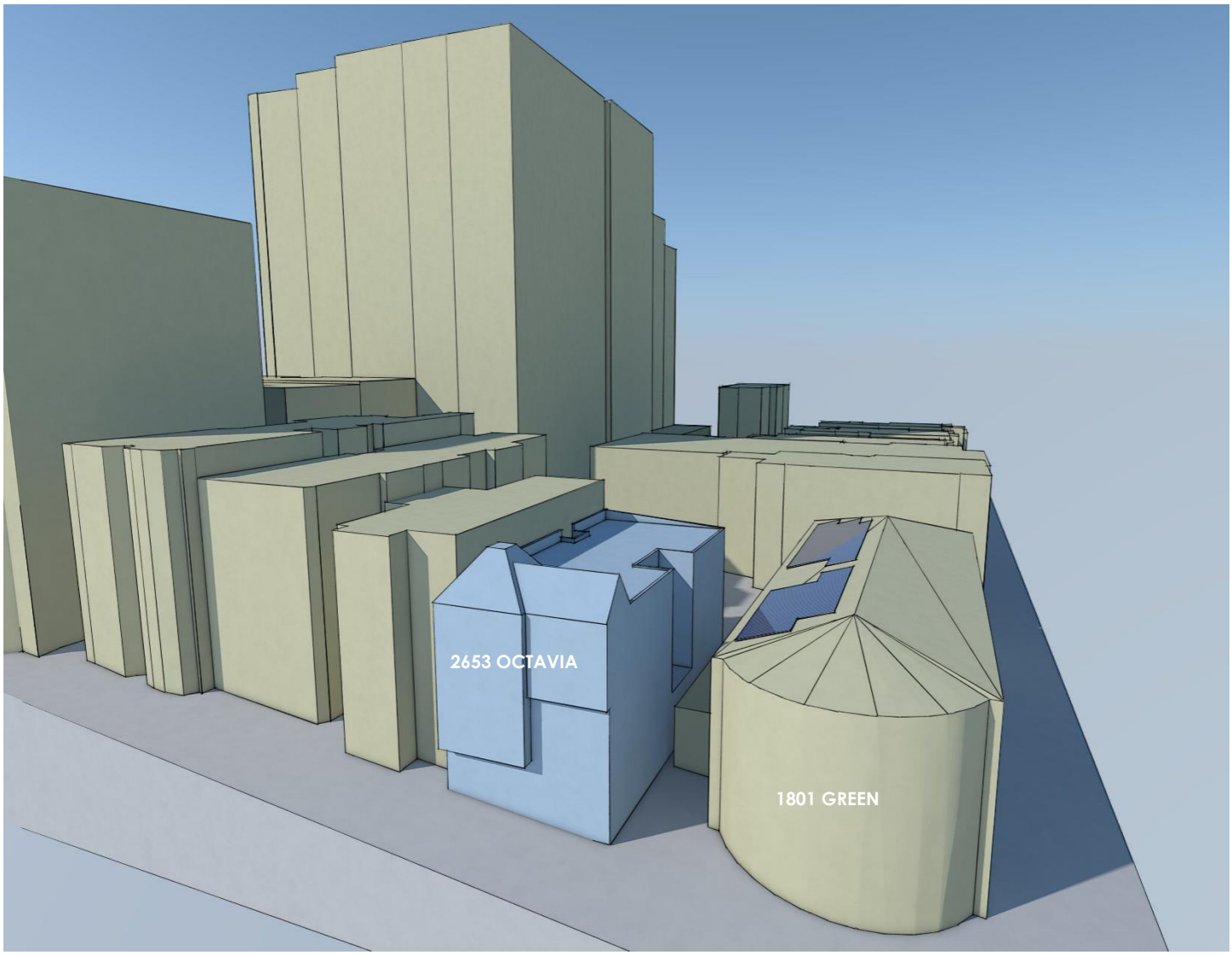


FIGURE 3: 3D MASSING MODEL OF THE EXISTING CONDITIONS.

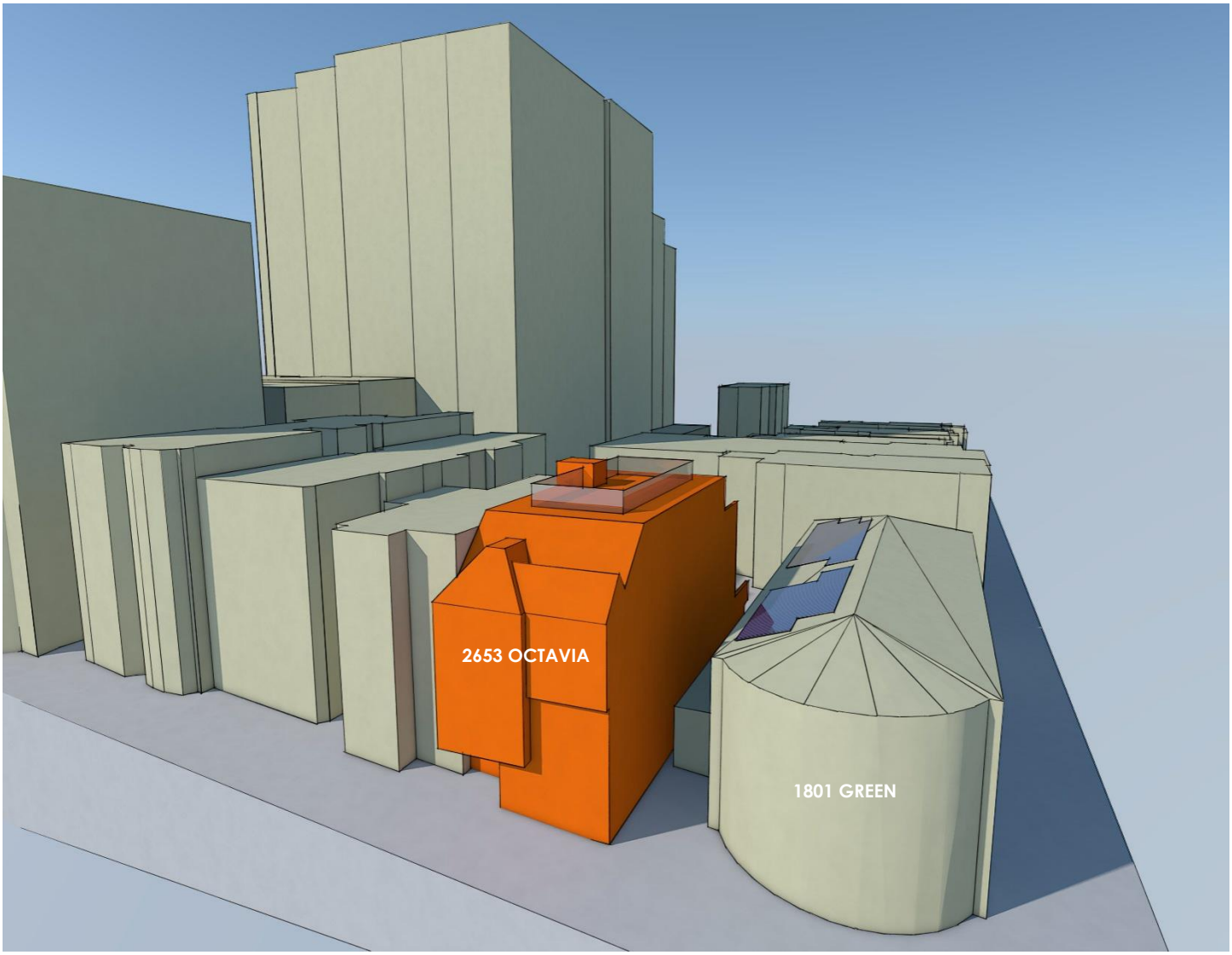


FIGURE 4: 3D MASSING MODEL OF THE PROPOSED DESIGN.

IV. ANALYSIS METHODOLOGY & FINDINGS

SYMPHYSIS utilized various tools to develop this shading impact analysis. Here is a breakdown of the analysis process, and the tools used at each stage of the analysis:

1) A 3D model of the existing and proposed conditions was created within a CAD software (ArchiCAD), using the 2D drawings from the architect of the proposed project. The surrounding buildings were constructed from the latest GIS (Geographic Information System) layer of San Francisco building footprints obtainable at data.sfgov.org. The heights of the buildings were derived from photogrammetric model from Google Earth. The size of the photovoltaic system located on the roof of the neighbor at 1801 Green Street was estimated from aerial photographs.

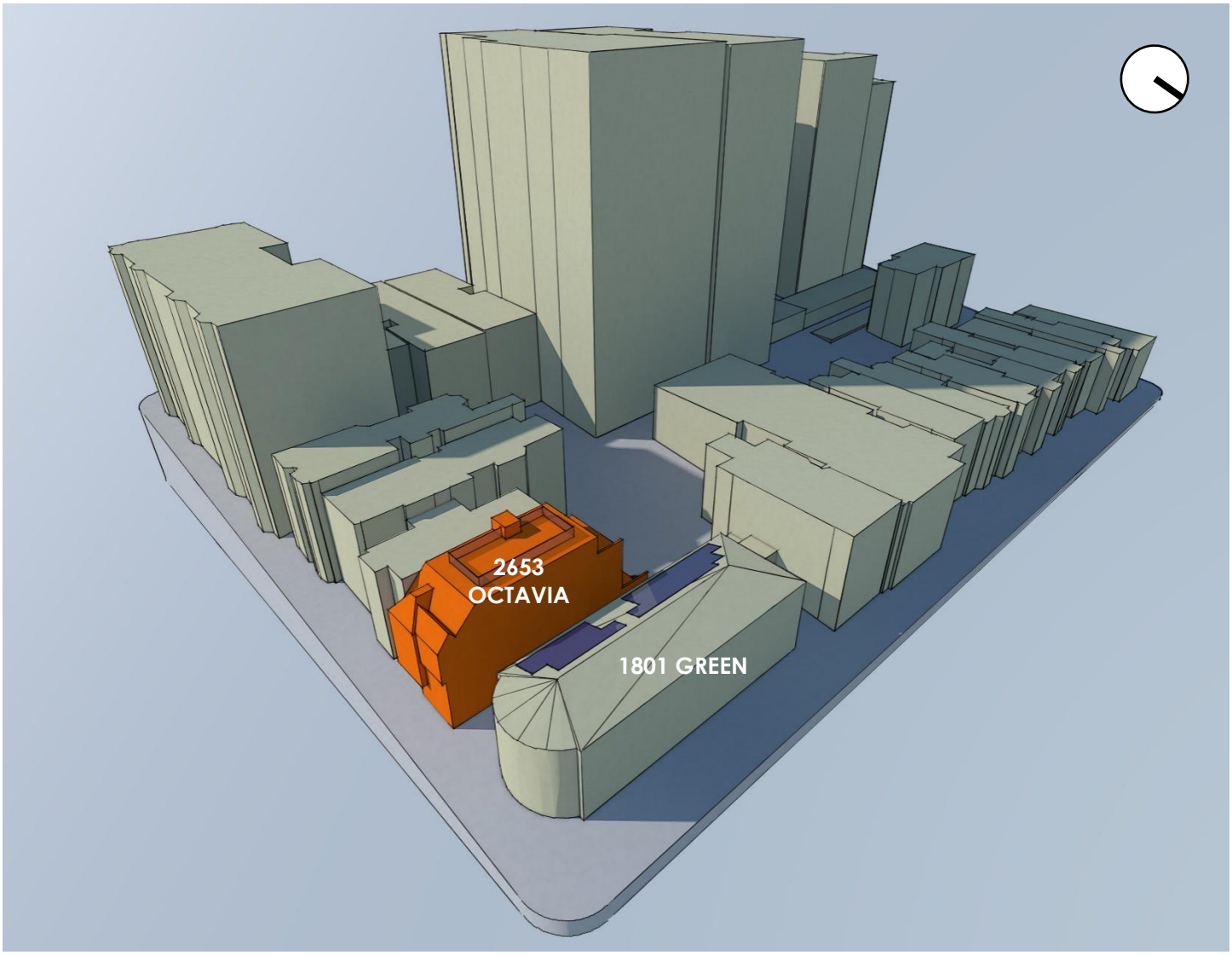


FIGURE 5: 3D MASSING MODEL OF PROPOSED CONDITIONS.

FIGURE 6: AERIAL PHOTOGRAPH OF THE PHOTOVOLTAIC SYSTEM AT 1801 GREEN STREET DATED 03/26/2018.

2) The 3D models were sent into a building performance analysis tool called Autodesk Ecotect to calculate shading and solar radiation specifically on the photovoltaic system of the Golden Gate Valley Library at 1801 Green Street. First the calculations were computed for the existing conditions, then another pass with the proposed design. The difference between the two conditions highlights the areas of the photovoltaic system that are most impacted by the proposed project. The calculations were set for the entire year, and every hours of the day.

After compiling all the results of the various analyses, SYMPHYSIS concludes that the proposed project at 2653 Octavia Street would reduce the amount of solar radiation on the existing photovoltaic system by 5.8%. Most of the shading impact would occur on the lower right (southeastern) panels located closer to the proposed project, and mainly between Fall and Winter, time at which solar radiation is weakest. At most, the solar array would see a 19.8% decrease in solar radiation on lower solar panels. Tables 1 & 2 below highlight these numbers.

TABLE 1: PERCENTAGE DECREASE IN GLOBAL HORIZONTAL RADIATION AT ROOF LEVEL

	EXISTING CONDITIONS	PROPOSED CONDITIONS	PERCENTAGE DIFFERENCE
SOLAR RADIATION	4,514 Wh/m^2/day	4,253 Wh/m^2/day	**-5.8%**
East Array	4,596 Wh/m^2/day	4,152 Wh/m^2/day	-9.7%
West Array	4,452 Wh/m^2/day	4,331 Wh/m^2/day	-2.7%

TABLE 2: INCREASE IN SHADING ON PHOTOVOLTAIC ARRAY

	EXISTING CONDITIONS	PROPOSED CONDITIONS	DIFFERENCE
SHADING	20.4%	29.0%	**+8.6%**
East Array	17.4%	29.4%	+12%
West Array	22.7%	28.7%	+6.0%

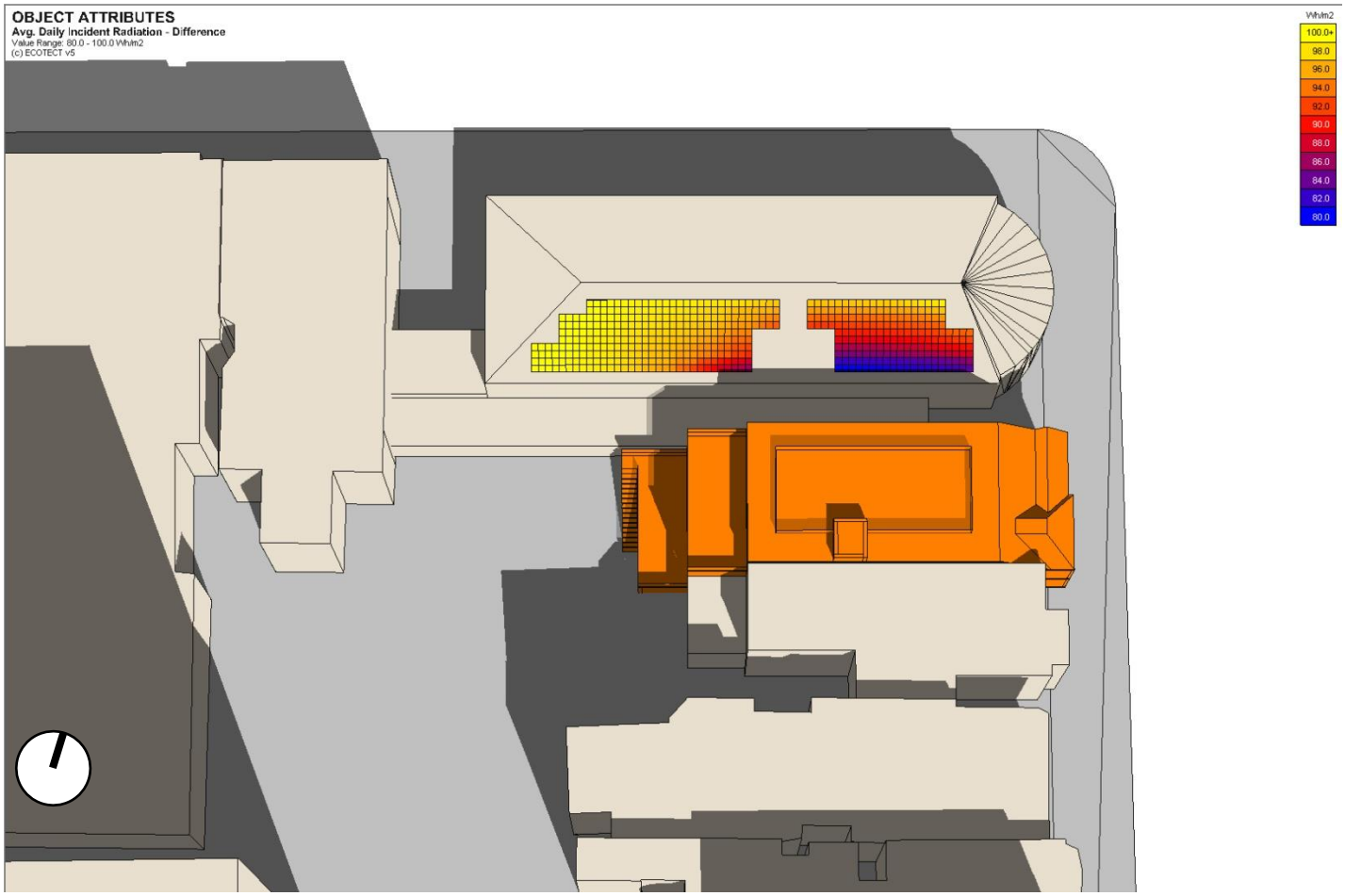


FIGURE 7: PERCENTAGE OF ANNUAL SOLAR RADIATION RECEIVED WITH THE PROPOSED PROJECT COMPARED TO EXISTING CONDITIONS.

Of note, the photovoltaic system is broken down into two arrays. The Eastern array is quite a bit more impacted than the Western array, with a 69% increase in shading on the Eastern array versus a 26.4% shading increase on the Western array. Similarly, the Eastern array would see its incident solar radiation reduced by 9.7%, versus a solar radiation decrease of 2.7% on the Western array.

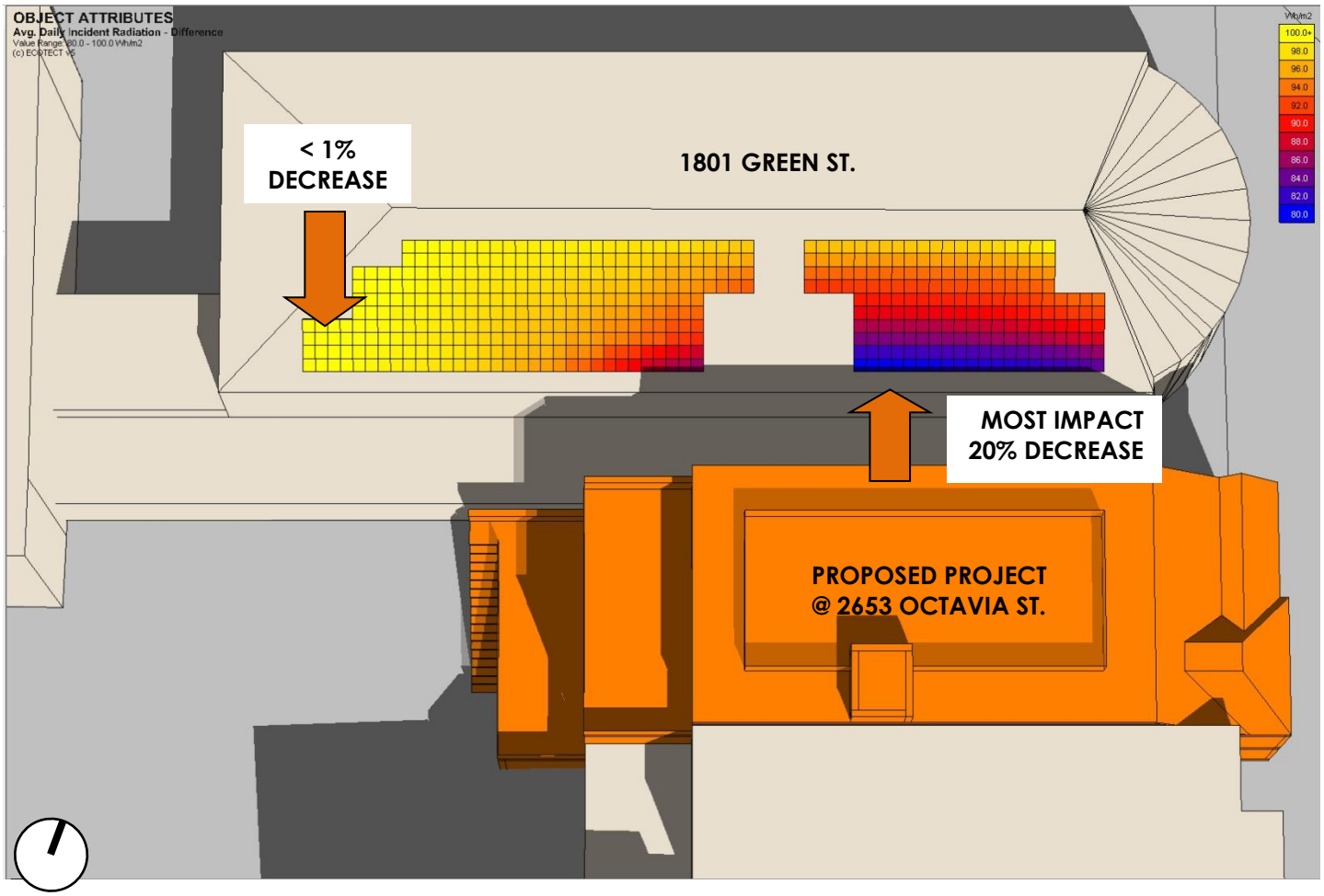


FIGURE 8: PERCENTAGE OF ANNUAL SOLAR RADIATION RECEIVED WITH THE PROPOSED PROJECT COMPARED TO EXISTING CONDITIONS.

The following diagram shows the shading difference between the existing and proposed conditions, highlighting in bright yellow the newly created shade on 1801 Green Street on the worst day of the year (the lowest sun angle on December 21st, and the highest solar radiation at solar noon).

The last diagram shows areas of the project's volume having the most impact on the shading of solar radiation upon the solar arrays. The brightest the dots, the highest-intensity solar radiation are being blocked by the project. As expected, the Northern-most areas of the fourth story addition's volume have the most impact on the solar panels. ■

A01

WINTER SOLSTICE SHADING ANALYSIS – PROPOSED vs EXISTING

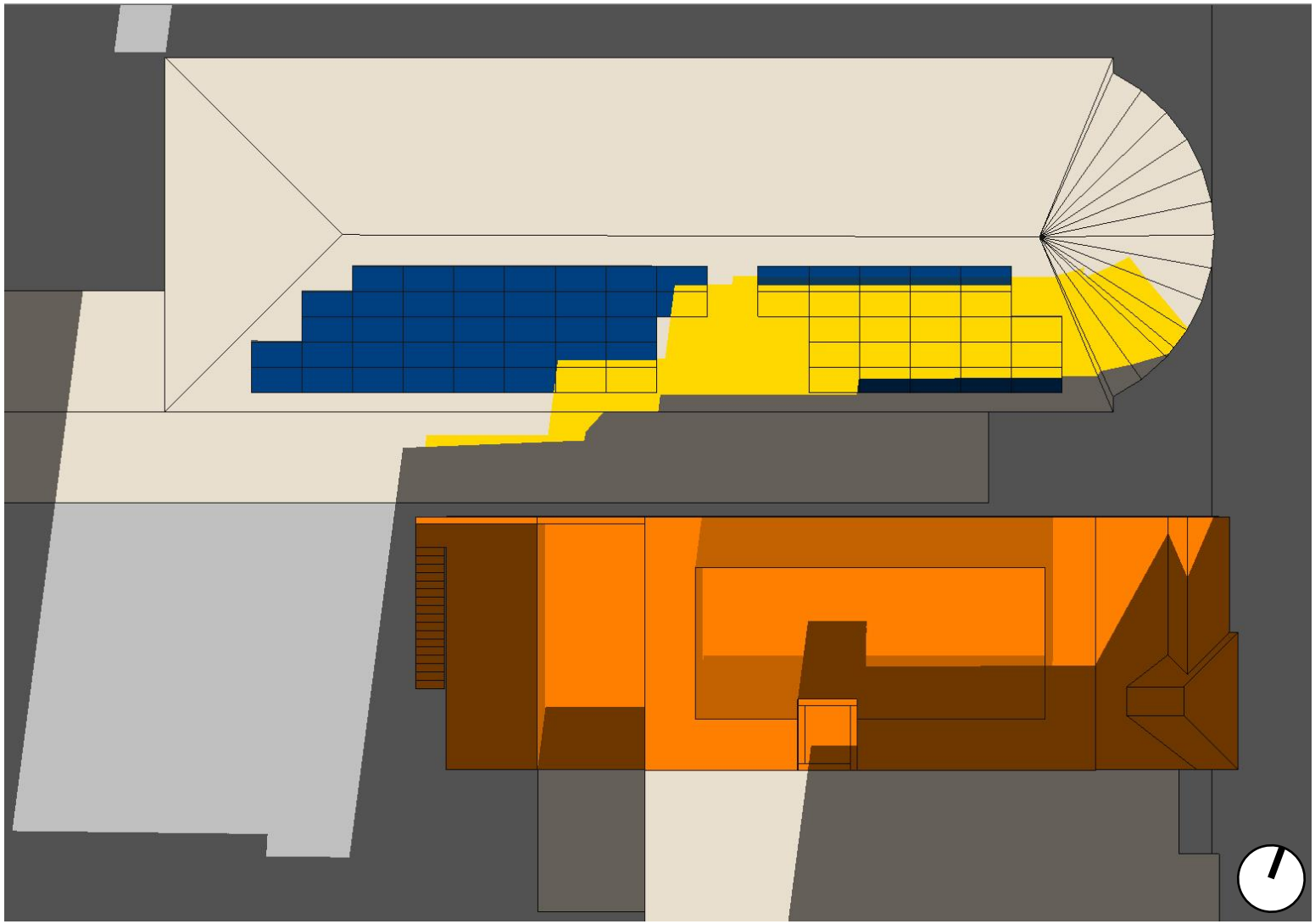
DECEMBER 21ST

12:00 PM Noon

PROPOSED PROJECT
@ 2653 OCTAVIA ST.

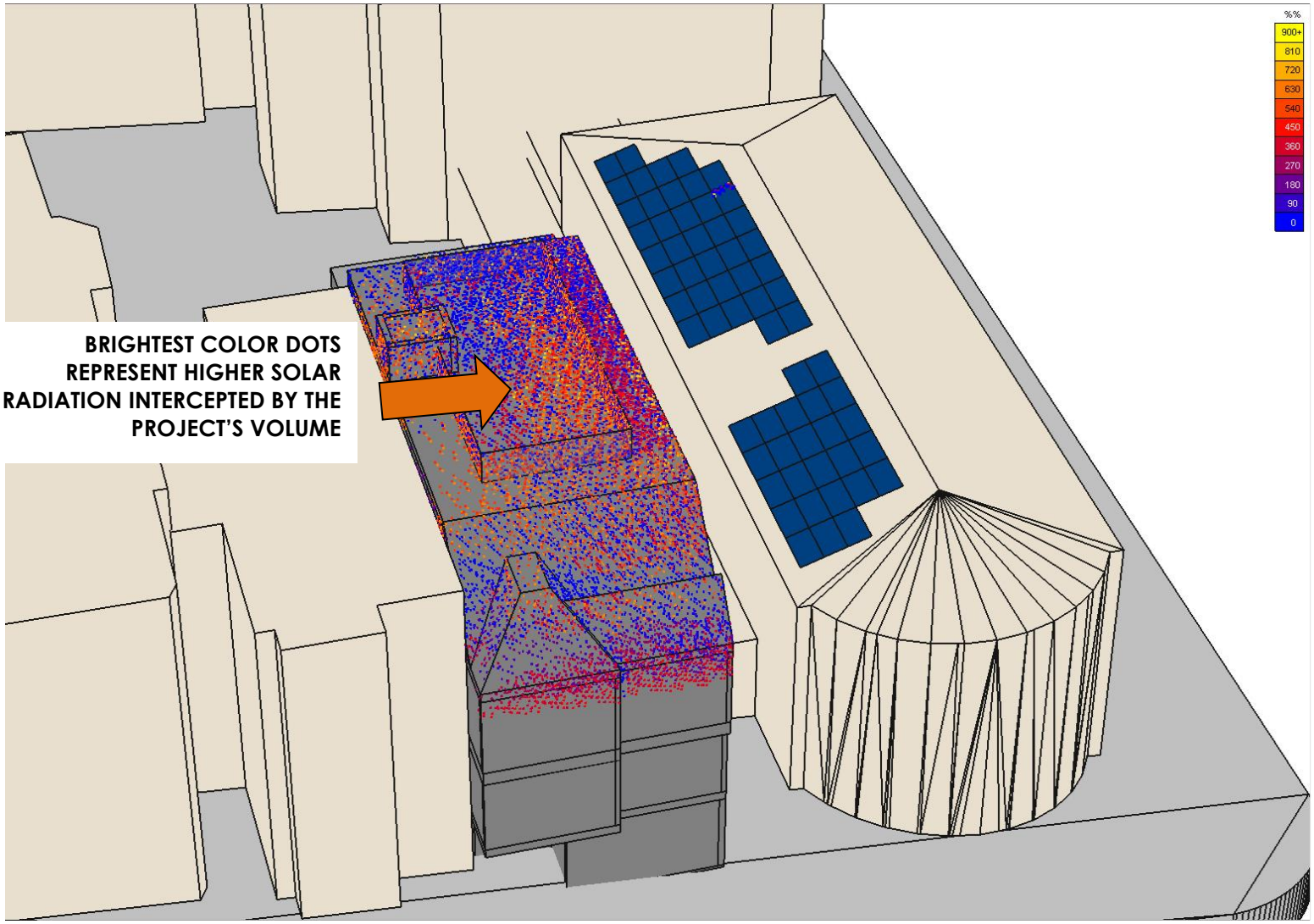
EXISTING SHADING

ADDITIONAL SHADING
@ 1801 GREEN ST.



A02

VOLUME IMPACT

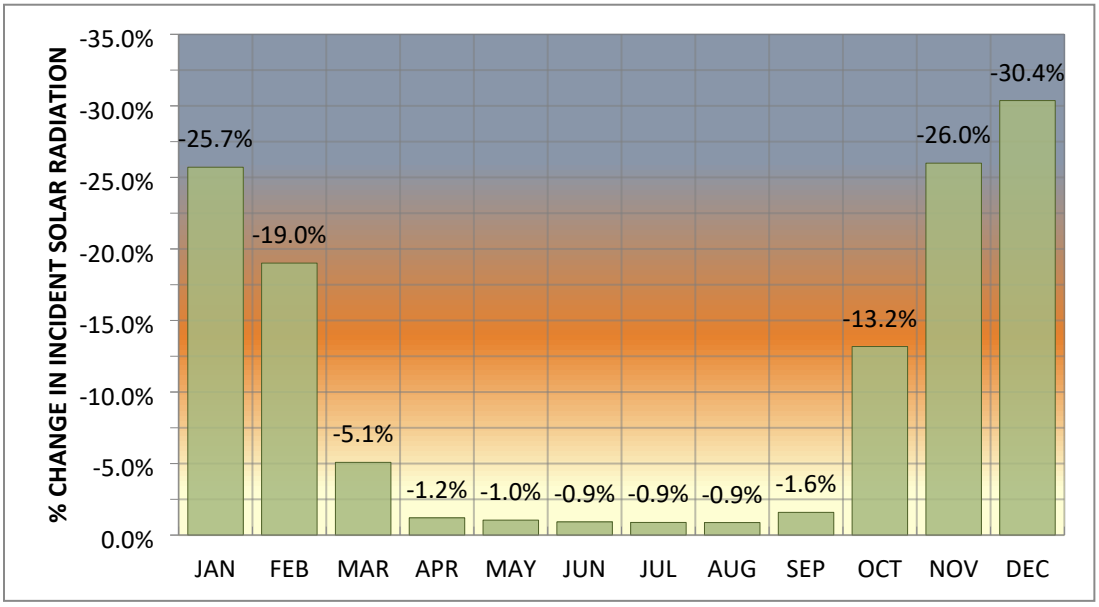


V. APPENDICES

A. IMPACT ON INCIDENT SOLAR RADIATION ON THE SOLAR ARRAY

The following table and graph show how the proposed project would impact the library's solar array electrical generation mainly from October to March, with the highest electrical production occurring May through September.

INCIDENT SOLAR RADIATION (Wh/m2/DAY)			
ANALYSIS PERIOD	EXISTING CONDITIONS	PROPOSED CONDITIONS	% Δ
JAN	1,709	1,270	-25.7%
FEB	2,748	2,226	-19.0%
MAR	4,476	4,248	-5.1%
APR	5,683	5,614	-1.2%
MAY	6,212	6,147	-1.0%
JUN	6,792	6,730	-0.9%
JUL	6,765	6,705	-0.9%
AUG	6,323	6,267	-0.9%
SEP	5,755	5,663	-1.6%
OCT	3,571	3,100	-13.2%
NOV	2,316	1,714	-26.0%
DEC	1,667	1,161	-30.4%
YEAR	4,514	4,253	-5.8%



B. TIMES OF IMPACT

The following table shows the various times throughout the year when the proposed project would impact the library's solar array, and how many days are recorded with no impact for the noted hour of the day:

	EXISTING	PROPOSED	Δ
SHADE @ 9AM	30-Sep 18-Mar	8-Sep 5-Apr	
NO-IMPACT DAYS	**197**	**157**	40
SHADE @ 10AM	15-Nov 5-Feb	12-Sep 2-Apr	
NO-IMPACT DAYS	**284**	**164**	120
SHADE @ 11AM	29-Nov 21-Jan	18-Sep 30-Mar	
NO-IMPACT DAYS	**313**	**173**	140
SHADE @ NOON	14-Dec 4-Jan	23-Sep 24-Mar	
NO-IMPACT DAYS	**345**	**184**	161
SHADE @ 1PM	25-Sep 21-Mar	26-Sep 21-Mar	
NO-IMPACT DAYS	**189**	**190**	-1
SHADE @ 2PM	1-Oct 16-Mar	1-Oct 15-Mar	
NO-IMPACT DAYS	**200**	**201**	-1
SHADE @ 3PM	6-Oct 11-Mar	6-Oct 11-Mar	
NO-IMPACT DAYS	**210**	**210**	0

C. SOLAR RADIATION CALCULATIONS

The following tables the estimated power generated by the library's solar array under existing and proposed conditions; the calculation were done with the PVWatts tool from the National Renewable Energy Laboratory (NREL):

USING PVWATTS 4.85 kWh/M2/DAY @ 0°TILT BASE RADIATION

EXISTING CONDITIONS: 15 kWh SYTEM, 20.4% SHADING

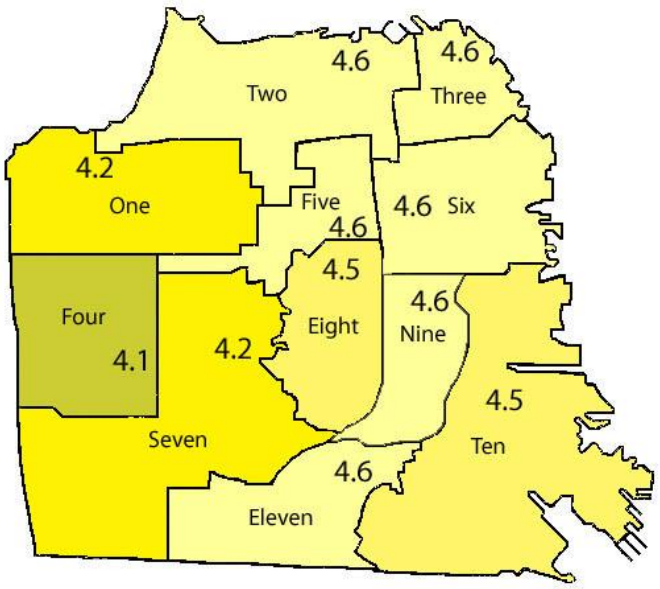
Month	Solar Radiation (kWh / m2 / day)	AC Energy (kWh)	Value ($)
January	3.14	961	86
February	3.98	1101	99
March	5.53	1,653	148
April	6.72	1,948	175
May	7.05	2,090	188
June	7.39	2,108	189
July	6.92	2,020	181
August	6.42	1,869	168
September	6.26	1,745	157
October	5.05	1,487	134
November	3.89	1,131	102
December	3.15	964	87
Annual	5.46	**19,077**	**$1,714**

PROPOSED CONDITIONS: 15kWh SYSTEM, 29.0% SHADING

Month	Solar Radiation (kWh / m2 / day)	AC Energy (kWh)	Value ($)
January	3.14	856	77
February	3.98	981	88
March	5.53	1,473	132
April	6.72	1,736	156
May	7.05	1,862	167
June	7.39	1,879	169
July	6.92	1,800	162
August	6.42	1,665	150
September	6.26	1,555	140
October	5.05	1,325	119
November	3.89	1,007	90
December	3.15	858	77
Annual	5.46	**16,997**	**$1,527**

The difference in generated electricity is 2,080 kWh per year, equivalent to a loss of $187 using the $0.09/kWh commercial rate.

When using the solar radiation data of 4.6 kWh/m2/day (on horizontal surface) recorded from weather stations located in the neighborhood of the library rather than the higher radiation data from NREL (based on SFO airport data), **the loss is minimized to $178 per year**:



INSOLATION MAP RECORDED IN SAN FRANCISCO (kWh/m2/day). DATA BY SFOG.US

USING SFOG.US 4.6 kWh/M2/DAY @ 0°TILT BASE RADIATION

EXISTING CONDITIONS: 15 kWh SYTEM, 20.4% SHADING

	Solar Radiation	AC Energy	Value
Month	(kWh / m2 / day)	(kWh)	($)
January	2.98	913	82
February	3.77	1,046	94
March	5.24	1,570	141
April	6.37	1,851	166
May	6.69	1,986	179
June	7.01	2,003	180
July	6.56	1,919	172
August	6.09	1,776	160
September	5.94	1,658	149
October	4.79	1,413	127
November	3.69	1,074	97
December	2.99	916	83
Annual	5.18	**18,123**	**$1,628**

PROPOSED CONDITIONS: 15kWh SYSTEM, 29.0% SHADING

	Solar Radiation	AC Energy	Value
Month	(kWh / m2 / day)	(kWh)	($)
January	2.98	813	73
February	3.77	932	84
March	5.24	1,399	125
April	6.37	1,649	148
May	6.69	1,769	159
June	7.01	1,785	161
July	6.56	1,710	154
August	6.09	1,582	143
September	5.94	1,477	133
October	4.79	1,259	113
November	3.69	957	86
December	2.99	815	73
Annual	5.18	**16,147**	**$1,451**

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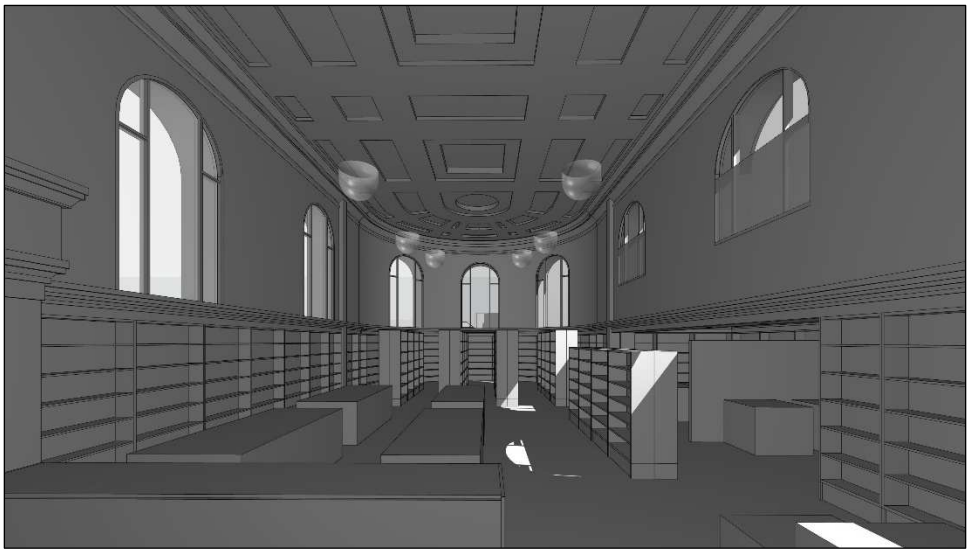
ILLUMINATION IMPACT ANALYSIS REPORT

DAYLIGHT & ELECTRICAL LIGHTS ILLUMINATION STUDY

FOR **Golden Gate Valley Library**



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I. INTRODUCTION

SYMPHYSIS was hired to conduct a study to determine the normal use conditions in the Golden Gate Valley Library, and analyze the illumination impact of the proposed project at 2651-53 Octavia.

Using photographic evidence from photos taken in all years 2013-2021 (see appendix), it was determined that during open hours, the normal use condition in the library is **natural light from the windows AND illumination from electric lights**. To determine the electric light data for the simulation model, SYMPHYSIS used the library's architectural permit plans and fixture schedule dated May 21, 2009, and verified with site photographs.

SYMPHYSIS analyzed 2,406 individual points on the interior of the library's main reading room for the following conditions:

- Overcast sky (no sun) December 21st for all times of day, to represent the worst-case daylight conditions.
- Partly cloudy sky for September 21st at 9:00 am, 12:00 pm, and 3:00 pm, to represent the mid-season case daylight conditions.
- Clear sky for June 21st at 9:00 am, 12:00 pm, and 3:00 pm, to represent the best daylight conditions.

The report herein presents the results of this analysis. ■

Olivier A. Pennetier, M.Arch, LEED AP
SYMPHYSIS Principal

CABEC
California Association of Building Energy Consultants
CERTIFIED ENERGY ANALYST
CEA# R16-19-2017

Our services consist of professional opinions and conclusions developed in accordance with generally accepted environmental design, solar engineering and daylighting design principles and practices. Our conclusions and recommendations are based on the information provided by the clients, USGS Digital Elevation Model and publicly available Geographic Information System database.

II. ANALYSIS SUMMARY

SYMPHYSIS concludes that in the NORMAL library use condition (daylight + electrical lights), the proposed project at 2651-53 Octavia will have a minimal impact on the illumination levels and no impact on visual comfort experienced by the patrons and staff of the library.

The daily average differences in illumination levels between the existing and proposed condition **are -1.0% for overcast skies, -4.2% for partly cloudy skies and -2.0% for clear skies**. Note that in all cases, the illumination levels in the Golden Gate Valley Library are within the minimum CIE (International Commission on Illumination) recommended levels for library use, between 300 and 500 lux.

TABLE **1**: AVERAGE ILLUMINANCE (LIGHT LEVELS) VALUES FOR THE **ENTIRE LIBRARY MAIN FLOOR** (LUX).

SKY	**OVERCAST SKY**	**PARTLY CLOUDY SKY**			**CLEAR SKY**		
DAY	*ALL DAYS OF YEAR*	*SEPTEMBER 21ST*			*JUNE 21ST*		
TIME	ALL TIMES OF DAY	9:00 AM	*9:00 AM*	*12:00 PM*	*03:00 PM*	12:00 PM	03:00 PM
EXISTING AVG LUX	398.45	503.20	522.81	434.23	1,095.97	808.71	669.67
PROPOSED AVG LUX	394.30	492.53	474.48	429.47	1,078.30	775.67	668.41
% DIFFERENCE	-1.0%	-2.1%	-9.2%	-1.1%	-1.6%	-4.1%	-0.2%
DAILY AVERAGE	**-1.0%**	**-4.2%**			**-2.0%**		

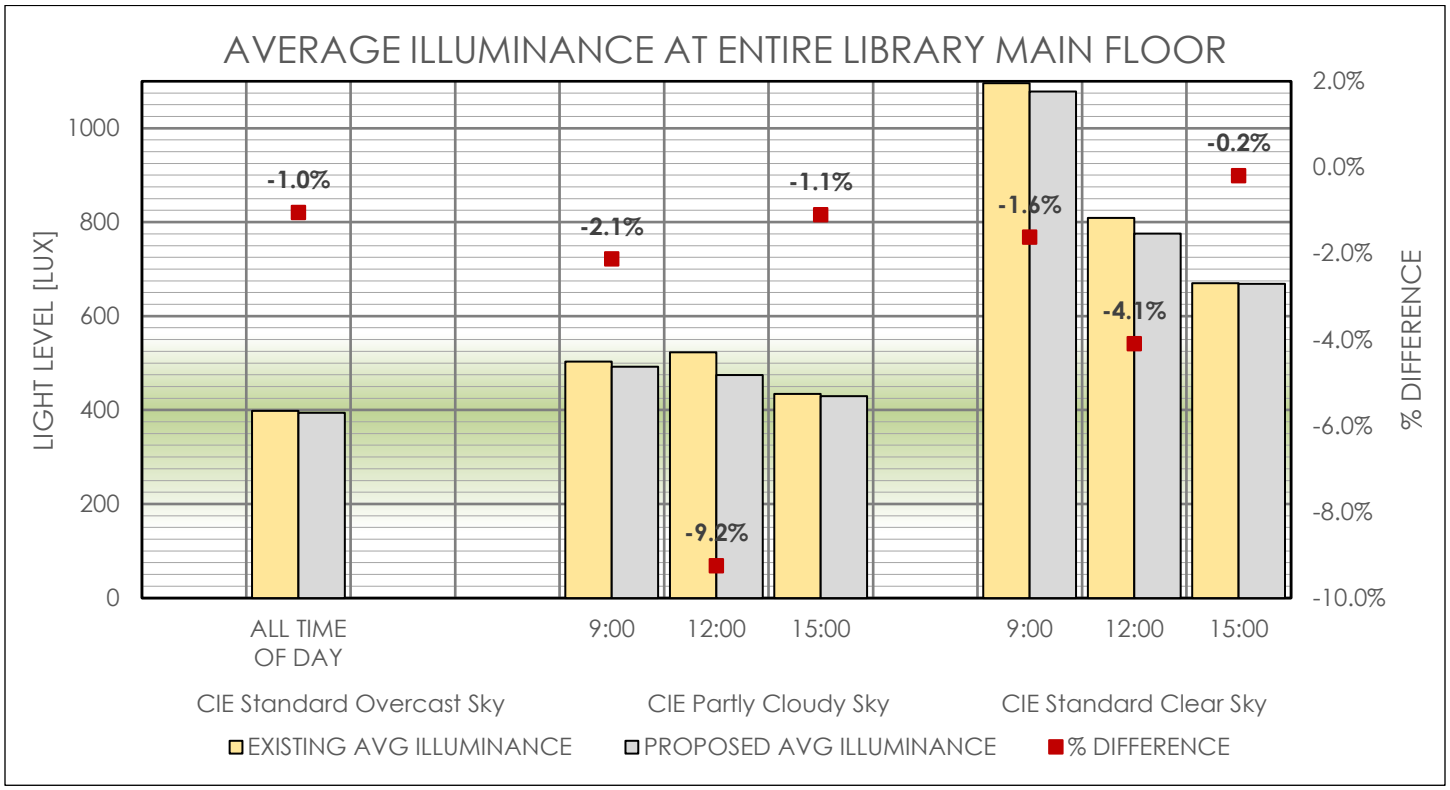


FIGURE **1**: GRAPH OF AVERAGE ILLUMINANCE VALUES FOR THE **ENTIRE LIBRARY MAIN FLOOR.**

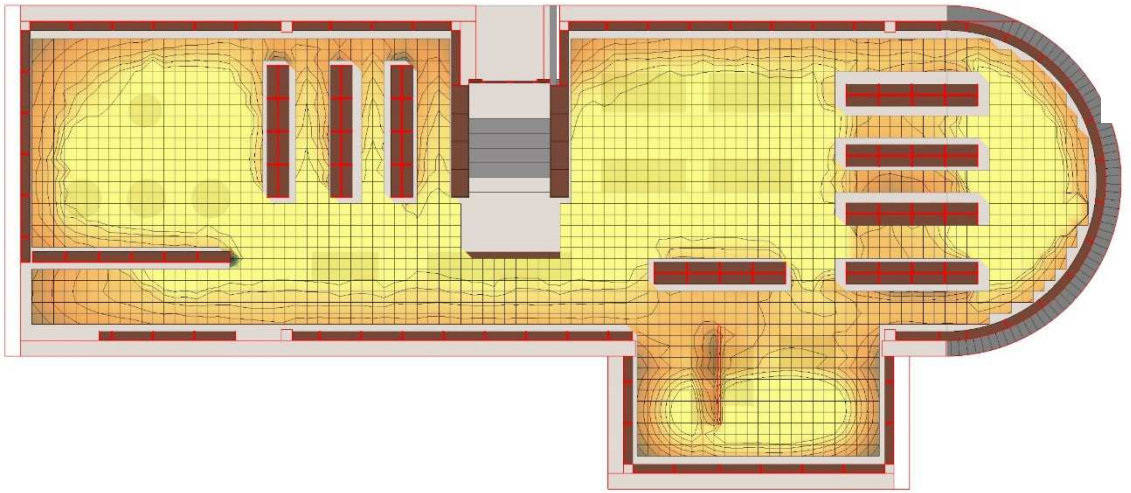
A01

DAYLIGHT + ELECTRICAL LIGHT LEVELS [LUX]

SEPTEMBER 21ST PARTLY CLOUDY SKY – 12:00 PM [worst case]

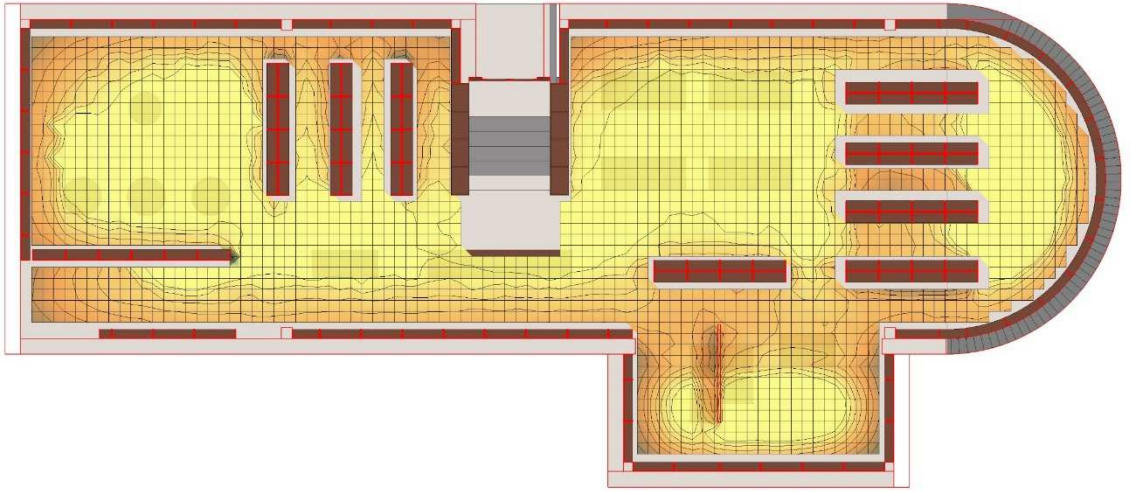
EXISTING CONDITIONS

AVERAGE = 522.81 LUX



PROPOSED CONDITIONS

AVERAGE = 474.48 LUX



ILLUMINATION LEVELS [LUX]

+500	450	400	350	300	250	200	150	100	50	0

III. APPENDICES

A. EVIDENCE THAT ELECTRIC LIGHTS ARE TURNED ON UNDER NORMAL CONDITIONS

Here is a list of links pointing to numerous photographs showing electric lights on within the library, between 2013 and 2021:

Google Street Views:

Dec 2013	Feb 2014	Jan 2015	Jun 2016	Feb 2017	Mar 2018	April 2019
	June 2014	Oct 2015		Sept 2017	Jun 2018	
	Sept 2014	Nov 2015		Dec 2017		
	Aug 2014					
	Nov 2014					

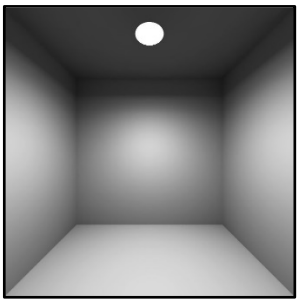
Library Patrons Internet Photographs:

Sept 2017	Feb 2019	Feb 2021
	April 2019	

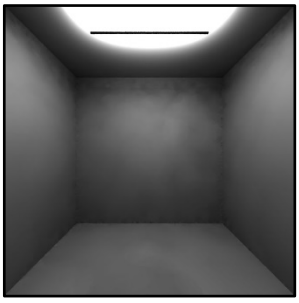
Project Sponsor's Photographs – verified by Metadata:

Owner Photos

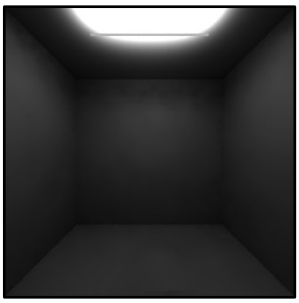
B. IES LUMINAIRE FILES USED IN THE MODEL (PER PERMITED TITLE 24 LTG-2-C)



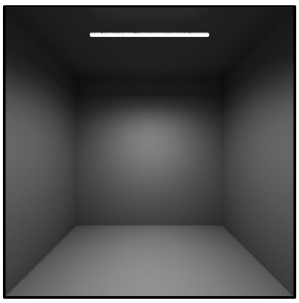
Luminaire ID on plan = **F1**
Lamp type = CF42DT
Lumen = 3,200
Luminaire # = 14
Lamp /Luminaire = 4
Note = Main pendant fixtures at library room



Luminaire ID on plan = **F2**
Lamp type = F28T5
Lumen = 2,900
Luminaire # = 58
Lamp /Luminaire = 1
Note = Fluorescent uplights around library walls

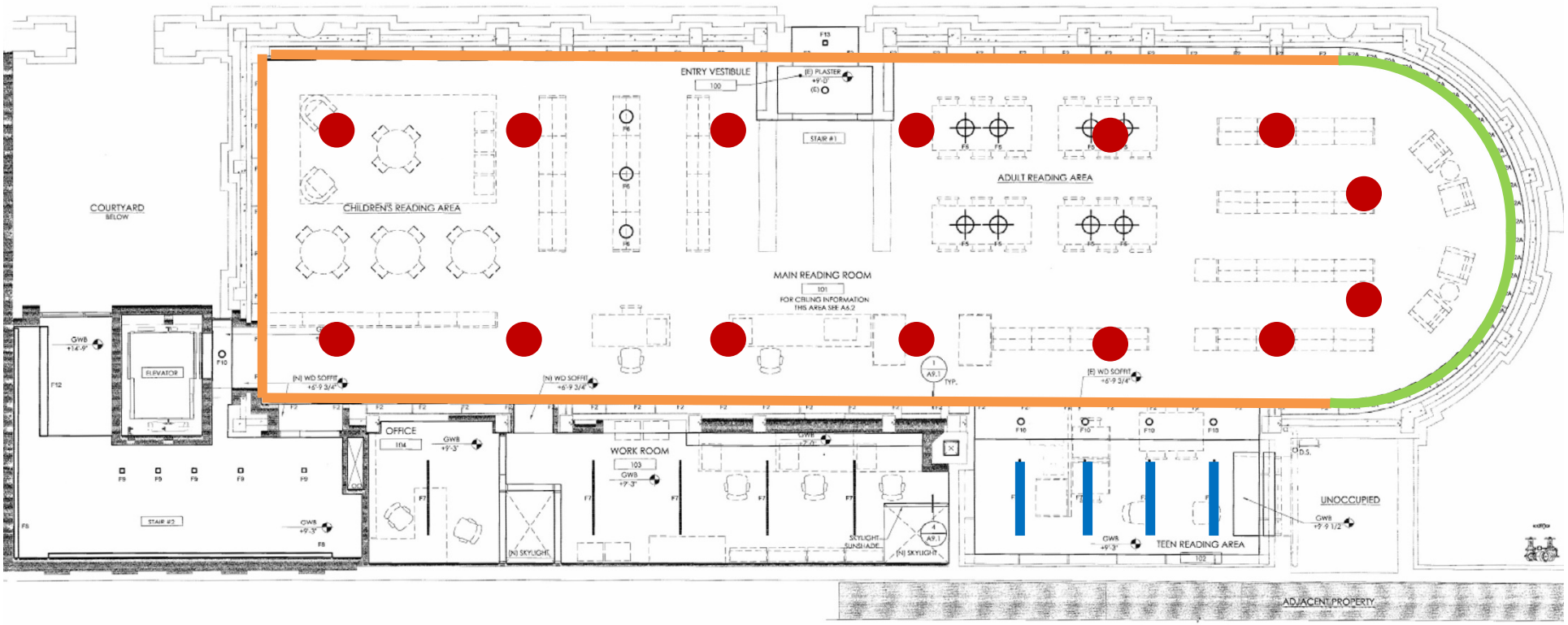


Luminaire ID on plan = **F2A**
Lamp type = F14T5
Lumen = 1,350
Luminaire # = 30
Lamp /Luminaire = 1
Note = Fluorescent uplights at library East walls

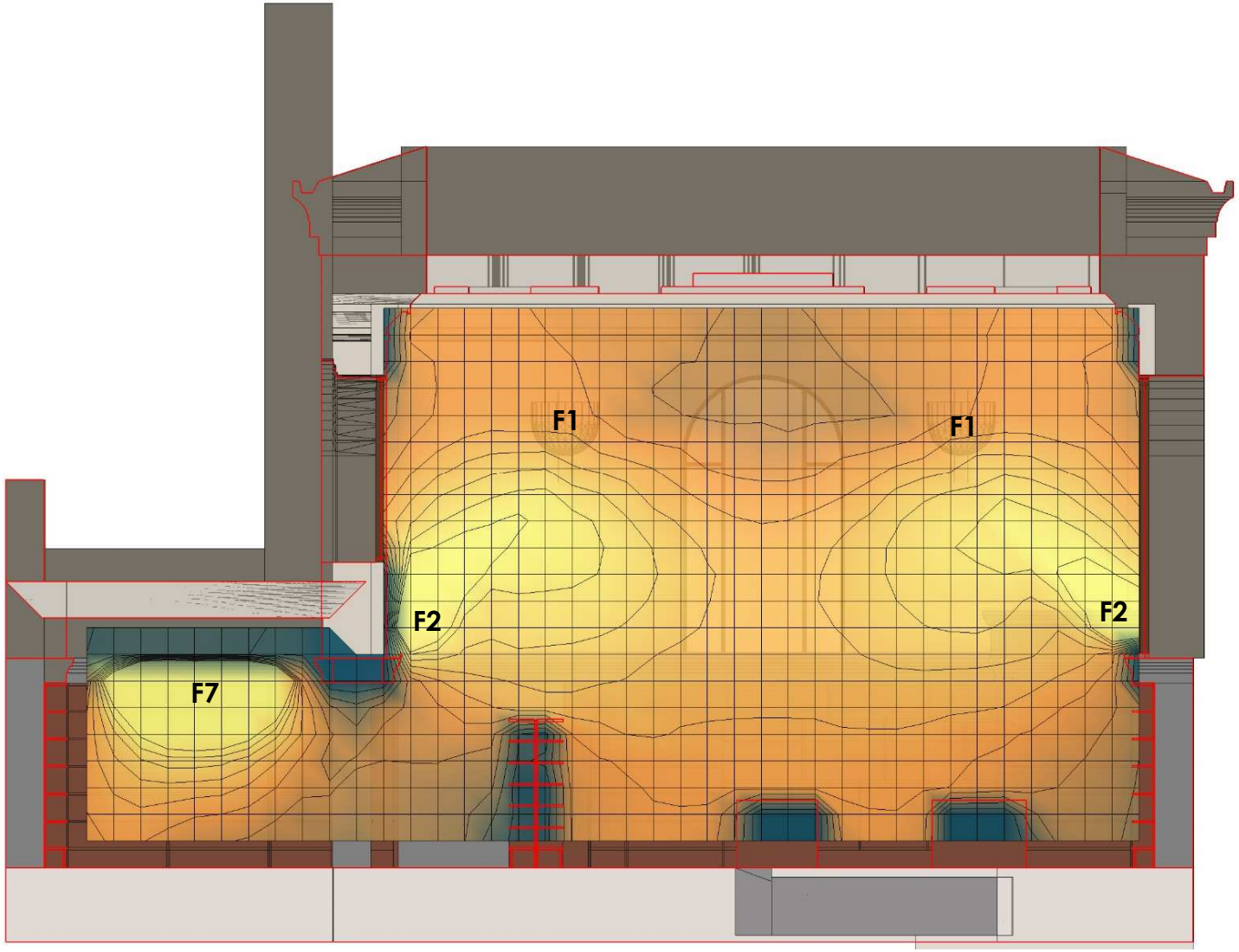


Luminaire ID on plan = **F7**
Lamp type = F24T5 (replaces F21T5 with similar lumen output)
Lumen = 2,000
Luminaire # = 4
Lamp /Luminaire = 4
Note = Fluorescent pendants at Teen's reading room

C. LUMINAIRES LOCATION



ELECTRICAL PLAN FROM ARCHITECTURAL PERMIT SET, SHEET A6.1, AND LUNMINAIRES USED IN THE SIMULATION



ELECTRIC LIGHT CROSS-SECTIONAL DISTRIBUTION AT THE LIBRARY FLOOR. F1 & F2A BEYOND CUTTING PLANE.

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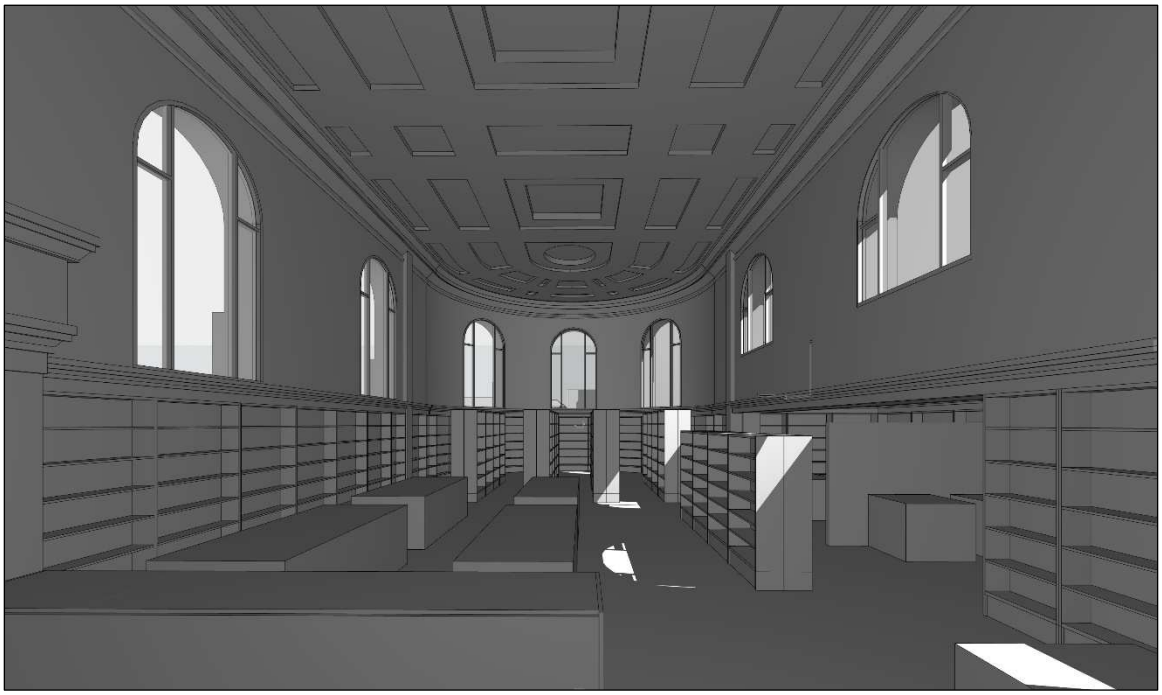
DAYLIGHT IMPACT ANALYSIS REPORT

FOR **2651-53 OCTAVIA STREET** | DECEMBER 13TH 2020



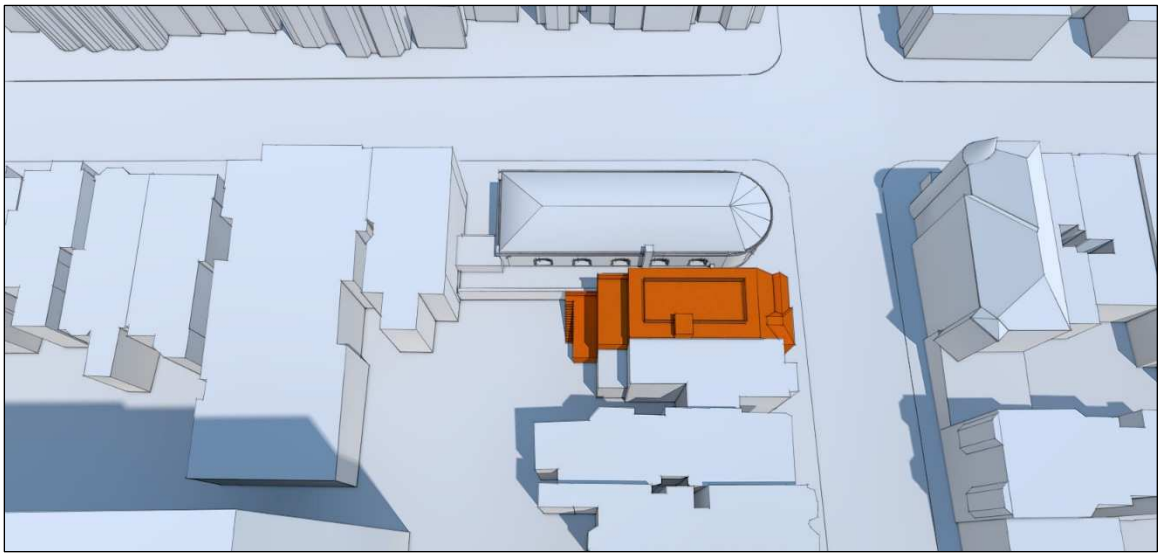


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TABLE OF CONTENTS

I. INTRODUCTION & ANALYSIS SUMMARY

SYMPHYSIS was asked to perform a daylight study to assess the impact of the proposed addition project at 2651-2653 Octavia Street (Planning Department Case # 2018-011022PRJ) upon the natural light (daylight) levels and quality at the main floor reading room of the Golden Gate Valley Branch library. Although this study is not required for the proposed project's environmental review under CEQA, it was conducted in response to some of the comments made at the July 28, 2020 public hearing before the San Francisco Board of Supervisors regarding the appeal of the categorical exemption issued by the San Francisco Planning Department on September 5, 2019 for the 2651-2653 Octavia Street project.

After performing the daylighting analysis, SYMPHYSIS concludes that **the proposed project at 2653 Octavia Street will not reduce the visual comfort of the library's patrons** in any significant way, when compared to the current existing conditions. The proposed project reduces the libraries' averaged illumination levels minimally for clear sky (-1.8%), overcast sky (-4%), and partly cloudy sky (-11.1%). For both the overcast and partly cloudy skies, the existing conditions require electrical illumination at ALL times to provide the necessary illumination recommended for libraries (300-500 LUX), thus even the small reductions with the proposed condition are irrelevant.

The report herein describes the proposed project, the methodology used for the daylight study, and the results that led to the conclusion. ■

Olivier A. Pennetier, M.Arch, LEED AP
SYMPHYSIS Principal
12/13/2020

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CEA# R16-19-2017

Our services consist of professional opinions and conclusions developed in accordance with generally accepted environmental design, solar engineering and daylighting design principles and practices. Our conclusions and recommendations are based on the information provided by the clients, USGS Digital Elevation Model and publicly available Geographic Information System database.

II. PROJECT LOCATION

The proposed project is located at 2653 Octavia Street, in the Northeastern corner of the Pacific Heights neighborhood, block 0554, lot 002. ■

FIGURE **1**: LOCATION MAP

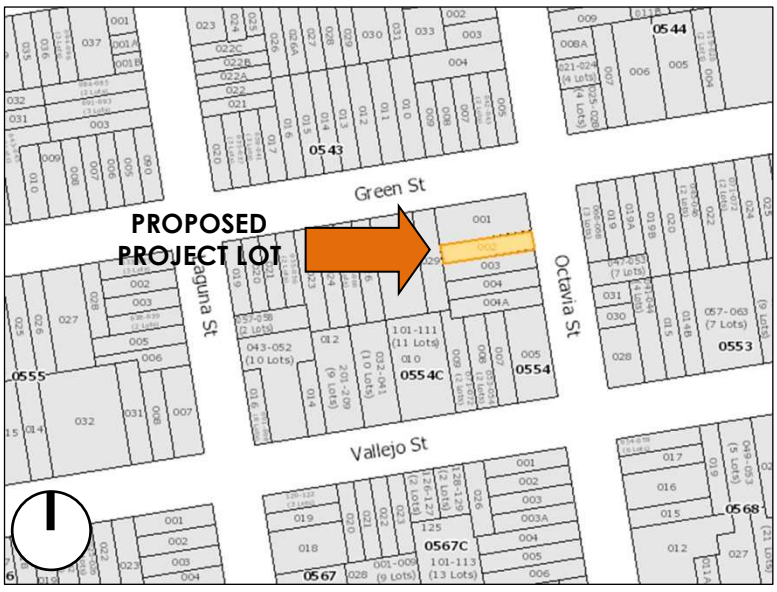


FIGURE **2**: BLOCK MAP

III. PROPOSED PROJECT DESCRIPTION

The proposed design features a new fourth story addition on top of an existing 3 story single family residence. The new addition will increase the height of the building to 39'-10 ½", and the building will be pushed toward the rear yard by an additional 19.5 feet at the lowest level.

The following images show the 3D massing models for the existing conditions and proposed design. ■

FIGURE **3**: 3D MASSING MODEL OF THE EXISTING CONDITIONS.

FIGURE **4**: 3D MASSING MODEL OF THE PROPOSED DESIGN.

FIGURE **5**: AERIAL VIEW OF THE CURRENT CONDITIONS AS OF 07/06/2020.

IV. ANALYSES RESULTS & CONCLUSIONS

This chapter presents the analyses results and conclusions of the study. The methodology used for each analysis is explained briefly in this chapter; for the full detail and description, see chapter V, Analysis Methodology.

A. DAYLIGHT AUTONOMY

The Daylight Autonomy analysis calculates the percentage of time, during the libraries open hours (10am - 8 pm), **when supplemental light is NOT required** to meet acceptable illuminance levels. The IES recommended values for libraries are 300 LUX for stacks and 500 LUX for task and reading areas. To calculate an overall difference at the highest-level analysis, we used an average of 400 LUX as our target, and averaged all light sensor points (2,406) in the library.

In the table below, the analysis shows that there is minimal difference (-1.7 %) between the existing and proposed conditions, when NO supplemental lighting is necessary.

TABLE **1**: DAYLIGHT AUTONOMY VALUES FOR THE **ENTIRE LIBRARY MAIN FLOOR**.

EXISTING DAYLIGHT AUTONOMY	47.80%
PROPOSED DAYLIGHT AUTONOMY	46.97%
% DIFFERENCE	**-1.7%**

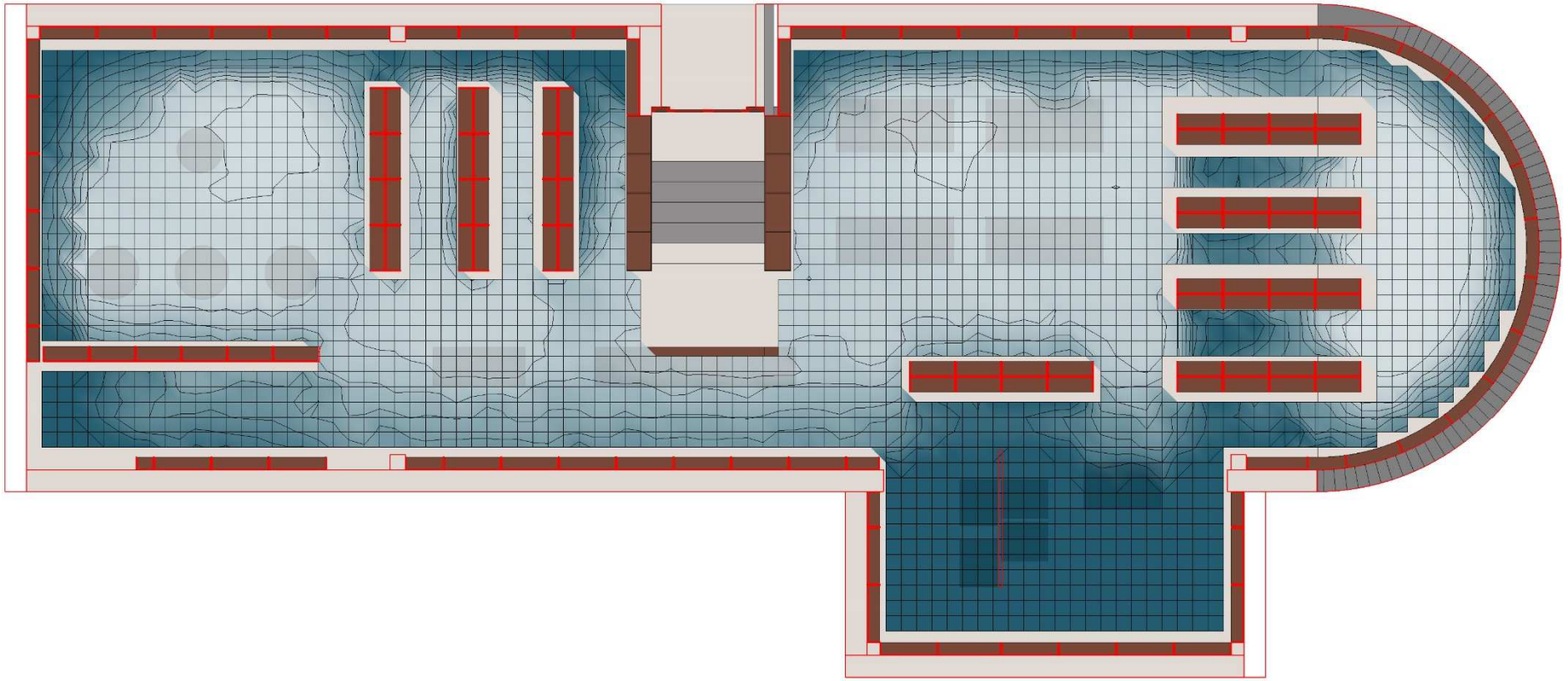
The diagrams below – **A01** (existing) and **A02** (proposed) show the analysis of the annual Daylight Autonomy in specific locations of the library. The darkest blue means that the space requires artificial light 100% of the time and the lightest white means that the space requires supplemental light 0% of the time. Note that there is very little difference between the existing and the proposed conditions and that artificial light is required in all areas of the library at a minimum of 52.2% of the time.

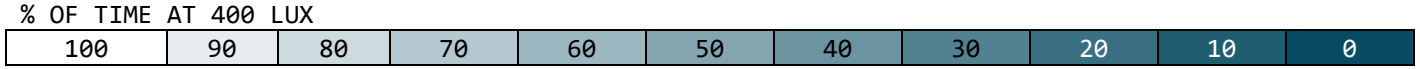
A01

DAYLIGHT AUTONOMY FOR EXISTING CONDITIONS

TARGET:400 LUX 10:00 AM – 08:00 PM | MONDAY THROUGH SUNDAY | ALL YEAR

Daylight Analysis
Daylight Autonomy (400 Lux)

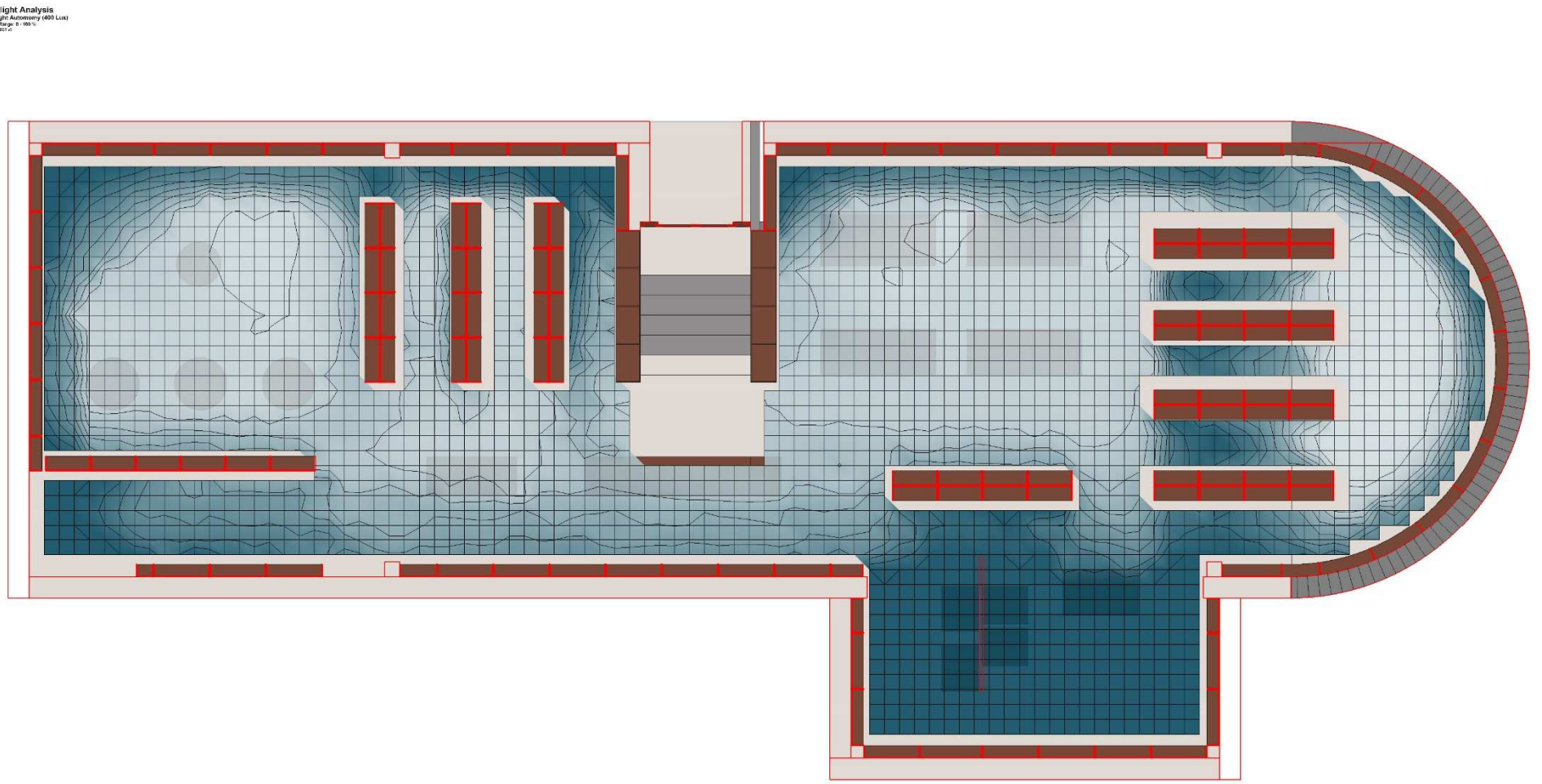


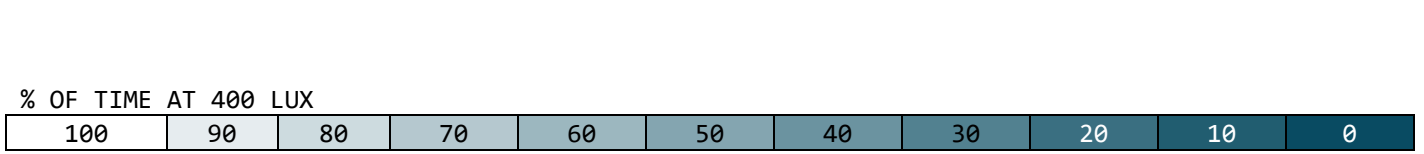


A02

DAYLIGHT AUTONOMY FOR PROPOSED CONDITIONS

TARGET:400 LUX 10:00 AM – 08:00 PM | MONDAY THROUGH SUNDAY | ALL YEAR





B. ILLUMINANCE ANALYSIS:

Illuminance analysis assesses the light levels on working planes, as defined in the Analysis Methodology, chapter V. For this study, the analysis was completed for the entire library's main floor. Also, to obtain a more granular spatial assessment, analysis was completed separately for the most used areas of the library - the adult reading area and the children reading area.
To encompass a wide range of various daylighting conditions, the study simulated light levels for the following dates and sky conditions:

- Best-case Illuminance - June 21st (highest sun angle), and clear sky for the times 9am, 12pm, and 3pm.
- Intermediate-case Illuminance - September 21st (mid sun angle, which is also similar to March 21st), partly cloudy sky for the times 9am, 12pm, 3pm.
- Worst-case Illuminance - overcast sky, where all days and times are the same since there is no sun.

The following tables and graphs present the results of the illuminance (light levels) calculations for the selected various conditions and locations within the library:

TABLE **2**: AVERAGE ILLUMINANCE (LIGHT LEVELS) VALUES FOR THE **ENTIRE LIBRARY MAIN FLOOR** (LUX).

SKY	OVERCAST SKY	PARTLY CLOUDY SKY			CLEAR SKY		
DAY	*ALL DAYS OF YEAR*	*SEPTEMBER 21ST*			*JUNE 21ST*		
TIME	ALL TIMES OF DAY	9:00 AM	12:00 PM	03:00 PM	9:00 AM	12:00 PM	03:00 PM
EXISTING AVG LUX	110.12	186.88	191.62	116.27	828.52	500.69	374.11
PROPOSED AVG LUX	105.75	177.42	144.94	111.63	812.93	478.36	377.57
% DIFFERENCE	-4.0%	-5.1%	-24.4%	-4.0%	-1.9%	-4.5%	0.9%
DAILY AVERAGE	**-4.0%**	**-11.1%**			**-1.8%**		

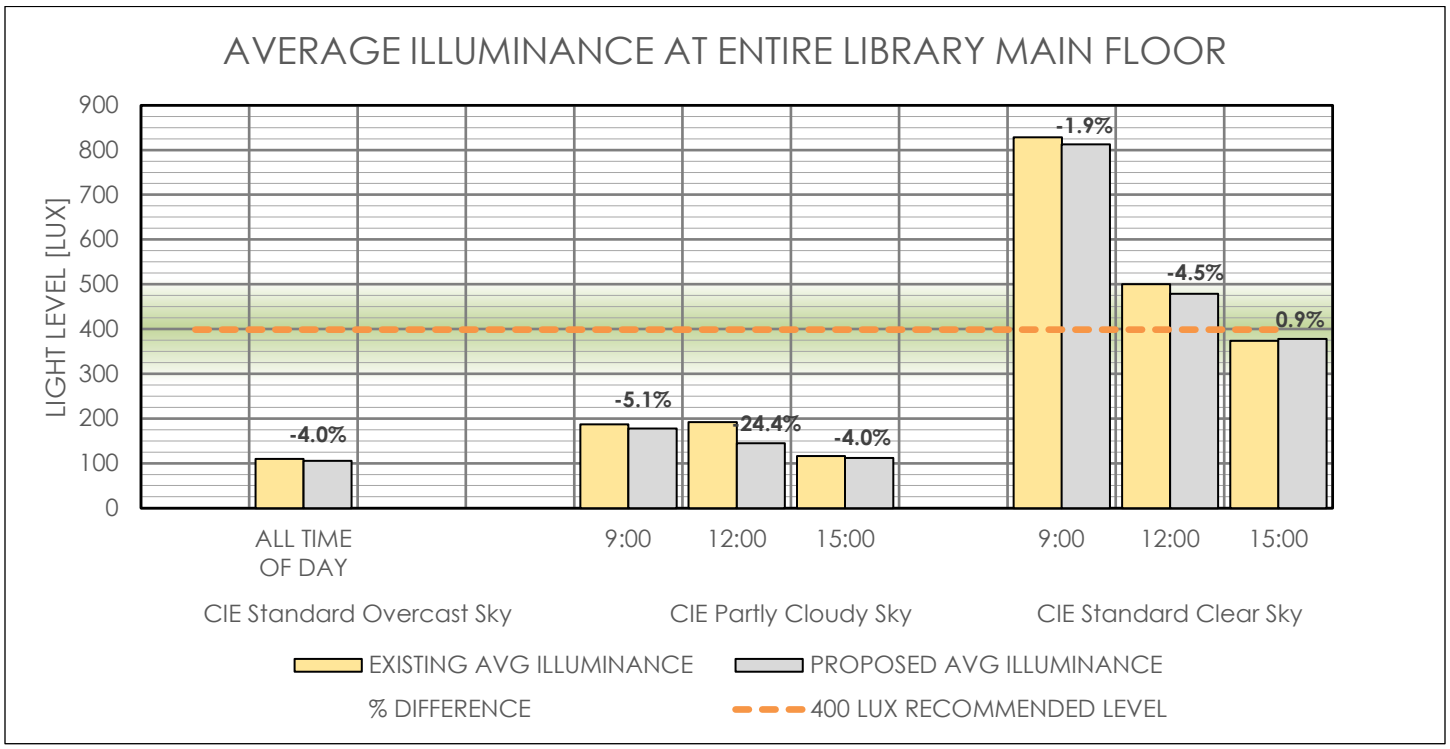


FIGURE **7**: GRAPH OF AVERAGE ILLUMINANCE VALUES FOR THE **ENTIRE LIBRARY MAIN FLOOR.**

The average illumination results show that in the best-case scenario the proposed condition of the library's light is reduced by 1.8%, the intermediate scenario reduction is -11.1% and the worst-case scenario reduction is -4%. **Of importance to note, as indicated by the orange line at 400 LUX, for both the intermediate-case (partly cloudy) and the worst-case (overcast) , the existing and the proposed conditions will require supplemental electric lights to meet the necessary LUX requirement for libraries.**

TABLE **3**: AVERAGE ILLUMINANCE (LIGHT LEVELS) VALUES FOR THE **ADULTS READING AREA** (LUX).

SKY	OVERCAST SKY	PARTLY CLOUDY SKY			CLEAR SKY		
DAY	*ALL DAYS OF YEAR*	*SEPTEMBER 21ST*			*JUNE 21ST*		
TIME	ALL TIMES OF DAY	9:00 AM	12:00 PM	03:00 PM	9:00 AM	12:00 PM	03:00 PM
EXISTING AVG LUX	155.87	148.35	151.01	164.66	532.84	691.07	557.99
PROPOSED AVG LUX	148.08	142.86	129.63	154.6	504.86	635.95	555.46
% DIFFERENCE	-5.0%	-3.7%	-14.2%	-6.1%	-5.3%	-8.0%	-0.5%
DAILY AVERAGE	**-5.0%**	**-8.0%**			**-4.6%**		

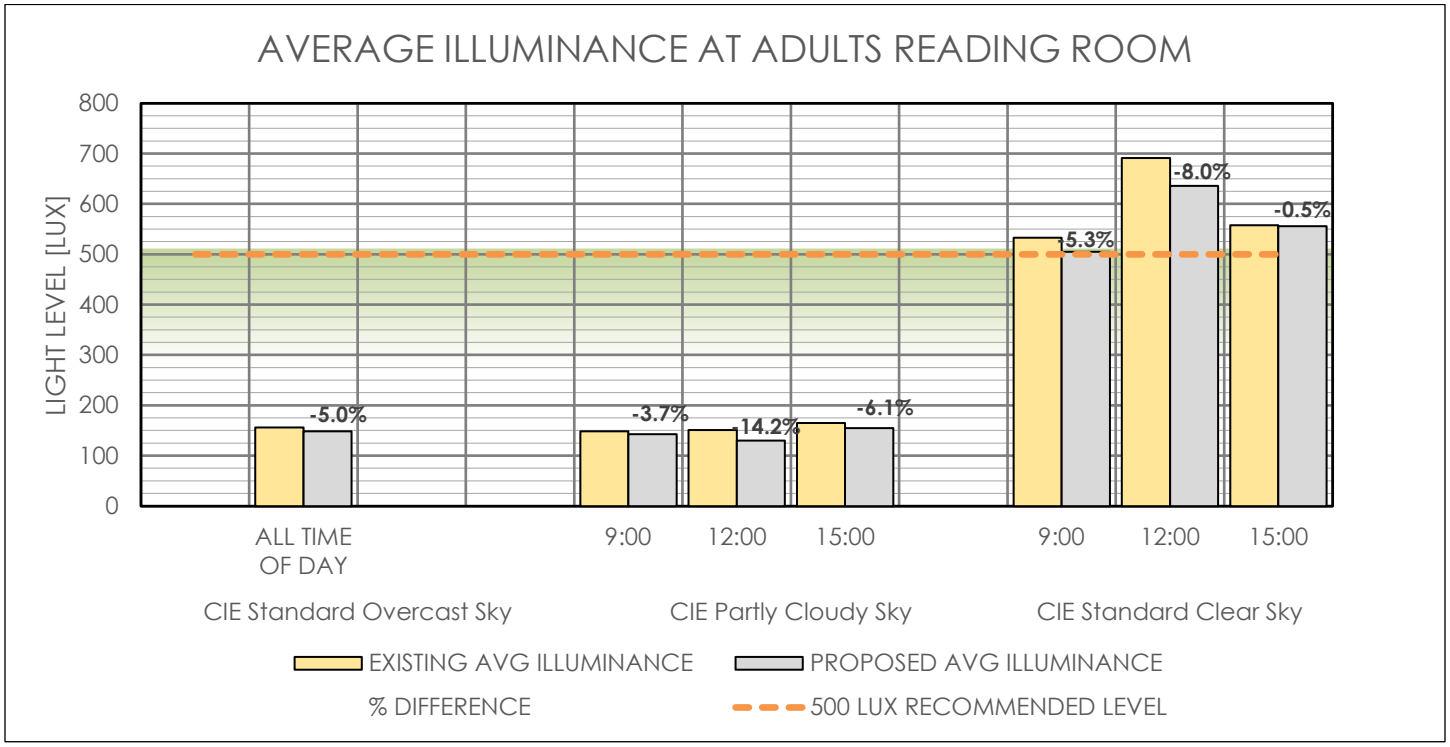


FIGURE **8**: GRAPH OF AVERAGE ILLUMINANCE VALUES FOR THE **ADULTS READING ROOM**.

TABLE **4**: AVERAGE ILLUMINANCE (LIGHT LEVELS) VALUES FOR THE **CHILDREN READING AREA** (LUX).

SKY	OVERCAST SKY	PARTLY CLOUDY SKY			CLEAR SKY		
DAY	*ALL DAYS OF YEAR*	*SEPTEMBER 21ST*			*JUNE 21ST*		
TIME	ALL TIMES OF DAY	9:00 AM	12:00 PM	03:00 PM	9:00 AM	12:00 PM	03:00 PM
EXISTING AVG LUX	128.06	165.49	149.74	131.55	482.92	489.05	393.62
PROPOSED AVG LUX	126.3	146.72	142.29	130.76	468.41	493.6	389.22
% DIFFERENCE	-1.4%	-11.3%	-5.0%	-0.6%	-3.0%	0.9%	-1.1%
DAILY AVERAGE	**-1.4%**	**-5.6%**			**-1.1%**		

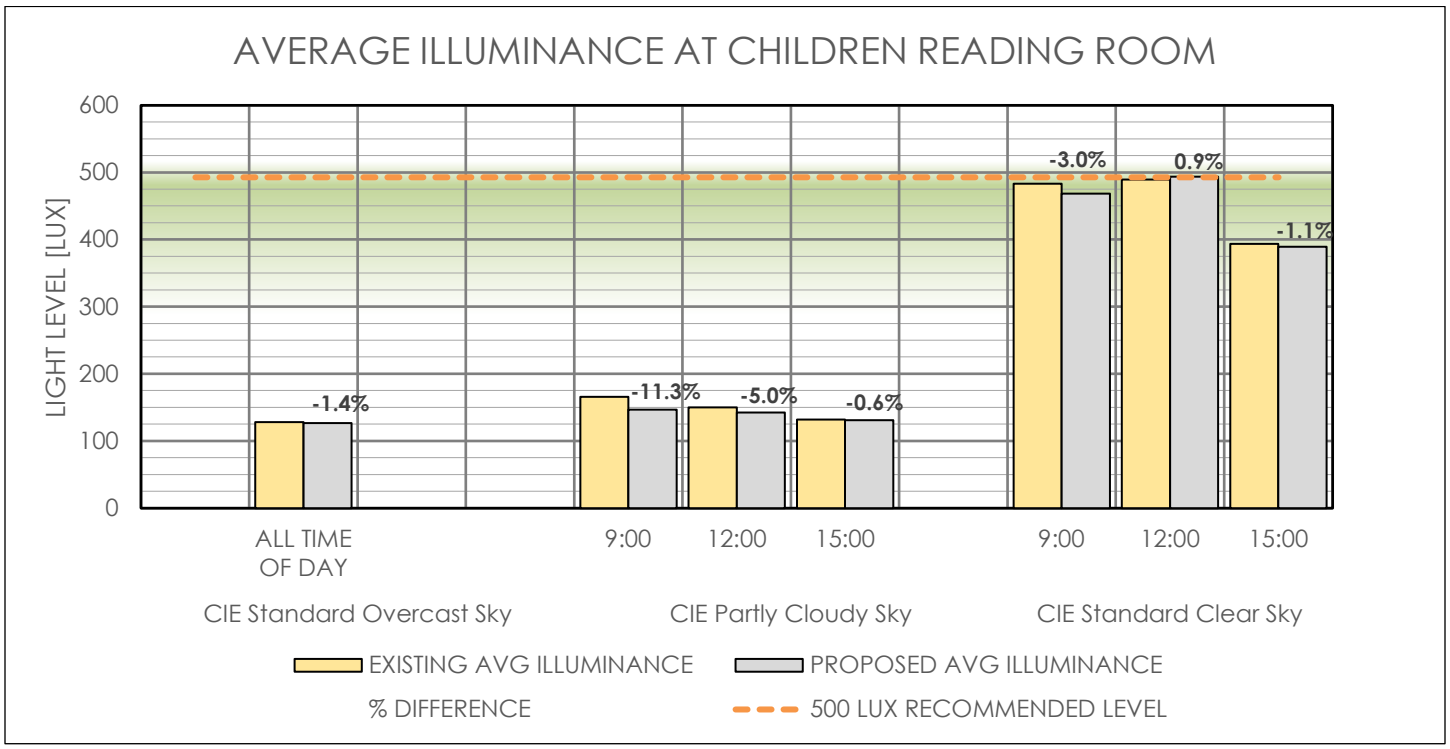


FIGURE **9**: GRAPH OF AVERAGE ILLUMINANCE VALUES FOR THE **CHILDREN READING ROOM**.

Here again, we see the average minimal decreases in light levels:

Adult Reading Area: overcast -5%, partly cloudy -8%, and clear sky -4.6%

Children's Reading area: overcast -1.4%, partly cloudy -5.6% and clear sky -1.1%

For overcast and partly cloudy sky conditions, the average existing light levels within the library reading areas are well below the 500 LUX light levels recommended by the IES for library small print reading areas, therefore supplemental lighting (electrical) is necessary, for BOTH the existing and proposed conditions. As such, the reduction of natural light levels from the proposed condition is irrelevant.

For clear sky conditions in the adult reading area, the proposed light levels fall at or above the IES recommended 500 LUX, so **the small reduction in light would not impact the patrons' visual acuity within the library reading rooms.**

For the clear sky condition in the children's reading area, notice that there was a slight increase in light levels at 12 noon. This is most likely due to the proposed project addition reflecting additional light into the library.

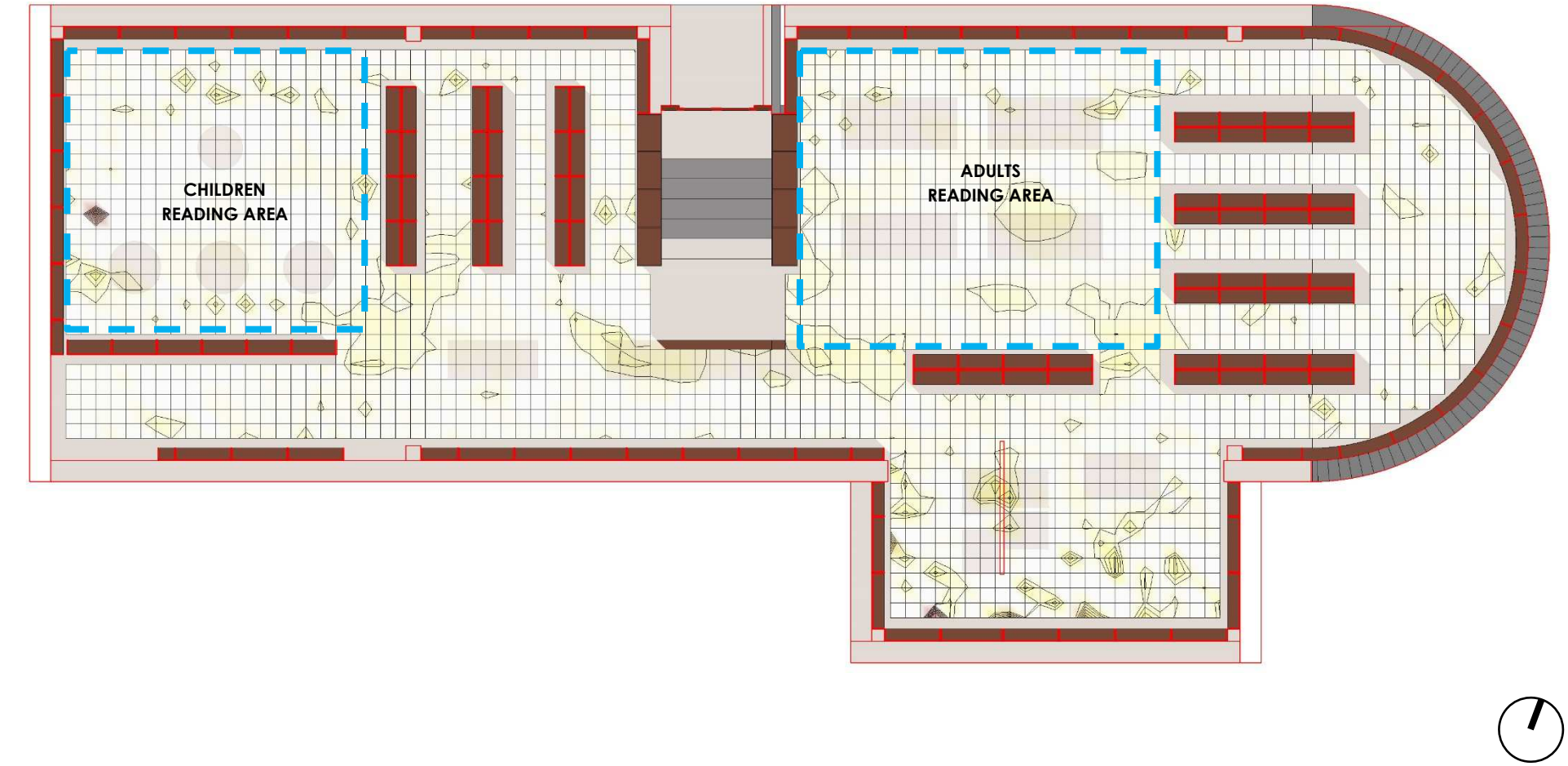
The following diagrams show the **percent difference** in lighting at every light sensor point in the library.

B03

LIGHT LEVELS PERCENTAGE DIFFERENCE [%]

ALL YEAR

OVERCAST SKY – ALL TIMES



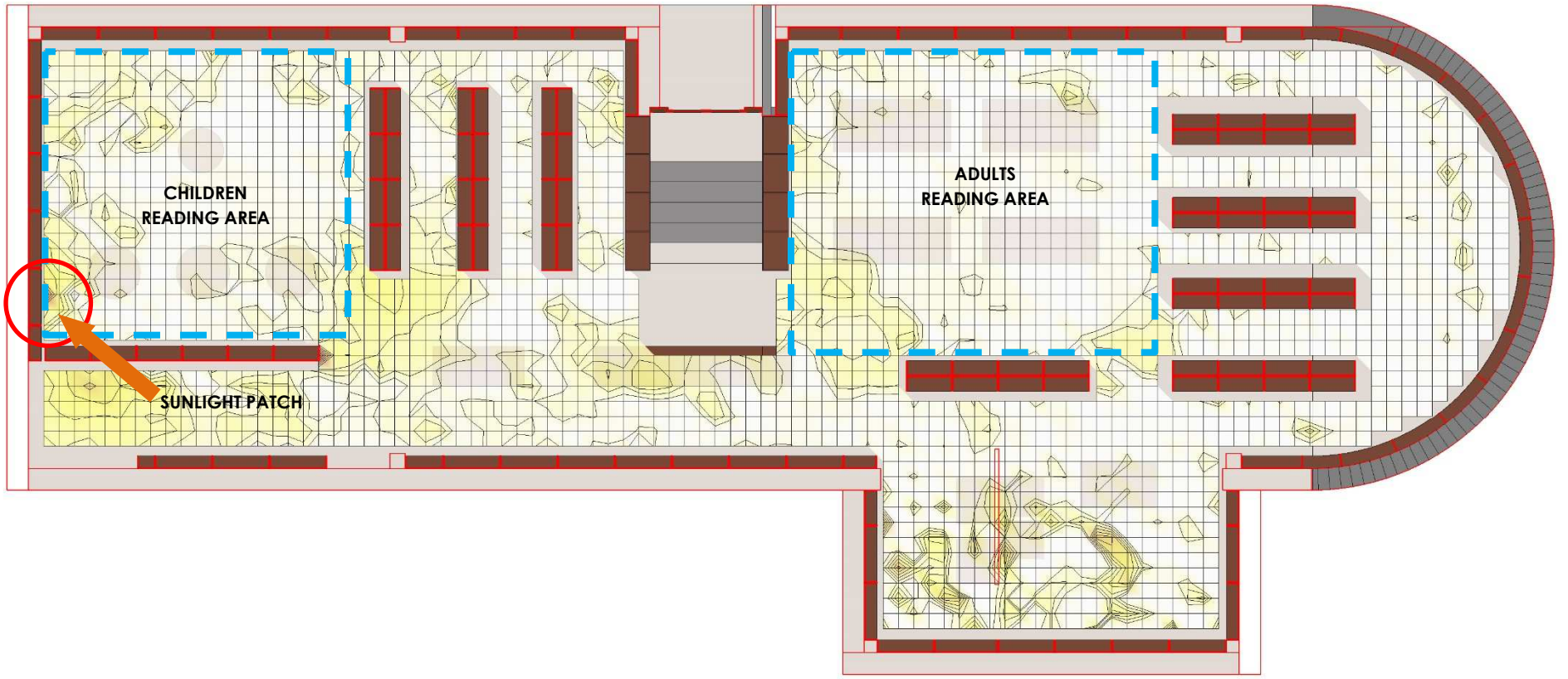
% DIFFERENCE

0.00	-0.10	-0.20	-0.30	-0.40	-0.50	-0.60	-0.70	-0.80	-0.90	-1.00

C03

LIGHT LEVELS PERCENTAGE DIFFERENCE [%]

SEPTEMBER 21ST PARTLY CLOUDY SKY – 09:00 AM



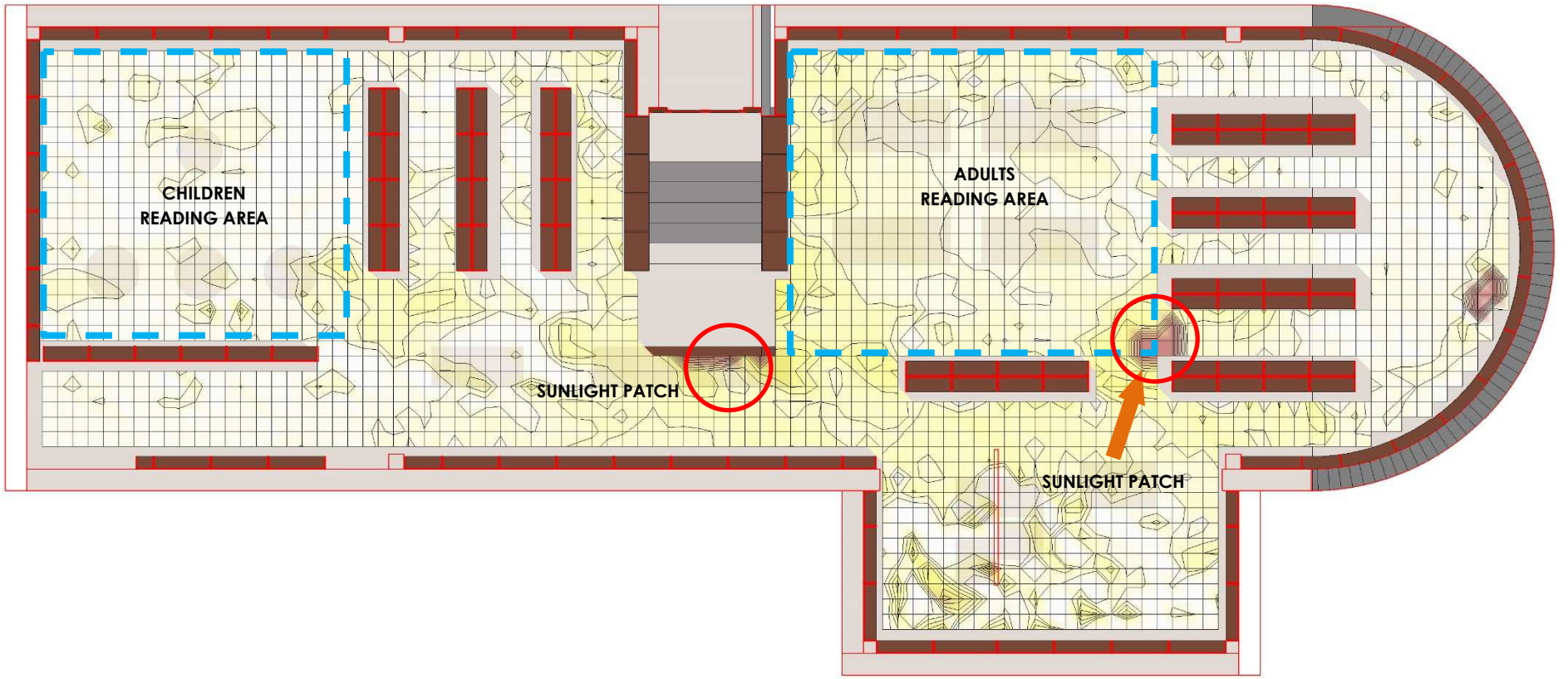
% DIFFERENCE

0.00	-0.10	-0.20	-0.30	-0.40	-0.50	-0.60	-0.70	-0.80	-0.90	-1.00

C06

LIGHT LEVELS PERCENTAGE DIFFERENCE [%]

SEPTEMBER 21ST PARTLY CLOUDY SKY – 12:00 PM



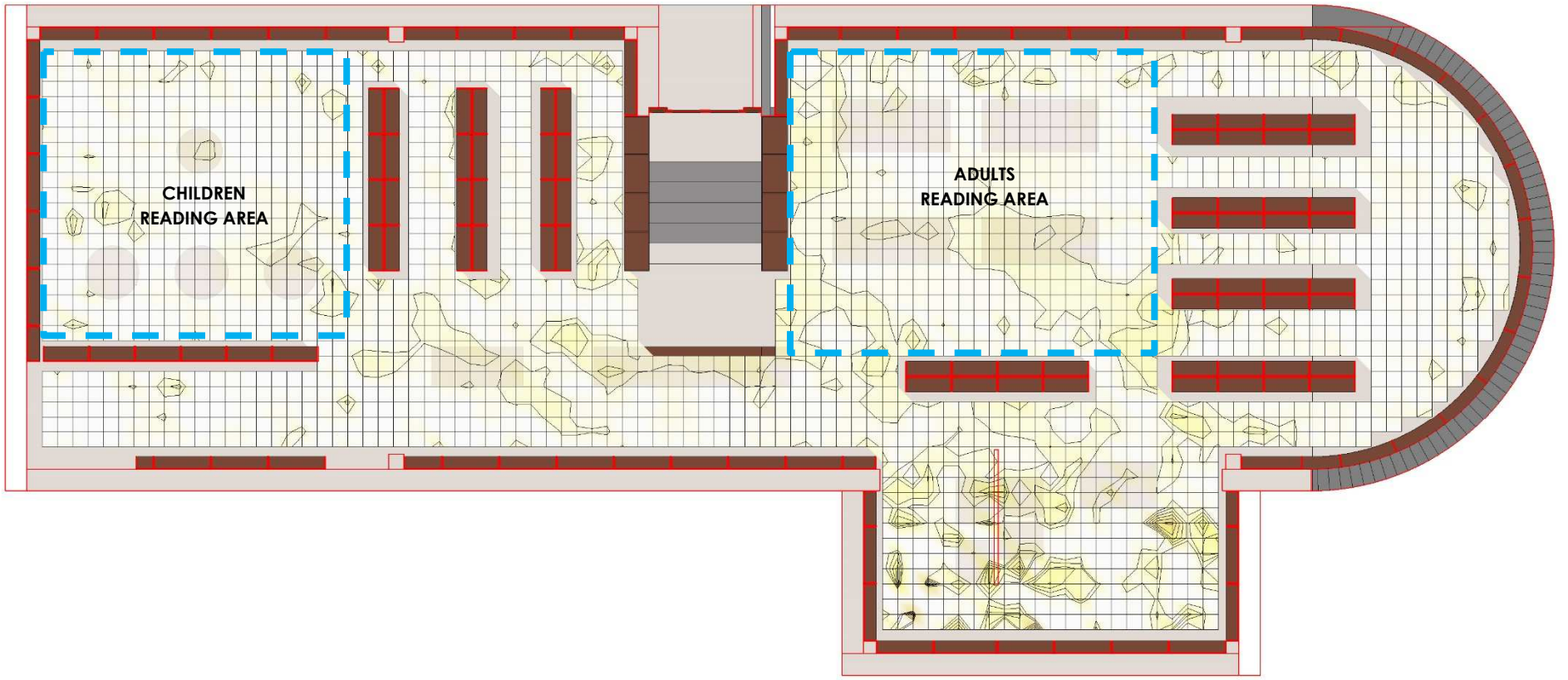
% DIFFERENCE

0.00	-0.10	-0.20	-0.30	-0.40	-0.50	-0.60	-0.70	-0.80	-0.90	-1.00

C09

LIGHT LEVELS PERCENTAGE DIFFERENCE [%]

SEPTEMBER 21ST PARTLY CLOUDY SKY – 03:00 PM



% DIFFERENCE

0.00	-0.10	-0.20	-0.30	-0.40	-0.50	-0.60	-0.70	-0.80	-0.90	-1.00

D03

LIGHT LEVELS PERCENTAGE DIFFERENCE [%]

JUNE 21ST

CLEAR SKY – 09:00 AM

Analysis Grid
RAD Illuminance [lx]

% DIFFERENCE										
0.00	-0.10	-0.20	-0.30	-0.40	-0.50	-0.60	-0.70	-0.80	-0.90	-1.00

D06

LIGHT LEVELS PERCENTAGE DIFFERENCE [%]

JUNE 21ST

CLEAR SKY – 12:00 PM

% DIFFERENCE

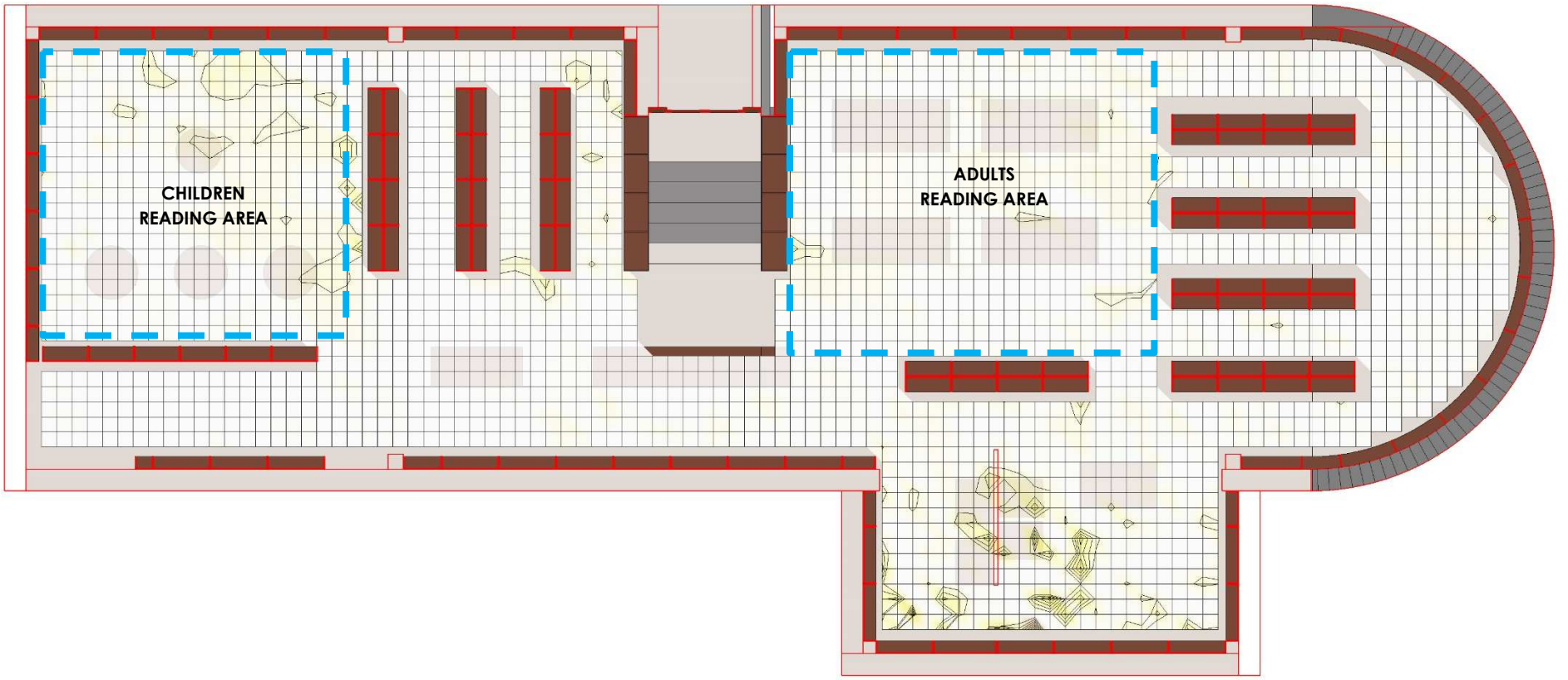
0.00	-0.10	-0.20	-0.30	-0.40	-0.50	-0.60	-0.70	-0.80	-0.90	-1.00

D09

LIGHT LEVELS PERCENTAGE DIFFERENCE [%]

JUNE 21ST

CLEAR SKY – 03:00 PM



% DIFFERENCE

0.00	-0.10	-0.20	-0.30	-0.40	-0.50	-0.60	-0.70	-0.80	-0.90	-1.00

The next diagrams are in LUX units of illuminance and show the light levels at every point in the library. By placing side by side the existing and proposed diagrams for each light / time scenario, one can easily compare the variant light conditions in the library. Looking at the PDF report on the computer, it is easy to flip between two diagrams, with the same sky / day / time, one existing and one proposed, to visually see the light differences. **When evaluating these diagrams, it is important to be aware of the IES light level threshold for libraries (300 for stacks, circulation desk, computer areas, 400 average of all areas, 500 for reading areas).**

An additional analysis was done for a partly cloudy sky at 12:00 pm under proposed conditions without the book stacks to evaluate their effect on the overall daylight levels within the library's main floor. The result shows that the book stacks can reduce the overall light levels by up to 36.7%.

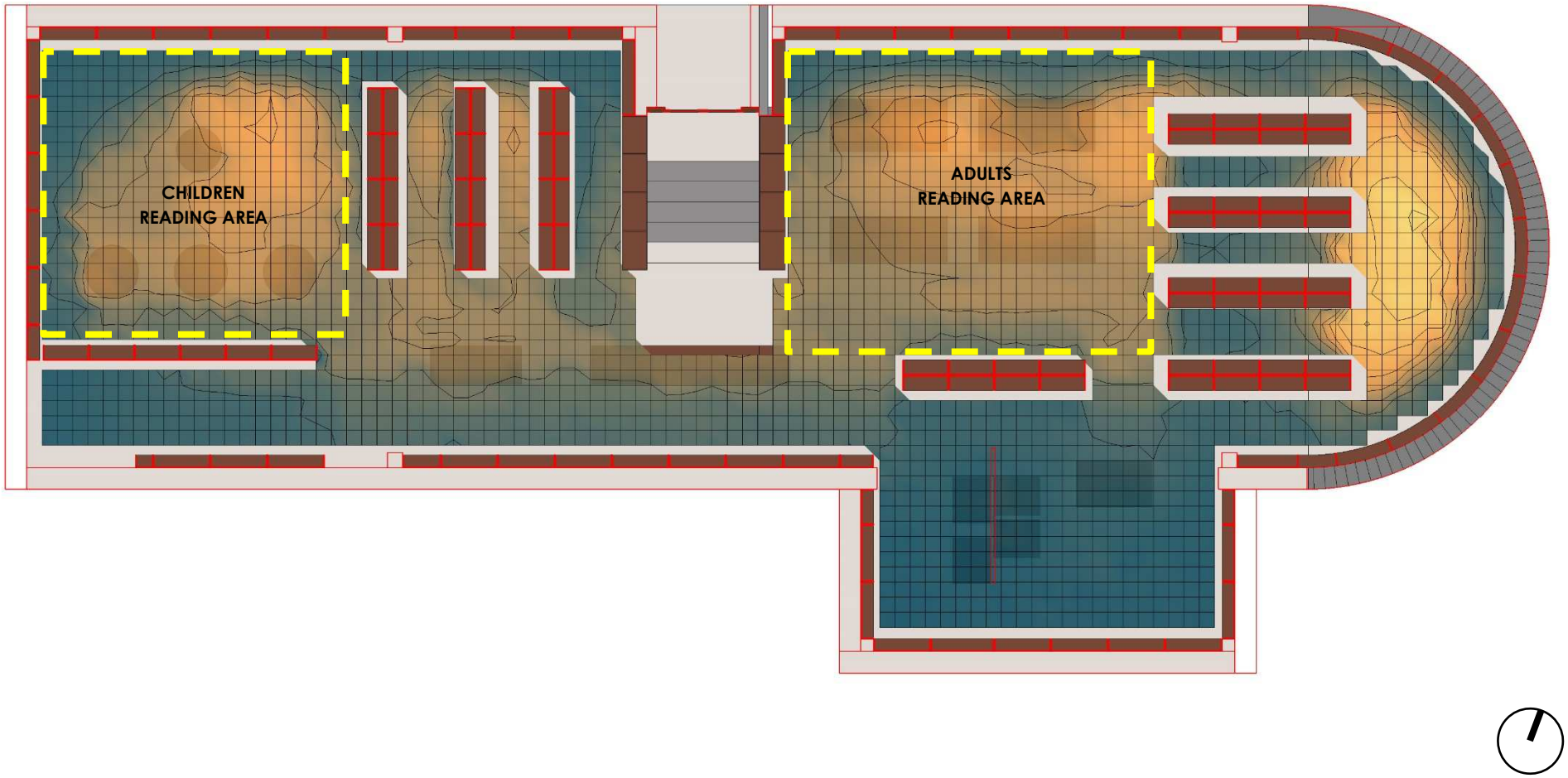
For any colored area that is below 300, supplemental light is needed in all areas. For the children's and adult's reading areas - the yellow LUX level of 500+ means that NO electrical lights are needed, any other color in those reading areas would suggest that supplemental lighting is necessary.

B01

LIGHT LEVELS [LUX] FOR EXISTING CONDITIONS

ALL YEAR

OVERCAST SKY – ALL TIMES

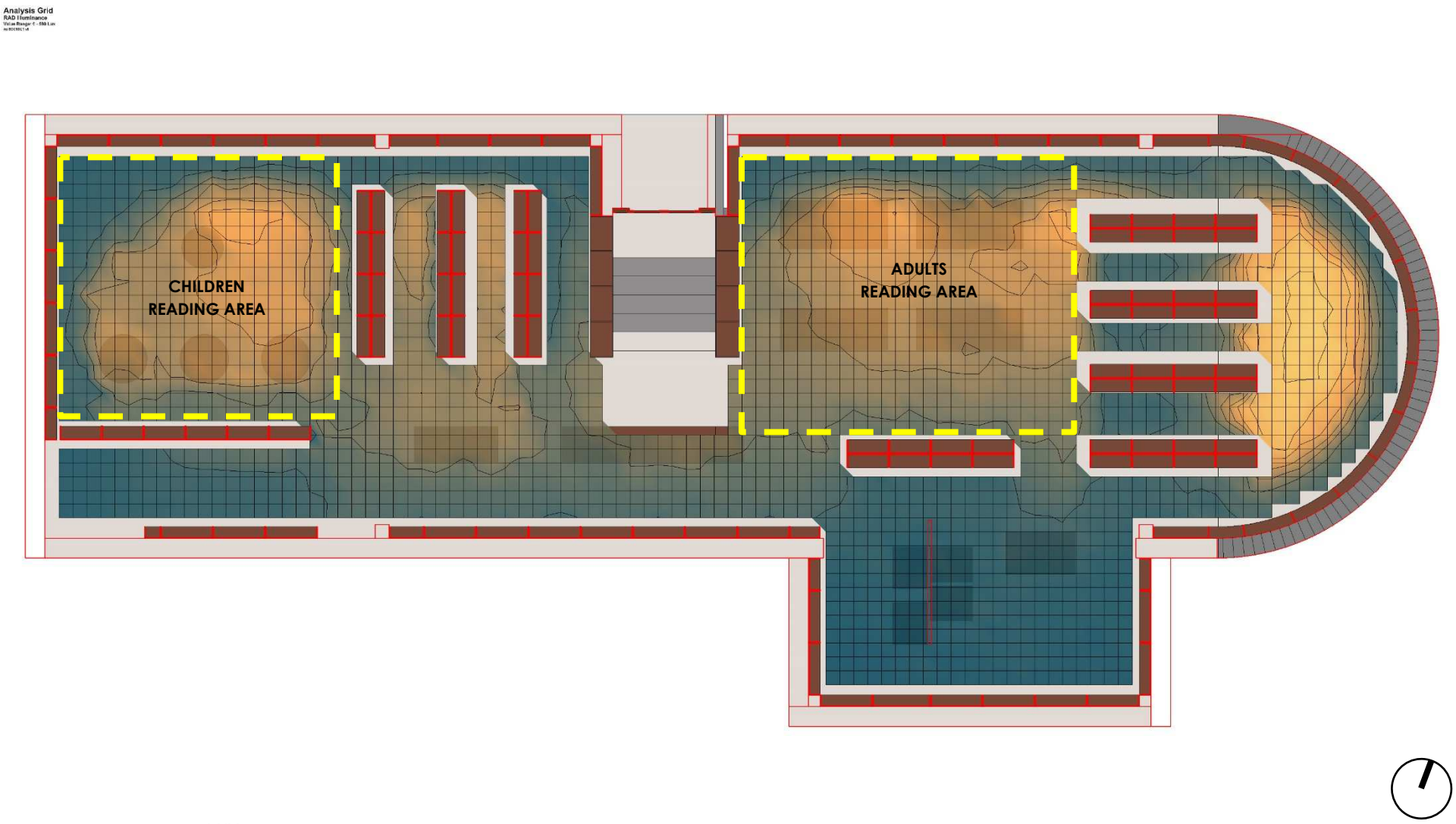


B02

LIGHT LEVELS [LUX] FOR PROPOSED CONDITIONS

ALL YEAR

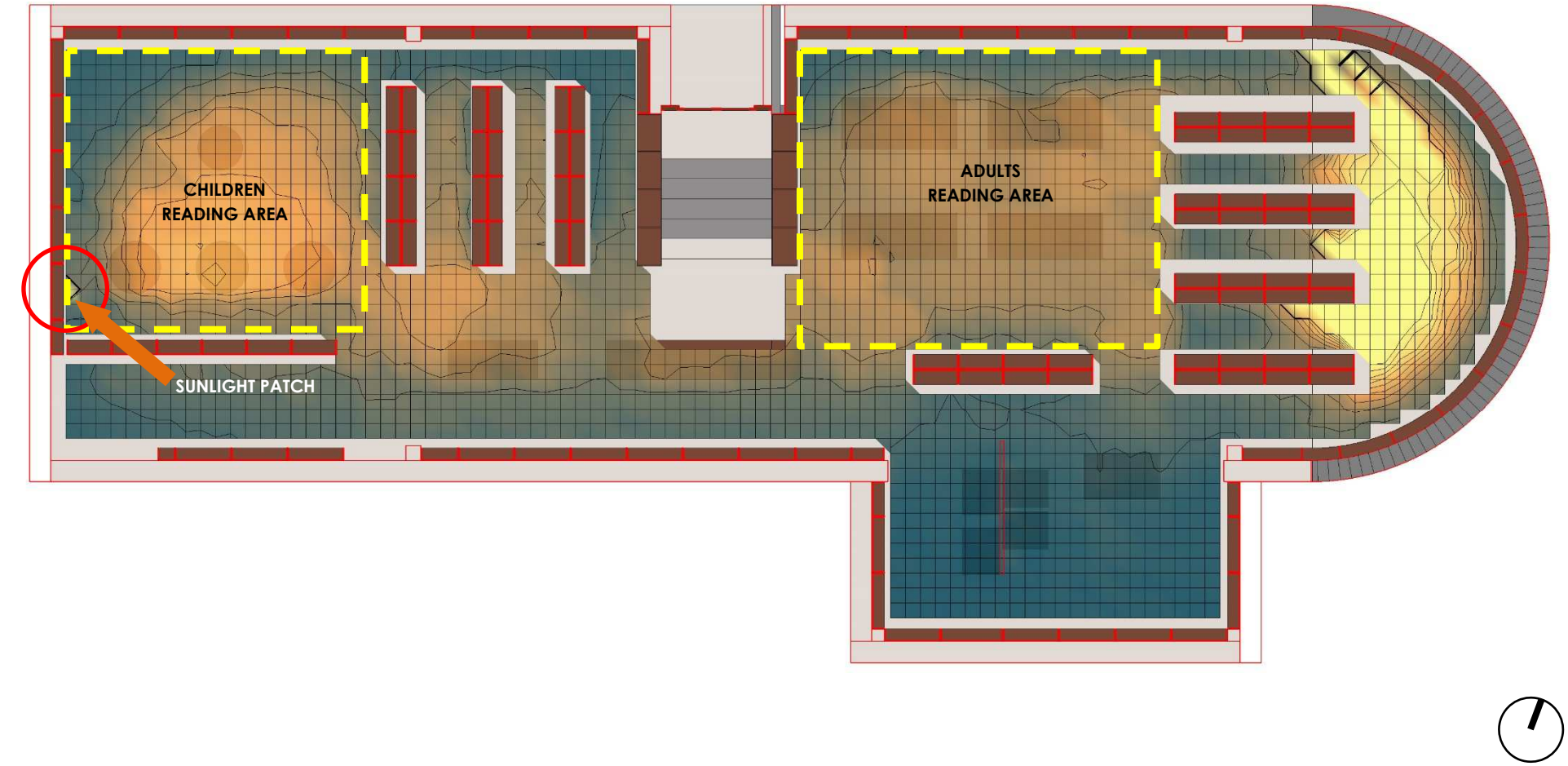
OVERCAST SKY – ALL TIMES



C01

LIGHT LEVELS [LUX] FOR EXISTING CONDITIONS

SEPTEMBER 21ST PARTLY CLOUDY SKY – 09:00 AM



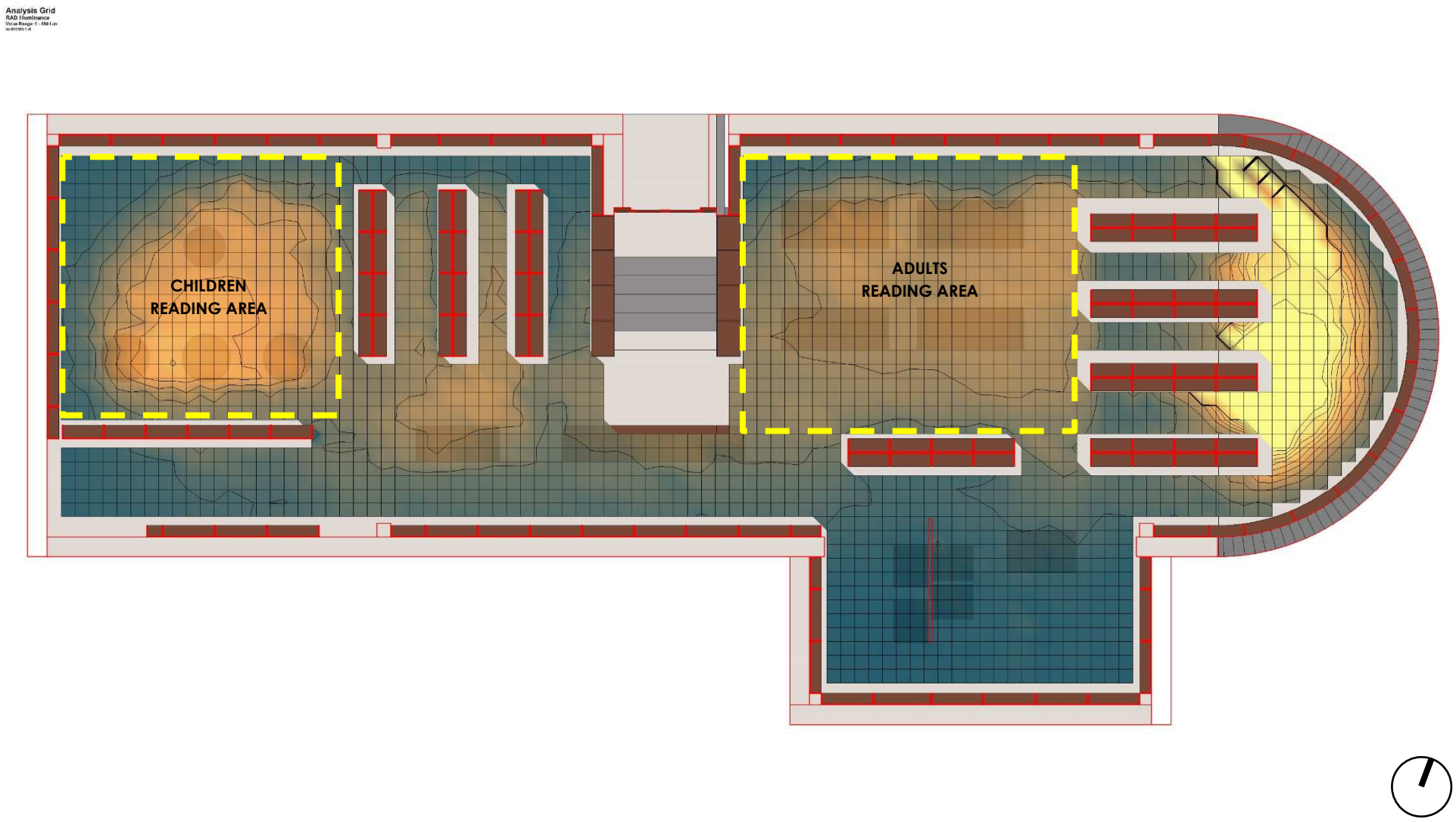
LUX

500	450	400	350	300	250	200	150	100	50	0

C02

LIGHT LEVELS [LUX] FOR PROPOSED CONDITIONS

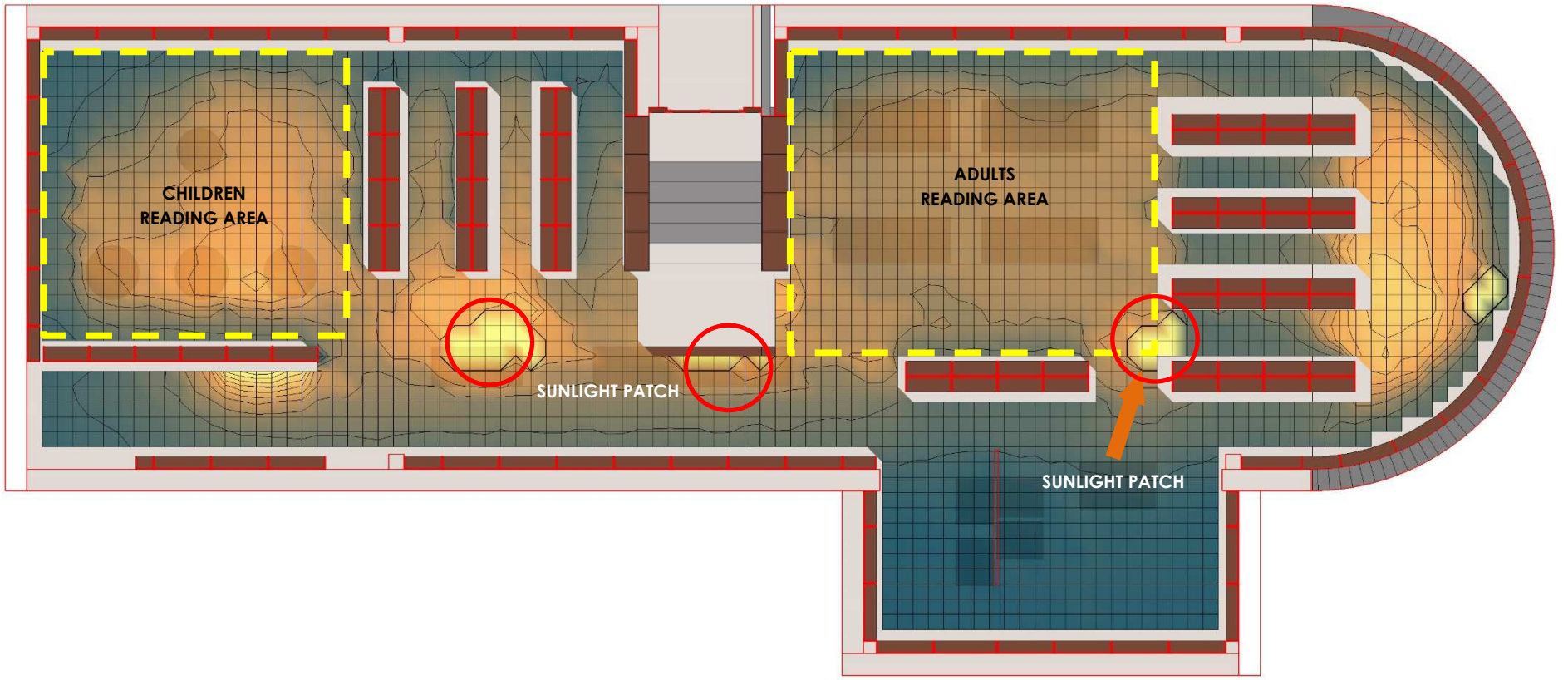
SEPTEMBER 21ST PARTLY CLOUDY SKY – 09:00 AM



C04

LIGHT LEVELS [LUX] FOR EXISTING CONDITIONS

SEPTEMBER 21ST PARTLY CLOUDY SKY – 12:00 PM



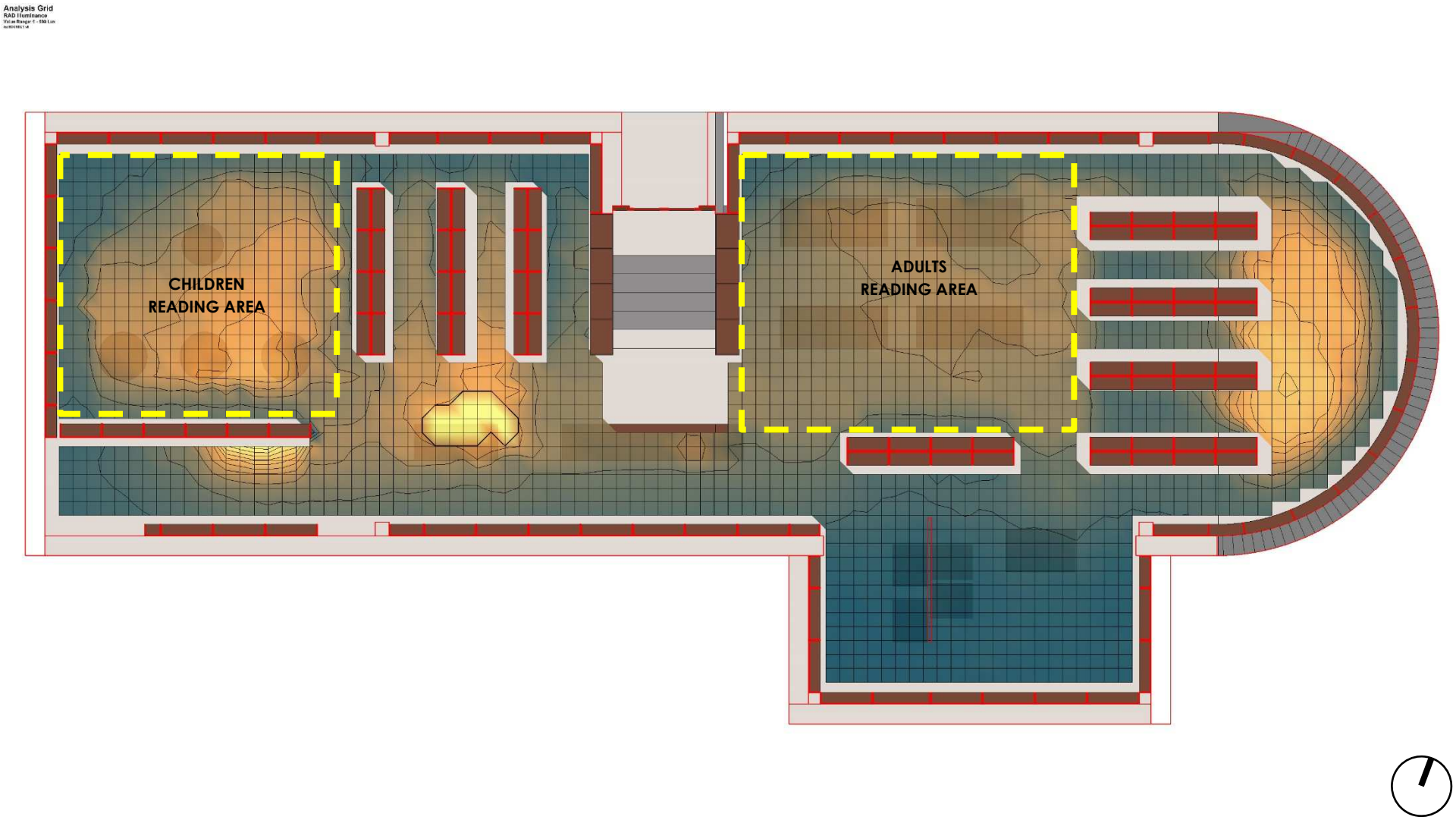
LUX

500	450	400	350	300	250	200	150	100	50	0

C05

LIGHT LEVELS [LUX] FOR PROPOSED CONDITIONS

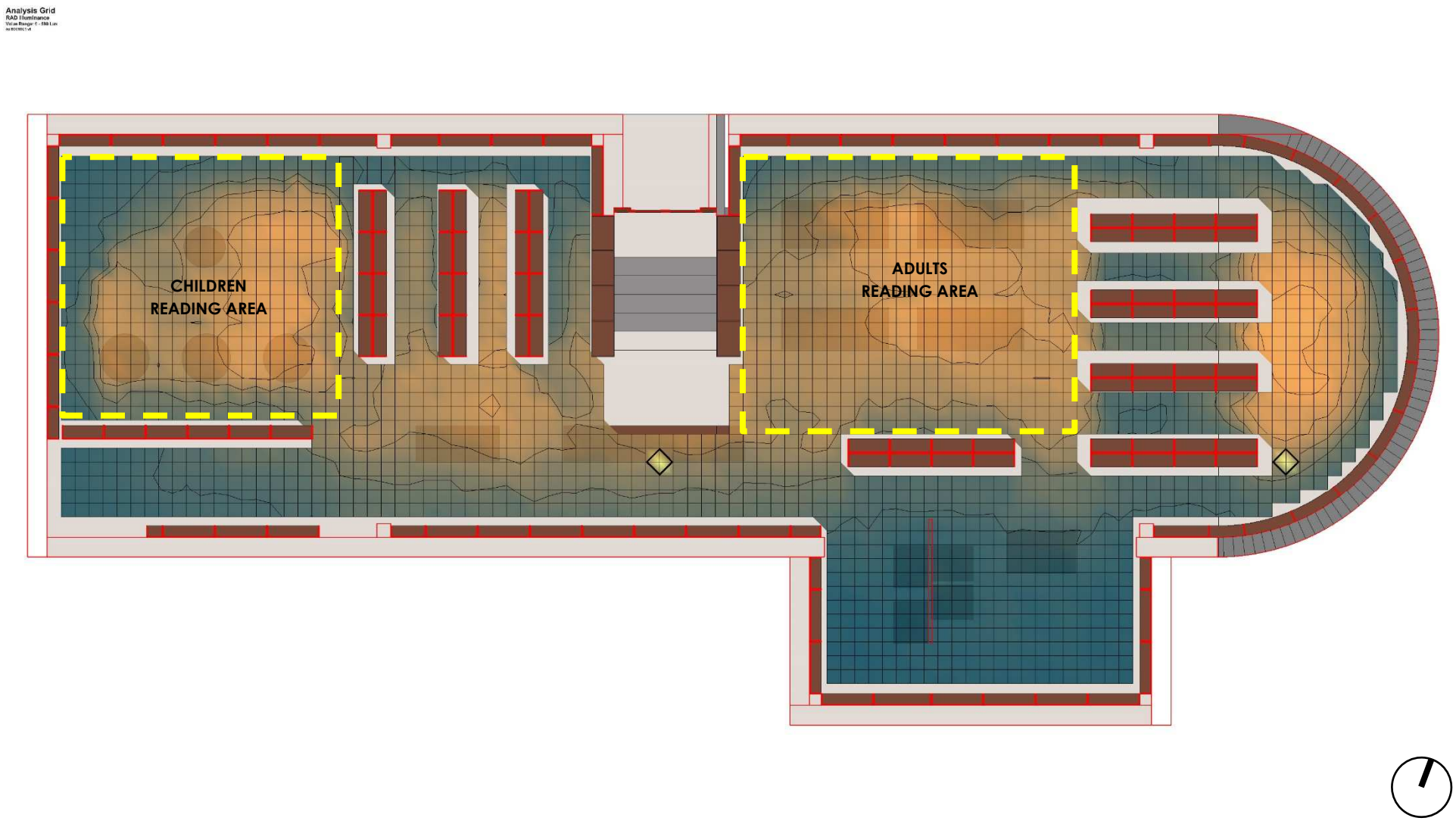
SEPTEMBER 21ST PARTLY CLOUDY SKY – 12:00 PM



C07

LIGHT LEVELS [LUX] FOR EXISTING CONDITIONS

SEPTEMBER 21ST PARTLY CLOUDY SKY – 03:00 PM

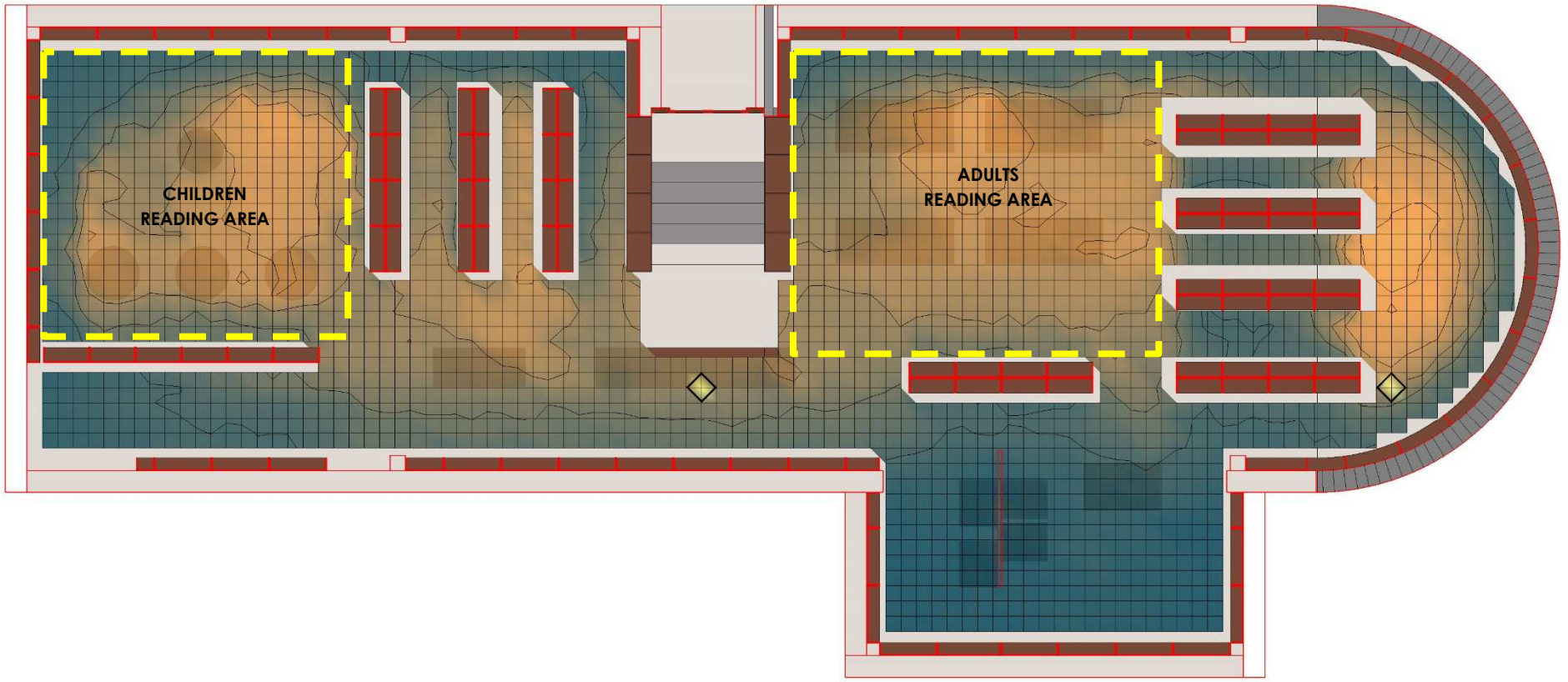


C08

LIGHT LEVELS [LUX] FOR PROPOSED CONDITIONS

SEPTEMBER 21ST PARTLY CLOUDY SKY – 03:00 PM

Analysis Grid
RAD Illuminance



LUX

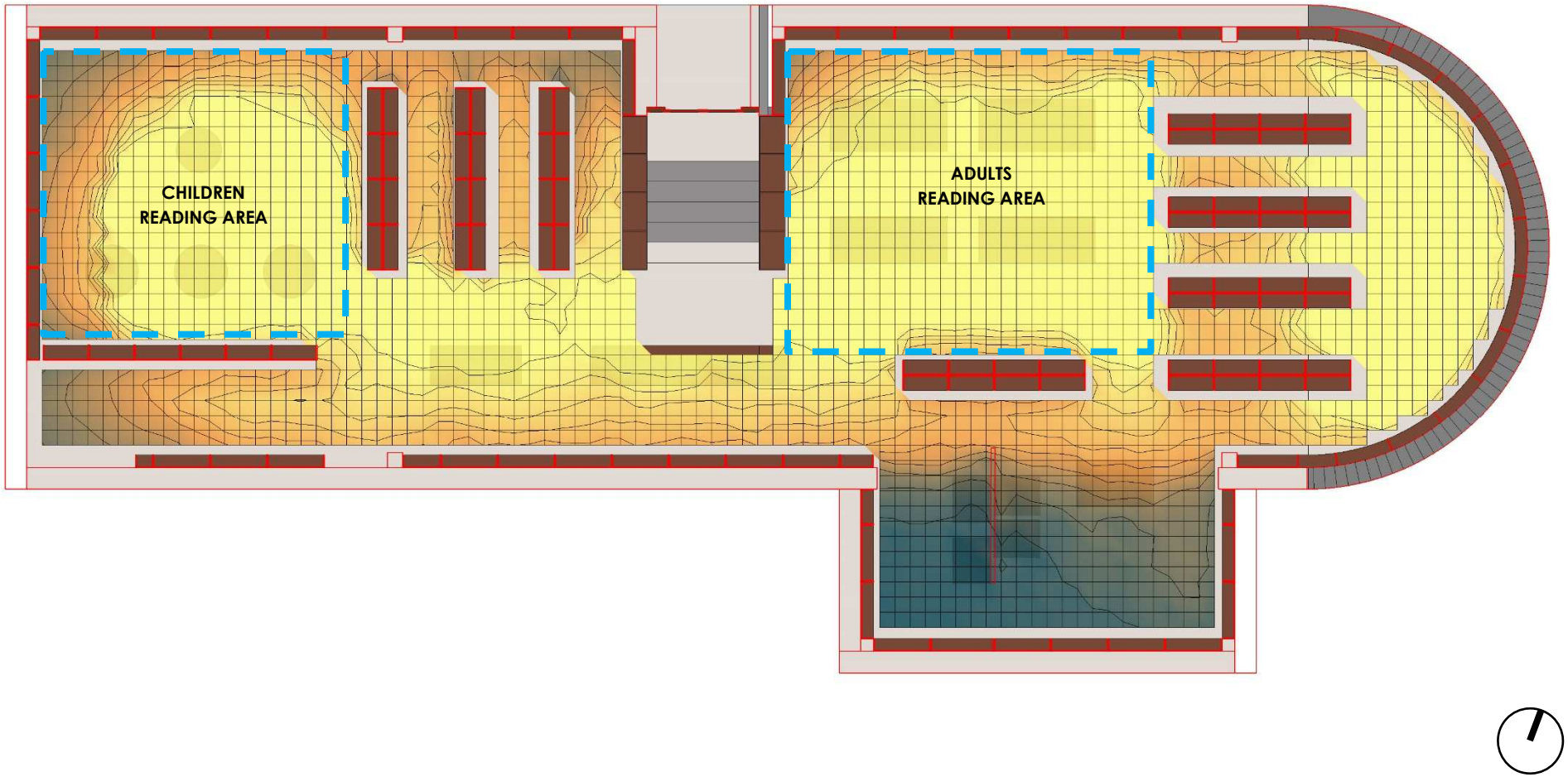
500	450	400	350	300	250	200	150	100	50	0

D01

LIGHT LEVELS [LUX] FOR EXISTING CONDITIONS

JUNE 21ST

CLEAR SKY – 09:00 AM

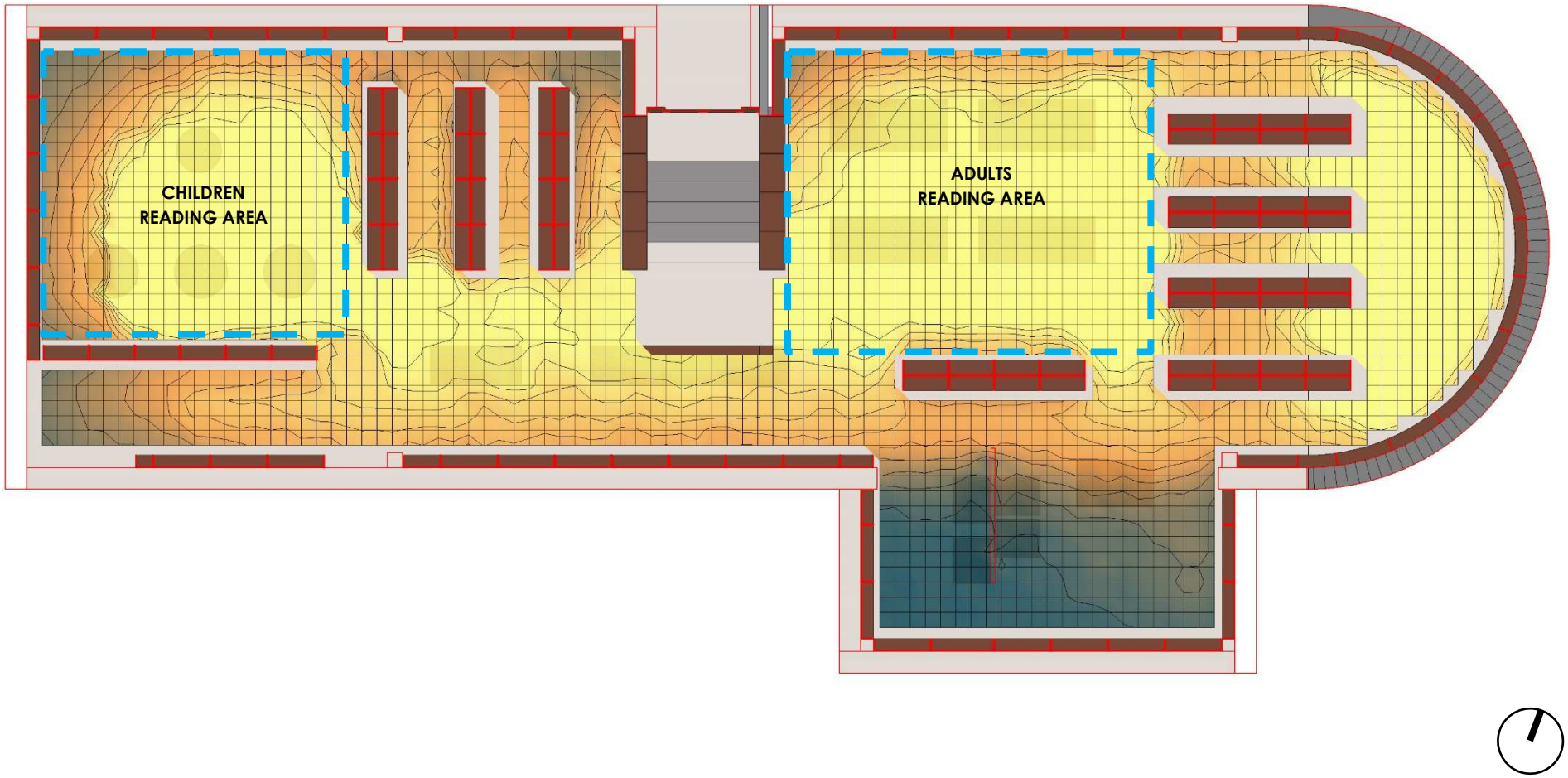


D02

LIGHT LEVELS [LUX] FOR PROPOSED CONDITIONS

JUNE 21ST

CLEAR SKY – 09:00 AM



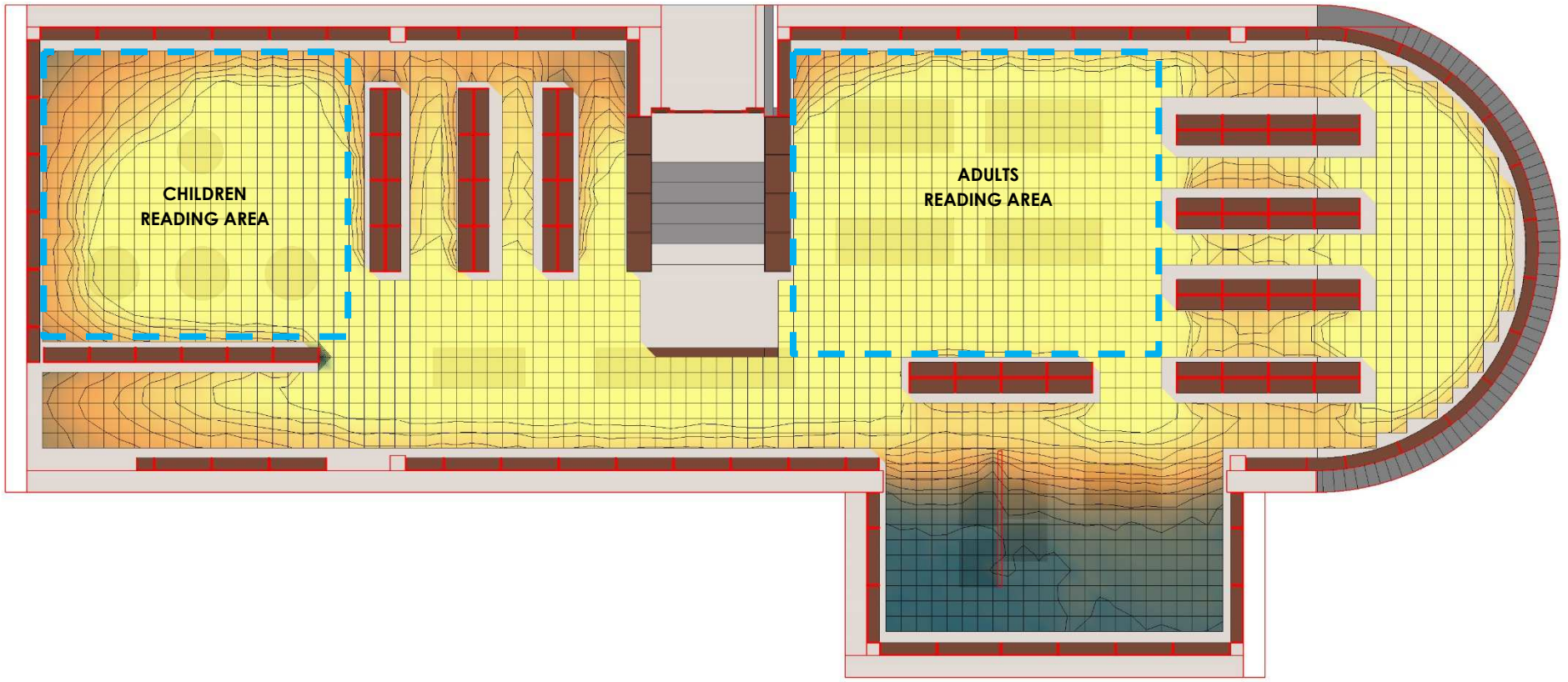
D04

LIGHT LEVELS [LUX] FOR EXISTING CONDITIONS

JUNE 21ST

CLEAR SKY – 12:00 PM

Analysis Grid
RAD Illuminance



LUX

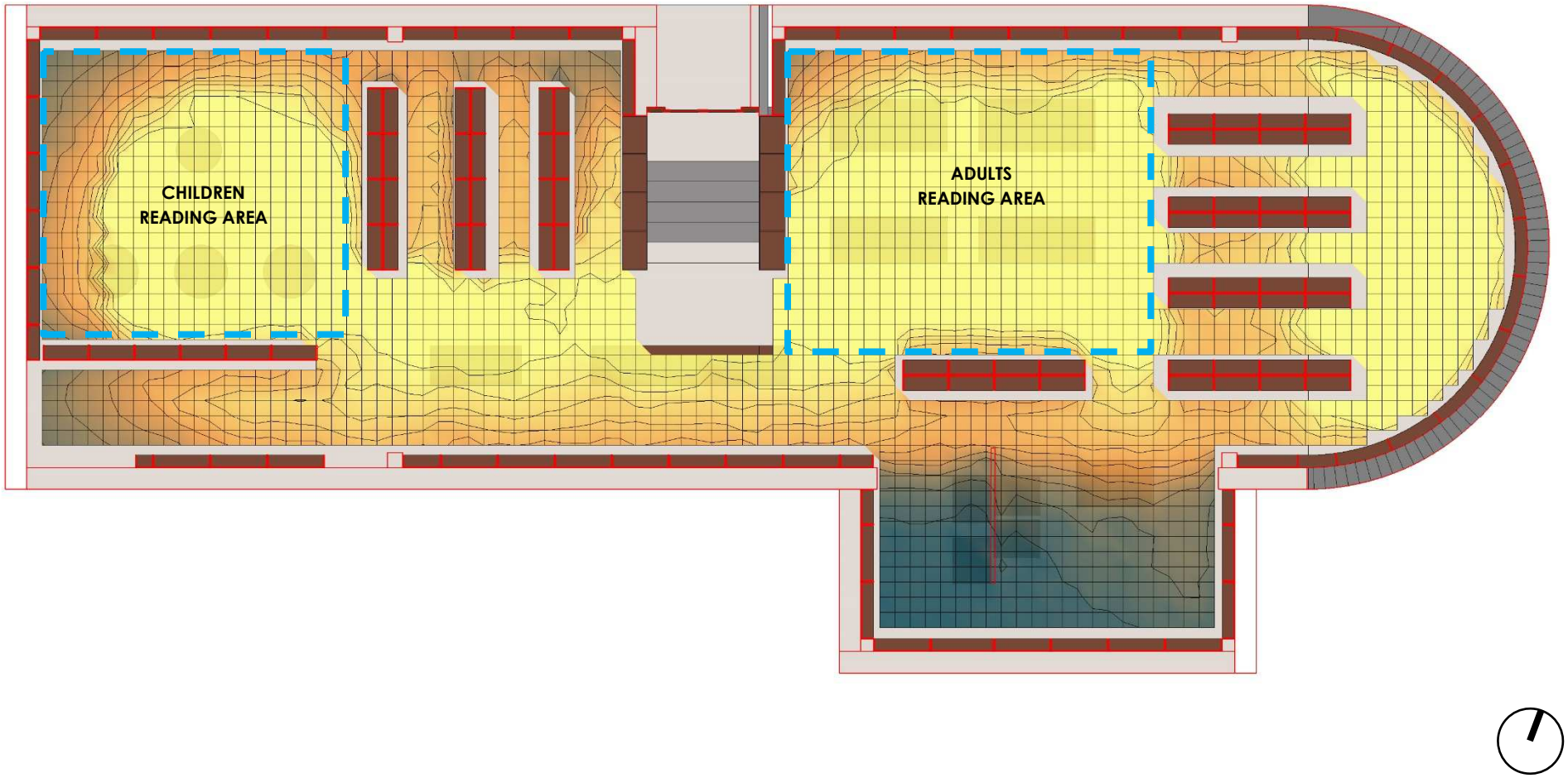
500	450	400	350	300	250	200	150	100	50	0

D05

LIGHT LEVELS [LUX] FOR PROPOSED CONDITIONS

JUNE 21ST

CLEAR SKY – 12:00 PM



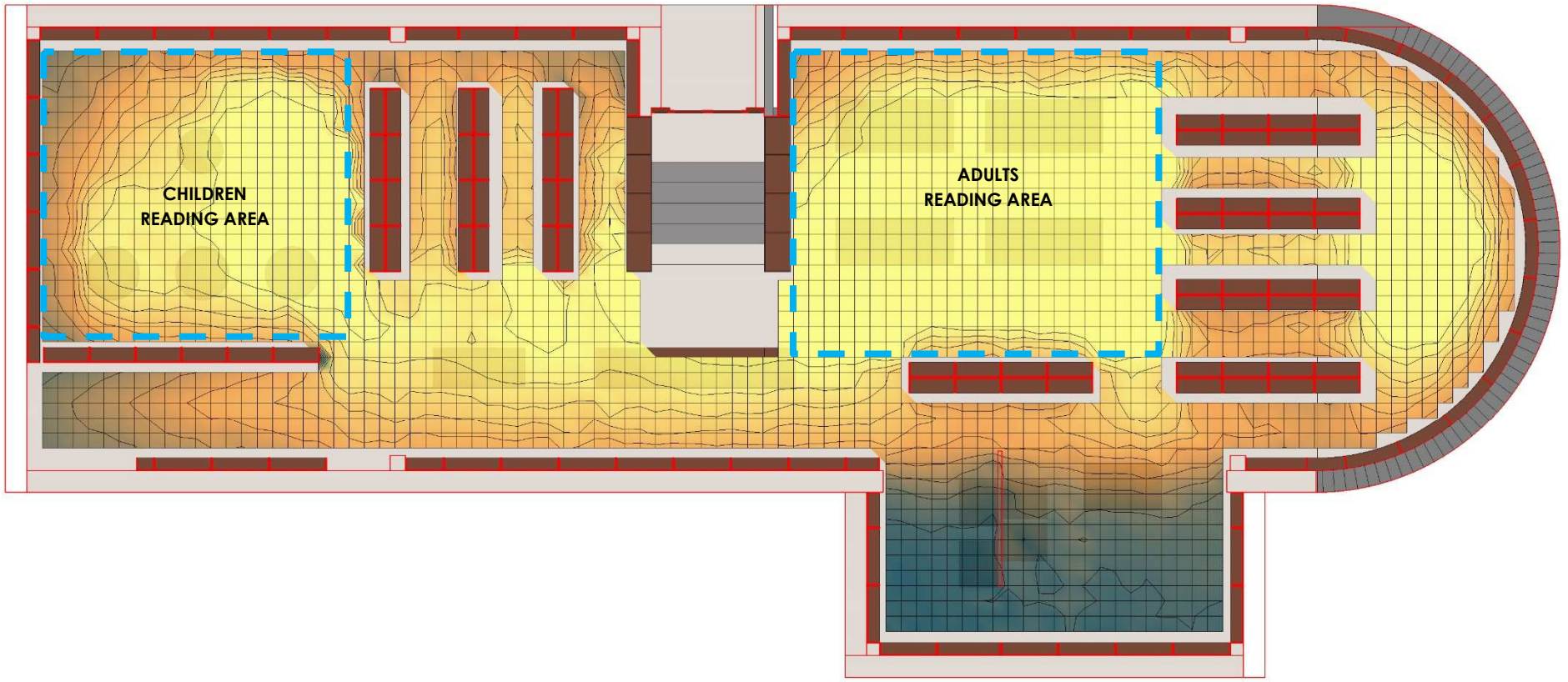
D07

LIGHT LEVELS [LUX] FOR EXISTING CONDITIONS

JUNE 21ST

CLEAR SKY – 03:00 PM

Analysis Grid
RAD Illuminance



LUX

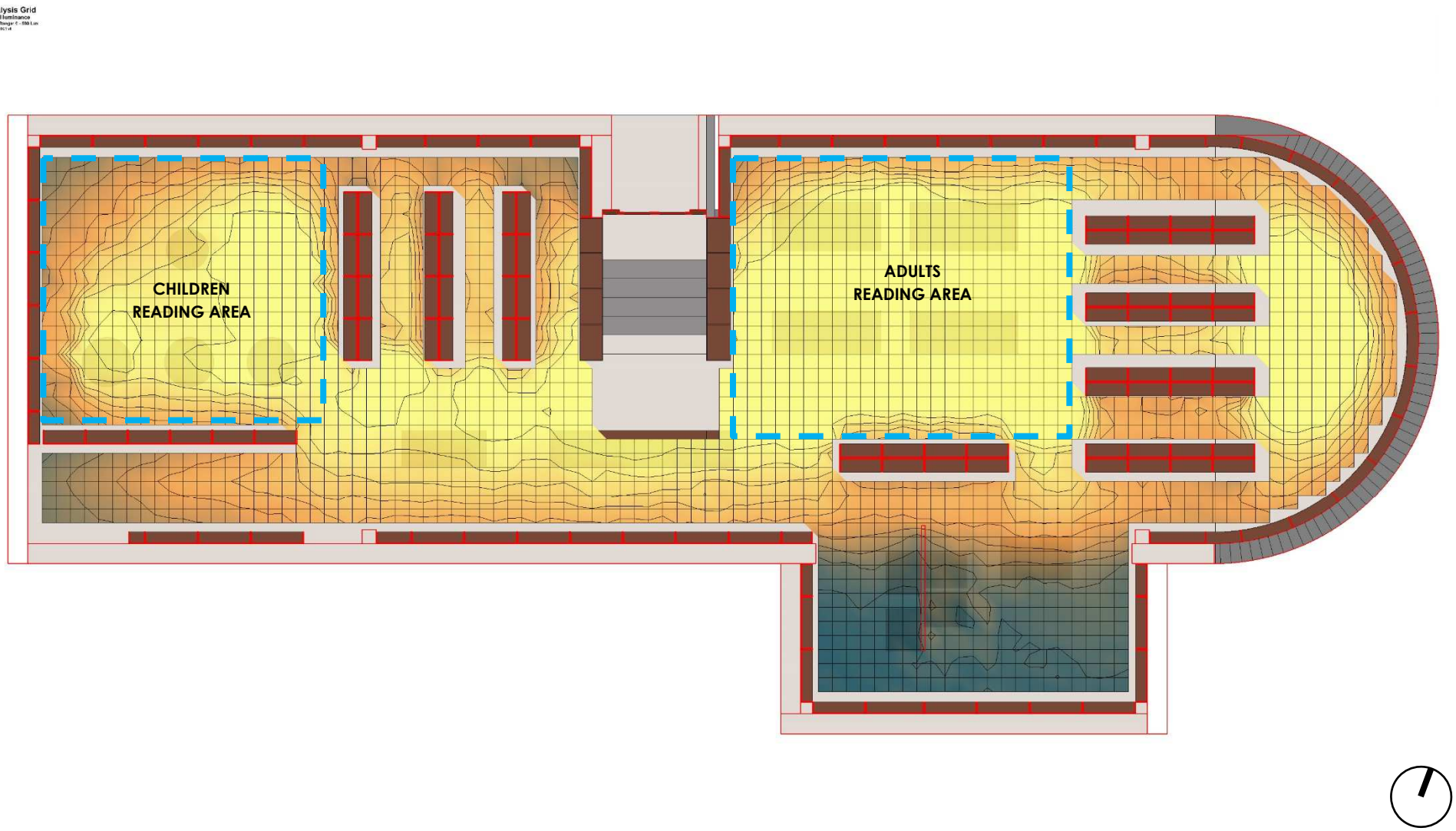
500	450	400	350	300	250	200	150	100	50	0

D08

LIGHT LEVELS [LUX] FOR PROPOSED CONDITIONS

JUNE 21ST

CLEAR SKY – 03:00 PM



The following images shows the light levels (LUX) at the reading tables with intermediate/ partly cloudy conditions, September 21st at noon under existing conditions:

View point 1 (the adult area)- the minimum LUX is 152 and the max is 189, well below the IES recommended 500 LUX lighting for small print reading.

View Point 2 (the children's area)- the minimum LUX is 180 and the maximum is 206, well below IES the recommended 500 LUX lighting for small print reading.

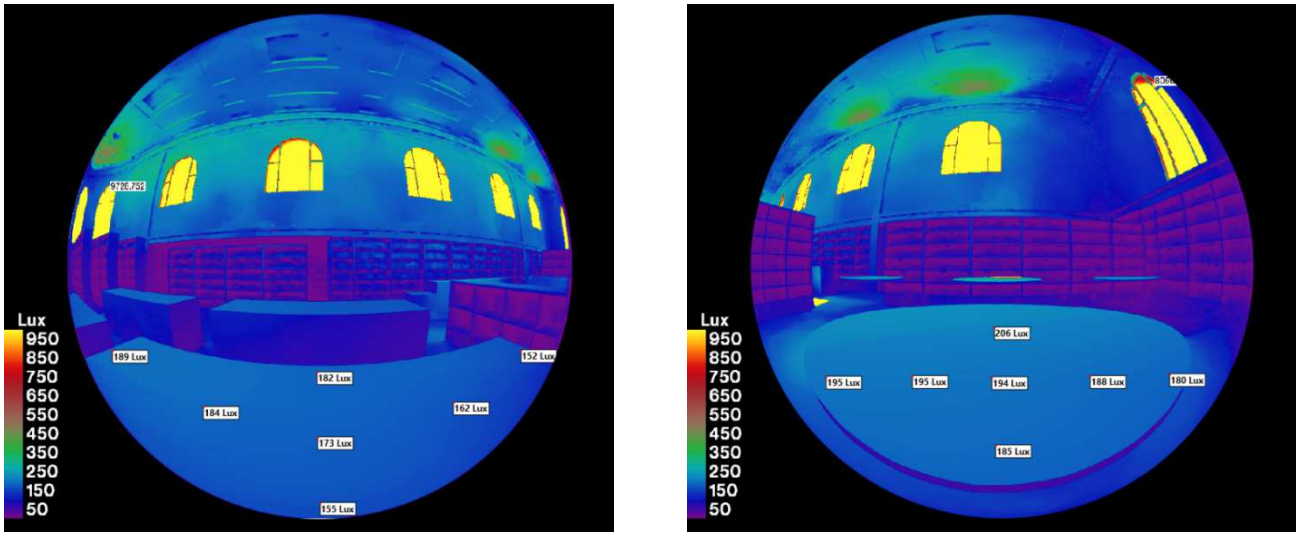


FIGURE **6**: LIGHT LEVELS AT TABLE UNDER EXISTING CONDITIONS ON SEPTEMBER 21ST AT NOON.

C. LUMINANCE & GLARE ANALYSIS:

After calculating luminance fisheye images for the adult and children's area viewpoints, analysis was done to calculate the Daylight Glare Probability (DGP) index. As mentioned in the Analysis Methodology, Chapter V, any DGP over .30 can be a source of unwanted glare by the observer.
The following tables and glare images show the results of the analysis, calculated during clear sky conditions (worst-case for glare), when the sky is at its brightest.

TABLE **5**: DAYLIGHT GLARE PROBABILITY INDEX FOR THE **ADULT READING AREA**.

SKY	**CLEAR SKY**		
DAY	*JUNE 21ST*		
TIME	9:00 AM	12:00 PM	03:00 PM
EXISTING DGP	0.212129	0.207914	0.198932
PROPOSED DGP	0.199746	0.204958	0.202397
% DIFFERENCE	**-5.8%**	**-1.4%**	**1.7%**

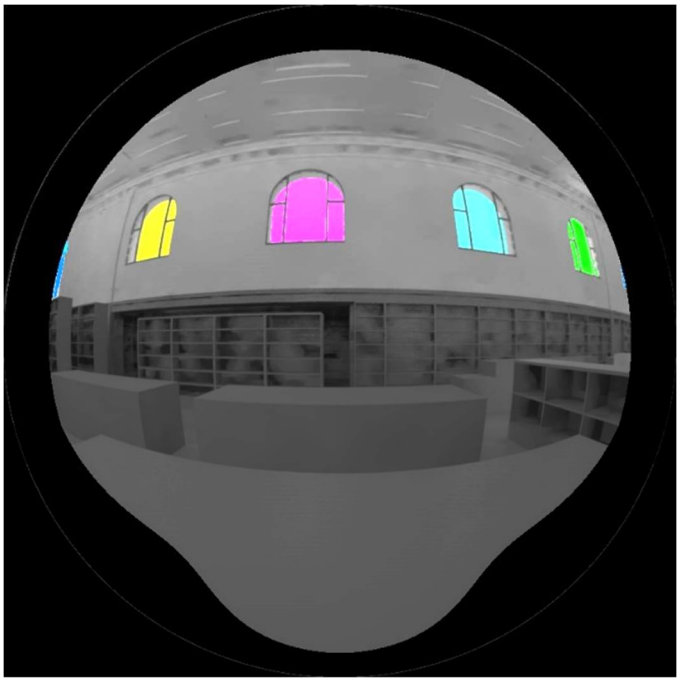


FIGURE **10**: SOURCES OF GLARE POTENTIAL AT THE **ADULT READING AREA**.

TABLE **6**: DAYLIGHT GLARE PROBABILITY INDEX FOR THE **CHILDREN READING AREA**.

SKY	CLEAR SKY		
DAY	*JUNE 21ST*		
TIME	9:00 AM	12:00 PM	03:00 PM
EXISTING DGP	0.190864	0.196406	0.210993
PROPOSED DGP	0.18921	0.195514	0.183943
% DIFFERENCE	-0.9%	-0.5%	-12.8%

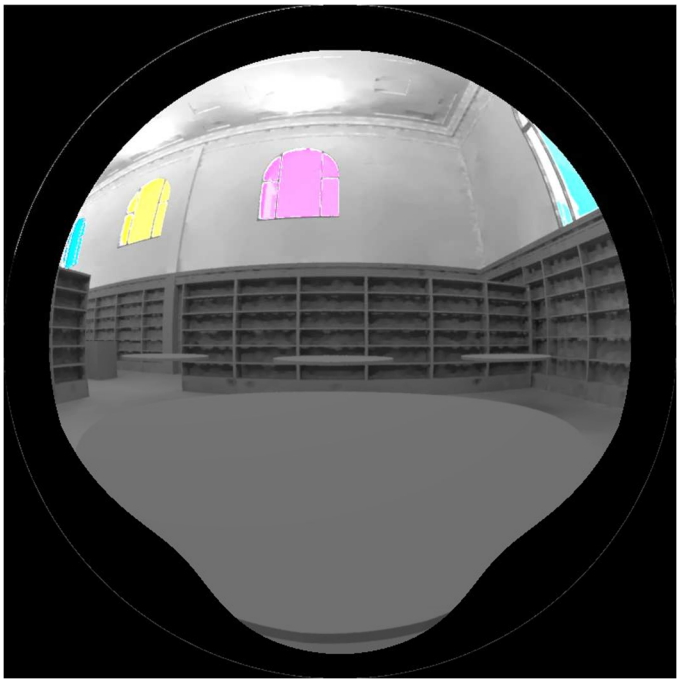


FIGURE **11**: SOURCES OF GLARE POTENTIAL AT THE **CHILDREN READING AREA**.

The proposed project mostly reduces any glare potential to the library, and ALL the DGP values, for both the adult and children's reading areas, are comfortably under the 0.30 threshold, **thus not a significant source of concern for visual comfort for most patrons.** ■

V. ANALYSIS METHODOLOGY

SYMPHYSIS utilized various tools to develop this daylight impact analysis. Here is a breakdown of the analysis process, and the tools used at each stage of the analysis:

A. 3D MODELING:

A 3D model of the existing and proposed conditions was created within a CAD software using the 2D drawings from the architect of the proposed project. For the purposes of this analysis, the "proposed condition" refers to the environment inside the library with the proposed vertical and horizontal addition at 2651-53 Octavia. The "existing condition" refers to the environment in the library currently. The surrounding buildings of blocks were constructed from the latest GIS layer of San Francisco building footprints obtainable at data.sfgov.org. The heights of the buildings were derived from photogrammetric model from Google Earth. Due to highly variability in height, opacity during seasons, growth and maintenance, existing trees were not modeled for this analysis.
The library was modeled using the latest approved building permit set #2009-0527-9175 dated 06/26/09, provided by the Planning Department, Environmental Planning Division, with the approved stamp date of 11/16/2009. The 3D model of the library includes all necessary and relevant details for daylighting analysis: wall thickness, glazing (window) areas, mullions and furniture.

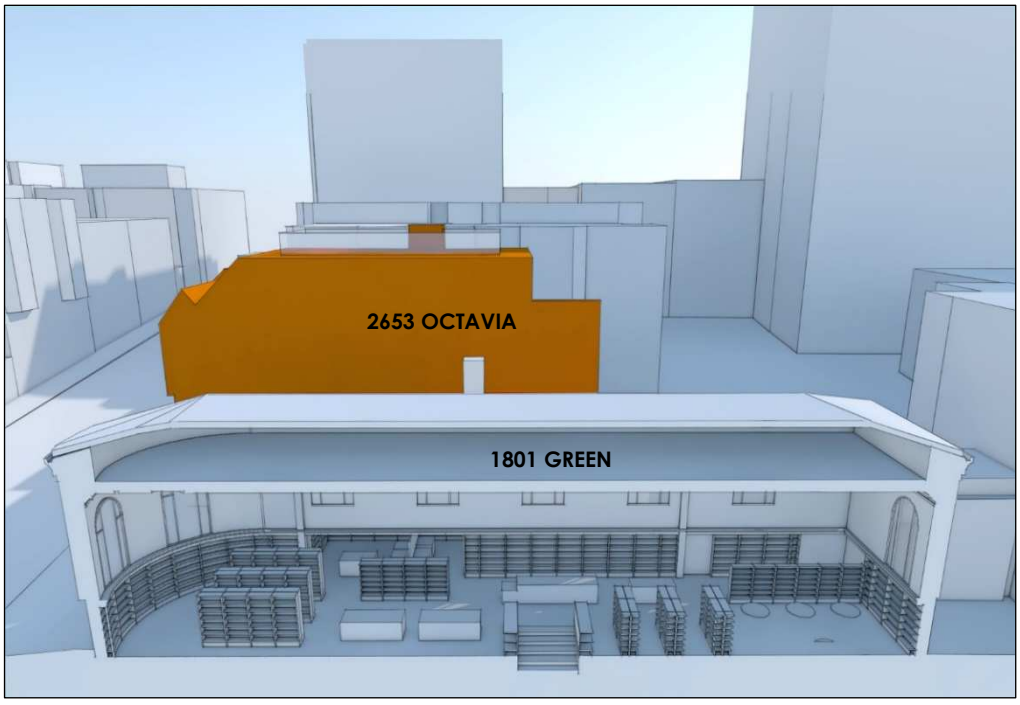
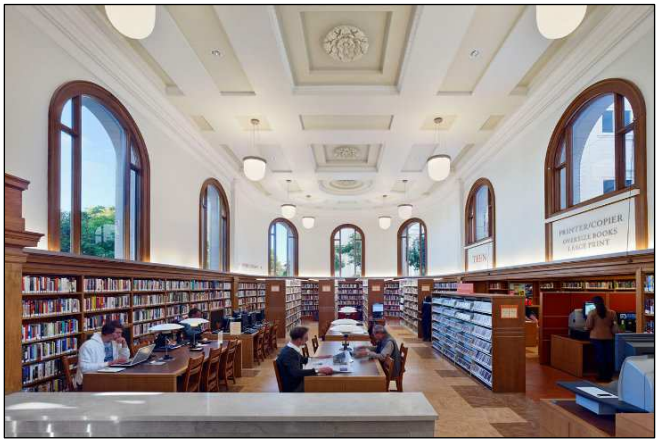


FIGURE **12**: 3D MODELING OF PROPOSED PROJECT AND LIBRARY.



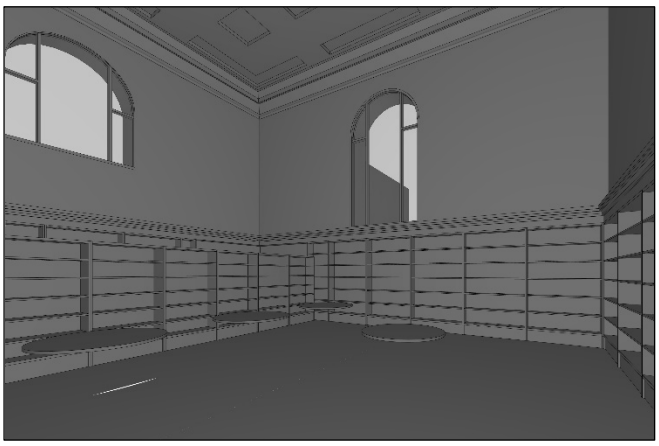
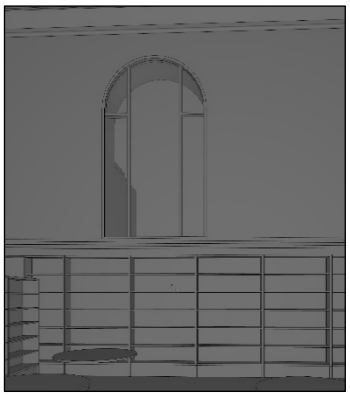


FIGURE **13**: COMPARISONS OF PHOTOGRAPHS VERSUS 3D MODEL.

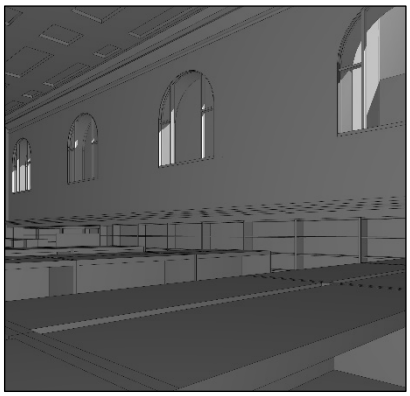
The library's furniture layout has been visually verified against the plans provided by the Planning Department to ensure no changes were made post-renovation. The following photographs were taken between December 2018 and January 2020 to support the validity of the 3D model used in the study:

DECEMBER 2018



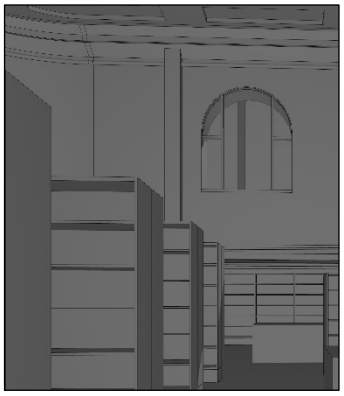
3D MODEL

DECEMBER 2018



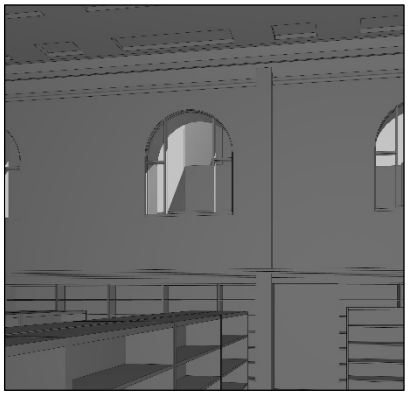
3D MODEL

DECEMBER 2018



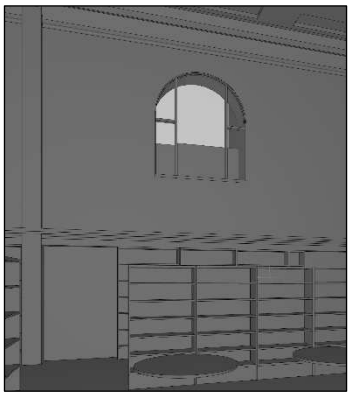
3D MODEL

DECEMBER 2018



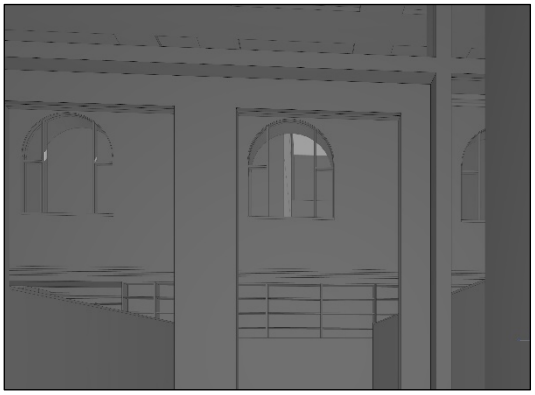
3D MODEL

DECEMBER 2018



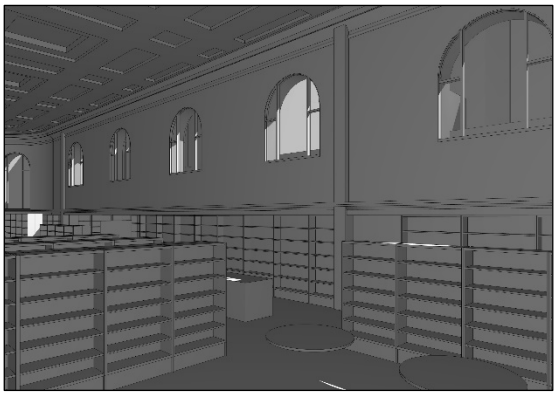
3D MODEL

NOVEMBER 2019



3D MODEL

JANUARY 2020



3D MODEL

JANUARY 2020

3D MODEL

B. MATERIALS & REFLECTIVITY

The existing materials present within and outside the library affect the overall light levels reaching the library's main reading room. This is due to the inherent reflectivity of every material. It is important to assess the materials present to determine their reflectivity, in order to derive material files that can be read by the daylighting engine, which performs the Radiance calculation.

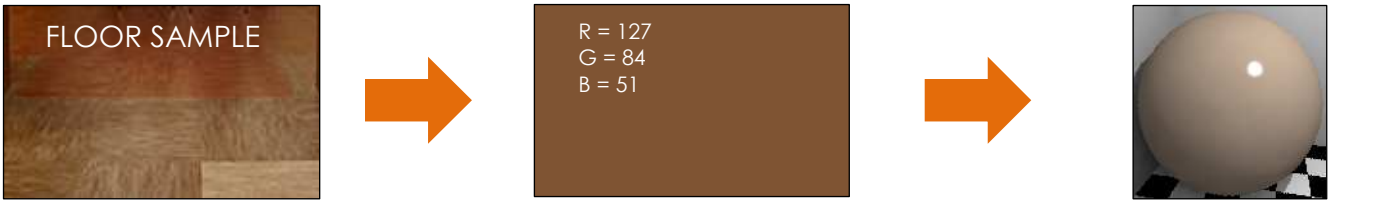
Eleven (11) different materials were identified to conduct this study:

- Library Floor
- Library High Walls
- Library Ceiling
- Library Dark Wood (including low walls and all furniture)
- Library Exterior Walls
- Library Low Roof (low flat roof at South side of the library)
- Exterior Walls of the existing and proposed project (assumed similar)
- Urban Fabric (an average of all buildings surrounding the library)
- Street
- Library Entry Stairs
- Glazing

For each material, a sample image was selected which was most representative of the material's inherent qualities. For the Urban Fabric, aerial photographs were used. The image was processed to derived its average color, using an online tool available here. Using this average color, another tool was used to derive the material file that will be necessary for the calculations.

The glazing material was created using another tool called Glazing Calculator which defines glazing material files for Radiance based on its type, its maintenance factor, and other variables. The calculator derived a final total transmittance (VT) of 0.62, which is very much in line with what typical code compliant glazing would have been in 2009. The Title 24 report refers only to the code maximum Solar Heat gain Coeficient at the time of 0.40. Given that only the southern windows were replaced and the older ones have high transmittance (older windows with no low-e or high SHGC), the value of 0.62 VT was appropriate to the study.

The images below shows evaluation the process:




```
# Reflectance: rho=0.319
void plastic identifier
0
0
5  0.35 0.265 0.2  0.05 0.05
```

FIGURE **14**: DERIVATION OF RADIANCE MATERIAL FILES

A complete list of all the material files can be found in the appendices.

C. ECOTECT PERFORMANCE SIMULATION SOFTWARE

The 3D model was imported into the environmental performance simulation software Autodesk Ecotect for analysis. This software allows the user to setup all the calculation settings required for this study, and acts as a platform to the Radiance lighting simulation engine, as well as the display of the results.

An analysis grid was set up over the entire floor of the library, which consisted of 2,406 sensor points spread one foot apart. The grid was set 3 feet above the finished floor, which is 2" above the highest working surface (information desk is 2' 10" high). Sensors were eliminated under the library's book stacks so that the results were not skewed by "blind sensors".

The image below shows the set-up of the analysis grid on the library floor:

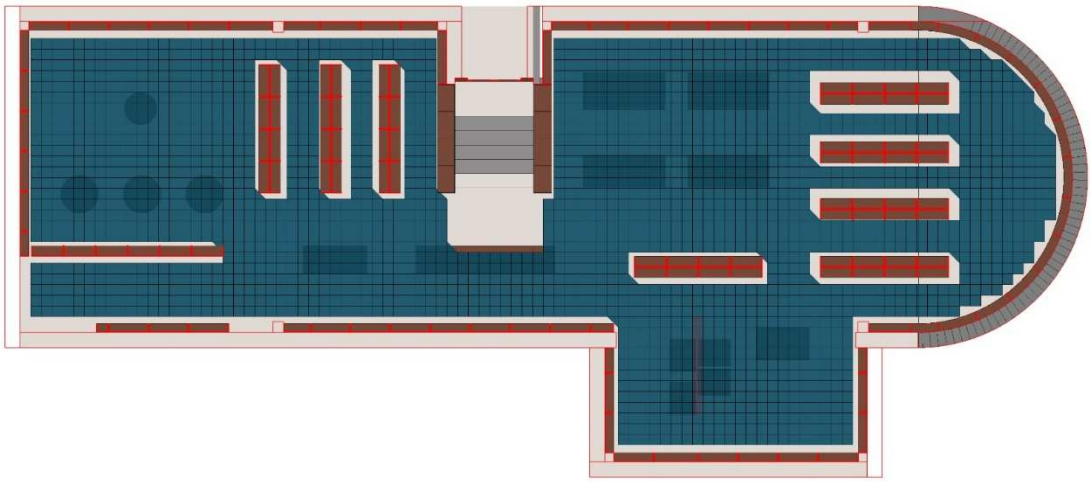


FIGURE **15**: ANALYSIS GRID SETUP ON LIBRARY MAIN FLOOR.

D. RADIANCE CALCULATIONS

For this study, Radiance, the most widely used lighting simulation engine, was selected. Radiance calculates both illuminance and luminance values. Illuminance is the amount of light that reaches a surface plane, such as a desk. It is very important to measure its value and assess whether there is enough light available to perform specific task without impacting visual comfort and acuity. The Illuminating Engineering Society (IES) provides the following recommended illuminance levels for libraries:

TABLE **7**: IES RECOMMENDED LIGHT LEVELS FOR LIBRARIES

SPACE	**RECOMMENDED ILLUMINANCE fc (LUX)**
Active Book Stacks	6–35 (60-350)
Inactive Book Stacks	5 (50)
Circulation and Reference Desk	30 (300)
Computer Areas	30 (300)
Reading (normal size and contrast)	30 (300)
Reading (very smal size and low contrast)	50 (500)

When light levels fall below these recommended ranges, it becomes necessary to supplement daylight with artificial (electric) light to avoid visual strain.

While most daylight studies perform daylighting analyses for a single worst-case scenario (overcast sky, no sun), this study analyzed 3 different sky conditions for 3 different times of the day, for both existing and proposed conditions, totaling 14 different lighting conditions (since overcast skies have no sun, there are no specific time of day or day of year).

Radiance uses "Standard Skies" to evaluate the luminance distribution from the sky dome under certain conditions. For this study, 3 sky conditions were used:

- CIE Standard Overcast Sky: no sun, brightest at the zenith.
- CIE Intermediate Sky: partly clouded sky with some sun.
- CIE Clear Sky: full sun, clear sky.

Each of these standard skies has a specific embeded algorithm that gives the Radiance engine the proper light distribution over the entire sky dome. In this study, the Intermediate Sky was renamed "partly cloudy" for clarity.

The images below show the 3 standard skies used in this study:

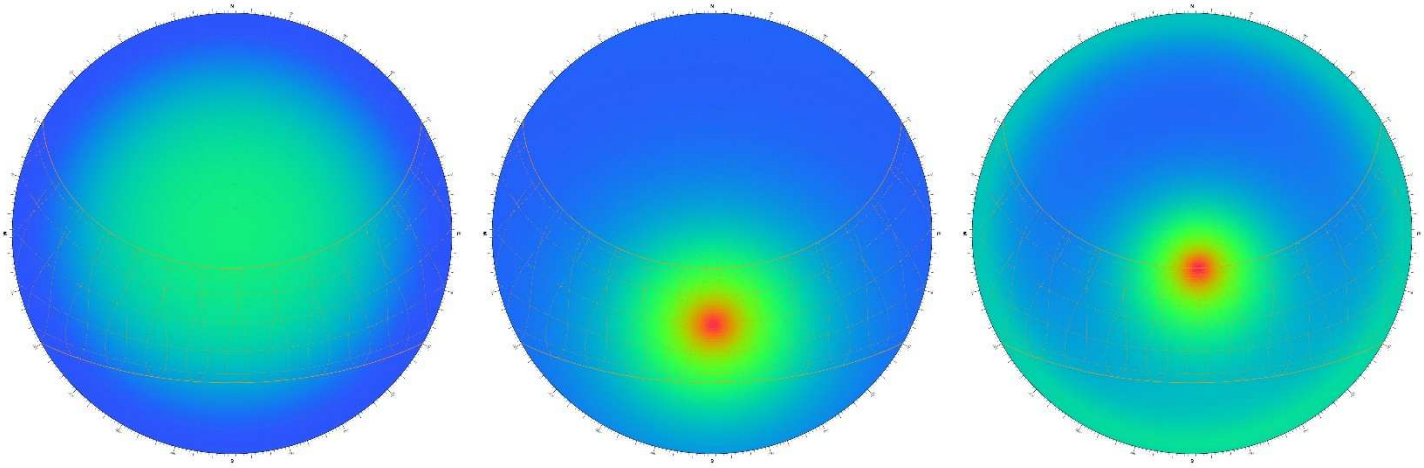


FIGURE **16**: CIE OVERCAST SKY, CIE INTERMEDIATE SKY, CIE CLEAR SKY.

The analysis was conducted for 2 dates of the year to cover a wide variety of sky conditions: June 21st with a clear sky model (best case, highest light levels) and September 21st with a partly cloudy model (intermediate light levels). Because there is no sun on overcast days (worst-case, low light levels), there is minimal variability in light levels during the day, thus this sky condition can be applied to any time of the day and any day of the year. For the clear sky and partly cloudy scenarios, when the sun in present, three times were analyzed 9am, 12pm, and 3pm.

While the standard skies give us the illuminance distribution for each sky condition, it does not give us the illuminance value from the sky itself. This is derived from the Design Sky value, which is the 15th percentile (exceeded 85% of the time) illumination value of the sky, calculated from the San Francisco weather file (USA_CA_San.Francisco.Intl.AP.724940_TMY3.epw). This analysis used a Design Sky value of 8,500 LUX.

Illuminance calculations were completed for each sky condition and time of day described above, for both the existing and proposed conditions, at each of the 2406 sensor points of the analysis grid. After all calculations were completed, the existing condition illuminance results were subtracted from the proposed results then divided by the existing results to create an illumination percentage difference. The percentage difference maps are very useful to identify where reduction of light levels might occur within the library.

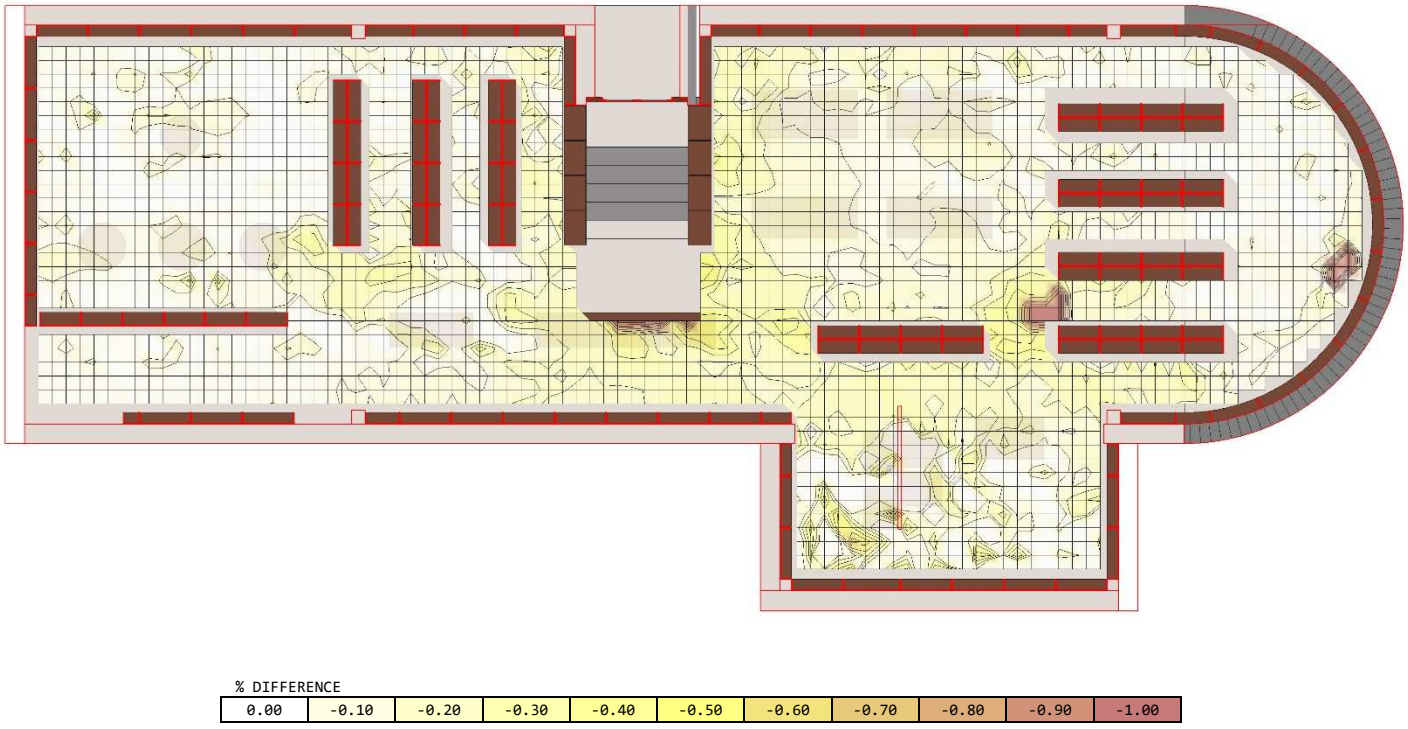


FIGURE **17**: EXAMPLE OF AN ILLUMINATION PERCENTAGE DIFFEERENCE MAP.

Radiance also calculates reflected luminance values, where one can assess the level of brightness within a space and identify potential glare issues that might impact the visual acuity and comfort.

Luminance calculations are best completed using a fisheye image that would represent the field of view of a person in a specific location. For this study, two view points were created, viewpoint 1 at the desk of the adult reading area and viewpoint 2 at the children's area.

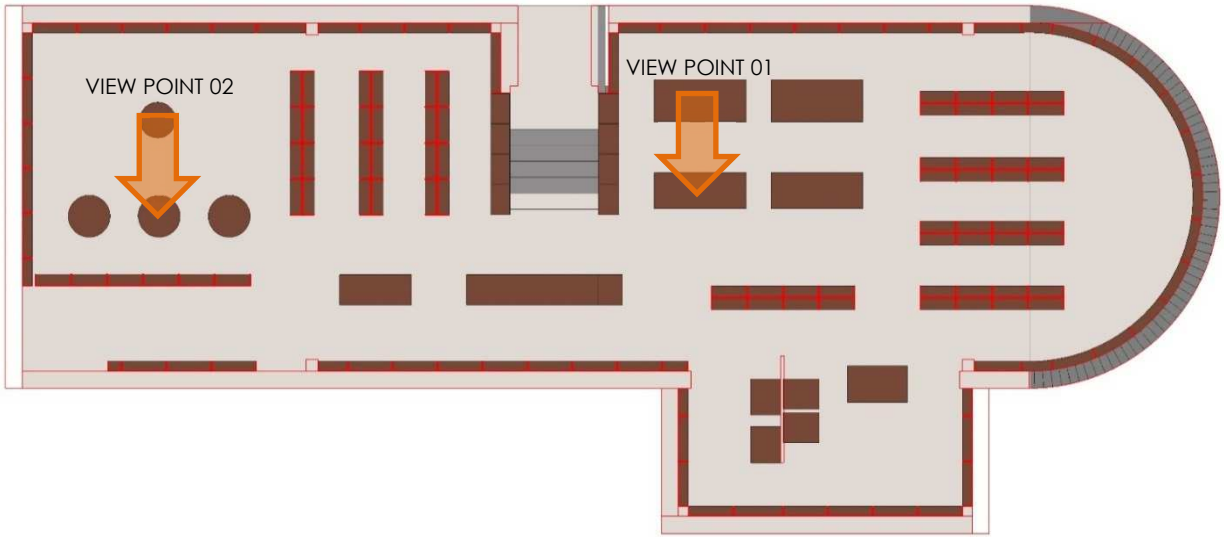


FIGURE **18**: LUMINANCE VIEW POINTS LOCATION.

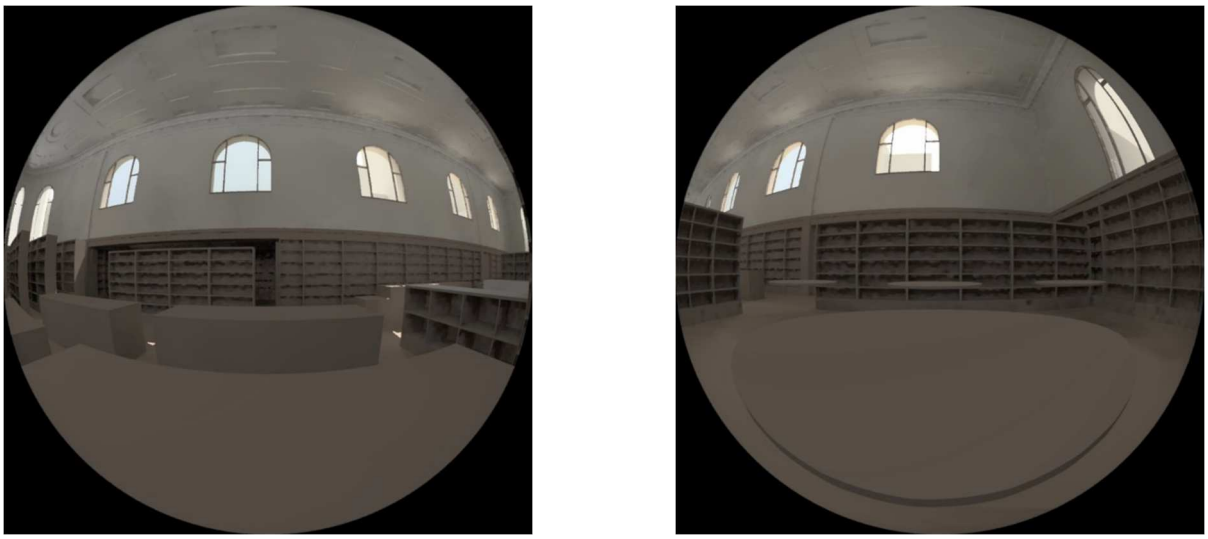


FIGURE **19**: VIEW POINT 01 AND VIEW POINT 02

The viewpoint images are then analyzed to assess any sources of brightness and potential glare. For this study, the appropriate index to use in this study is the Daylight Glare Probability index (DGP). DGP below .30 is imperceivable to the human eye and no glare is perceived. DGP between .30 and .45 is perceivable and a source of concern. DGP above .45 is intolerable.

Finally, a Daylight Autonomy analysis was done for the library's main reading room. Daylight Autonomy analysis calculates the percentage of time daylight levels are above a specified target illuminance value at a specific date and time. This is valuable to determine areas that are below the selected illuminance threshold and require supplemental lighting (electrical lights). For this study, the target illumination value was set to 400 LUX (40 fc) and the time of calculation was set at the library's opening hours of 10:00 am to 8:00 pm for all days of the week, all year long.

Radiance requires many parameters settings in order to do the calculation accurately and efficiently, depending on the size of the model, and the time required for each calculation. For reference, the radiance settings used in this study are included in the appendices. ■

VI. APPENDICES

A. MATERIALS RADIANCE FILES

The following are the Radiance material files that were used in the analysis. Each material includes its color, reflectivity, specularity and roughness:

```
LIBRARY FLOOR
H                              26
S                            0.43
L                            0.35
SPECULARITY                  0.05
ROUGHNESS                    0.05
REFLECTANCE                 0.319
# Reflectance: rho=0.319
void plastic identifier
0
0
5  0.35 0.265 0.2  0.05 0.05
```

```
LIBRARY WALLS
H                              38
S                            0.09
L                            0.83
SPECULARITY                  0.02
ROUGHNESS                     0.2
REFLECTANCE                 0.811
# Reflectance: rho=0.811
void plastic identifier
0
0
5  0.83 0.803 0.755  0.02 0.2
```

```
LIBRARY CEILING
H                              37
S                            0.11
L                            0.77
SPECULARITY                  0.02
ROUGHNESS                     0.2
REFLECTANCE                 0.748
# Reflectance: rho=0.748
void plastic identifier
0
0
5  0.77 0.738 0.685  0.02 0.2
```

```
LIBRARY DARK WOOD
H                              22
S                            0.37
L                            0.27
SPECULARITY                  0.02
ROUGHNESS                     0.1
REFLECTANCE                 0.237
# Reflectance: rho=0.237
void plastic identifier
0
0
5  0.27 0.207 0.17  0.02 0.1
```

```
LIBRARY EXTERIOR WALLS
H                              39
S                            0.15
L                            0.46
SPECULARITY                     0
ROUGHNESS                    0.12
REFLECTANCE                 0.439
# Reflectance: rho=0.439
void plastic identifier
0
0
5  0.46 0.436 0.391  0 0.12
```

```
LIBRARY LOW ROOF
H                              46
S                            0.27
L                            0.79
SPECULARITY                  0.01
ROUGHNESS                     0.2
REFLECTANCE                 0.745
# Reflectance: rho=0.745
void plastic identifier
0
0
5  0.79 0.74 0.577  0.01 0.2
```

2653 OCTAVIA (E & N)

H	208
S	0.22
L	0.85
SPECULARITY	0.01
ROUGHNESS	0.12
REFLECTANCE	0.745

```
# Reflectance: rho=0.745
void plastic identifier
0
0
5  0.663 0.763 0.85  0.01 0.12
```

URBAN FABRIC

H	48
S	0.11
L	0.46
SPECULARITY	0
ROUGHNESS	0.2
REFLECTANCE	0.45

```
# Reflectance: rho=0.45
void plastic identifier
0
0
5  0.46 0.45 0.409  0 0.2
```

STREET

H	212
S	0.08
L	0.65
SPECULARITY	0
ROUGHNESS	0.3
REFLECTANCE	0.618

```
# Reflectance: rho=0.618
void plastic identifier
0
0
5  0.598 0.622 0.65  0 0.3
```

LIBRARY ENTRY STAIRS

H	330
S	0.01
L	0.56
SPECULARITY	0.05
ROUGHNESS	0.02
REFLECTANCE	0.578

```
# Reflectance: rho=0.578
void plastic identifier
0
0
5  0.56 0.554 0.557  0 0.02
```

LIBRARY GLAZING

```
# Total, dirt-corrected glazing transmittance after CIBSE LG10:1999
# JALOXA LG10 Glazing Calculator for Radiance
# http://www.jaloxa.eu/resources/radiance/lg10_glazing.shtml
# Glazing transmittance (A1.5) => 0.69
# - Double glazing clear float + low E glass
# Percentage loss of daylight compared with clean glazing (A1.5) => 10%
# - Urban
# - Commercial, educational - rooms used by groups of people, office equipment
# Special conditions multiplier for calculating maintenance factor (A1.10) => x 1
# - Normal vertical glazing
# Exposure multiplier for calculating maintenance factor (A1.11) => x 1
# - Vertical glazing
# - Normal exposure for location
# Maintenance factor  ==> 90%

# Total transmittance ==> 0.62
void glass glazing_mat
                                0
                                0
3  0.68 0.68 0.68

RGB adjusted for TVis
                              137
                              137
                              137
                      137,137,137
```

B. RADIANCE SETTINGS

The following Radiance settings were used for the Illumination calculations as well as the Luminance images:

Illuminance Settings:

-dp=256
-ar=200
-ms=0.24
-ds=0
-dt=.2
-dc=.25
-dr=0
-ss=1
-st=.5
-ab=3
-af=RCP.amb
-aa=.25
-ad=256
-as=0
-av=0.01 0.01 0.01
-lr=3
-lw=0.002

Luminance Settings:

-dp=1024
-ar=476
-ms=0.24
-ds=.3
-dt=.1
-dc=.5
-dr=1
-ss=1
-st=.1
-ab=3
-af=RCP.amb
-aa=.15
-ad=768
-as=196
-av=0.01 0.01 0.01
-lr=6
-lw=0.002

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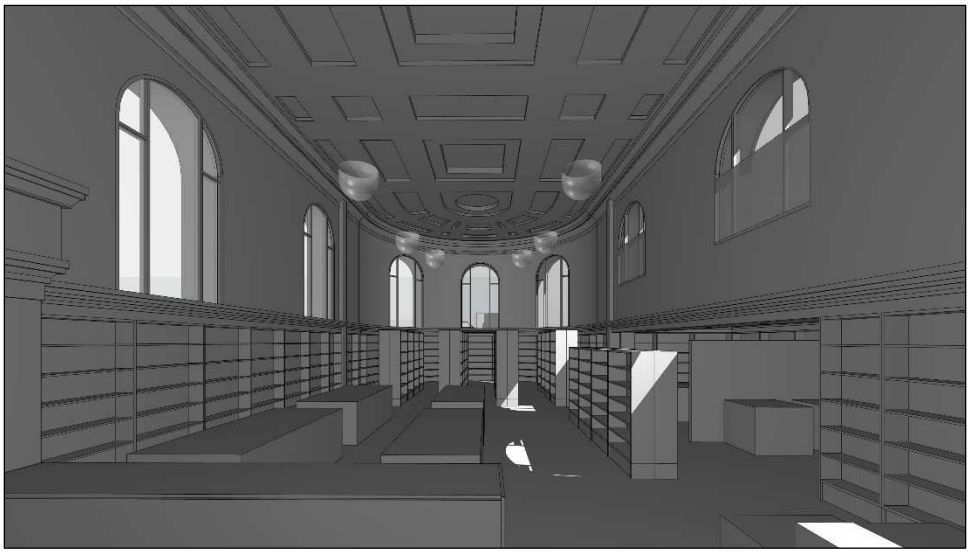
ILLUMINATION IMPACT ANALYSIS REPORT

SUN SHADE DEVICES IMPACT STUDY

FOR **Golden Gate Valley Library**



Report prepared by
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TABLE OF CONTENTS

I. INTRODUCTION

SYMPHYSIS was hired to conduct a study to determine if dark grey shades are consistently used in the Golden Gate Valley Library, to analyze the impact the shades have on the illumination levels in the library, and to compare the results to the study previously conducted, which analyzed the impact of the proposed project on the illumination in library using natural light only in modeling.

Using photographic evidence from photos taken in all years 2013-2021 (see appendix), it was determined that there is consistent use of **dark grey shades**, which cover half the glass of all south facing windows, outlooking to 2651-53 Octavia Street. The shades are identified with 10% openness, filtering 90% of daylight through the glass.

SYMPHYISIS analyzed 2,406 individual points on the interior of the library's main reading room for the following conditions:

- Overcast sky (no sun) December 21st for all times of day, to represent the worst-case daylight conditions.
- Partly cloudy sky for September 21st at 9:00 am, 12:00 pm, and 3:00 pm, to represent the mid-season case daylight conditions.
- Clear sky for June 21st at 9:00 am, 12:00 pm, and 3:00 pm, to represent the best daylight conditions.

The report herein presents the results of this analysis. ■

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SYMPHYSIS Principal

CABEC
California Association of Building Energy Consultants
CERTIFIED ENERGY ANALYST
CEA# R16-19-2017

Our services consist of professional opinions and conclusions developed in accordance with generally accepted environmental design, solar engineering and daylighting design principles and practices. Our conclusions and recommendations are based on the information provided by the clients, USGS Digital Elevation Model and publicly available Geographic Information System database.

II. ANALYSIS SUMMARY

SYMPHYSIS concludes that the dark grey, light filtering shades have a significant impact on the overall illumination levels within the Golden Gate Valley Library.

The daily average differences in illumination levels between shades up and shades down **are -13.6% for overcast skies, -24.5% for partly cloudy skies and -14.2% for clear skies**.

From the previous analyses calculated by SYMPHYSIS, the illumination differences in the library between the existing conditions and the proposed conditions (with the addition at 2651-53 Octavia) were **-4% for overcast skies, -11.1% for partly cloudy skies and -1.8% for clear skies**.

The dark grey shades have a significantly larger impact on the illumination in the library than the proposed project. It can be assumed that since the patrons and staff currently use the library with the dark shades covering half of all the south facing windows and have a positive experience, they should have a similar experience with the proposed addition at 2651-53 Octavia Street, which has less impact. If at any time additional light is desired, for both existing and proposed conditions, the shades can be easily lowered.

TABLE **1**: AVERAGE ILLUMINANCE (LIGHT LEVELS) VALUES FOR THE **ENTIRE LIBRARY MAIN FLOOR** (LUX).

SKY	**OVERCAST SKY**	**PARTLY CLOUDY SKY**			**CLEAR SKY**		
DAY	*ALL DAYS OF YEAR*	*SEPTEMBER 21ST*			*JUNE 21ST*		
TIME	ALL TIMES OF DAY	9:00 AM	*9:00 AM*	*12:00 PM*	*03:00 PM*	12:00 PM	03:00 PM
EXISTING AVG LUX	114.28	218	239.02	150.68	820.71	538.09	390.62
PROPOSED AVG LUX	98.78	192.06	140.09	120.39	755.99	427.68	335.59
% DIFFERENCE	-13.6%	-11.9%	-41.4%	-20.1%	-7.9%	-20.5%	-14.1%
DAILY AVERAGE	**-13.6%**	**-24.5%**			**-14.2%**		

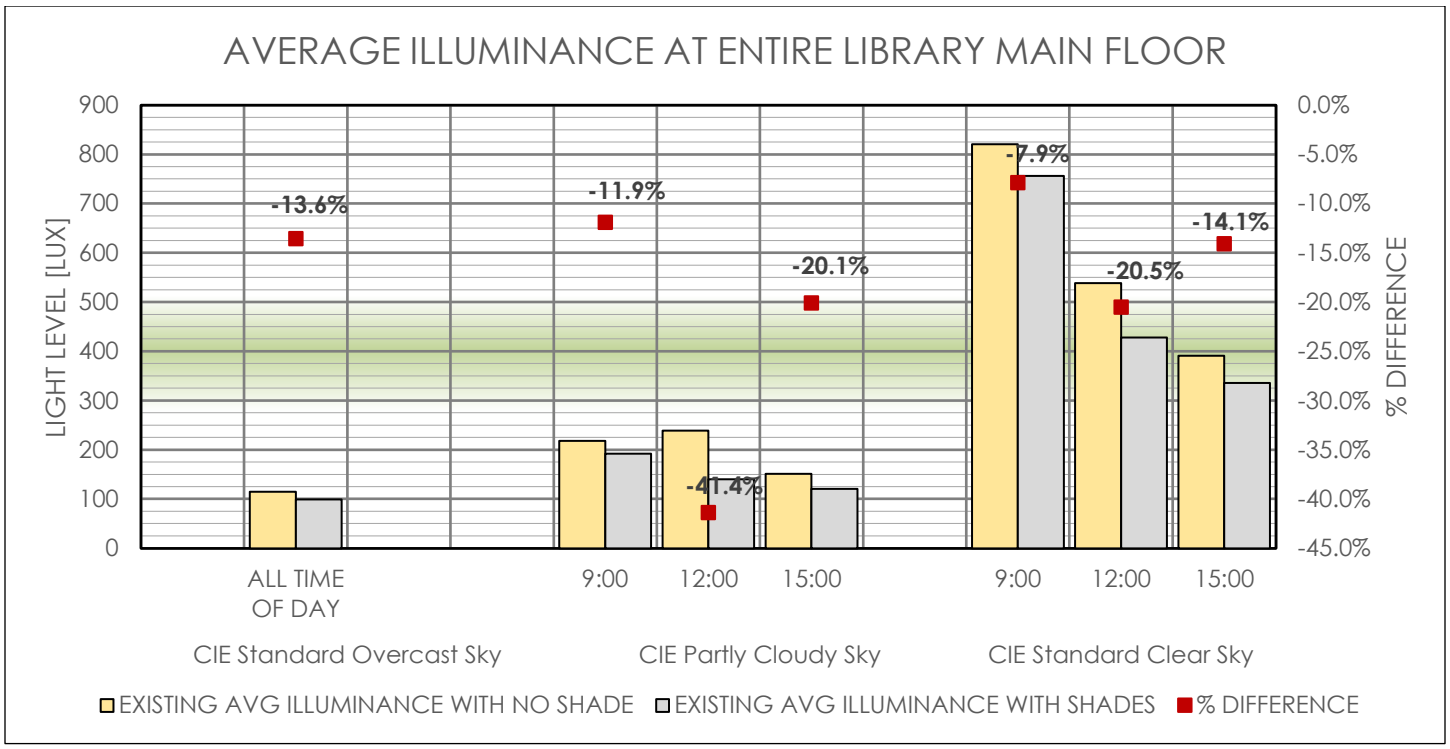


FIGURE **1**: GRAPH OF AVERAGE ILLUMINANCE VALUES FOR THE **ENTIRE LIBRARY MAIN FLOOR.**

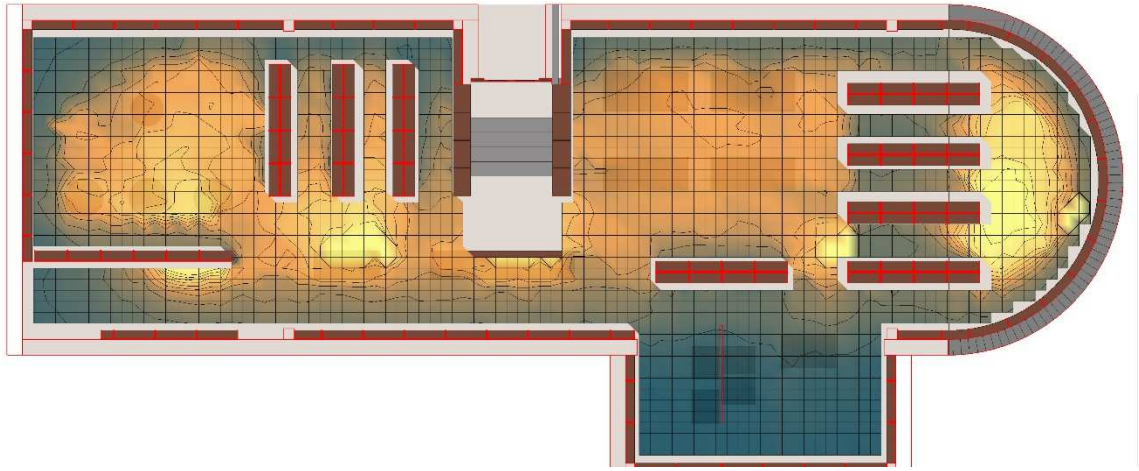
B01

DAYLIGHT LIGHT LEVELS [LUX] WITH AND WITHOUT SHADES

SEPTEMBER 21ST PARTLY CLOUDY SKY – 12:00 PM [worst case]

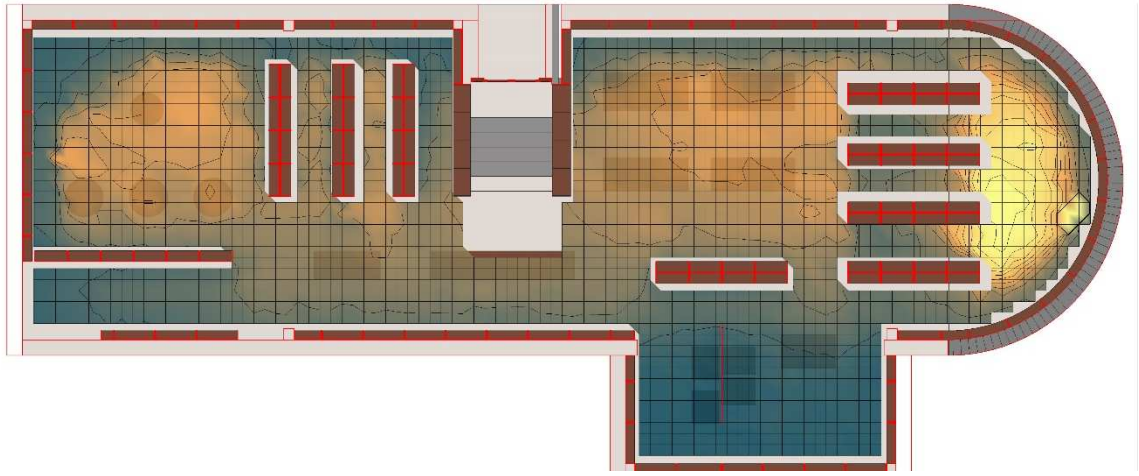
EXISTING - NO SHADES

AVERAGE = 239.02 LUX



EXISTING - WITH SHADES

AVERAGE = 140.09 LUX

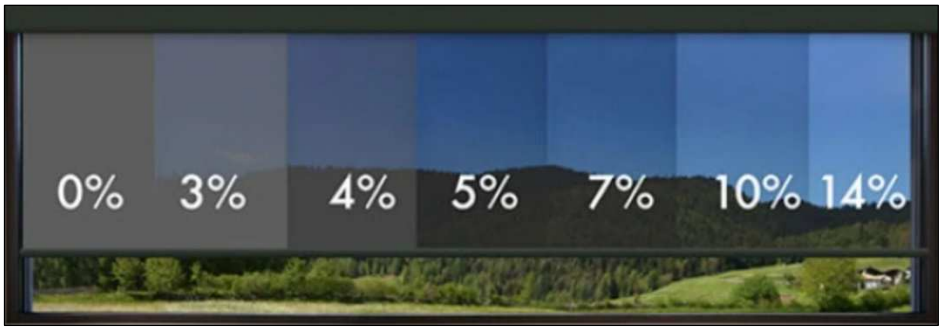


ILLUMINATION LEVELS [LUX]										
+500	450	400	350	300	250	200	150	100	50	0

III. APPENDICES

A. SUN SHADING DEVICES PARAMETERS

It was assessed by photographs and on-site visits that the shading devices are similar to a charcoal gray fabric with 10% openness. Additional information on shading fabric openness can be found at this link: [Zebra Blinds Blog on openness]



The existing library's shading devices located on the five southern windows:

B. EVIDENCE THAT SUN SHADES ARE DRAWN UP UNDER NORMAL CONDITIONS

Here is a list of links pointing to numerous photographs showing sun shades drawn up within the library, between 2013 and 2021:

Google Street Views:

Dec 2013	Feb 2014	Jan 2015	Jun 2016	Feb 2017	Mar 2018	April 2019
	June 2014	Oct 2015		Sept 2017	Jun 2018	
	Sept 2014	Nov 2015		Dec 2017		
	Aug 2014					
	Nov 2014					

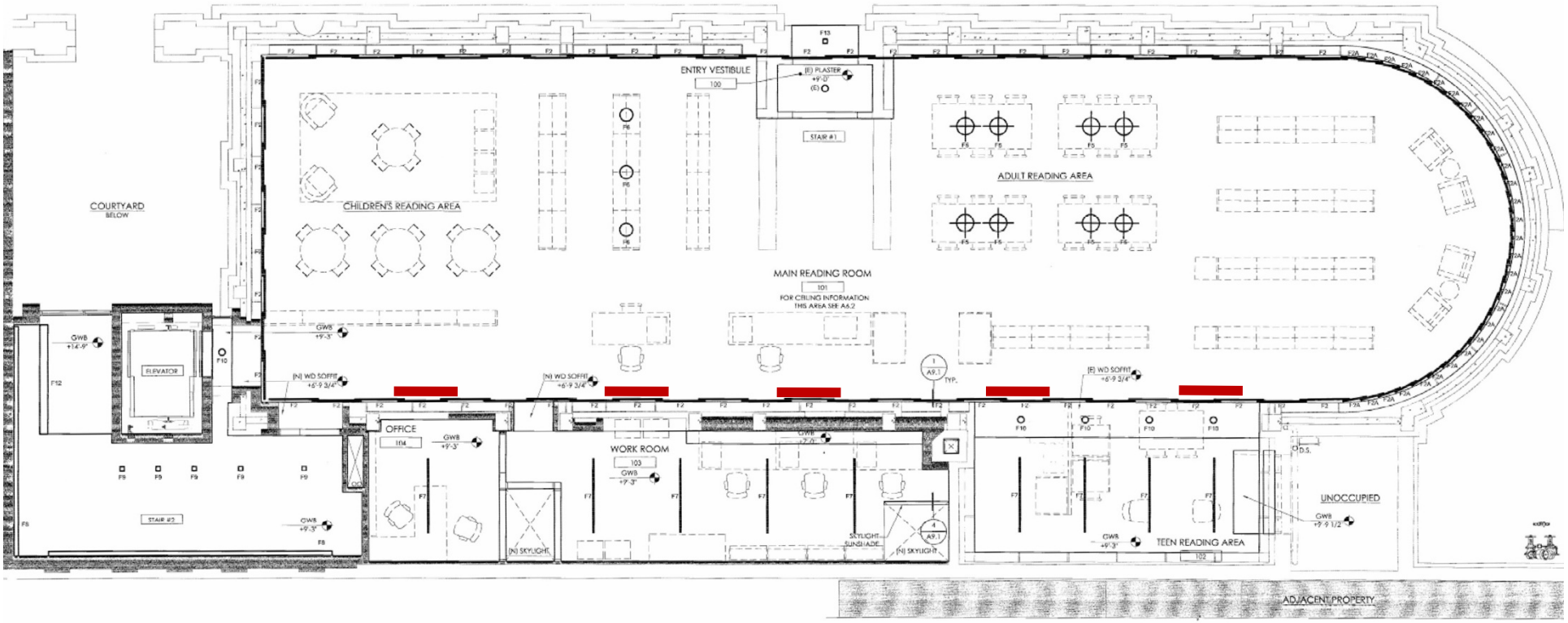
Library Patrons Internet Photographs:

Sept 2017	Feb 2019	Feb 2021
	April 2019	

Project Sponsor's Photographs – verified by Metadata:

Owner Photos

C. SUN SHADES LOCATION



SUN SHADE

1 MAIN LEVEL REFLECTED CEILING PLAN

SCALE: 1/4" = 1'-0"

N

SUN SHADING DEVICE LOCATION, AS USED IN THE LIGHTING SIMULATION.

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