

MEMO

To: Manager

ALMADEN GOLF & COUNTRY CLUB

From: Darcy Kremin, Michael Baker International
Lance Mackie, Michael Baker International

Date: June 5, 2017

Re: Pool Area & Upper Court Remodel Project – Lighting Technical Memorandum

Almaden Golf and Country Club contracted Michael Baker International (Michael Baker) to prepare an environmental impact lighting study of the Pool Area & Upper Court Remodel Project as required by the City of San Jose, California, and the California Environmental Quality Act (CEQA). Michael Baker evaluated the environmental impact of the illumination from the proposed lighting to be installed as part of the project. We used AGi32 lighting analysis software to evaluate the effects of glare, light pollution, and trespass lighting across property lines.

ENVIRONMENTAL IMPACTS

Michael Baker determined that the environmental impact is affected more by the type of fixtures installed than by the average illumination levels or the number of fixtures. The environment is impacted by light pollution (uplight), glare, and trespass light. The amount of uplight and glare from each fixture can be limited by locating the lamp/light source deep enough inside the body of the fixture that the lamp cannot be seen unless a person is standing directly underneath it. Light trespass is limited by using low lumen output fixtures that are low to the ground or fixtures which control the amount of light that extends beyond the property line.

CITY COUNCIL POLICY # 4-3 OUTDOOR LIGHTING ON PRIVATE DEVELOPMENTS

MBI has determined that the Project meets the intent of the requirements in Policy # 4-3. The City Policy allows exceptions to the requirement for Low Pressure Sodium (LPS) lighting if a photometric study is provided as part of the development permit which shows the project's impact on the Lick Observatory. This study was conducted as part of this report and is explained in detail below. All of the lighting is fully shielded LED with a maximum output of 2,751 lumens, well below the maximum of 4,050 lumens allowed for LPS light sources. All exterior building mounted lights, step lights, low Bocce court accent lights, court entry feature and the two fire pits are controlled by a timer to stay on from dusk to dawn. These provide life safety lighting needed for safety and security in these areas. Pathway lights and general ambient lighting are controlled by a timer to go on at dusk and off by 11:00 pm and on again from 5:00 until sunrise: These include general pathway lights and pool, spa and wading pool underwater lights. The underwater lights are not a part of this project. The Bocce awning/trellis lights and cabinet lights are controlled by manual timer switches that are turned on only when the area is

being utilized, such that they would shut off an hour or two after being turned on. Facility regulations prohibit Bocce games from starting after 10 PM.

LIGHT POLLUTION (DARK SKY VIOLATION)

Light pollution is defined by the International Dark Sky Association and accepted by the Illuminating Engineering Society of North America as "brightening of the night sky caused by streetlights and other man-made sources, which has a disruptive effect on natural cycles and inhibits the observation of stars and planets." Most of the fixtures evaluated for this report had no uplight at all because they were full cutoff fixtures as shown in **Figure 1**. Full cutoff is defined as a fixture having zero light emitted at or above horizontal. These fixtures have the added advantage of limiting the spill light onto adjacent property and reducing glare. No light will be emitted directly from the fixture into the sky with full cutoff fixtures. This is especially important in San Jose because of the city's proximity (within 25 miles) to the Lick Observatory. The light fixtures used on this project are shown on **Figure 1**. The highest light fixture installed as part of the project was fixture Type FD, which is at 9 feet above the ground. No uplight will come from this fixture as long as the lamps are aimed toward the ground. An evaluation plane was placed at 10 feet above ground level, looking down, to measure the amount of light directed skyward from the project. The only fixture that provided any uplight was fixture Type FB, which is a wall sconce producing 695 lumens, that provides indirect light reflected upward off of the wall behind it. This meets the criteria of the City's Outdoor Lighting policy that no light source be directed skyward. The maximum uplight from this project is 2.4 foot-candles, measured at one point. (See page 1 of the AGi analysis calculations in the appendix.) A foot-candle is the amount of light emitted by a candle measured at a radius of 1 foot from the candle. The 2.4 foot-candles emitted skyward by this project will not result in discernable light pollution.

TRESPASS

Light trespass occurs when spill light is cast past the property line. Michael Baker used AGi32 to evaluate the amount of light from the project that falls on areas outside of project's property line. There was none.

GLARE

Glare is difficulty seeing in the presence of bright light. It is a visual sensation caused by excessive and uncontrolled brightness. Its effect can be disabling or simply uncomfortable. Glare is subjective, and sensitivity to glare can vary widely depending on the individual. Older people are usually more sensitive to glare due to the aging characteristics of the eye. Disability glare is the reduction in visibility caused by intense light sources in the field of view. This is the glare on a glossy magazine that makes it hard to read outside in bright sunlight.

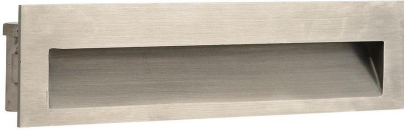
The Glare Rating (GR) is a numerical evaluation of the amount of glare experienced by an observer. Veiling Luminance is the light reflected off a surface that obscures an object, making it difficult to see. It is used by AGi to calculate the Glare Rating, as shown below. GR runs from 10, which is unnoticeable, to 90, which is unbearable, actually causing pain. The level of GR that is acceptable depends on the application and task being performed. If one is doing fine work, repairing a watch for example, the maximum desired GR is 45. If a ditch is being dug, a GR of 55 is acceptable. For the purposes of this report, the safety of pedestrians on the sidewalk adjacent to the facility is the primary concern, and the maximum acceptable GR is 55. Each GR value is tied to one observer position.

The observer positions for this study are shown on **Figure 2** and are labeled sequentially as Glare Evaluation Point #1, Glare Evaluation Point #2, etc. For example, a grid labeled Glare Evaluation Point #1 has one observer position and would have a Glare Rating grid associated with it. Glare was evaluated at 12 points around the perimeter of the property as shown on **Figure 2**. The Glare Rating calculation does not take into account reflective or obstructive entities around or within the GR grid. The equations below explain how AGi calculates glare. Each glare evaluation point is associated with its observer position as shown in **Figure 3**.

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Type A: SPJ17-04



Type B: SPJ-MSL2



Type C: SPJ-SC-1



Type F: SPJ-LW-7



Type FC: DL300



Type G: SPJ-B10-Telescopic



Type FD: WP-LED430-aGH



Type D: SPJ07-10



Type FA: WS-55-21-BZ
(Causes uplight.)



Type E: Cambria 206



Type FB: F4STFS

Michael Baker

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Drawing Title:
FIXTURE TYPES

Project
ALMADEN COUNTRY CLUB CEQA

Revision Description:

Date:
5/6/2017

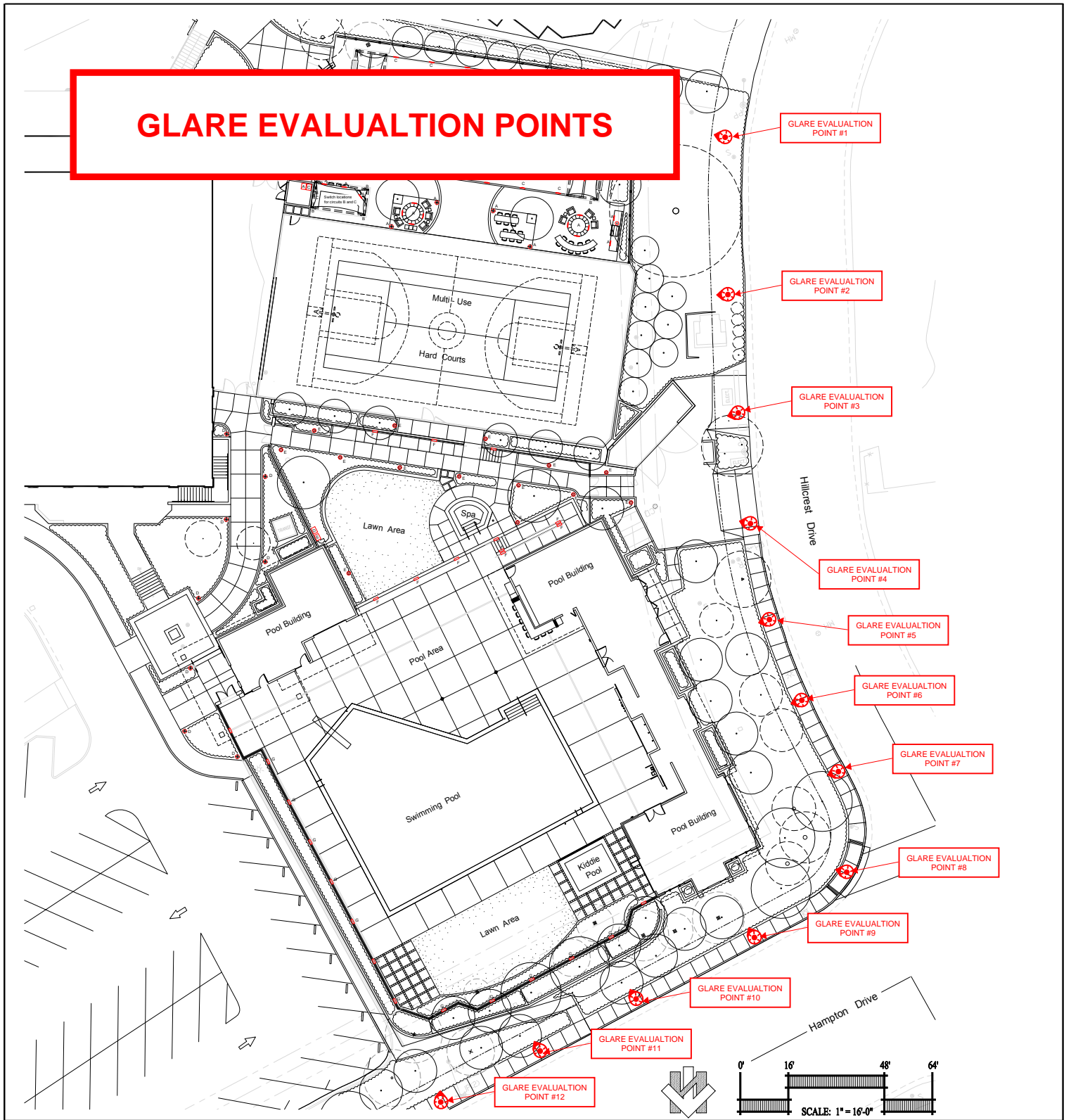
Project No.:
160167

Scale:
SCALE

Drawing
Number:

Figure 1

GLARE EVALUATION POINTS



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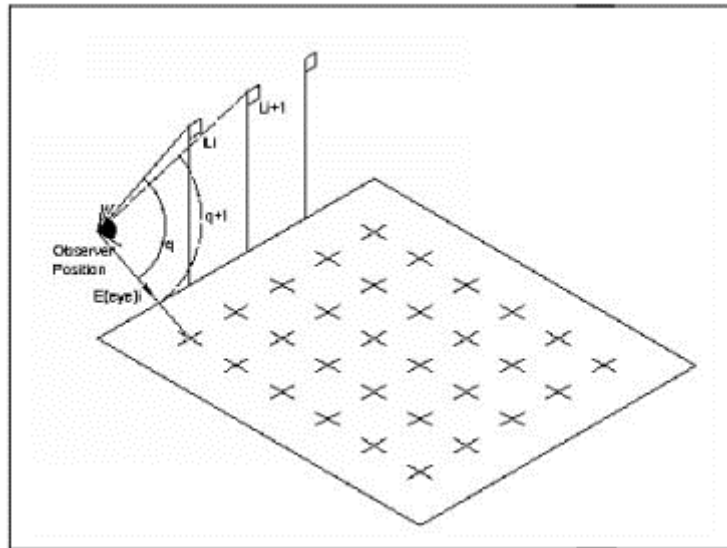
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Scale:
SCALE

Drawing
Number:

Figure 2

FIGURE 3: GLARE RATING



The Glare Rating is an indication of the glare experienced by an observer. It is calculated based on the light returned to the eye from each point on a horizontal grid. AGi32 calculates the amount of light reflected to the eye from each fixture from each point in the grid.

The formula used by AGi32 to determine Glare Rating (GR) is:

$$GR = 27 + 24 \lg (L_{VL} / L_{VE}^{0.9})$$

Where:

GR = Glare Rating

L_{VL} = Veiling Luminance on the eye produced by the project's lights at the glare evaluation point

L_{VE} = Veiling Luminance on the eye produced by the environment at the glare evaluation Point

The formula used by AGi32 to determine Veiling Luminance on the eye at the glare evaluation point is:

$$L_{vl} = 10 \sum_{i=1}^n \frac{E_{(eye)_i}}{(q_i)^2}$$

Where:

L_{VL} = Veiling Luminance on the eye produced by all fixtures at the glare evaluation point

$E_{(eye)}$ = the illuminance produced on the observer's eye in a plane perpendicular to the line of sight, produced by the i th source, in LUX

q_i = the angle between the observer's line of sight and the direction of light

The formula used by AGi32 to determine Veiling Luminance produced on the eye by the environment is:

$$L_{ve} = 0.035 * \left[\frac{E_{hor,av} * \rho}{(\pi * \Omega)} \right]$$

Where:

L_{VE} = Veiling Luminance on the observer's eye produced by the environment

$E_{hor,av}$ = average horizontal area illuminance on the ground plane

P = the angle between the observer's line of sight and the direction of light

Ω = the unity solid angle in steradians

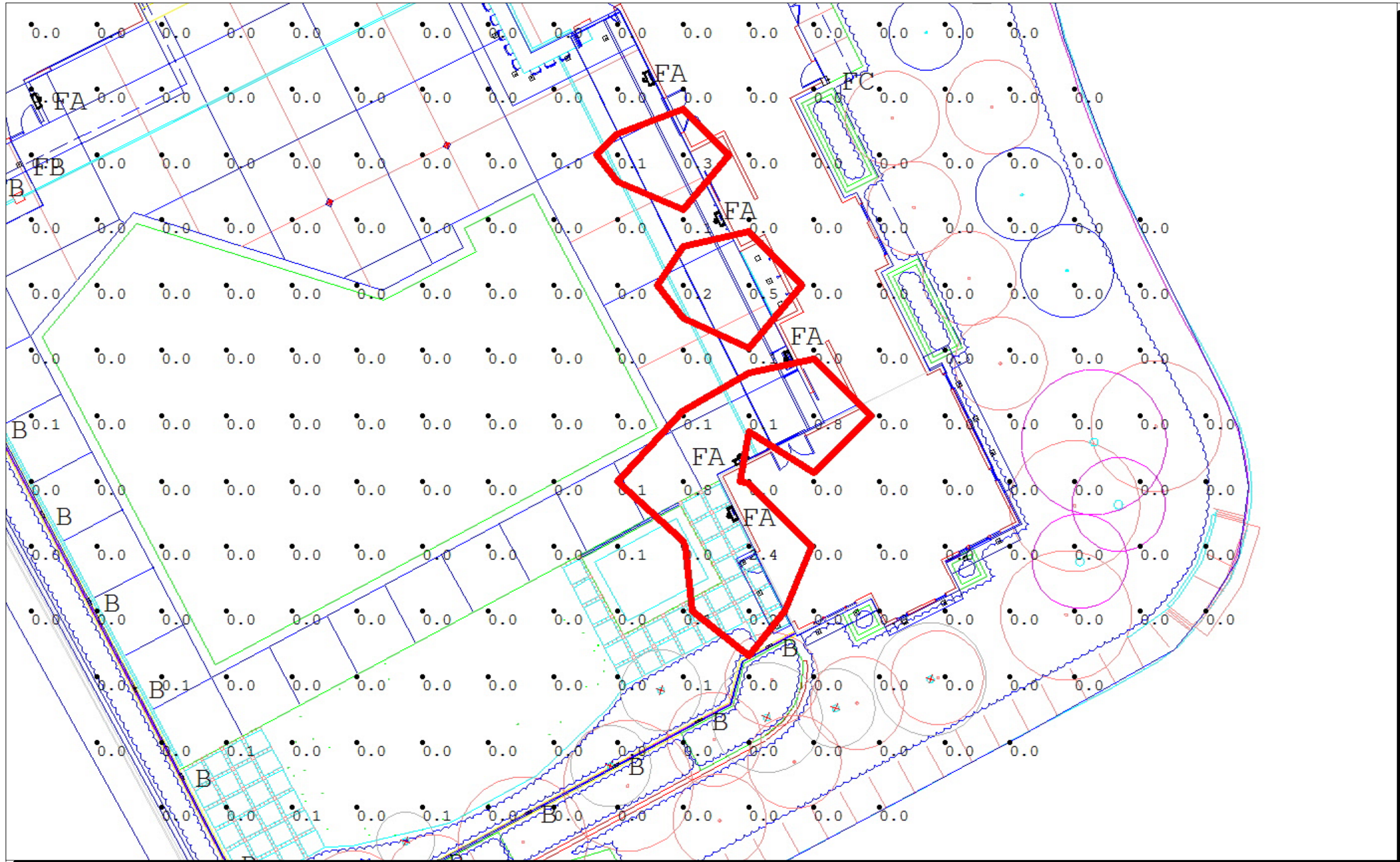
Evaluation Point	Glare Rating		
	Avg.	Max.	Min.
Glare Evaluation Point # 1	10.40	26	10
Glare Evaluation Point # 2	11.10	27	10
Glare Evaluation Point # 3	11.24	30	10
Glare Evaluation Point # 4	11.75	35	10
Glare Evaluation Point # 5	10.79	26	10
Glare Evaluation Point # 6	10.57	25	10
Glare Evaluation Point # 7	11.08	33	10
Glare Evaluation Point # 8	12.79	37	10
Glare Evaluation Point # 9	11.89	34	10
Glare Evaluation Point # 10	12.19	33	10
Glare Evaluation Point # 11	11.27	30	10
Glare Evaluation Point # 12	11.19	28	10

As seen in the table and in AGi analysis pages 4 to 15 included in the appendix, the glare from this project is barely discernable at its worst case and unnoticeable on average.

CONCLUSION

Our findings show that the light from the project will not substantially impact the environment in San Jose and would be considered less than significant under CEQA. Because the construction of the original structure predates the widespread concern about light pollution and LED fixtures, it can be expected that the project's light pollution (uplight) will be reduced. There is no measurable environmental impact from light trespass or glare. For more information about the luminance, illuminance, light trespass, and Glare Rating levels, refer to the AGi reports in the appendix.

APPENDIX A
AGI ANALYSIS

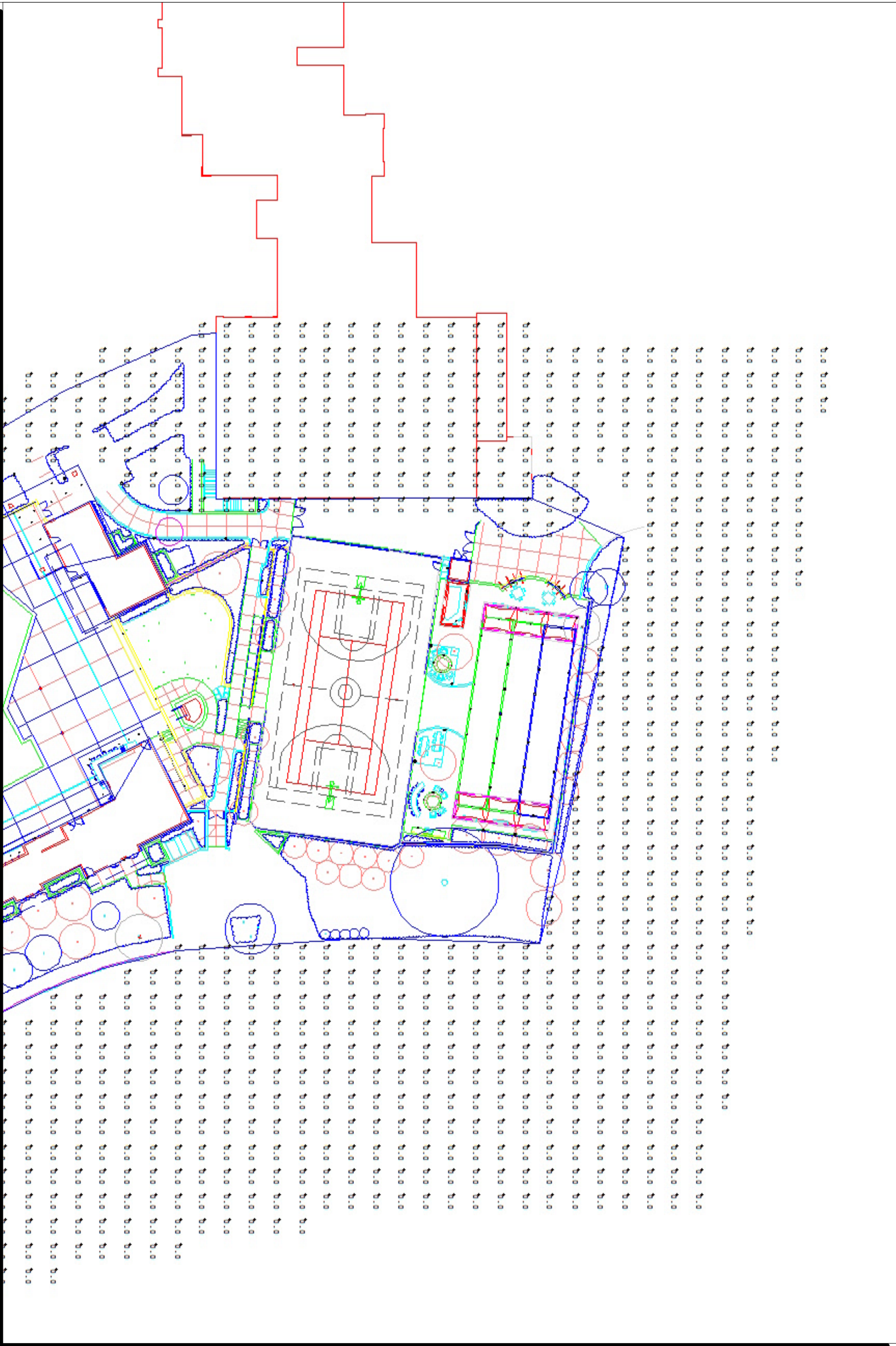


The whole site is not shown since only a small part of it has any uplight. The areas with uplight are outlined above. The uplight is caused by the decorative wall sconces (Luminair FA.)

#	Date	Comments
Revisions		

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Almaden Env. Study- AGI Analysis
 Uplighting Photometric Analysis



Almaden Env. Study- AGI Analysis

Trespass Photometric Analysis- North

Drawn By: Neil Hinckley

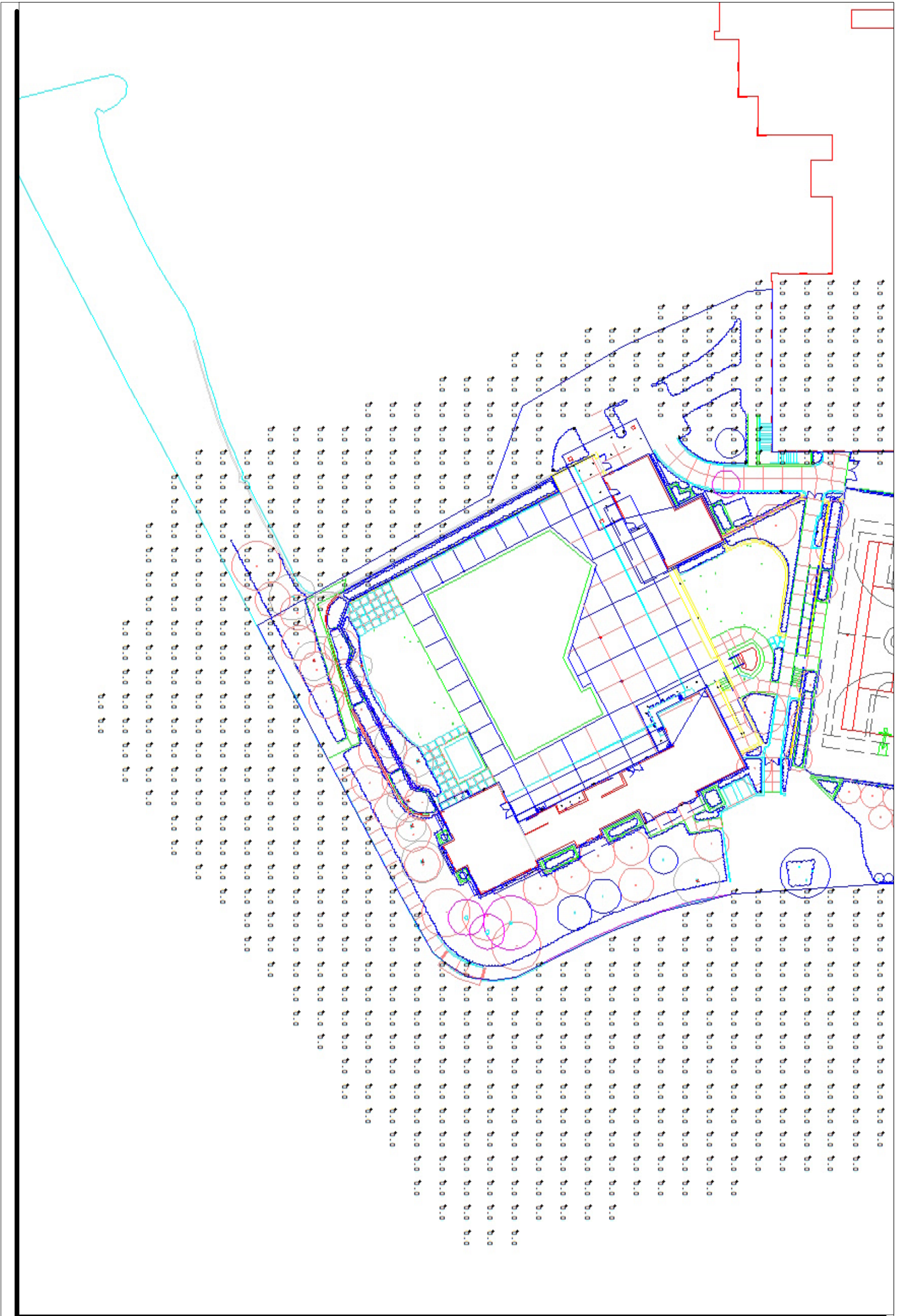
Checked By: Lance Mackie

Date: 6/1/2017

Scale: N/A

Revisions	#	Date	Comments





Almaden Env. Study- AGI Analysis

Trespass Photometric Analysis- South

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #1

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





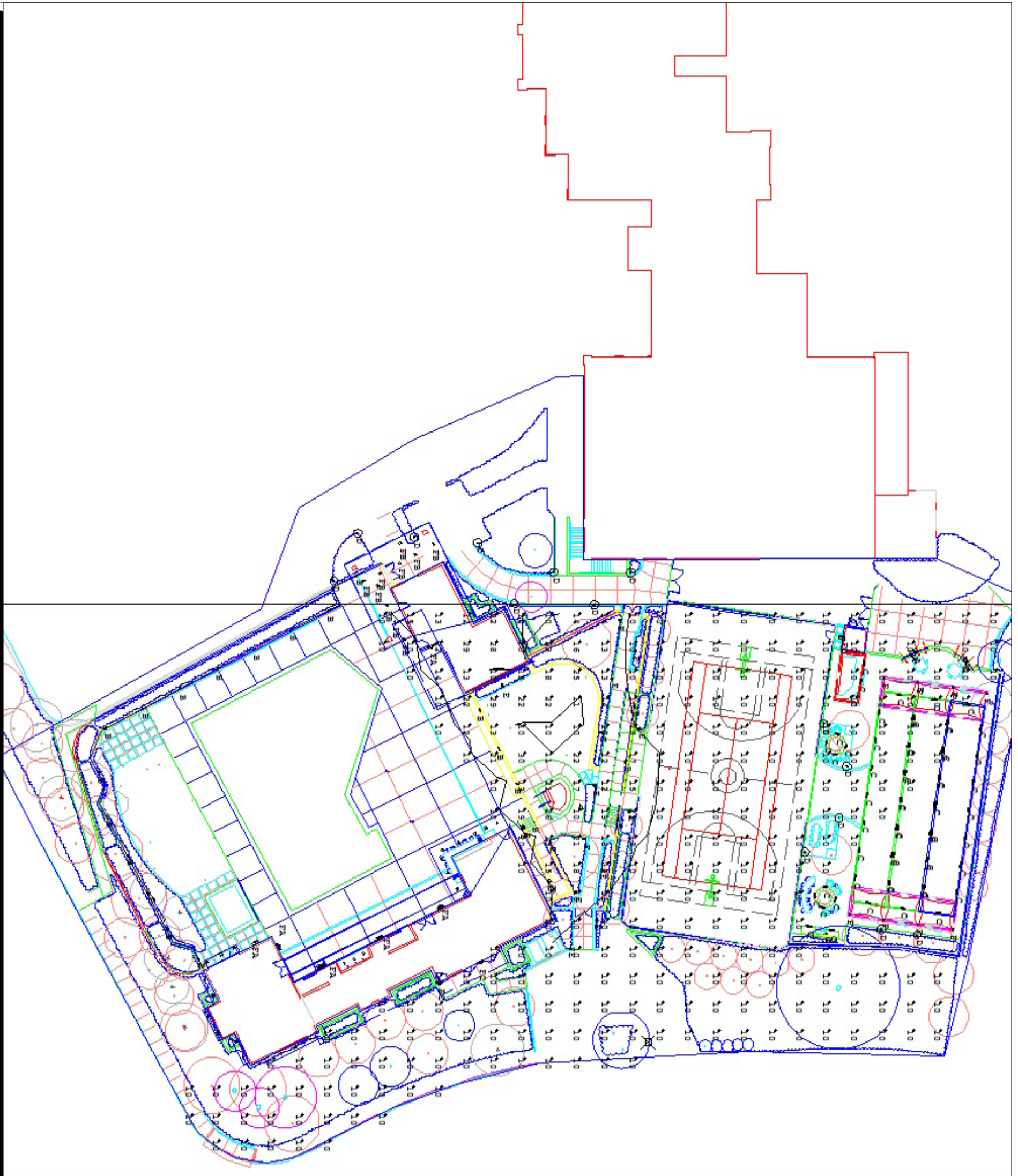
Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #2

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments



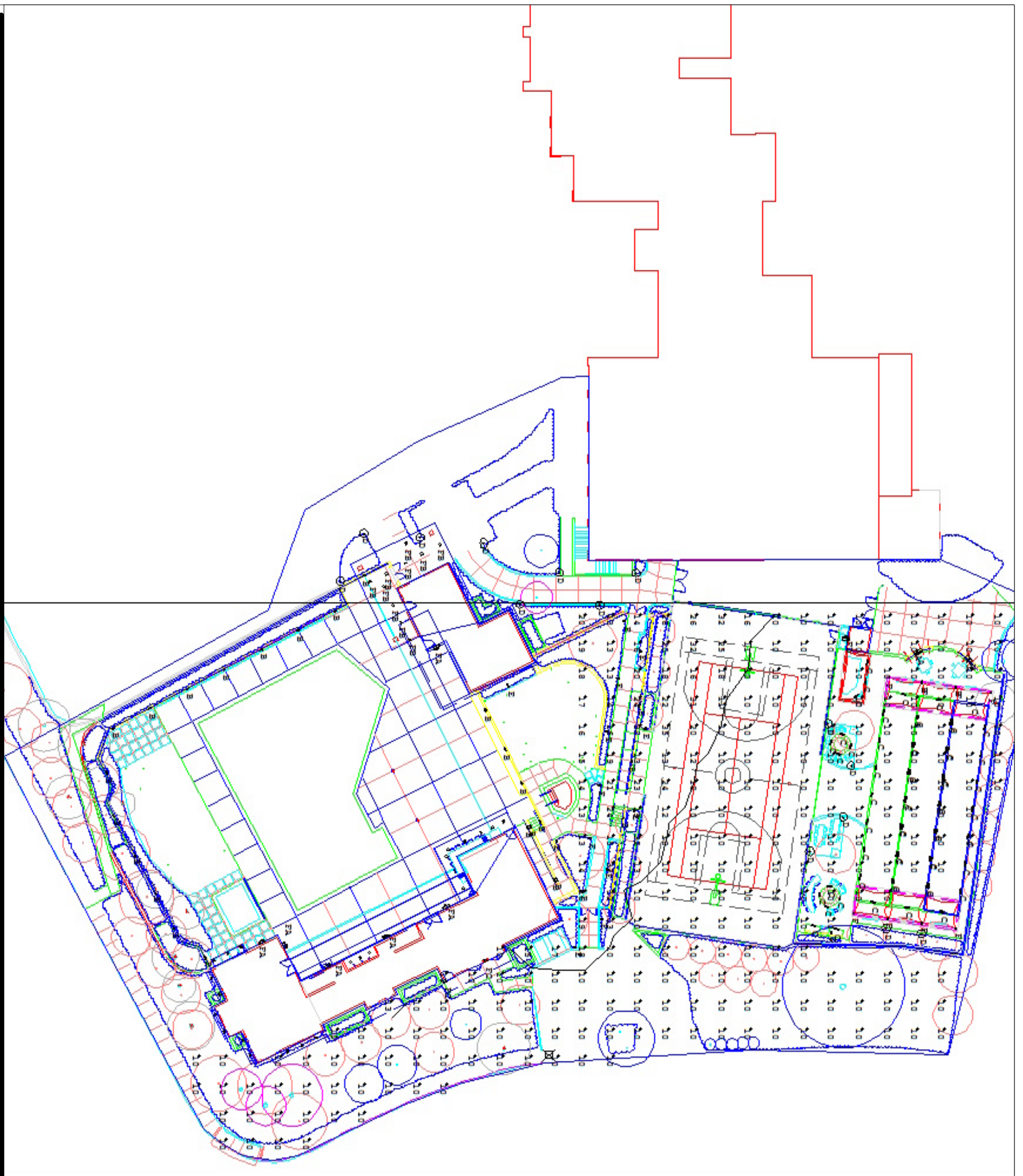


Almaden Env. Study- AGI Analysis
 Glare- Evaluation Point #3

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





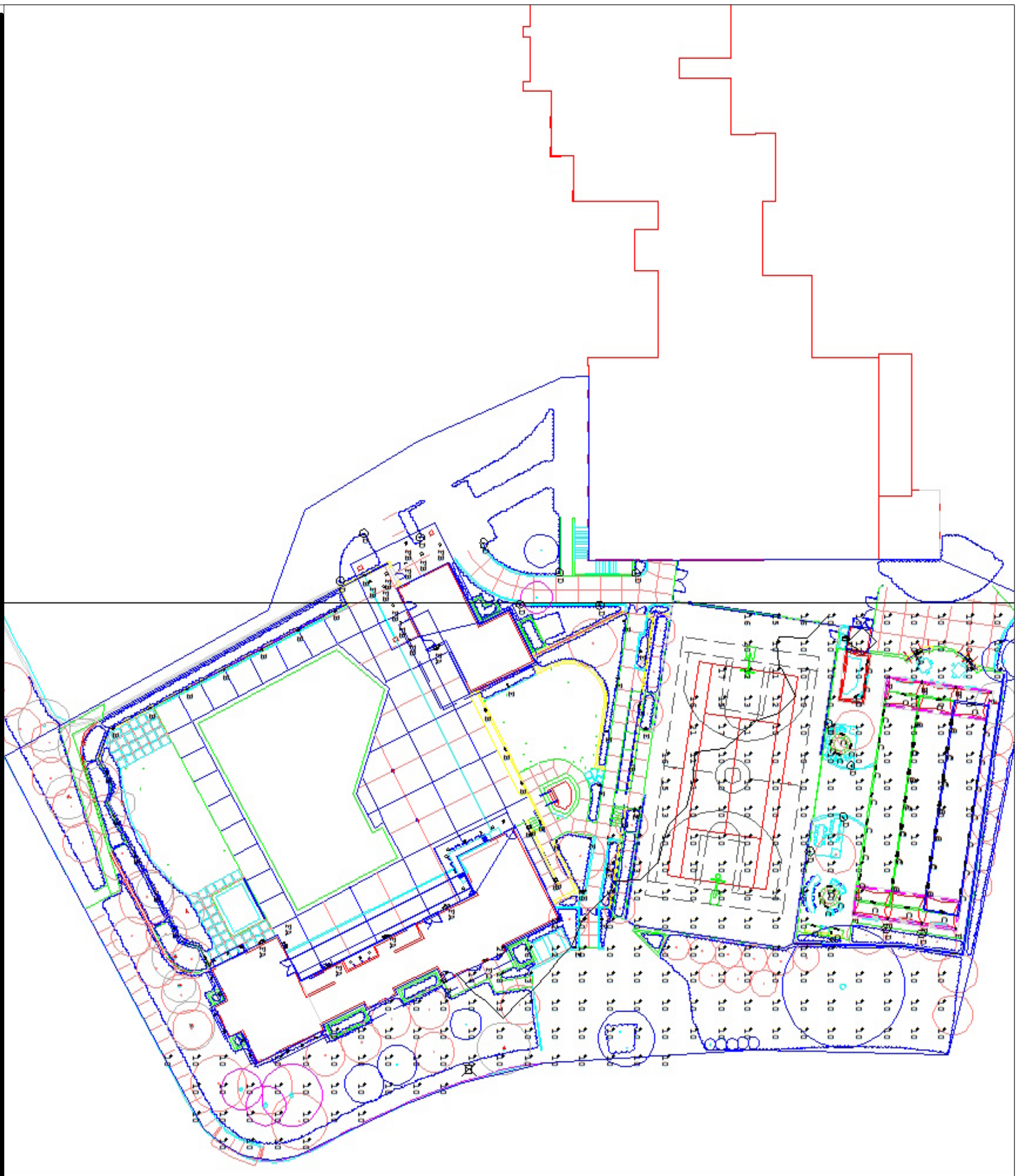
Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #4

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





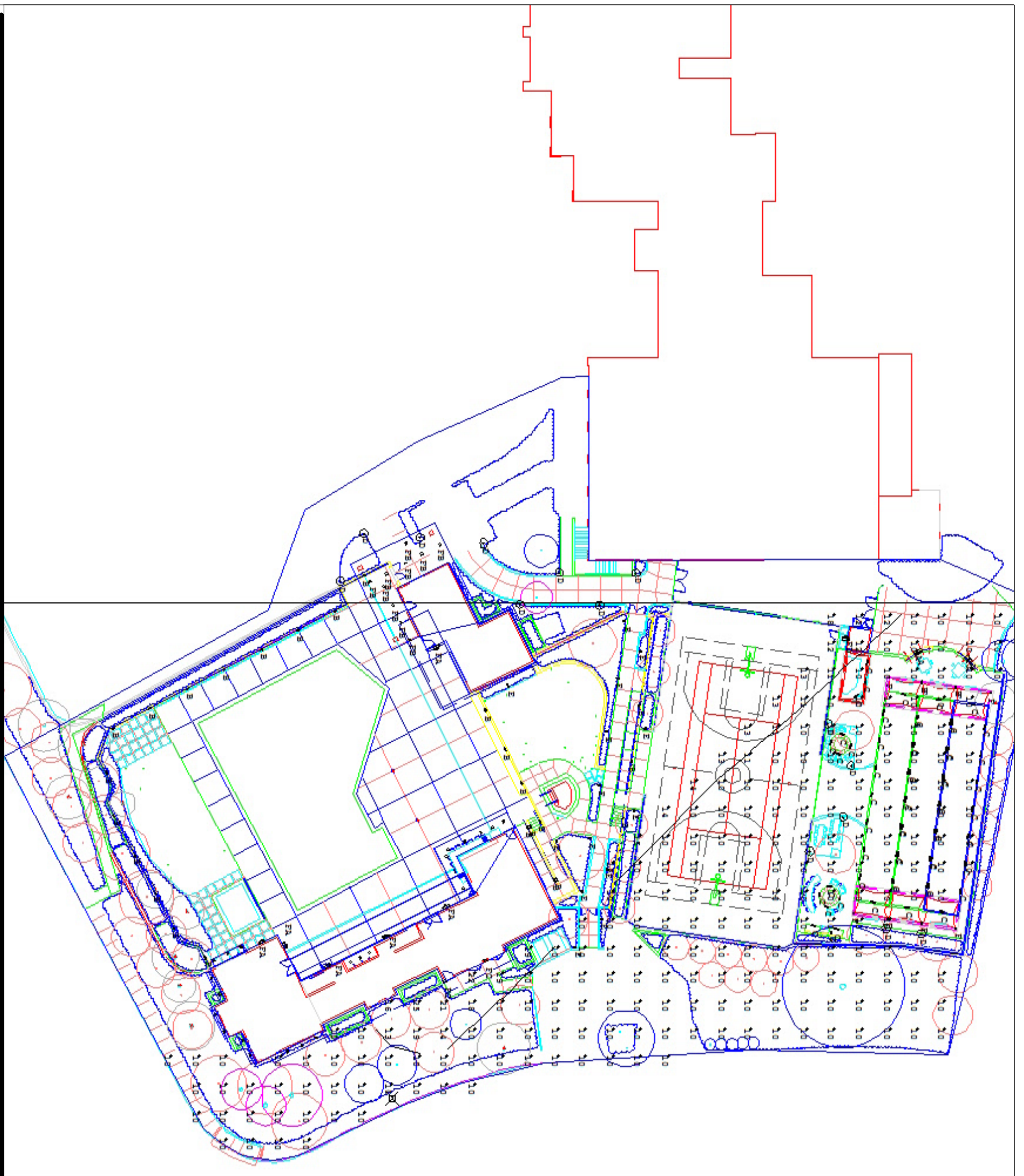
Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #5

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #6

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





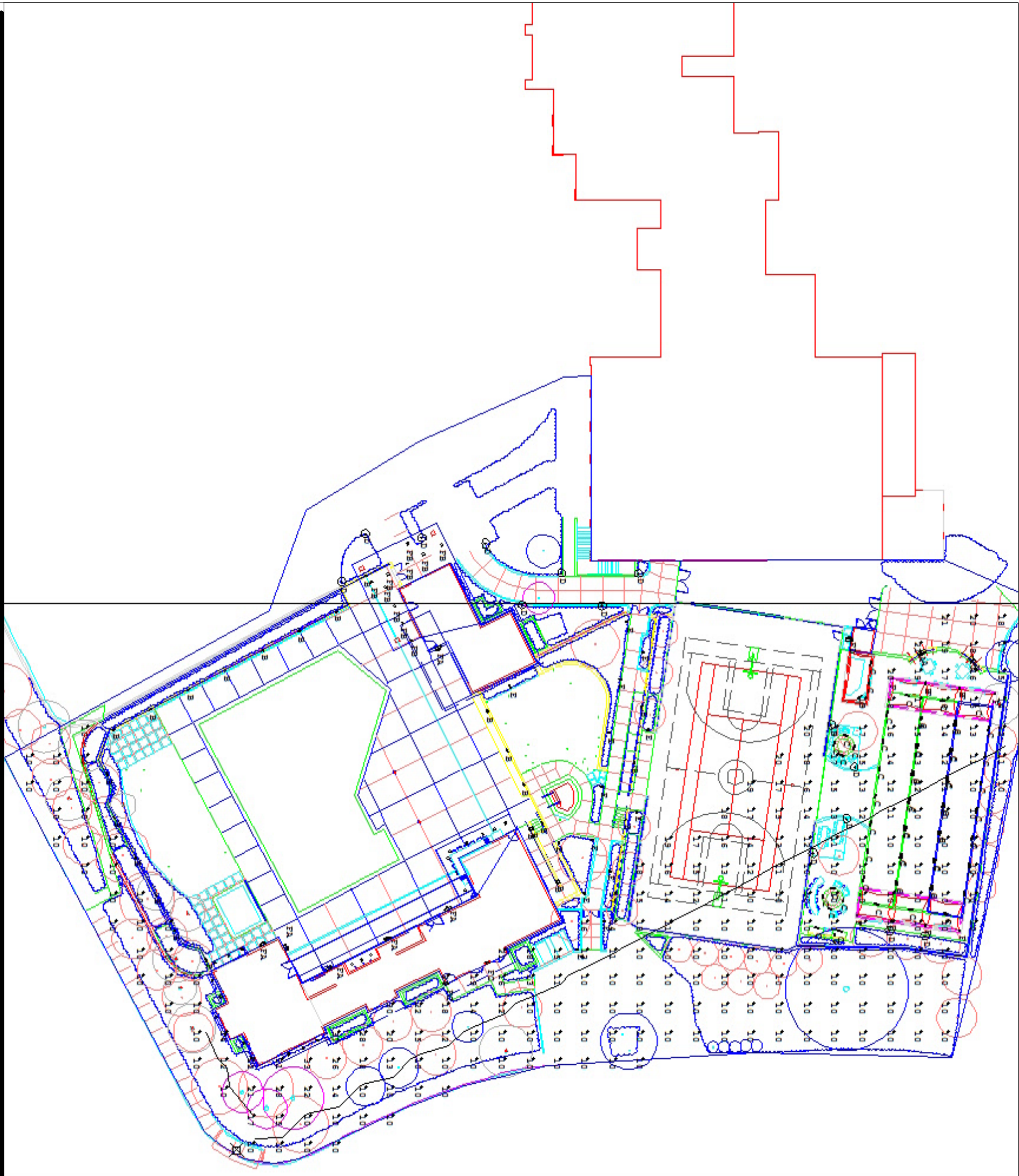
Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #7

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





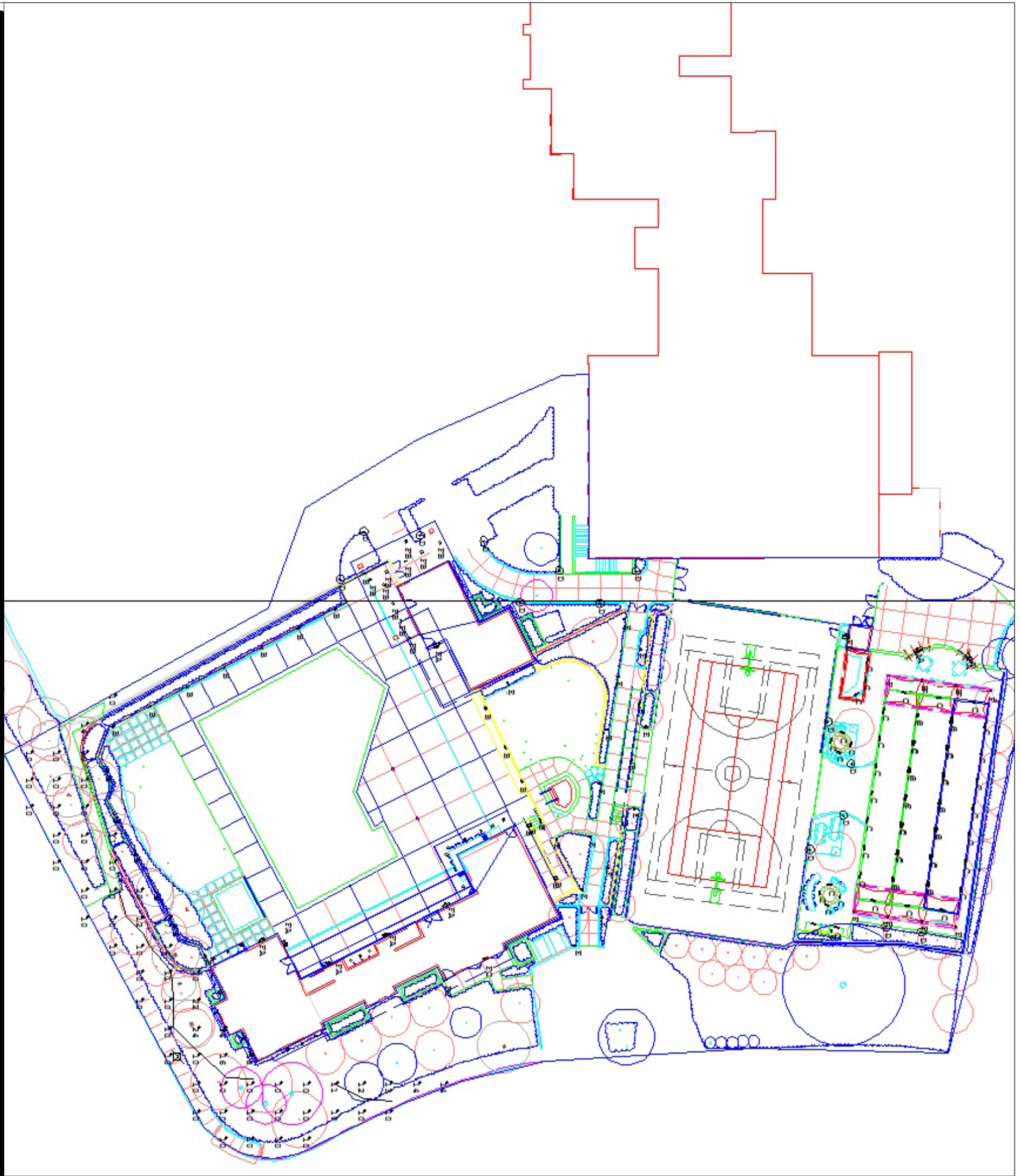
Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #8

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments



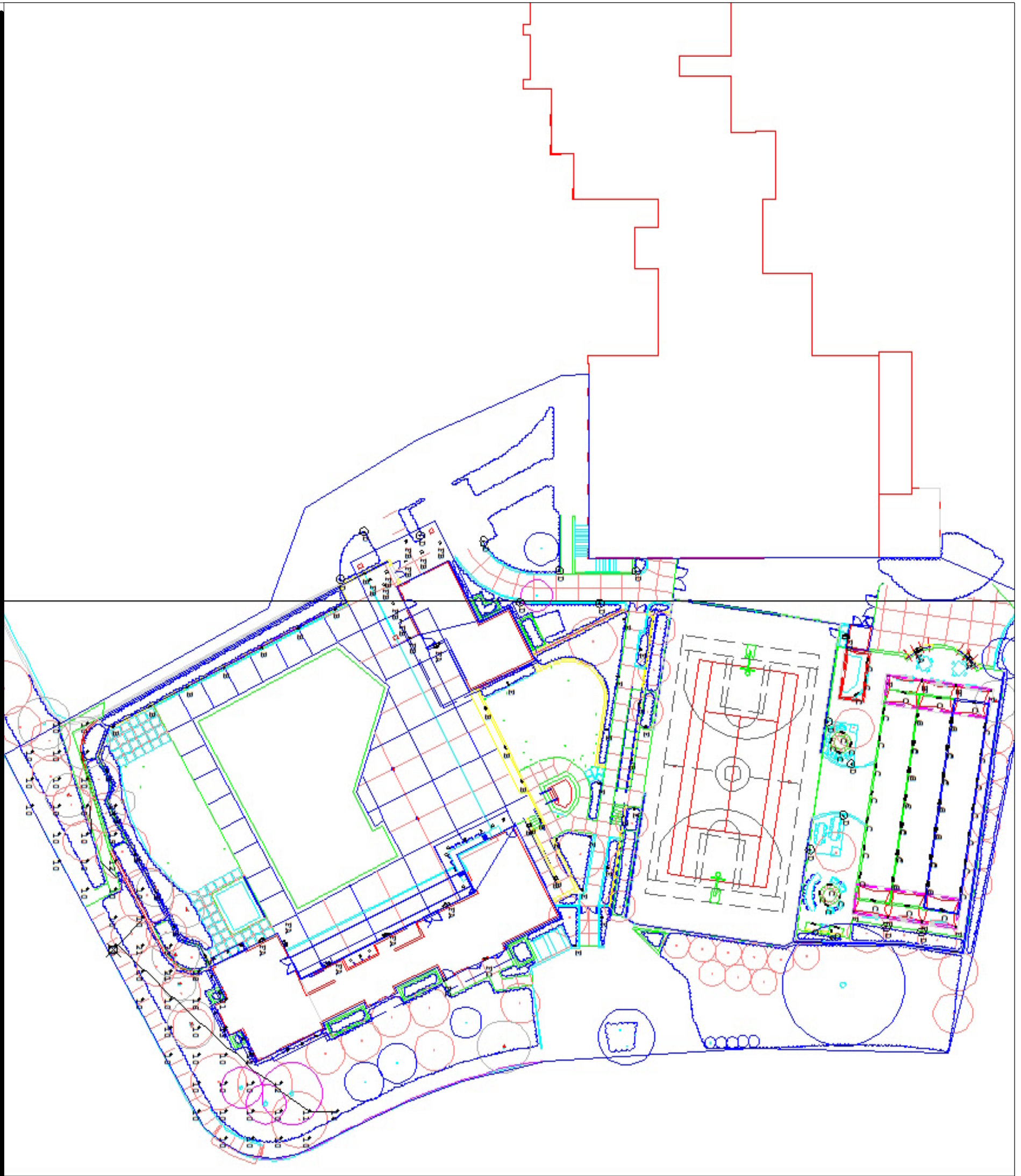


Almaden Env. Study- AGI Analysis
 Glare- Evaluation Point #9

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments



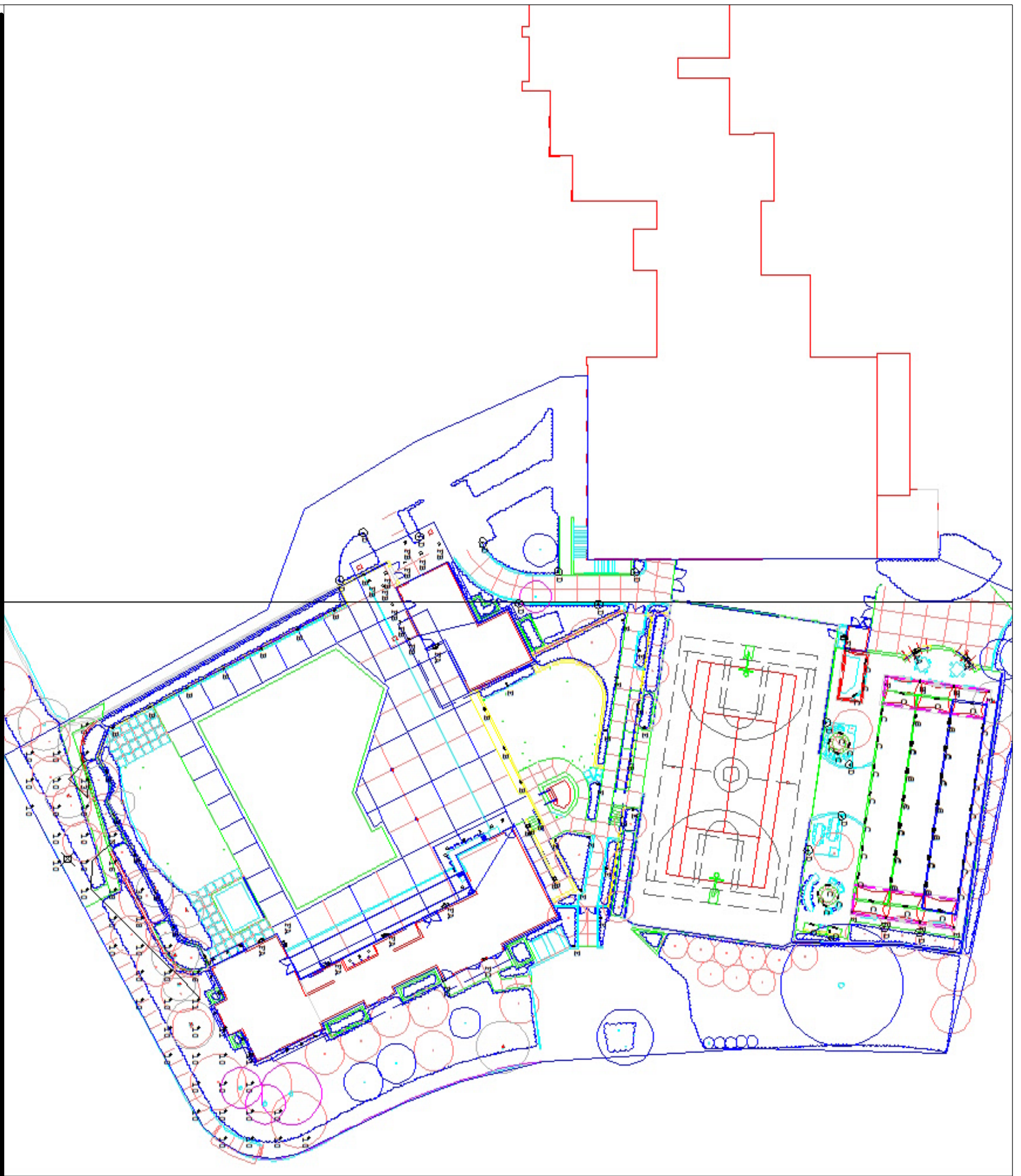


Almaden Env. Study- AGI Analysis
 Glare- Evaluatino Point #10

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





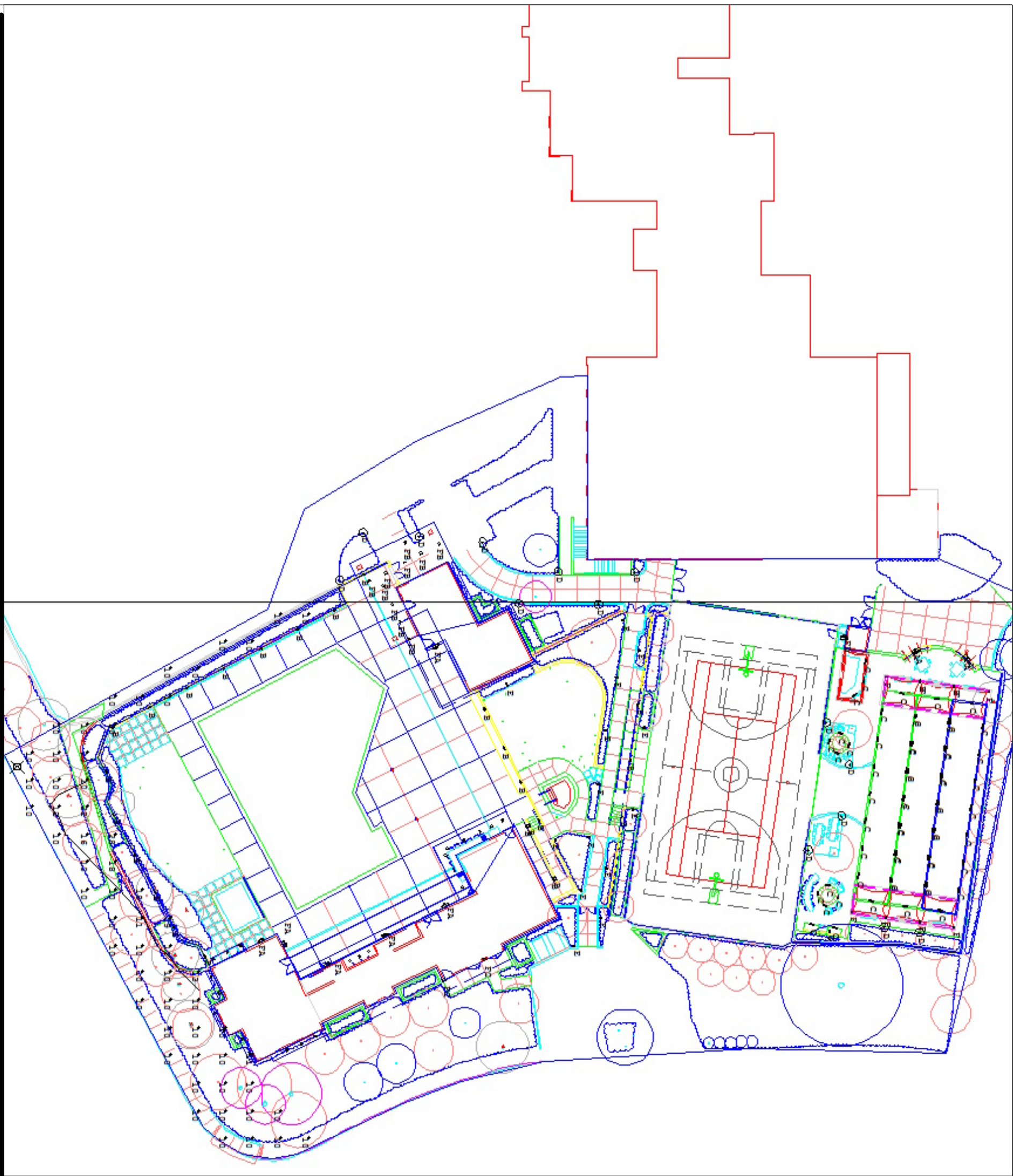
Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #11

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments



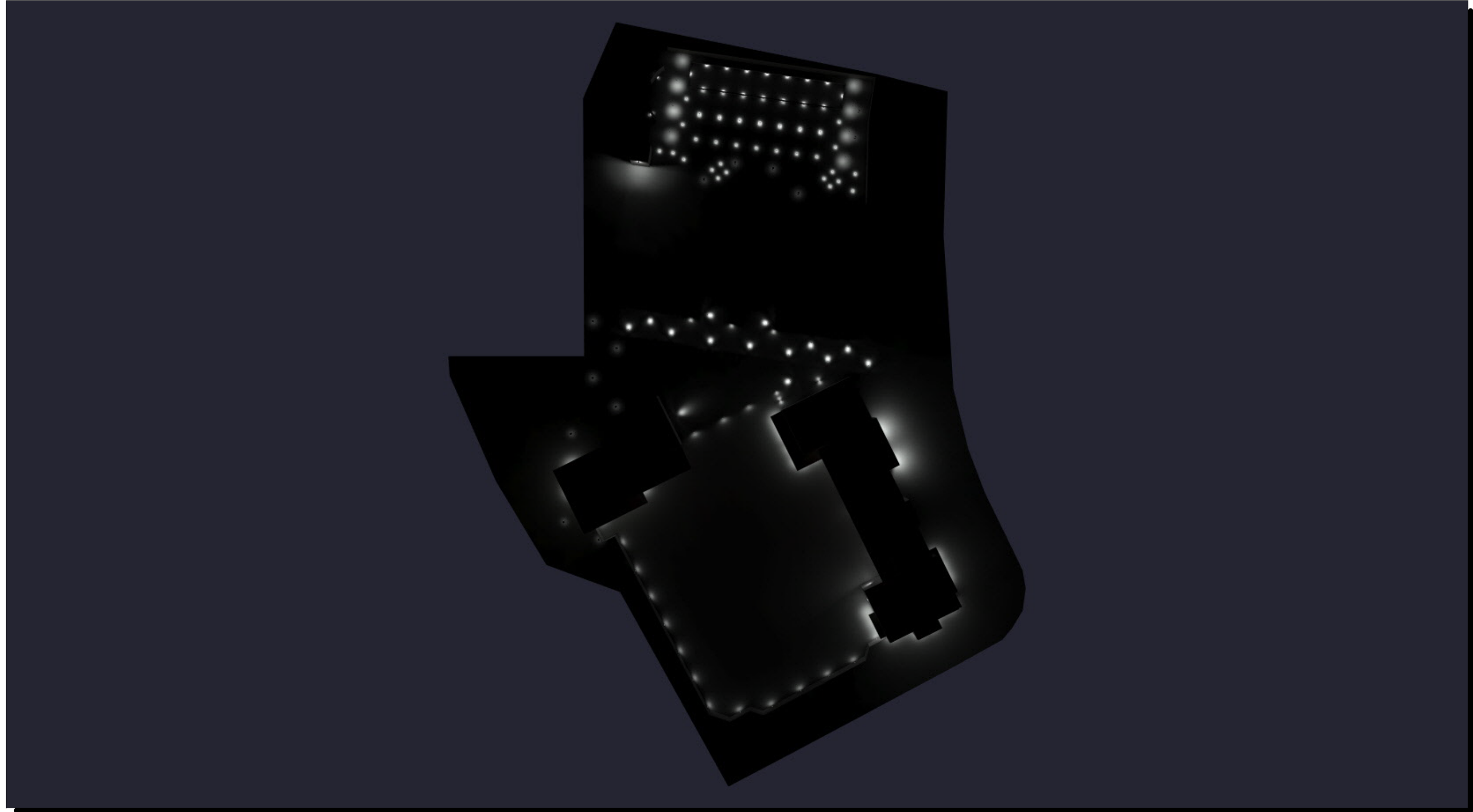


Almaden Env. Study- AGI Analysis

Glare- Evaluation Point #12

Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments



Night View From Above

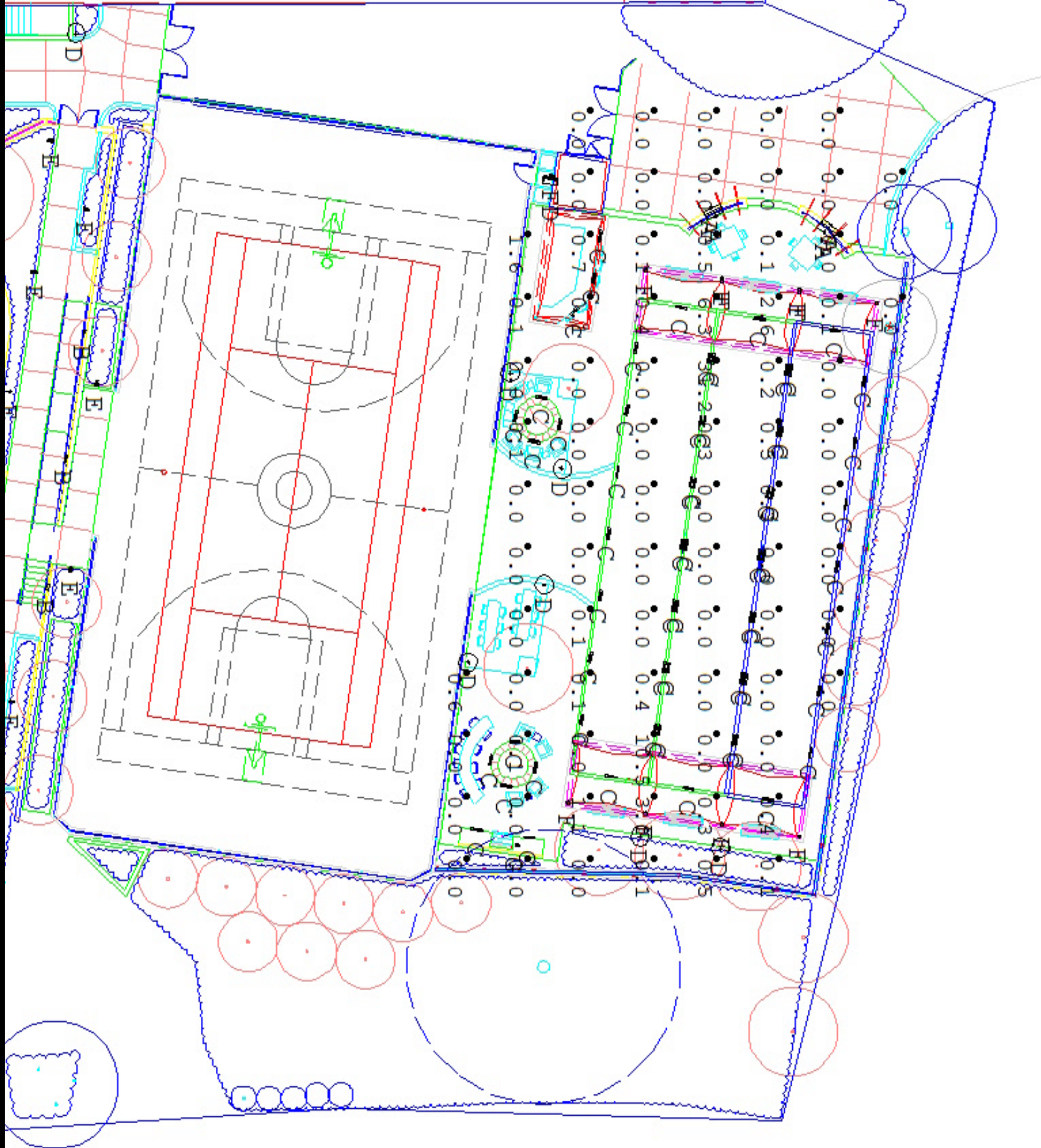
This view includes light reflected from the ground, and is an approximation only. Reflected light will be reduced by plants, canopies, and other physical structures.

#	Date	Comments

Revisions

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date: 6/1/2017
Scale: N/A

Almaden Env. Study- AGI Analysis
Reflected Light Image



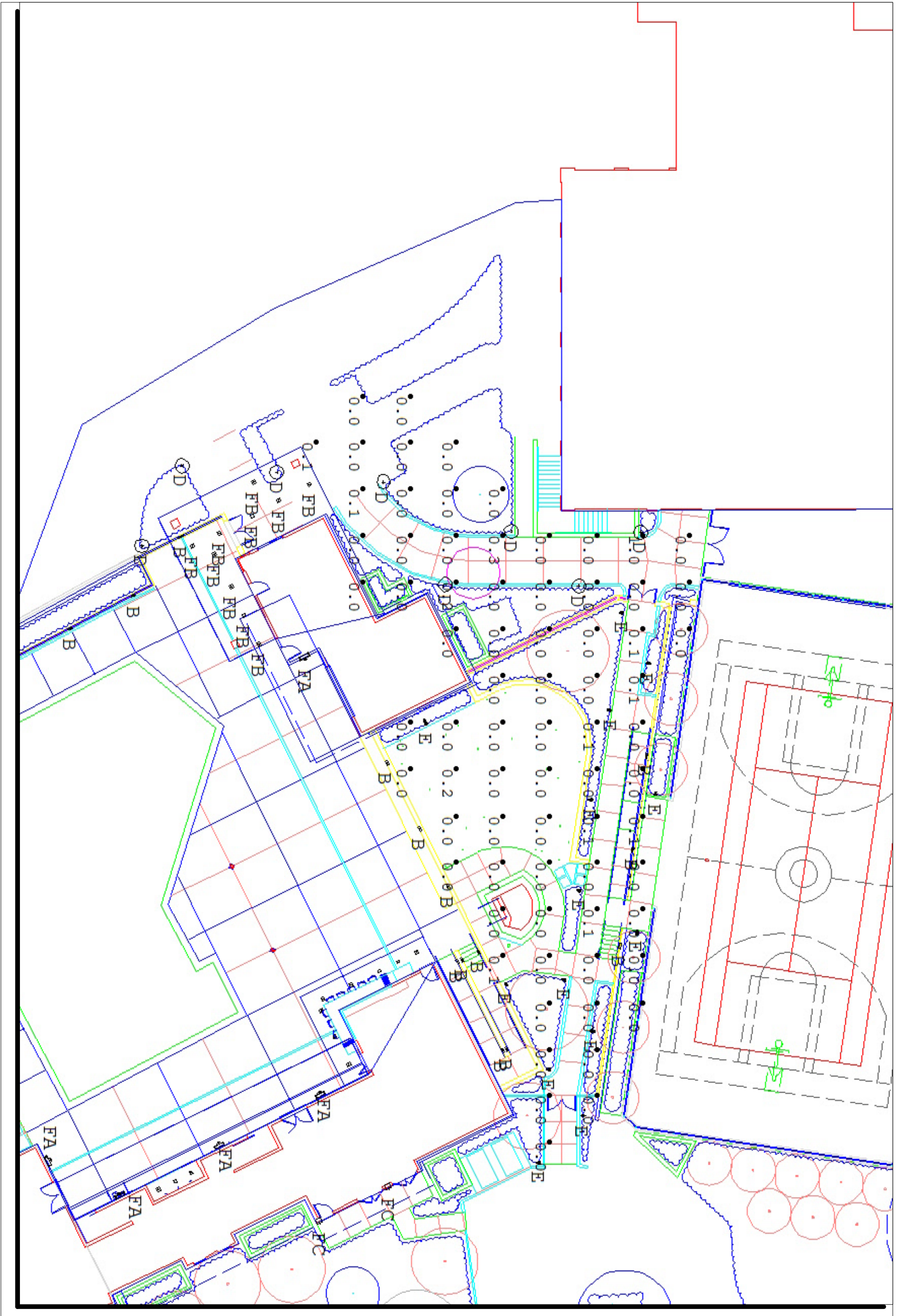
Almaden Env. Study- AGI Analysis

Photometric Study-Bocce Area

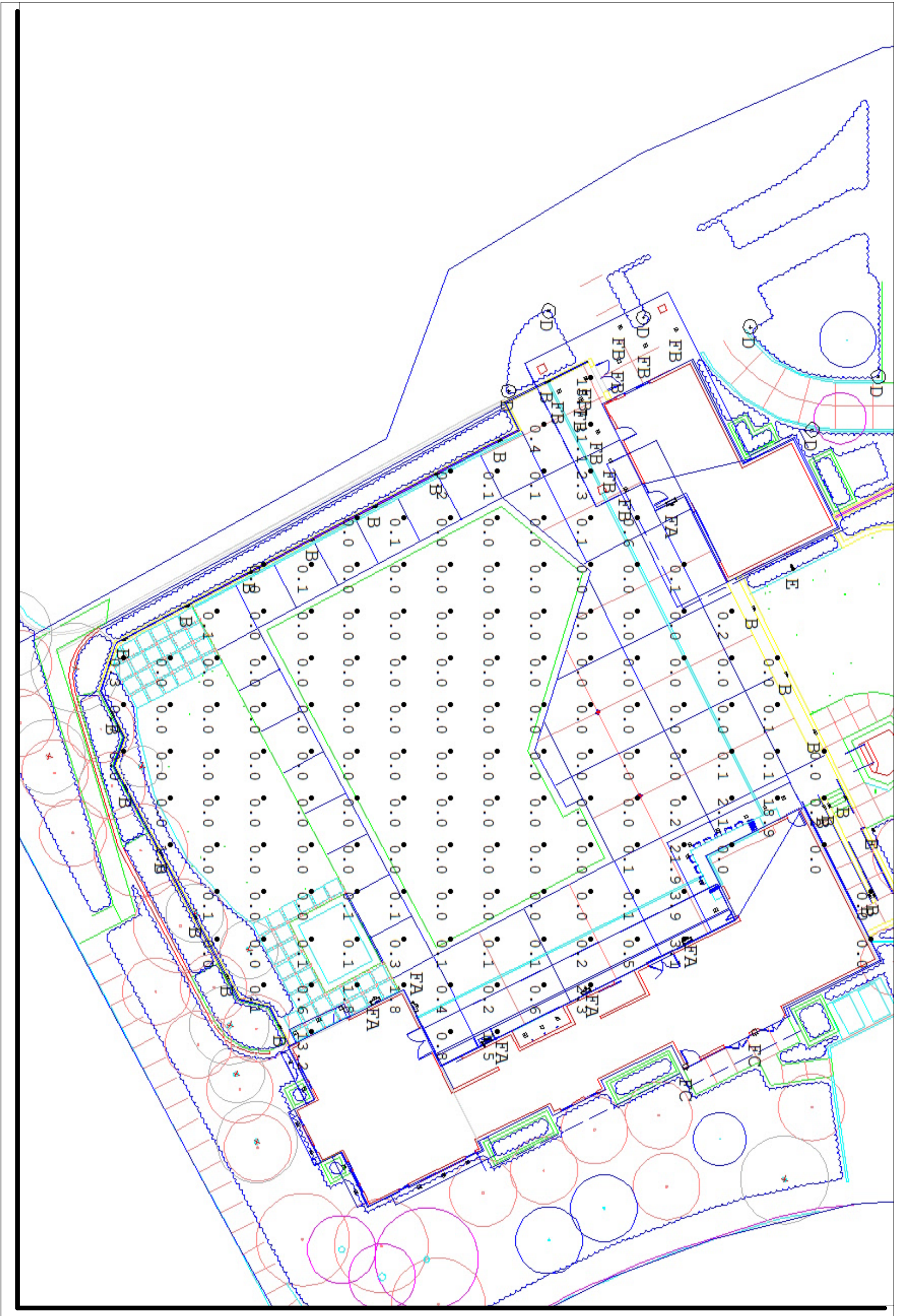
Drawn By: Neil Hinckley
 Checked By: Lance Mackie
 Date: 6/1/2017
 Scale: N/A

Revisions	#	Date	Comments





Revisions	#	Date	Comments



Luminaire Schedule							
Symbol	Qty	Label	Light Loss Factor	Model Number	Manufacturer	Lum. Lumens	Description
	4	A	0.850	SPJ17-04	SPJ Lighting Inc.	31	Recessed step/path light, louvered
	25	B	0.850	SPJ-MSL2-12	SPJ Lighting Inc.	81	Recessed step/path light
	61	C	0.850	SPJ-SC-1	SPJ Lighting Inc.	381	Recessed bar light
	14	D	0.850	SPJ07-10	SPJ Lighting Inc.	39	Low post path light
	14	E	0.850	Cambria 206	Eaton- Cooper Lighting	241	Directional path light
	10	F	0.850	SPJ-LW-7	SPJ Lighting Inc.	241	Brass downlight
	1	G	0.850	SPJ-B10	SPJ Lighting Inc.	241	BBQ pole mounted light
	6	FA	0.850	WS-5521	Modern Forms	768	Decorative wall sconce
	33	FB	0.850	F4STFS	Lucifer Lighting	695	Recessed square downlight
	2	FC	0.850	DL300	Lumux	2751	Wall mounted downlight
	1	FD	0.850	WP-LED430-30-aGH	WC Lighting	1878	Wall mounted spotlight

Calculation Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
Photometric Study-Bocce Area	Illuminance	Fc	0.79	31.2	0.0	N.A.	N.A.
Photometric Study-Walkway	Illuminance	Fc	0.04	1.0	0.0	N.A.	N.A.
Photometric Study-Pool Area	Illuminance	Fc	0.75	21.9	0.0	N.A.	N.A.
Uplight	Illuminance	Fc	0.01	2.4	0.0	N.A.	N.A.
Glare Evaluation	Glare Rating	N.A.	10.40	26	10	1.04	2.60
Glare Evaluation	Glare Rating	N.A.	11.10	27	10	1.11	2.70
Glare Evaluation	Glare Rating	N.A.	11.24	30	10	1.12	3.00
Glare Evaluation	Glare Rating	N.A.	11.75	35	10	1.18	3.50
Glare Evaluation	Glare Rating	N.A.	10.79	26	10	1.08	2.60
Glare Evaluation	Glare Rating	N.A.	10.57	25	10	1.06	2.50
Glare Evaluation	Glare Rating	N.A.	11.08	33	10	1.11	3.30
Glare Evaluation	Glare Rating	N.A.	12.79	37	10	1.28	3.70
Glare Evaluation	Glare Rating	N.A.	11.89	34	10	1.19	3.40
Glare Evaluation	Glare Rating	N.A.	12.19	33	10	1.22	3.30
Glare Evaluation	Glare Rating	N.A.	11.27	30	10	1.13	3.00
Glare Evaluation	Glare Rating	N.A.	11.19	28	10	1.12	2.80
Tresspass	Illuminance	Fc	0.00	0.0	0.0	N.A.	N.A.

#	Date	Comments
Revisions		

Drawn By: Neil Hinckley
Checked By: Lance Mackie
Date: 6/1/2017
Scale: N/A

Almaden Env. Study- AGI Analysis
Lighting Calc. Summary Tables