

The Barnes Foundation
2025 Benjamin Franklin Parkway, Philadelphia, PA 19130

Technical Report I Part II

Lighting Existing Conditions & Design Criteria Report

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9/19/2014

Executive Summary

Five spaces of The Barnes Foundation in Philadelphia, PA, were analyzed based on existing conditions, specific design criteria and considerations, and evaluation of lighting systems. These spaces include:

Lower Lobby		Circulation Space
Open Office		Large Work Space
Light Court		Special Purpose Space
Light Box		Exterior Focal Point
Public Garden		Outdoor Space

Lighting and floor plans for each space were analyzed based on existing fixtures and material finishes. This was then followed by collecting design criteria for each space to be designed based on the most current codes, and developing design considerations for each space. For each space, the current lighting design has still met code requirements that were eight years ahead of when it was first designed. However, there is still the possibility for improvement in daylighting and controllability. The open office area specifically could benefit from including more daylight in the space, while many of the spaces could use an upgrade from fluorescents to LEDs. This change to LED fixtures would help in energy efficiency of the facility and give the opportunity to create a vast amount of scenes within the Light Court, lower lobby, and Light Box. Although not indicated in the report, the majority of lighting will be specified at 3500K for a slightly warmer white light that will evoke the warm colors of the stone and wood used throughout The Barnes Foundation.

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Building Overview

Building Name

The Barnes Foundation
Philadelphia Campus

Location

2025 Benjamin Franklin Parkway, Philadelphia, PA 19130

Building Occupant Name

The Barnes Foundation

Occupancy or Function Types

Assembly (A-3), Business
Conference Rooms, Auditorium, Lounges, Library

Size (Total square feet)

91,748 sq ft

Number of Stories Above Grade / Total Levels

2 Stories above ground | 61' above ground
3 Stories total

Dates of Construction

11/10/2009 – 2/23/2012

Cost Information

Total Cost - \$75,890,374

Project Delivery Method

Guaranteed Maximum Price (GMP)

Primary Project Team

Owner

The Barnes Foundation | <http://www.barnesfoundation.org/>

Architect

Tod Williams Billie Tsien Architects | <http://www.twbta.com/>

Associate Architect/LEED

Ballinger Architects | <http://www.ballinger-ae.com/>

Landscape Architect

Olin Partnership | <http://www.theolinstudio.com/>

MEP Engineer

Altieri Sebor Wieber | <http://www.altieriseborwieber.com/>

Lighting Designer

Fisher Marantz Stone | <http://www.fmsp.com/>

Existing Lighting Overview

The Barnes Foundation is illuminated mainly by fluorescent, halogen, and metal halide sources. This art education facility is separated into a variety of spaces; such as exhibit, event, auditorium, office, classroom, and lab spaces. A great deal of indirect lighting was included in the building with the use of cove lighting and clerestories due to the fragile artwork. The building received a LEED Platinum rating, partially due to its effective use of daylighting controls and low transmission glazing to protect artwork in the galleries.



Figure 1 | Open Office

Open Office

On the top floor, the East Open Office provides slightly over half the amount of the workspace available for Barnes Foundation employees. With closed offices on the North and South ends of the space, the open office allows direct daylight to enter through East-facing windows (Figure 4). The electric lighting consists of an array of fluorescent pendants throughout the area and cove lighting along the East side of the room. The open office area is indirectly lit through translucent glazing along the West wall (Figure 3), which looks into the Light Court, allowing both the daylight and electric light from the court to illuminate the space.

Existing Conditions

Approx. Area		3100 ft ²
Length		43 ft
Width		70 ft
Height		10 ft

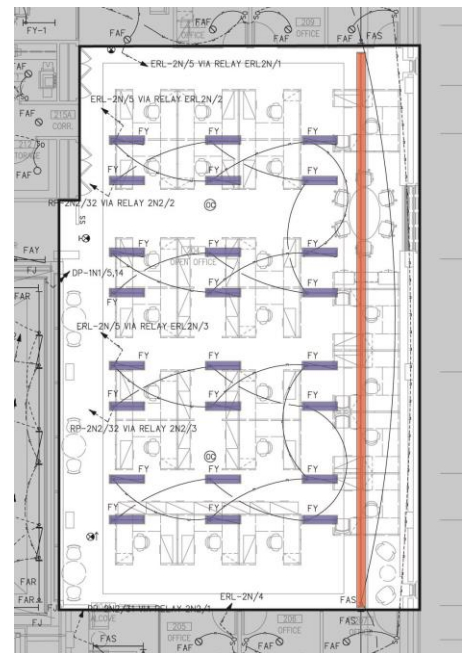
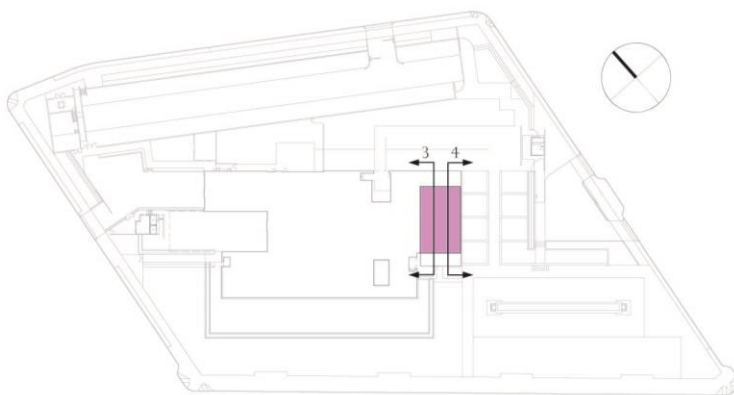


Figure 2 | Open Office Lighting Plan

Table 1 | Open Office Fixture Schedule

Type	Description	Lamp	Watt	MFR.
FY	Pendant mounted 1'x4' high output linear fluorescent direct/indirect troffer with integral electronic ballast. Cable length to be 24" long.	(2) Philips F54T5HO/835/ALTO	119W	Zumbobel
FAS	Surface mounted in architectural cove single lamp continuous row staggered linear fluorescent uplight channel with asymmetric reflector and integral electronic ballast. Lengths per Architectural drawings to within 2'-0" of cove ends. Shop drawings required showing coordinated lengths in Architectural condition.	(1) Philips F28T5/835/ALTO	8W/LF	Bartco

Although there are no controls in the open office area, the workspace uses T5HO pendants for ambient lighting of the space and a T5 cove fixture for decorative lighting along the East wall.

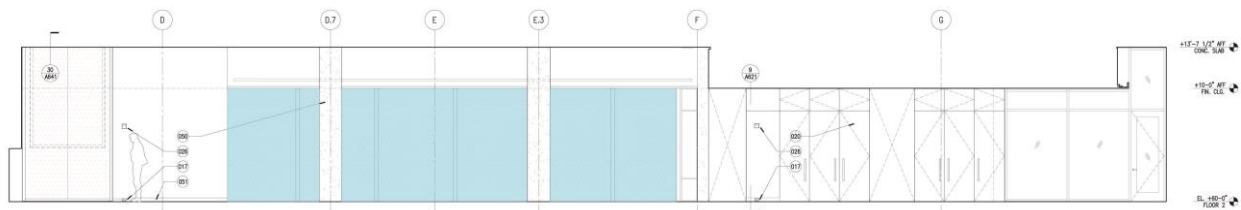


Figure 3 | West Elevation

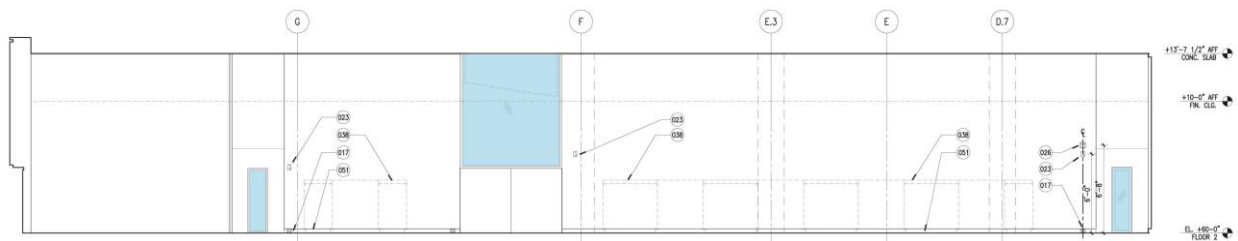


Figure 4 | East Elevation

The open office area continues the sophisticated ambiance of The Barnes by using many of the same materials found throughout the rest of the facility. The ceiling is primarily made up of 1' x 6' acoustic ceiling tile while the majority of the walls are gypsum. The exterior of the North and South offices are stainless steel frames with translucent glass to allow excess light from the open office to enter the private offices. The floor is made up of two different materials to define the areas of the room; oak wood along the interior pathways and carpet for the cubicle area.

Table 2 | Open Office Finishes

Surface	Material	LRV
Ceiling	Acoustic Ceiling Tile - Wood Fiber	0.8
	Gypsum Wall Board	0.9
	Exposed Lightly Sanblasted Concrete	0.25
Wall	Exposed Bush-Hammered Concrete	0.15
	Stainless Steel Partitions	0.45
	Gypsum Wall Board	0.9
Floor	Cut Pile Carpet	0.19
	Tongue-and-Groove Oak Strip Flooring	0.22

Clear glass is used on the exterior of the workspace to allow sunlight to enter the space in the morning and indirect light during the afternoon. The window height and size changes depending on the size of the stone paneling on the exterior of the building. Translucent glass on the opposite side of the office allows light to enter from the Light Court while protecting the privacy of the employees. At the same time, the glass is illuminated by the office lighting, creating a glowing effect to visitors in the Light Court.

Table 3 | Open Office Glass Transmittance

Surface	Material	VLT
Glass	Acid-Etched Tempered Glass	0.7
	Clear Tempered Glass	0.76

Design Criteria & Considerations

The main goal for the open office area will be to increase the amount of daylight entering the space and enhance the uniformity of the electric lighting through the office. With this mixture of daylight and electric light, a public and spacious feeling will be given to the room. It will enforce the idea that the employees can interact with each other but at the same time have their own room. This will also help to achieve the uniformity ratio recommended in Table 4. Furthermore, there have been complaints from staff that have offices that it is not bright enough; although the office lighting will not be redesigned, the daylight aspects added to the space will create more pleasing working conditions in both the offices and the open area.

An important factor to be researched is glare in both natural and electric lighting. Electrically, it will be studied to find the optimal luminaire placement to reduce glare; while for daylight, different types of daylighting systems will be researched to allow an optimal amount of indirect light into the space while preventing direct glare from the sun. Luminaires will be semi-indirect fixtures to create more diffuse light rather than hard shadows, and placed throughout the office so that they will be between 0° and 40° from the normal of the workplane to prevent any glare. Currently there are no controls in the open office; however, daylighting controls will be added into the design.

Table 4 | Open Office Illuminance Criteria

E_h	E_v	Avg:Min
30 fc	15 fc	2:1

Table 5 | Open Office LPD Allowance

Space	Allowance
Open Office	0.98 W/ft ²

The future design of this space will attempt to meet the following LEED v4 standards:

- Interior Lighting – To promote occupants' productivity, comfort, and well-being by providing high-quality lighting
 - Occupant controls to adjust light levels for 90% of individual occupant spaces
 - Use light fixtures with a luminance of less than 2,500 cd/m² between 45° and 90°
 - Use light sources with a CRI of 80 or higher
 - 75% of total connected lighting load are rated for 24,000 hours or more
 - 25% or less direct-only overhead lighting
- Daylight – To connect occupants with the outdoors, reinforce circadian rhythm, and reduce the use of electric light
 - Spatial daylight autonomy of at least 50% is achieved at 300 lux of 55% of the floor area
- Optimize Energy Performance – To achieve increasing levels of energy performance beyond the prerequisite standard

Evaluation of Existing Lighting

The existing lighting in the open office is acceptable; however, the horizontal illuminance values are high in comparison to the design criteria. Data were taken at both the workplane in the cubicle area, and the floor along the wooden walkway. The cubicles were found to have nearly 50 fc on the desks while the floor had 30 fc. While these amounts are slightly high, they will not likely cause any discomfort to the employees working in the area. In regards to the cove lighting, it does a good job at getting light into the taller and more private cubicles along the East wall. The LPD of the space was found to be 0.976 W/ft², just under the allowance of the most recent code.

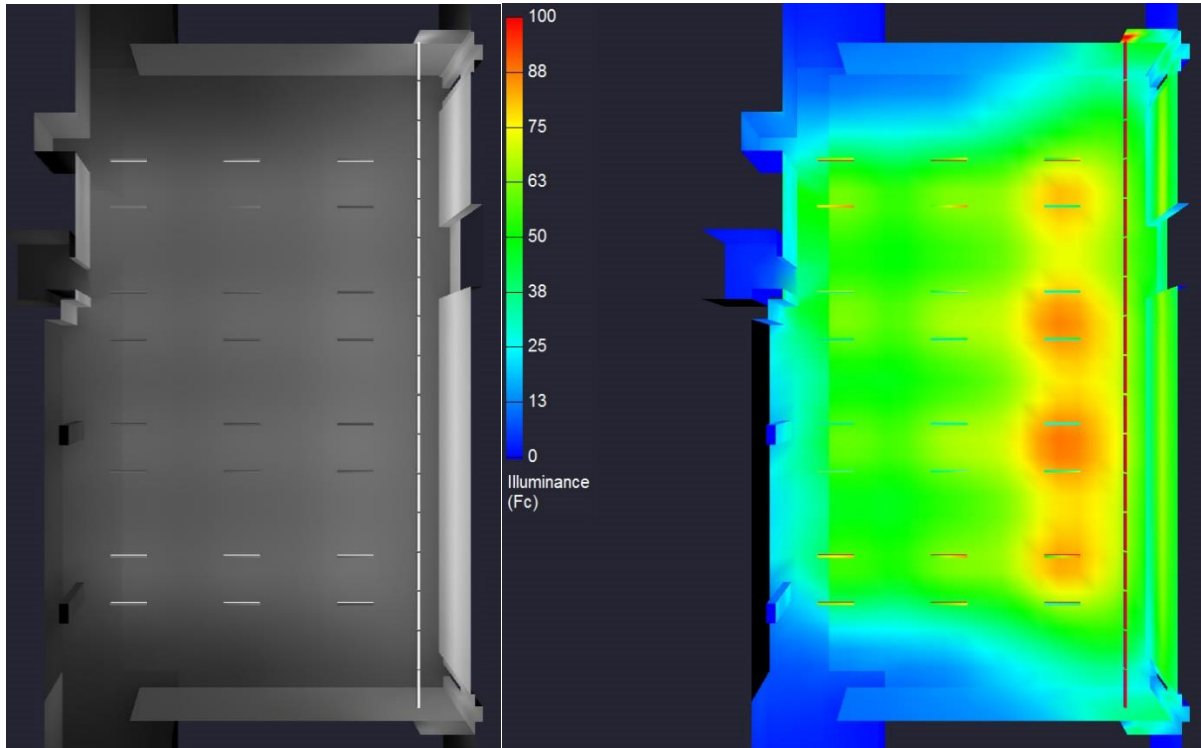


Figure 5 | Rendering and Pseudocolor of the Open Office

Table 6 | Open Office Fixture LLF's

	LLD	LDD	BF	Total
FY	0.93	0.9	0.8	0.670
FAS	0.93	0.8	-	0.744



Figure 6 | Lower Lobby

Lower Lobby

Acting as both a lobby to the auditorium and an entertainment space, the lower lobby can accommodate social and waiting needs. To prevent visitors from feeling trapped underground, an interior garden accompanies the lobby bringing daylight into the space as well as some greenery. The inclusion of this garden brings to life TWBTA’s concept of “a gallery in a garden and a garden in a gallery.” During the day the garden brings in the majority of ambient light; however, cove lighting running along the sides of the lobby and accent track lighting create the ambient and decorative lighting at night.

Existing Conditions

Approx. Area		4300 ft ²
Length		36 ft
Width		108 ft
Height		12 ft

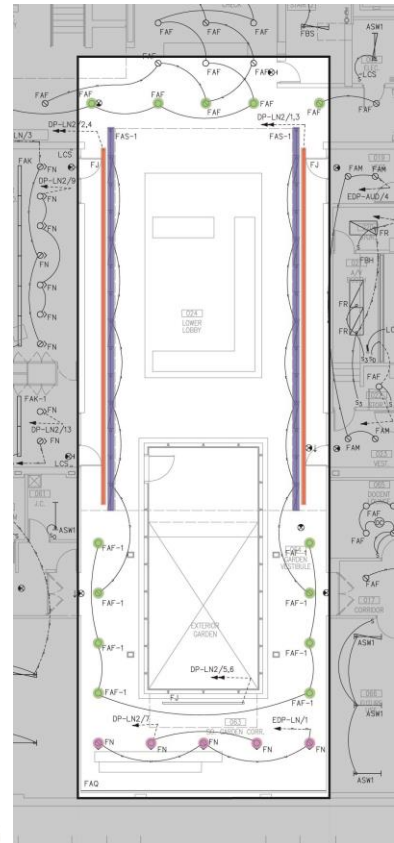
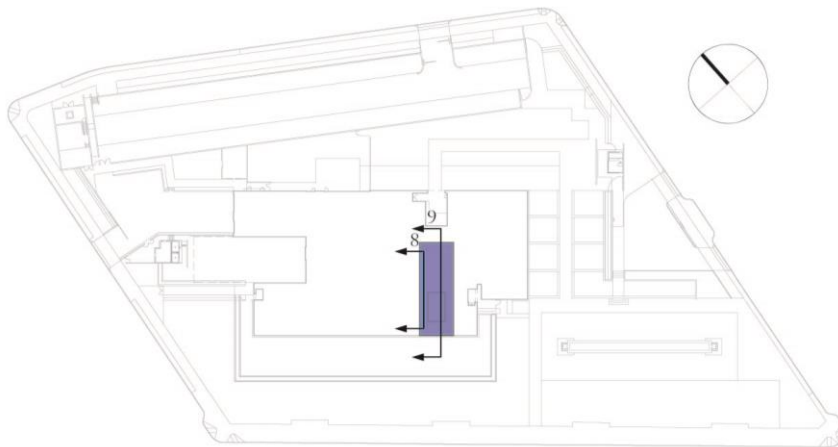


Figure 7 | Lower Lobby Lighting Plan

Table 7 | Lower Lobby Fixture Schedule

Type	Description	Lamp	Watt	MFR.
FJ	Fully recessed two circuit lighting track with flush trim and concealed splice compartment for continuous run appearance and in line feed. Lighting track to be continuous runs using minimum quantity of track sections; no track length to be shorter than 2'.	-	Allow 20W/LF per circuit	Edison Price
FK	Track mounted low voltage adjustable halogen accent light nominally 5" diameter with integral electronic transformer and accessory holder. Fixtures to be part of Owner Purchase.	(1) Sylvania 75AR111/SP8	75W	Edison Price
FN	Recess mounted nominally 4" aperture low voltage halogen adjustable accent light with integral electronic transformer.	(1) GE Constant Color Q50MR16/C/NFL25	50W	Edison Price
FAF	Fully recessed, nominally 6" aperture compact fluorescent downlight with integral electronic ballast.	(1) Philips PL-T26W/835/4P/ALTO	28W	Edison Price
FAF-1	Same as FAF, except with integral 5% Lutron Compact SE dimming ballast	(1) Philips PL-T26W/835/4P/ALTO	29W	Edison Price
FAS-1	Surface mounted in architectural cove single lamp continuous row staggered linear fluorescent uplight channel with asymmetric reflector and integral electronic ballast with integral Lutron Eco10 electronic dimming ballast. Lengths per Architectural drawings to within 2'-0" of cove ends. Shop drawings required showing coordinated lengths in Architectural condition.	(1) Philips F28T5/835/ALTO	Allow 9W/LF	Bartco

With no set furniture in the lower lobby, the most important fixtures in the space are the adjustable accent fixtures. These can be used to focus light on specific areas, whether it's to accent a piece of art or to create ambient light for an event. Although not technically a part of the lower lobby, the FAF-1 and FN fixtures that reside in the garden corridor to the south are equally as important to the lobby lower experience. At night these fixtures will complete the aura of light surrounding the interior garden and help to create the overall ambiance of the space.

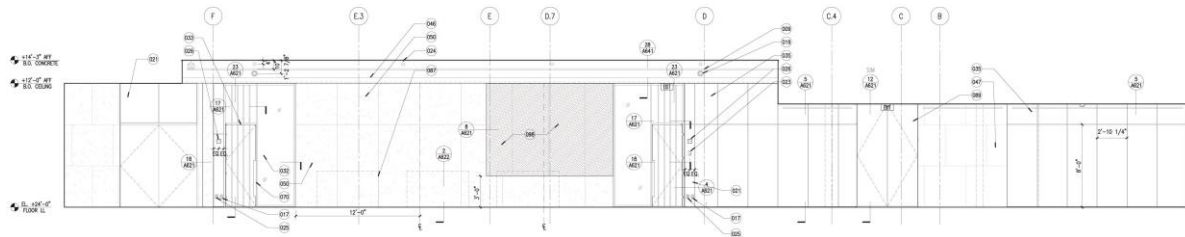


Figure 8 | West Elevation of Lobby

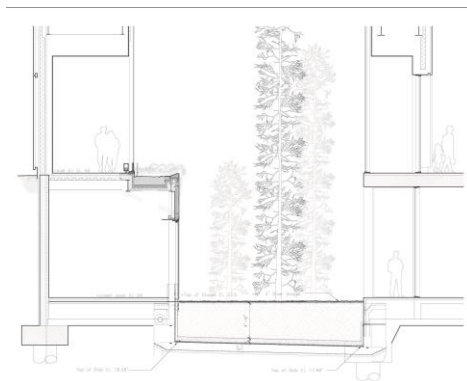


Figure 9 | West Elevation of Garden

It can be seen in Figure 6 that the lower lobby was given a more earthy feeling due to the presence of the interior garden. The mixture of wood and concrete in the space reaching towards the garden creates a connection with nature.

Table 8 | Lower Lobby Finishes

Surface	Material	LRV
Ceiling	Exposed Lightly Sanblasted Concrete	0.25
	Gypsum Wall Board	0.9
Walls	Exposed Bush-Hammered Concrete	0.15
	Exposed Form Finish Concrete	0.62
Floor	Renaissance Gray Limestone	0.4
	Tongue-and-Groove Oak Strip Flooring	0.22

The glass surrounding the garden is clear tempered glass, meant to allow as much daylight as possible to enter the space.

Table 9 | Lower Lobby Glass Transmittance

Surface	Material	VLT
Glass	Clear Tempered Glass	0.76

Design Criteria & Considerations

This space will be used to study the psychological aspects of lighting design, specifically the affects that lighting has on making a space feel public or private. These two opposites are crucial to this type of space. When acting as a waiting lobby, visitors should feel open to their surroundings; this is accomplished by creating an even distribution of light throughout the space. When there is an event to be catered to, the area should feel enriched and secluded from other parts of the building; this is done by focusing light on specific areas within the room based on where furniture or artwork are placed, moreover there will be a focus on the interior garden. The light will also be dimmer to create a feeling of separation from surrounding spaces and perimeter lighting will be used to emphasize the boundary of the area. Furthermore, these psychological aspects of lighting will also be studied in the garden to see how lighting the garden differently can bring out varying emotions.

The current controls of the lower lobby consists of the accent track lighting connected to a dimming panel. Preset scenes will be created to increase the controllability of the space expressing the psychology of light. This will allow users to easily set the lobby space to any mood they would like.

Table 10 | Lower Lobby Illuminance Criteria¹

E_h	E_v	Avg:Min
40 fc	15 fc	2:1

Table 11 | Lower Lobby LPD Allowance²

Space	Allowance
Lower Lobby	0.9 W/ft ²

The future design of this space will attempt to meet the following LEED v4 standards:

Interior Lighting – To promote occupant’s productivity, comfort, and well-being by providing high-quality lighting
 Occupant controls to adjust light levels for 90% individual occupant spaces
 Use light fixtures with a luminance of less than 2,500 cd/m² between 45° and 90°

Use light sources with a CRI of 80 or higher

75% of total connected lighting load are rated for 24,000 hours or more

25% or less direct-only overhead lighting

Optimize Energy Performance – To achieve increasing levels of energy performance beyond the prerequisite standard

Evaluation of Existing Lighting

The daylight from the interior garden is what fully brings this space together. Through the day the electric lighting acts more as accent and decorative lighting when compared to the amount of light the garden is bringing in. However, as the sun sets the interior lights take dominance. First the cove lighting draws your eye's towards the garden, and then the glow from the surrounding electric lights highlight the interior garden, making it a focal point throughout the day and night. With more controlability of the luminaires though, more depth could be added to the space rather than only having adjustable accent fixtures



Figure 10 | Public Fountain

Public Garden

“A gallery in a garden and a garden in a gallery,” this was the driving concept behind the design of The Barnes Foundation. The mixture of stone, grass, plants, and water take pedestrians out of their city surroundings and bring them to a more tranquil place. Trees that line the path from Benjamin Franklin Parkway to the entrance combine with shallow, yet large, pools of water to make The Barnes seem to be cut straight from one giant piece of limestone that had been lying around at this site.

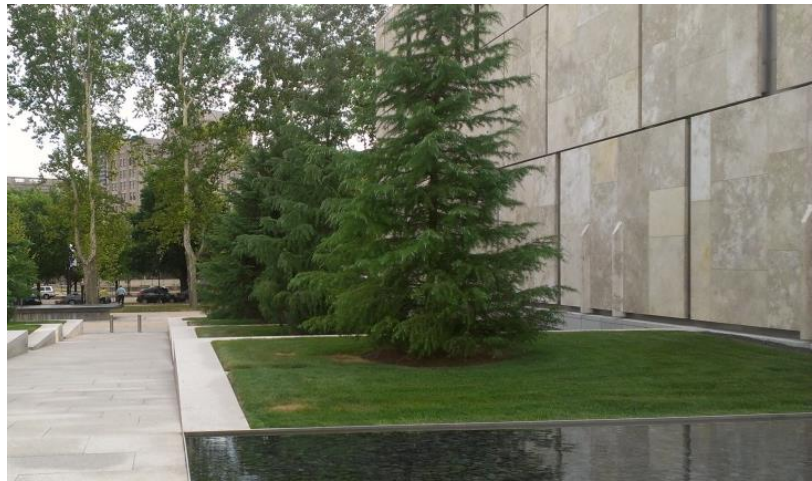


Figure 11 | Public Garden

Existing Conditions

Approx. Area | 46,500 ft²

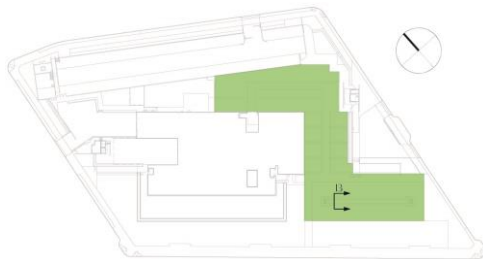


Figure 12 | Public Garden Lighting Plan

Table 12 | Public Garden Fixture Schedule

Type	Description	Lamp	Watt	MFR.
FC	Exterior in-grade ceramic metal halide well light with bronze housing, cast bronze grill and integral electronic ballast. Fixture suitable for wet location.	(1) Philips CDM35/PAR20L/M/FL/3K/ALTO	39W	Hydrel
FBY	Recessed in wall compact fluorescent steplight, 4"x8" form factor with die-formed steel housing, semi-specular aluminum reflector, cast aluminum faceplate, frosted tempered glass, and integral electronic ballast. Fixture suitable for wet locations.	(1) Philips PL-S 9W/835P/ALTO	10W	Cole Lighting

While step lights are used along ramps and steps, the primary fixtures creating ambient light are the in-grade fixtures acting as tree uplights. This allows for less light needing to be focused on the path thanks to the trees lining both sides of the path.

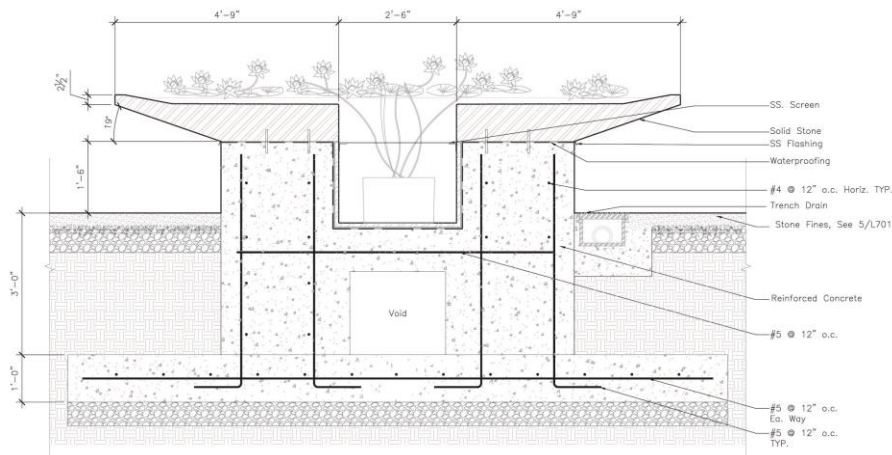


Figure 13 | Fountain Section

The site around the facility is made up of mainly grass and granite. Clearly defined paths are layed out with San Sebastian granite while the area around the fountain, shown in Figures 10 and 13, is decomposed stone paving. This change of material creates a clear division between walkways and standing areas. Even though much of the site is made up of stone there is never grass too far away to always create the feeling that this is a gallery within a garden.

Table 13 | Public Garden Finishes

Surface	Material	LRV
Ground	Decomposed Stone Paving	0.33
	Planting Area	0.2
	Granite Pavers Stone - Renaissance Gray Limestone	0.4
	San Sebastian Granite - Granite Pavers Stone	0.3
Walls	San Sebastian Granite - Granite Pavers Stone	0.3
Fountain	San Sebastian Granite - Granite Setts Stone	0.15

Design Criteria & Considerations

The goal in redesigning the public garden will be to emulate the same ambiance that is created by the Light Box. However, the main factor to consider in site lighting is controlling the upward light in accordance with the Model Lighting Ordinance. This states that for a site in Lighting Zone 3 there are 5.0 lumens allowed per square foot and the maximum vertical illuminance at any point of 0.8 fc. Currently the public garden lighting consists of tree uplights and step lights along the exterior ramps and stairs. These fixtures will be studied for energy efficiency and IP rating. Furthermore, wayfinding through lighting will be implemented to make it easier for visitors to locate the entrance of The Barnes. This will be done by focusing light on certain walls and walkways to emphasize specific paths.

Table 14 | Public Garden Illuminance Criteria

	E_h	E_v	Avg:Min
Plazas	4 fc	2 fc	5:1
Ramps	6 fc	4 fc	5:1

Table 15 | Public Garden LPD Allowance

Space	Allowance
Public Garden	0.2 W/ft ²

The dark sky initiative will be highly considered when designing the site lighting and all fixtures will have appropriate BUG ratings based on mounting height and distance from the property line. Photosensors will be used to control the site lighting.

Evaluation of Existing Lighting

While widely used by the public, this garden effectively creates a relaxed and safe area for pedestrians to walk through. The simple lighting design is able to supply a sufficient amount of lighting to the open area; although there should be more light directly on the paths to help in finding the entrance to The Barnes. Furthermore, features such as the fountain near Benjamin Franklin Parkway and the pools on either side of the entrance could be accented more to mimic the ethereal feeling of the Light Box at night.

Light Court

Acting as the grand entrance and the main lobby to The Barnes Foundation, the Light Court is thusly named for the large day lit ceiling. Other than as a lobby, this special purpose space is capable of holding large events throughout the day and night.

Existing Conditions

Approx. Area		8000 ft ²
Length		170 ft
Width		45 ft
Height		62.5 ft

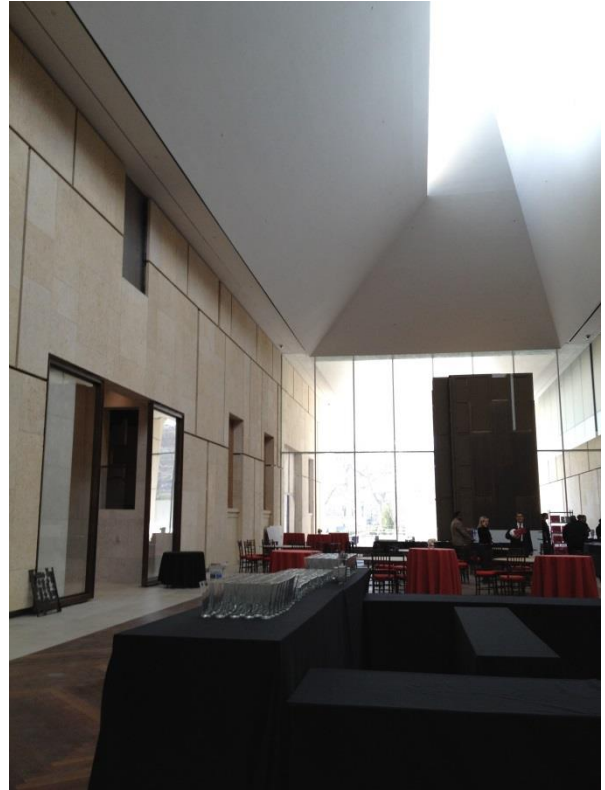


Figure 14 | Light Court

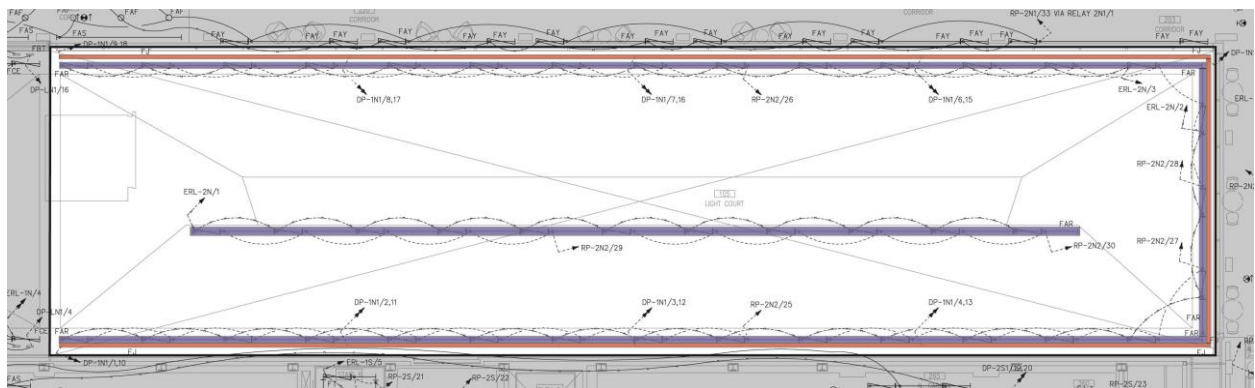
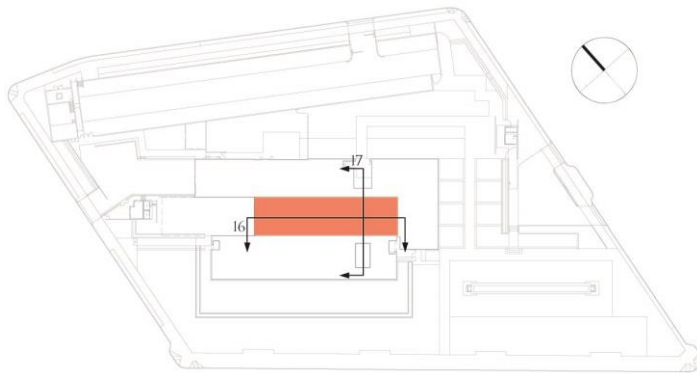


Figure 15 | Light Court Lighting Plan

Table 16 | Light Court Fixture Schedule

Type	Description	Lamp	Watt	MFR.
FJ	Fully recessed two circuit lighting track with flush trim and concealed splice compartment for continuous run appearance and in line feed. Lighting track to be continuous runs using minimum quantity of track sections; no track length to be shorter than 2'.	-	Allow 20W/LF per circuit	Edison Price
FK	Track mounted low voltage adjustable halogen accent light nominally 5" diameter with integral electronic transformer and accessory holder. Fixtures to be part of Owner Purchase.	(1) Sylvania 75AR111/SP8	75W	Edison Price
FAR	Surface mounted in architectural condition, 3 lamp continuous fluorescent channel. Fixture to be wired for 2-circuit with 1 lamp and 2 lamp Lutron Eco10 dimming ballasts. Site mockup required for 12'-0" run for Architect approval prior to final installation. Lengths per Architectural drawings to within 2'-0" of Light Court shelf edge.	(3) Philips F28T5/835/ALTO	31W + 61W Allow 2 circuits	Bartco

During the day, the daylight entering through the clerestory creates more than sufficient ambient light within the Light Court. Other than special events, The Barnes Foundation does not stay open late into the night. For these occasions, fluorescent cove lighting is hidden behind the lip of the clerestory structure, as can be seen in Figure 17, to create both ambient lighting and accent lighting to draw your eyes up and marvel at the height and form of the space. Accent track fixtures run along the North and South ends of the Light Court to provide accent lighting into the space to reach the 5 fc recommended illuminance levels.

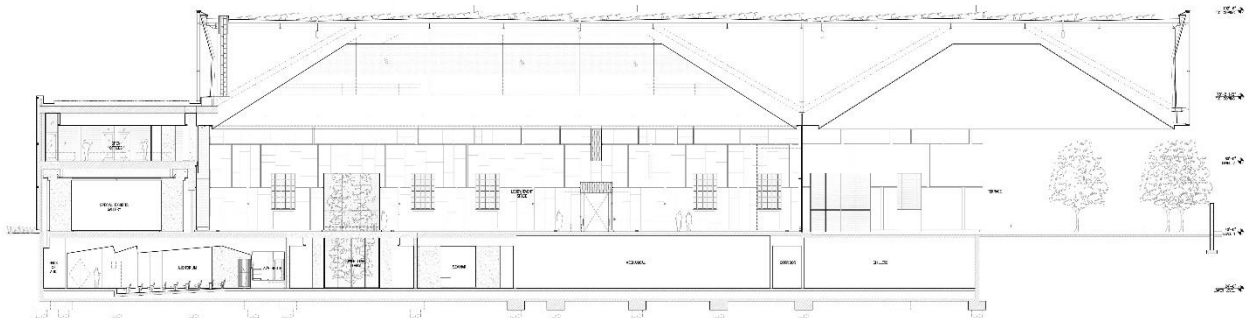


Figure 16 | South Elevation

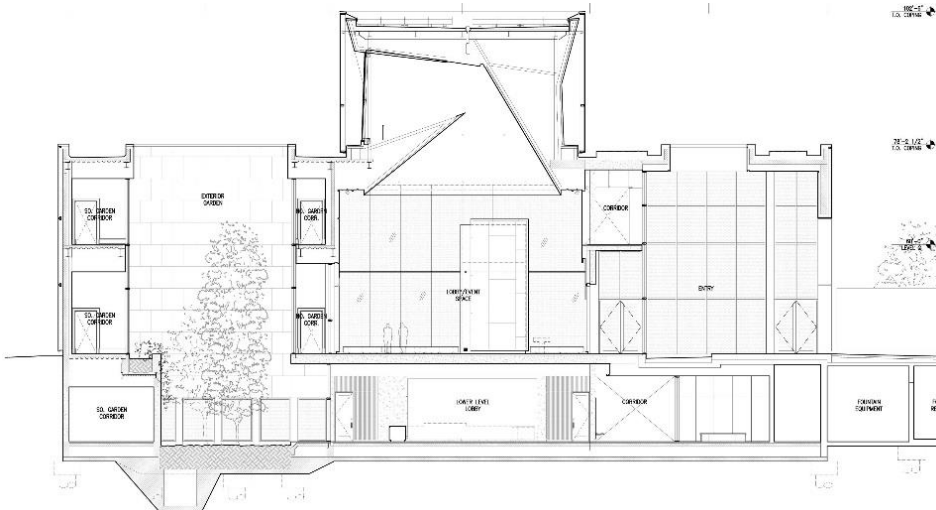


Figure 17 | West Elevation

The majority of the interior walls of the Light Court are made up of the same stone that is found on the exterior façade of the facility. When this is combined with the West glass façade and the Light Box canopy extending into the site, it creates the feeling of a large courtyard rather a lobby. Because of the scale of the Light Court, acoustics was highly considered in design. To prevent a large amount of reverberation the forms that create the clerestory are covered in acoustical plaster. Furthermore, similar to the one outside, there is another fountain inside the Light Court.

Table 17 | Light Court Finishes

Surface	Material	LRV
Ceiling	Acoustic Plaster	0.79
Walls	Ramon Gold Limestone	0.55
	Ramon Gray-Gold Stone	0.5
	Bronze Plated Statue	0.62
	Gypsum Wall Board	0.9
Floor	Renaissance Gray Limestone	0.4
	Tongue-and-Groove IPE Parquet Flooring	0.32

Along the North and South elevations on the second floor level of the Light Court is translucent glass separating the art educational facility with the offices above. For the glazing in the remainder of the space, multi-layered glass with thermal protection was placed to allow an optimal amount of daylight to enter while containing the heating and cooling.

Table 18 | Light Court Glass Transmittance

Surface	Material	VLT
Glass	Acid-Etched Tempered Glass	0.7
	Laminated Multi-Layered PPG Glass	0.5

Design Criteria & Considerations

Three different conceptual designs will be create for the Light Court. The main aspect of the space that will be altered between concepts is how to address the verticality of the space and how to draw a visitor's eyes. This will involve study not only into luminance ratios, but placement and orientation of light sources. Daylight sensors will be included into the design to control the levels of the cove fixture throughout the day. This will create a consistent amount of light on the ceiling throughout the day that visitors will not be able to notice a change between overcast and clear sky conditions.

Table 19 | Light Court Illuminance Criteria

	E_h	E_v	Avg:Min
Day	100 fc	30 fc	4:1
Night	50 fc	20 fc	4:1

Table 20 | Light Court LPD Allowance

Space	Allowance
Light Court	$0.4 + 0.02/\text{ft total height}$ $= 1.65 \text{ W}/\text{ft}^2$

The future design of this space will attempt to meet the following LEED v4 standards:

Interior Lighting – To promote occupant’s productivity, comfort, and well-being by providing high-quality lighting

Occupant controls to adjust light levels for 90% individual occupant spaces

Use light fixtures with a luminance of less than 2,500 cd/m² between 45° and 90°

Use light sources with a CRI of 80 or higher

75% of total connected lighting load are rated for 24,000 hours or more

25% or less direct-only overhead lighting

Daylight – To connect occupants with the outdoors, reinforce circadian rhythm, and reduce the use of electric light

Spatial daylight autonomy of at least 55% is achieved at 300 lux of 50% of the floor area

Illuminance levels between 9AM and 3PM will be between 300 lux and 3000 lux for at least 75% of the time

Optimize Energy Performance – To achieve increasing levels of energy performance beyond the prerequisite standard

Evaluation of Existing Lighting

Due to the size of the space, daylighting alone is able to sufficiently illuminate the area during the day. During the night, the majority of the ambient light is provided by the cove lighting near the clerestory, roughly 3.5 fc of the 5 fc recommended by the IES handbook. However, only the track fixtures are currently controllable. Daylight controls should be added to the Light Court to balance light levels throughout various weather conditions.

Much like the Lower Lobby, the Light Court has no set furniture in the space. However, it does have two stationary features with the water feature at the Northwest end of the court and the bronze-plated wall at the West end, shown in Figures 18 and 19. Both of these features could be highlighted more with the use of accent fixtures to emphasize their existence in the space.

One large benefit of the amount of daylighting entering the Light Court is that the LPD is currently 0.61 W/ft² which is much lower than the required limit of 1.65 W/ft².

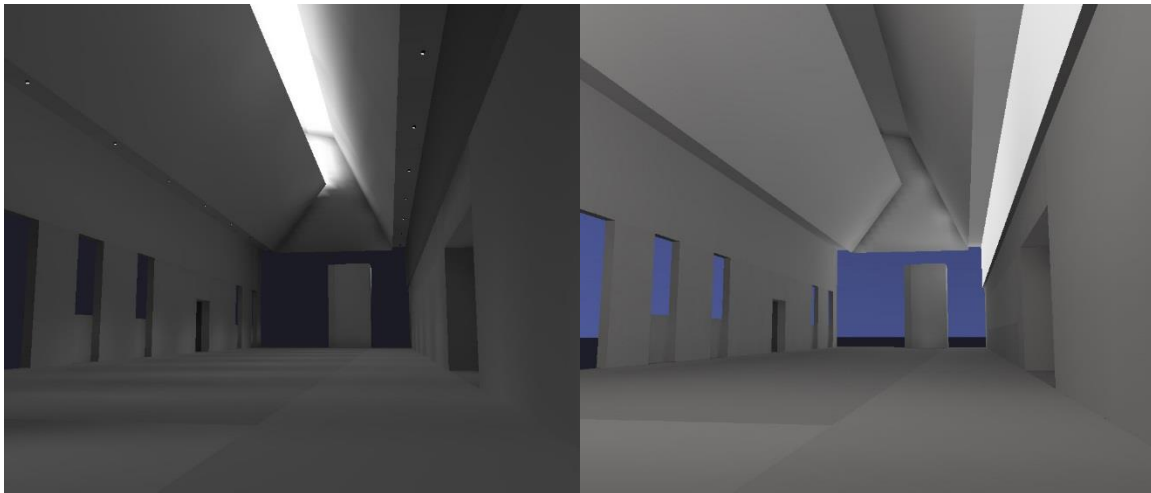


Figure 18 | Electric Lighting Only

Figure 19 | Daylighting Only

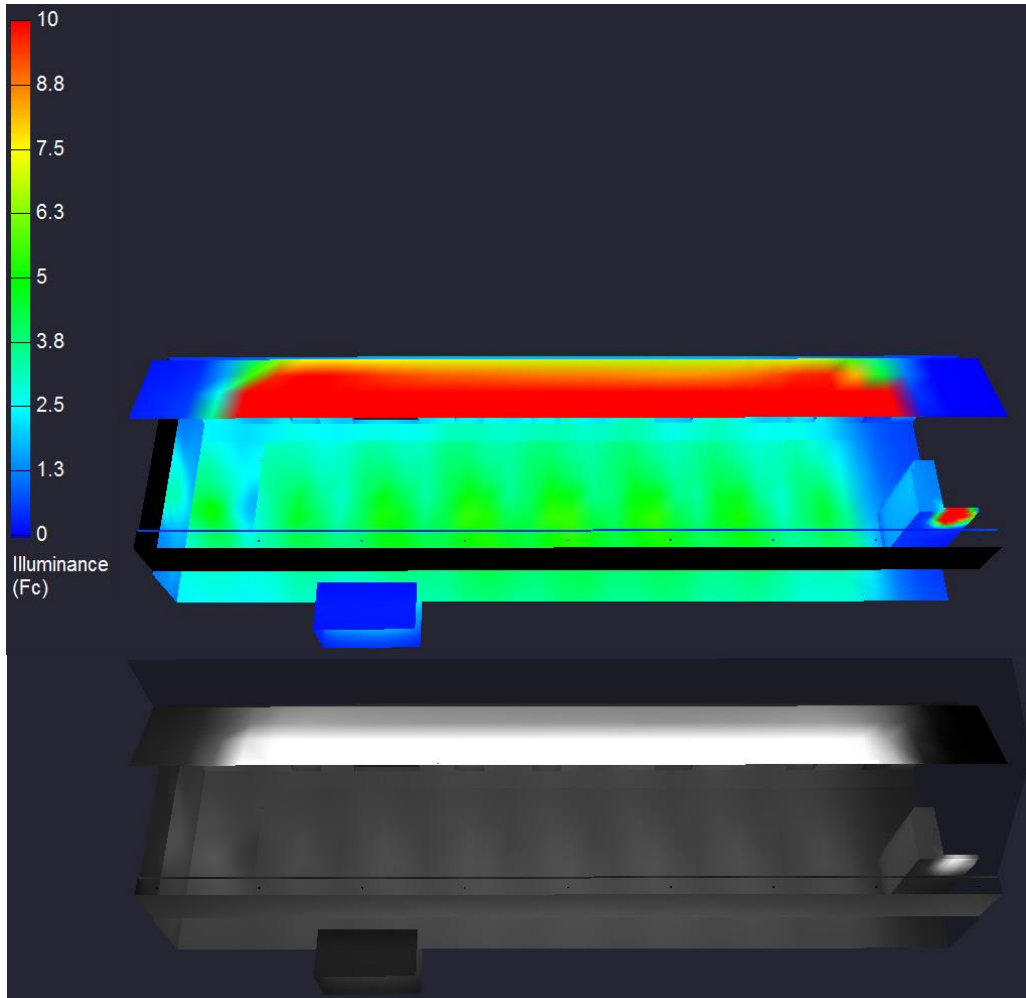


Figure 20 | Rendering and Pseudocolor of the Light Court

Table 21 | Light Court Fixture LLF's

	LLD	LDD	BF	Total
FK	0.93	0.74	0.8	0.551
FAS	0.93	0.8	-	0.744



Figure 21 | Light Box, Courtesy of Tom Crane

Light Box

Surrounding both the interior and exterior Light Court, the Light Box glows to become a welcoming lantern at night. Furthermore, it creates a symbol for The Barnes Foundation to the surrounding area without creating any obtrusive light.

Existing Conditions

Approx. Area		12,550 ft ²
Length		280 ft
Width		45 ft
Height		32 ft

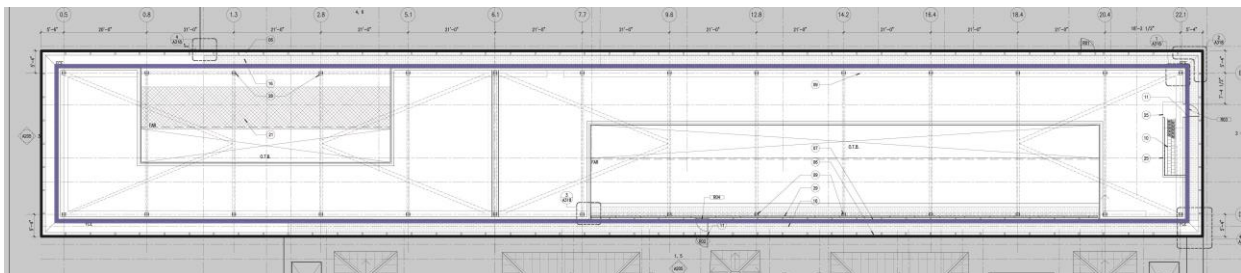
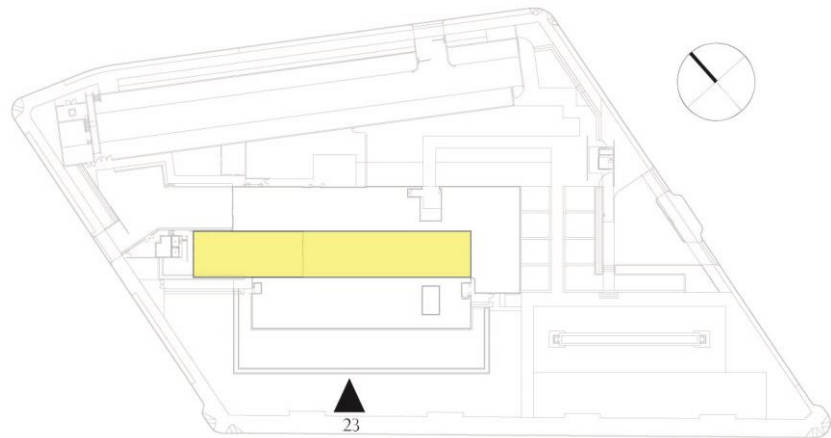


Figure 22 | Light Box Lighting Plan

Table 22 | Light Box Fixture Schedule

Type	Description	Lamp	Watt	MFR.
FCE	Surface mounted continuous (1) lamp linear fluorescent uplight with double row asymmetric reflectors, and integral electronic Lutron Eco10 dimming ballasts. Wired for 2 circuits. Site mockup required for 12'-0" run for Architect approval prior to final installation.	(1) Philips F28T5/835/ALTO	15W	Elliptipar

To illuminate the Light Box, elliptipar fixtures surround the interior forms that create the ceiling of the Light Court. These fixtures then illuminate the box from the bottom up to create the ethereal glow. While at first a two lamp fixture was specified, it was found that one lamp per fixture was plenty to receive the desired effect.

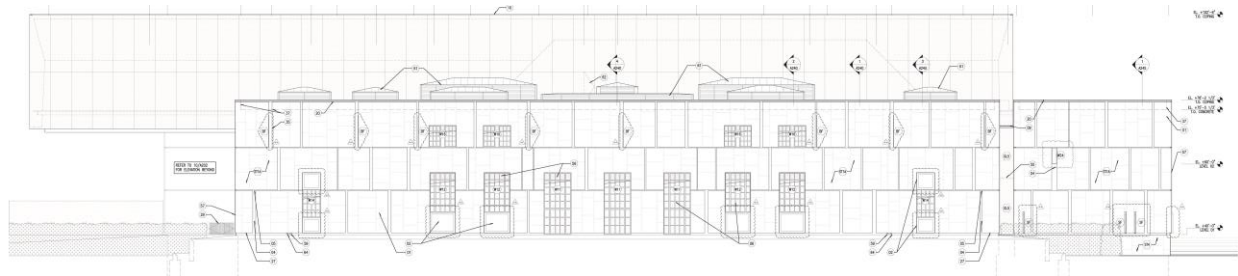


Figure 23 | North Elevation

A rubber walkway was put down inside the cavity between the Light Court ceiling and the Light Box to create a safe working environment. The fluorescent fixtures light the exterior of the Light Court's ceiling to accentuate its form; this light is then reflected onto the special translucent glass to create the lantern like effect. This glass also helps to prevent heat and cooling loss. Above the Light Box is an array of photovoltaic panels to capture energy from the sun and utilize it within the facility.

Table 23 | Light Box Finishes

Surface	Material	LRV
Floor	Rubber Walkway Surface	0.6

Table 24 | Light Box Glass Transmittance

Surface	Material	VLT
Glass	PPG Starphire Tempered Lite Translucent Glass with Acid Etch	0.7

Design Criteria & Considerations

Since this is such a unique space there are no set illuminance recommendations to achieve. For future design, fixtures will be chosen based on energy efficiency and controllability. Uniformity along the base of the Light Box will be very important to conserve to create as clean of an effect as possible to pedestrians. Projector systems will also be researched to have the capability to display exhibit advertisements on the Light Box at night. The main priority of the design will be to reduce upward light while maintaining the current glowing effect.

Evaluation of Existing Lighting

With the use of the luminaires combined with translucent glazing, the Light Box effectively creates a symbol for The Barnes Foundation without generating too much obtrusive light to the surrounding area. In re-designing the space, that location and intensity of luminaire will be studied to optimize effect and sustainability.

References

- ASHRAE Standard 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings*. 2010 ed. N.p.: ASHRAE, n.d. Print
- DiLaura, D. L., Houser, K. W., Mistrick, R. G., Steffy, G. R. *Illuminating Engineering Society The Lighting Handbook*. 10th ed. N.p.: IESNA, n.d. N. pag. Print.
- “New Construction & Major Renovations.” *New Construction*. U.S. Green Building Council, 2013. Web. 18 Sept. 2014. <<http://www.usgbc.org/leed/rating-system/new-construction>>.
- Model Lighting Ordinance (MLO)*. 2011. N.p.: IDA-IESNA, n.d. Print.

Appendix A – Illuminance Criteria Classifications

Open Office | Common Applications

- Reading & Writing
- VDT Screen & Keyboard
- Positive Polarity

Lower Lobby | Common Applications

- Transition Spaces
- Lounges
- Social/Waiting

Light Court | Common Applications

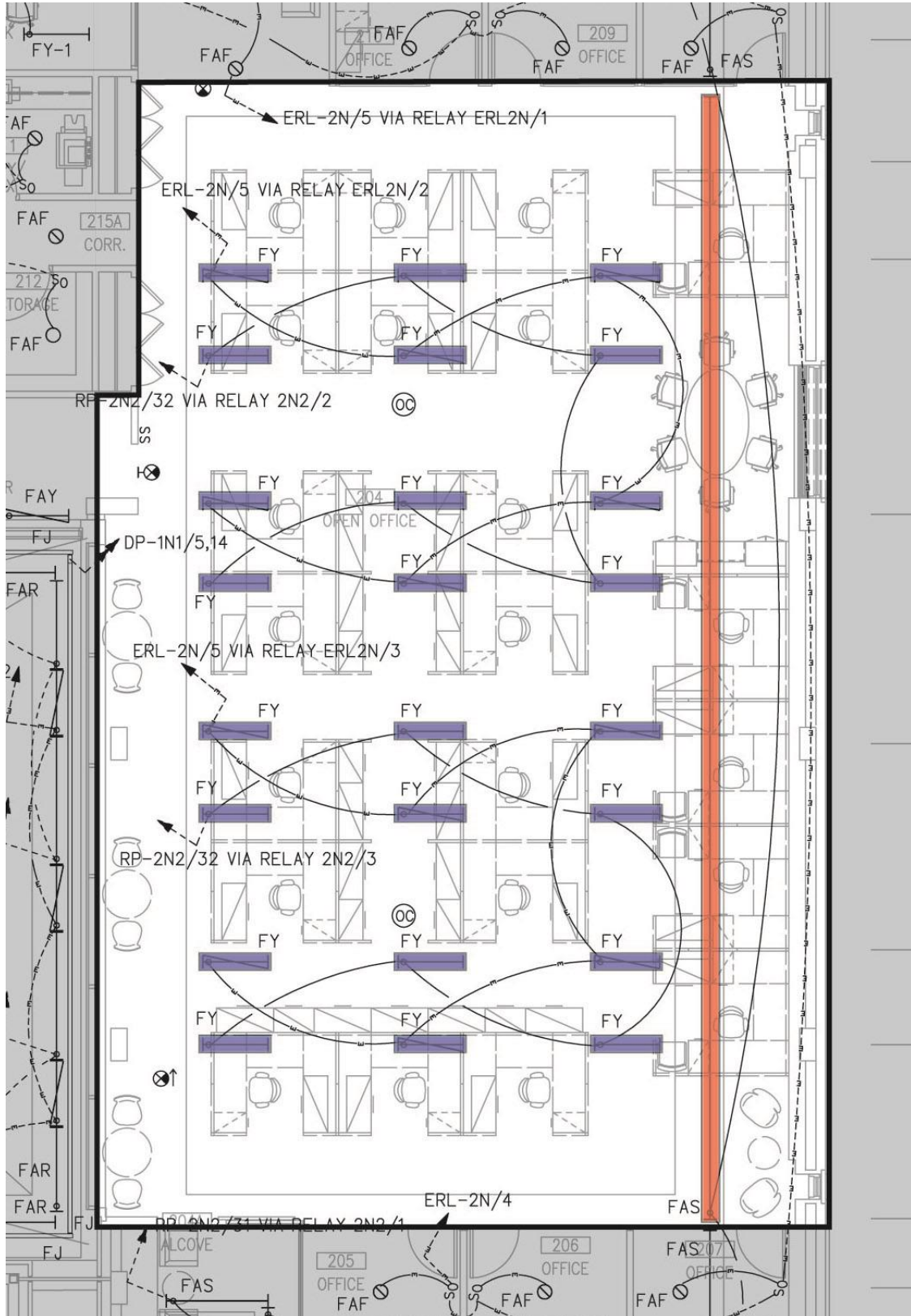
- Transition Spaces
- Lobby
- Day, Night

Public Garden | Retail

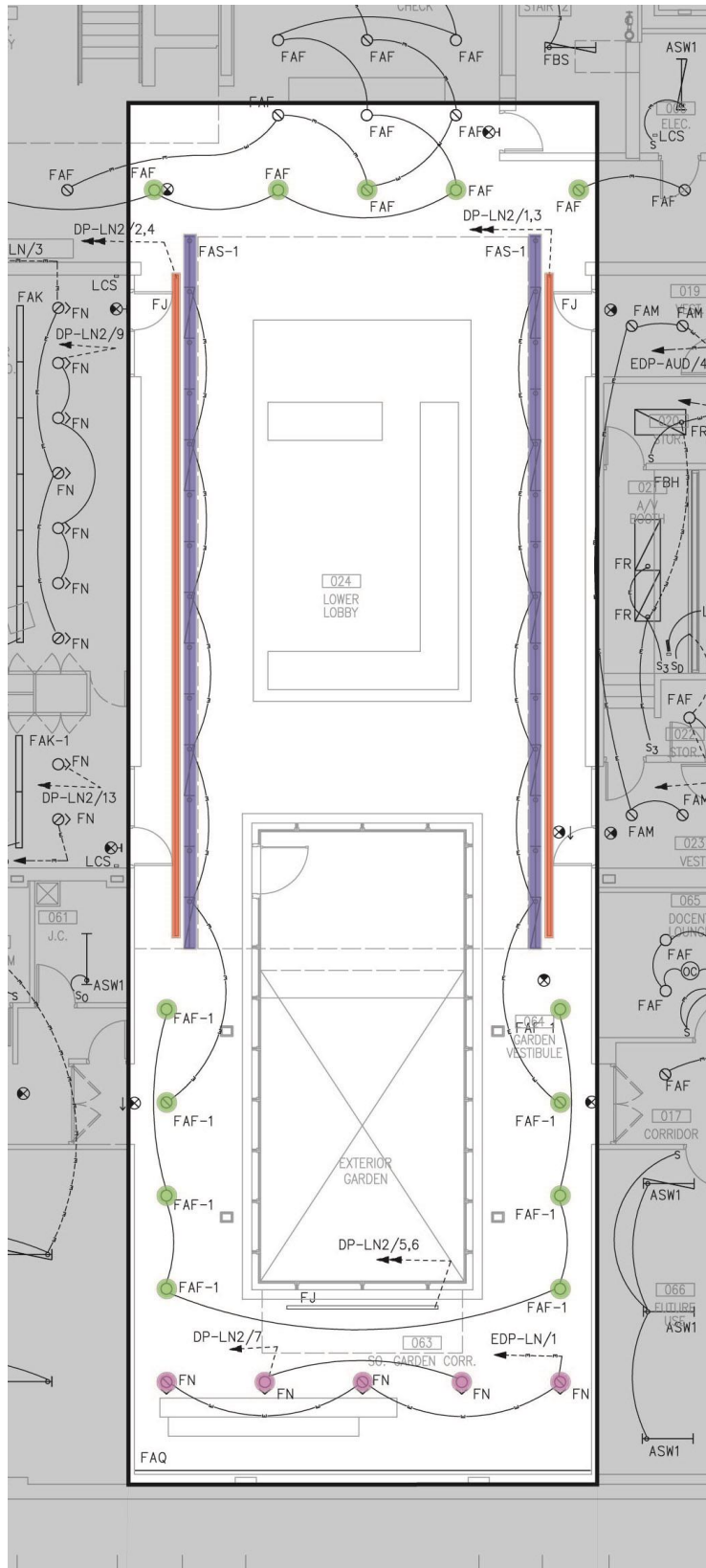
- Centers, Outdoors
- Plazas & Town Squares / Ramps, Stairs, & Steps
- Medium Activity
- LZ3

Appendix B – Enlarged Lighting Plans

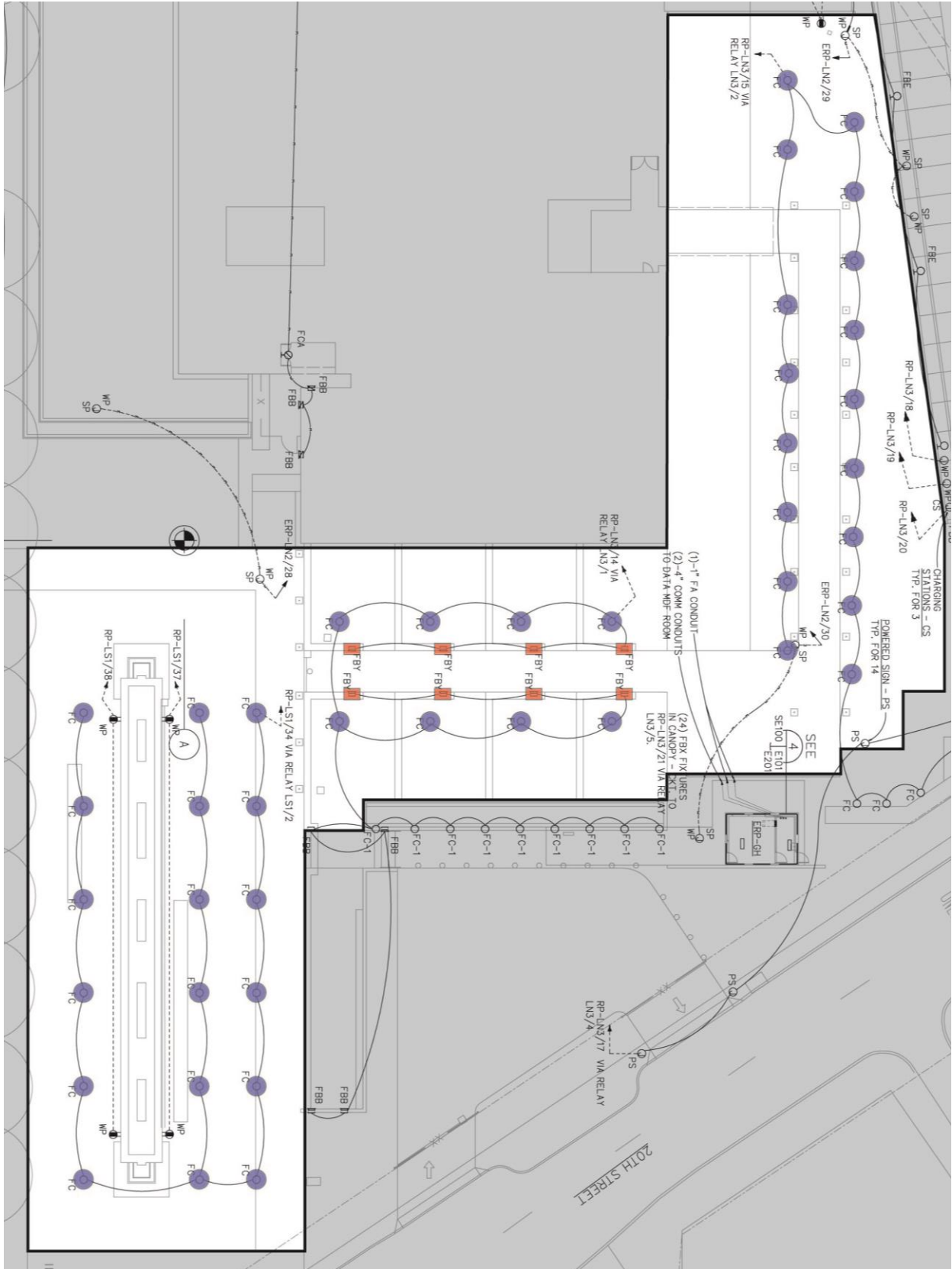
Open Office



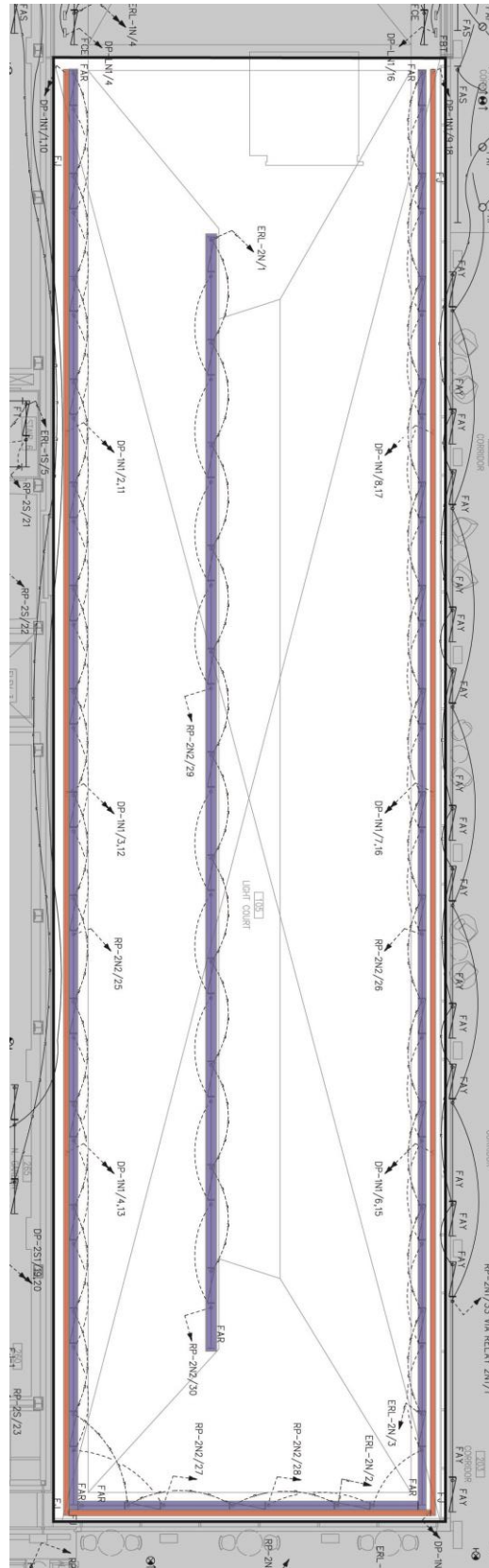
Lower Lobby



Public Garden



Light Court



Light Box

