Image Courtesy of
Ares Landscape Architects

Using Landscape BIM to Meet Site Design Requirements

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DLA 2019

Session Objectives

As a part of the DLA's BIM for Landscape – Future Development parallel lecture, participants in this portion will gain an understanding of how practicing firms are using BIM for Landscape to achieve jurisdictional and objective-driven requirements.

- **Ares Landscape Architects:** BIM Level 2 requirement (UK)
- **Holcombe Norton Partners:** LEED (USGBC)
- **Pacific Coast Land Design:** MWELO (California)

Nottingham City Hub

Project Location: **Nottingham, UK**

Project Type: College

Featured Firm: Ares Landscape Architects

Reason for BIM: Previous UK mandate for BIM Level 2

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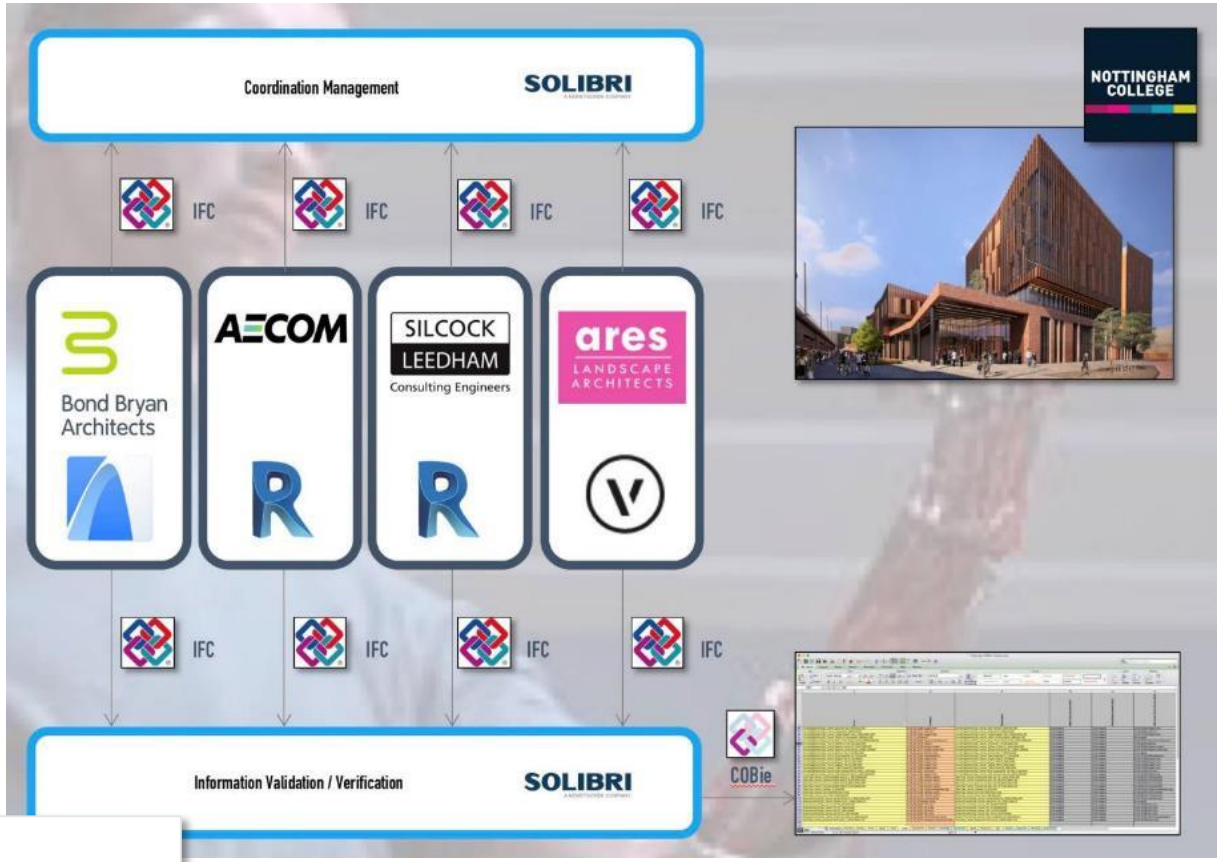
- work to the ‘Spirit of BIM Level 2’
- worked in accordance with the BIM Execution Plan (BEP) provided by Bond Bryan Digital

2.5.3 Compliance plan for Landscape Architect (Ares Landscape Architects Ltd)

- The architectural model shall be authored in Nemetschek Vectorworks 2017, which is able to fully meet Nottingham College’s defined requirements.
- All outputs from the model will be checked internally before sharing to the agreed Common Data Environment (CDE) (i.e. Asite).
- Regular reporting will highlight any issues that exist within the information provided.
- Drawings will be checked in line with Ares Landscape Architects Internal Quality Assurance System
- Ares Landscape Architects will input into the project Information Required Schedules and any further registers or schedules as required.
- Ares Landscape Architects will produce the required models and drawings where relevant and required by the client. This will be as per our scope of services set out in the fee proposal document REF ALA500.165 FP01 B Ares Fee Proposal
- We will also work collaboratively with other team members to address any issues arising from information delivery.

4.2.1 Processes for collaboration and information modelling

Organization	Solution	Type
All	Solibri Model Viewer	Free model viewing
AECOM	Autodesk Revit	Model authoring and drawing/schedule production
AECOM	Autodesk Navisworks	Geometry model federation. Coordination checking (inc clash detection). Internal use by AECOM.
Ares Landscape Architects	Vectorworks	Model authoring and drawing/schedule production



Client: **Nottingham College**

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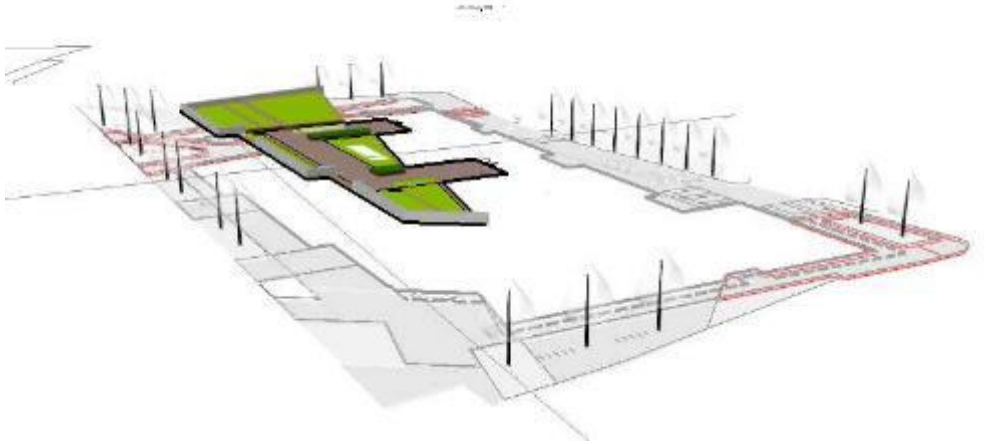

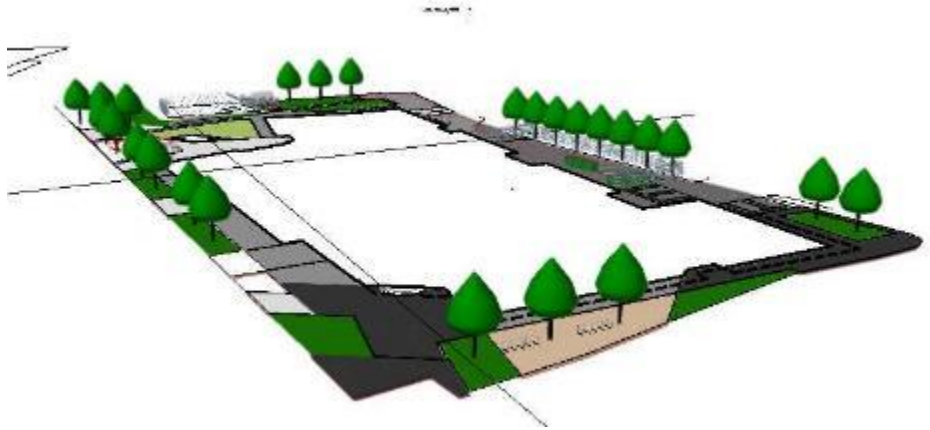

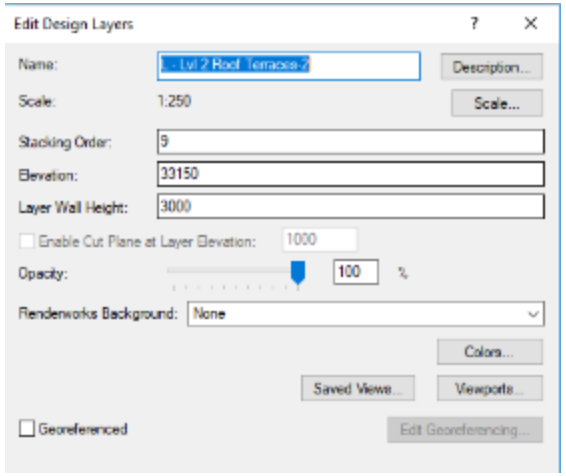

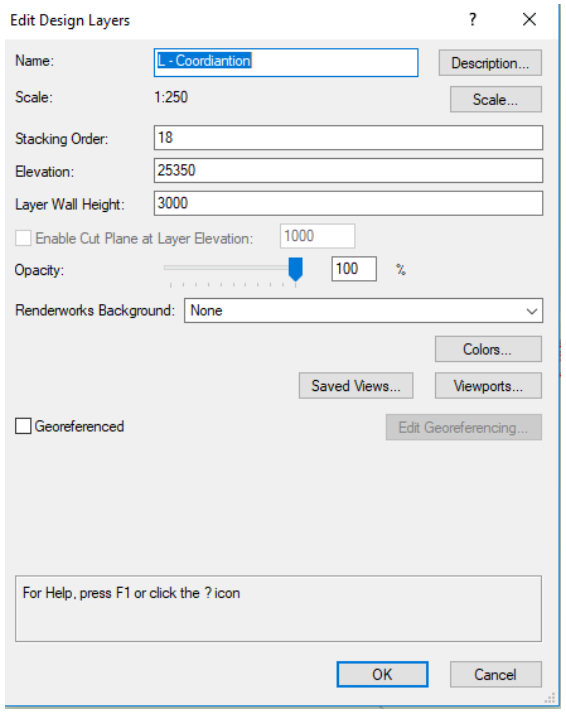

Coordinating Levels

- Design Layers set to Building FFL Elevations
- Roof Terrace: 33.15m
- Ground Floor: 25.35m

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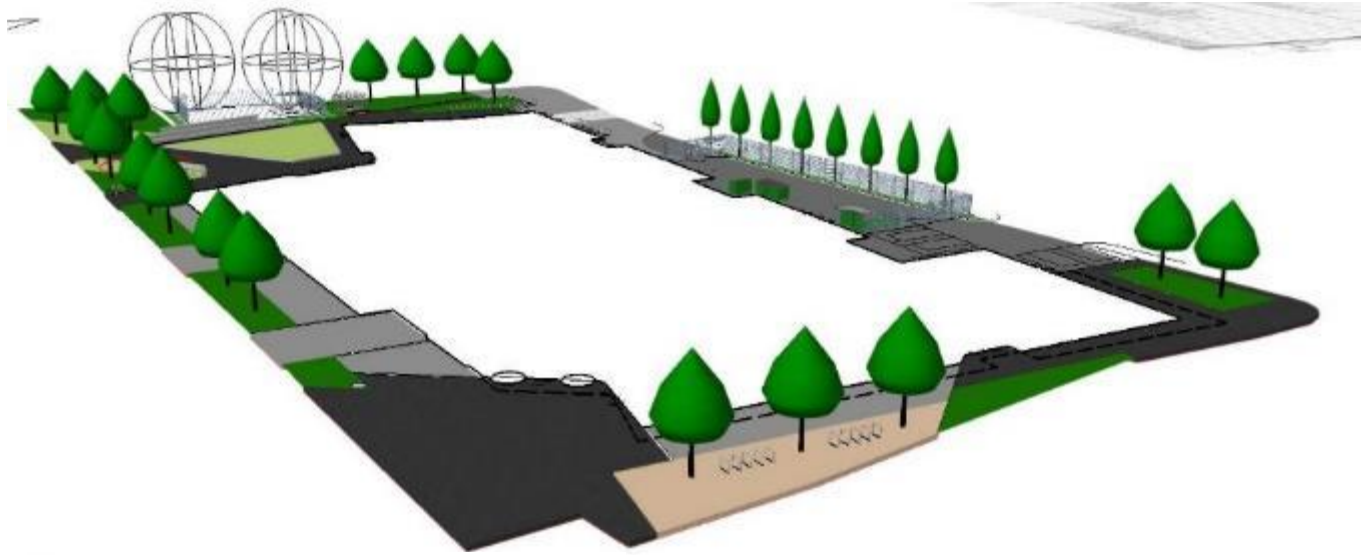
Smart/Hybrid Objects

- 3D information generated
- 2D outputs in line with firm drawing standards
  - Hardscapes
  - Site Furniture (2D/3D Symbols and Autohybrid objects)
  - Fence/Rail objects
  - Plants
  - Landscape Areas



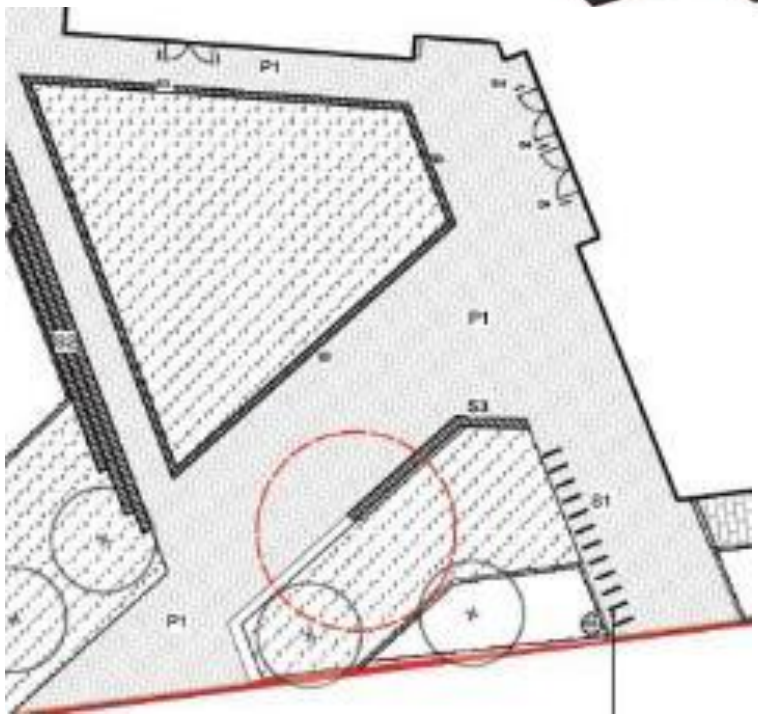


Image Courtesy of Ares Landscape Architects

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Coordination with others

- Architect's IFC file
- On-structure landscape Adding surrounding urban context aided in shadow path analysis

Image Courtesy of Ares Landscape Architects

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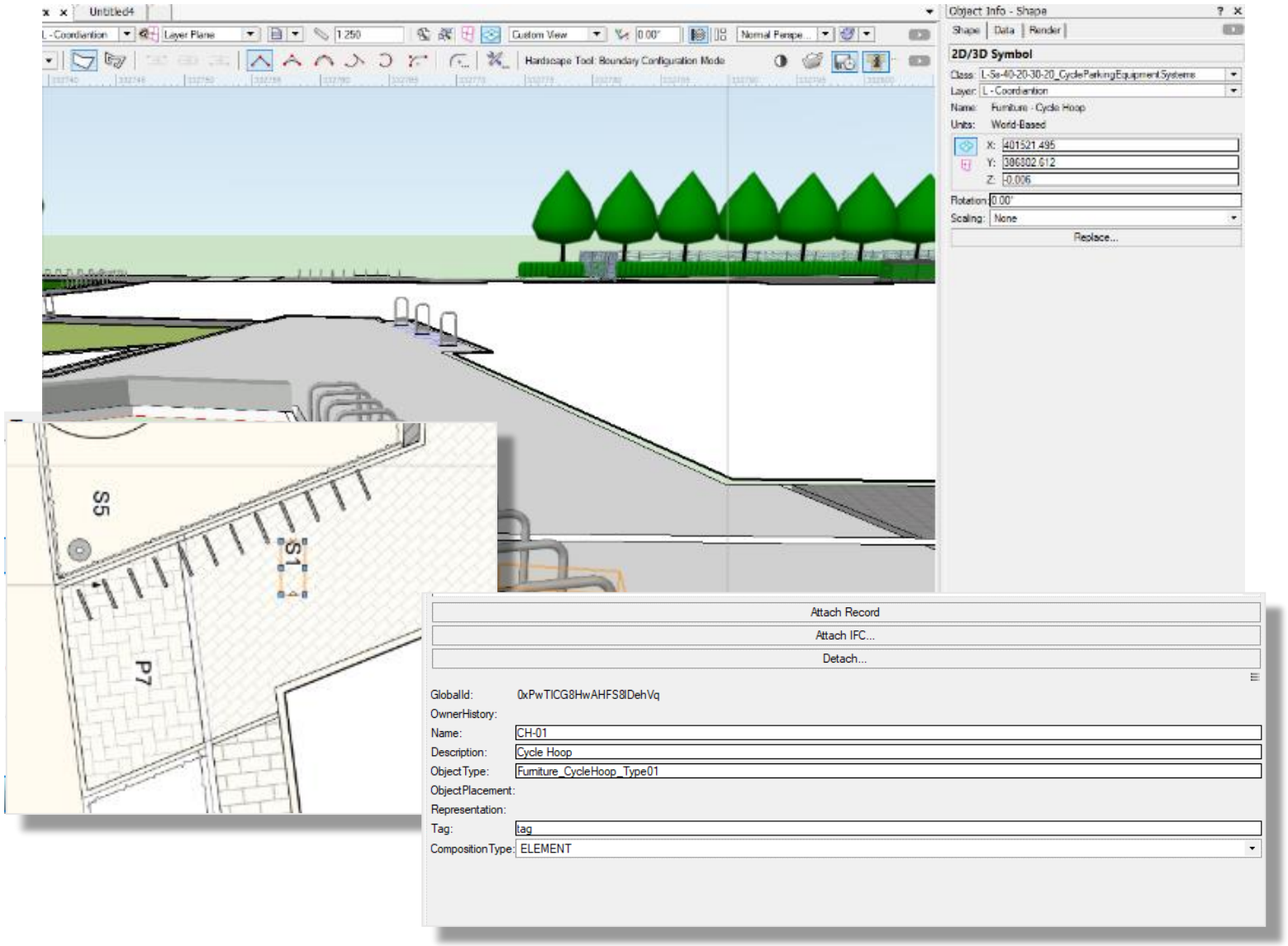

Setting up libraries

- Efficiencies are gained when routine material is made into reusable content
- Duplicate and customize for site-specific differences
- Import manufacturer-produced 3D library objects and/or custom modeled

- Append data...

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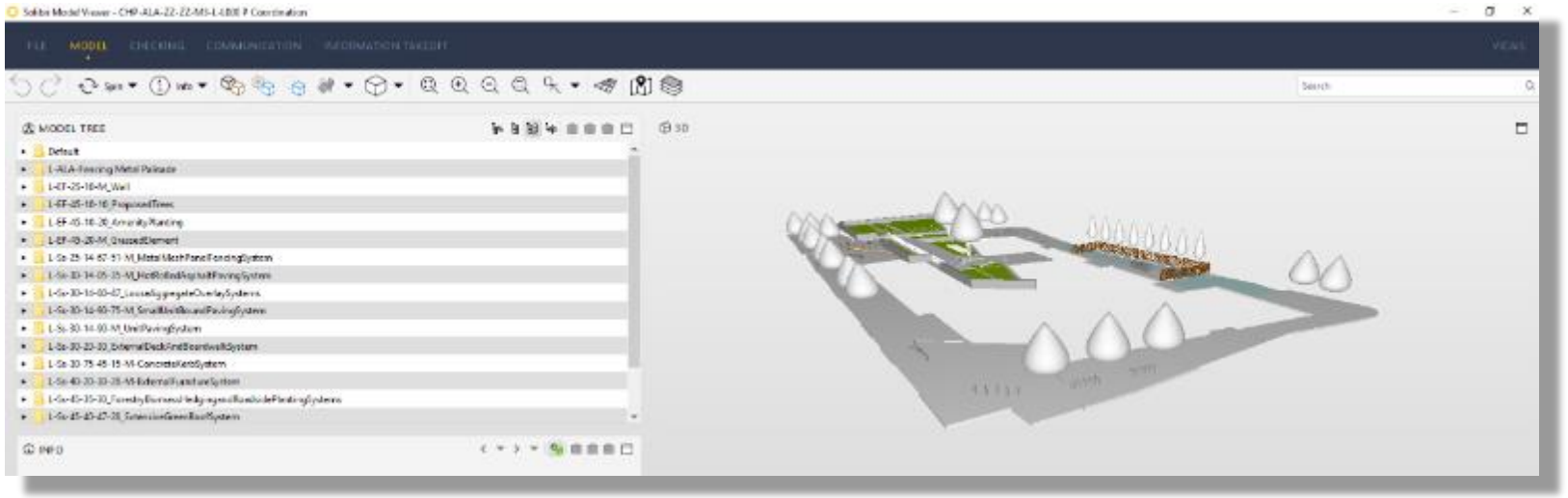
Data is king in BIM

- identify what data is needed from objects.
- test between BIM application and model-viewer application (Solibri)
- form input requirements
- form export rules
- For UK...they needed to include COBie fields



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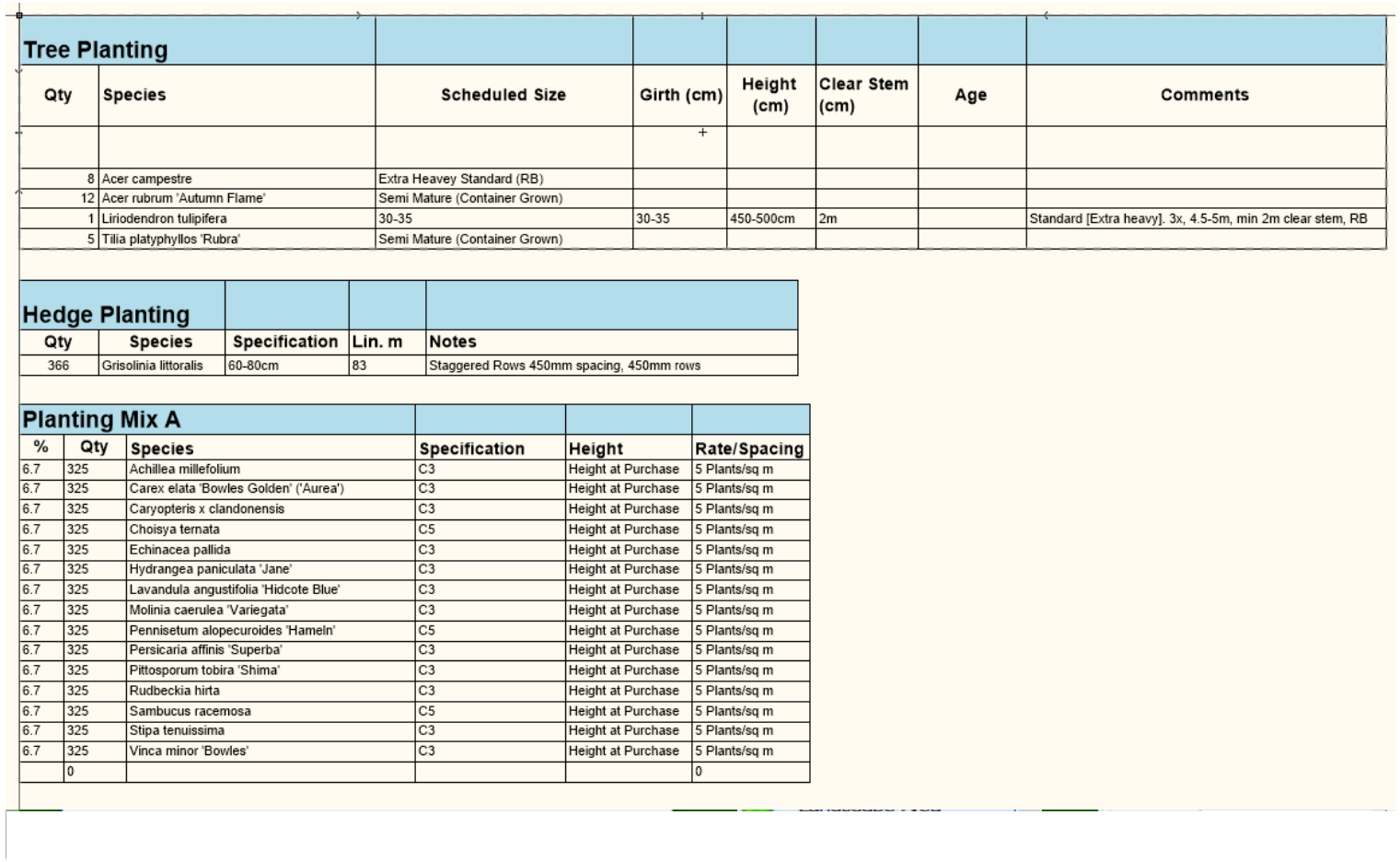

Tree Planting

Qty	Species	Scheduled Size	Girth (cm)	Height (cm)	Clear Stem (cm)	Age	Comments
8	Acer campestre	Extra Heavey Standard (RB)					
12	Acer rubrum 'Autumn Flame'	Semi Mature (Container Grown)					
1	Liriodendron tulipifera	30-35	30-35	450-500cm	2m		Standard [Extra heavy]. 3x, 4.5-5m, min 2m clear stem, RB
5	Tilia platyphyllos 'Rubra'	Semi Mature (Container Grown)					

Hedge Planting

Qty	Species	Specification	Lin. m	Notes
366	Grisolinia littoralis	60-80cm	83	Staggered Rows 450mm spacing, 450mm rows

Planting Mix A

%	Qty	Species	Specification	Height	Rate/Spacing
6.7	325	Achillea millefolium	C3	Height at Purchase	5 Plants/sq m
6.7	325	Carex elata 'Bowles Golden' ('Aurea')	C3	Height at Purchase	5 Plants/sq m
6.7	325	Caryopteris x clandonensis	C3	Height at Purchase	5 Plants/sq m
6.7	325	Choisya ternata	C5	Height at Purchase	5 Plants/sq m
6.7	325	Echinacea pallida	C3	Height at Purchase	5 Plants/sq m
6.7	325	Hydrangea paniculata 'Jane'	C3	Height at Purchase	5 Plants/sq m
6.7	325	Lavandula angustifolia 'Hidcote Blue'	C3	Height at Purchase	5 Plants/sq m
6.7	325	Molinia caerulea 'Variegata'	C3	Height at Purchase	5 Plants/sq m
6.7	325	Pennisetum alopecuroides 'Hameln'	C5	Height at Purchase	5 Plants/sq m
6.7	325	Persicaria affinis 'Superba'	C3	Height at Purchase	5 Plants/sq m
6.7	325	Pittosporum tobira 'Shima'	C3	Height at Purchase	5 Plants/sq m
6.7	325	Rudbeckia hirta	C3	Height at Purchase	5 Plants/sq m
6.7	325	Sambucus racemosa	C5	Height at Purchase	5 Plants/sq m
6.7	325	Stipa tenuissima	C3	Height at Purchase	5 Plants/sq m
6.7	325	Vinca minor 'Bowles'	C3	Height at Purchase	5 Plants/sq m
	0				0

Plants

- Plant tool for trees
- Landscape area for mixes, grasses and green roof
- 3D not required but used
- Worksheets pull the data from the plants and landscape areas

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Open BIM with IFC

- IFC files successfully exported
- in world coordinates (to coordinate between consultants)
- Table created by architect harvested the IFC data for COBie reporting (BIM level 2 requirement)

Name	AssetType	Manufacturer	ModelNumber	WarrantyGuarantorParts	WarrantyDurationParts	WarrantyGuarantorLabor	WarrantyDurationLabor	WarrantyDurationUnit	ExtSystem	ExtObject
Furniture_Bench_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcFurnitureType
Furniture_Bins_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Furniture_CycleHoop_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Furniture_Edging_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Furniture_Fencing_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Furniture_Fencing_Type02	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Furniture_Seating_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Furniture_Seating_Type02	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
MultiStemTree_Type01	Fixed	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Paving_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Paving_Type02	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Paving_Type03	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Paving_Type04	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Paving_Type05	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Paving_Type06	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Paving_Type07	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Planting_Tree_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Planting_Tree_Type02	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Planting_Tree_Type03	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Planting_Type01	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Planting_Type02	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Planting_Type03	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Planting_Type04	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy
Planting_Type05	Fixed	n/a	n/a	n/a	0.0	n/a	0.0	n/a	Vectorworks Architect 2017 SP4 (Build 373796) (64-Bit) by Vectorwor	IfcBuildingElementProxy

Image Courtesy of Ares Landscape Architects

From BIM to Build

- As of end of 2018...
- Hand-over planned for May 2020
- BIM model will still inform facility management

Image Courtesy of Ares Landscape Architects

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Student Wellness Center

Project Location: Auburn University Montgomery Campus, Alabama

Project Type: College

Featured Firm: Holcombe Norton Partners

Reason for BIM: LEED Silver (USGBC)

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- raise building pad (req. 40,000 cu yd)
- achieve LEED Silver Facility
  - preserve red oak 26m dia canopy
  - capture and recirculate rainwater
  - encourage infiltration
  - meet water use reduction credit
  - reduce heat island effect

Client: **Auburn University at Montgomery Campus**

Images Courtesy of
Holcombe Norton Partners

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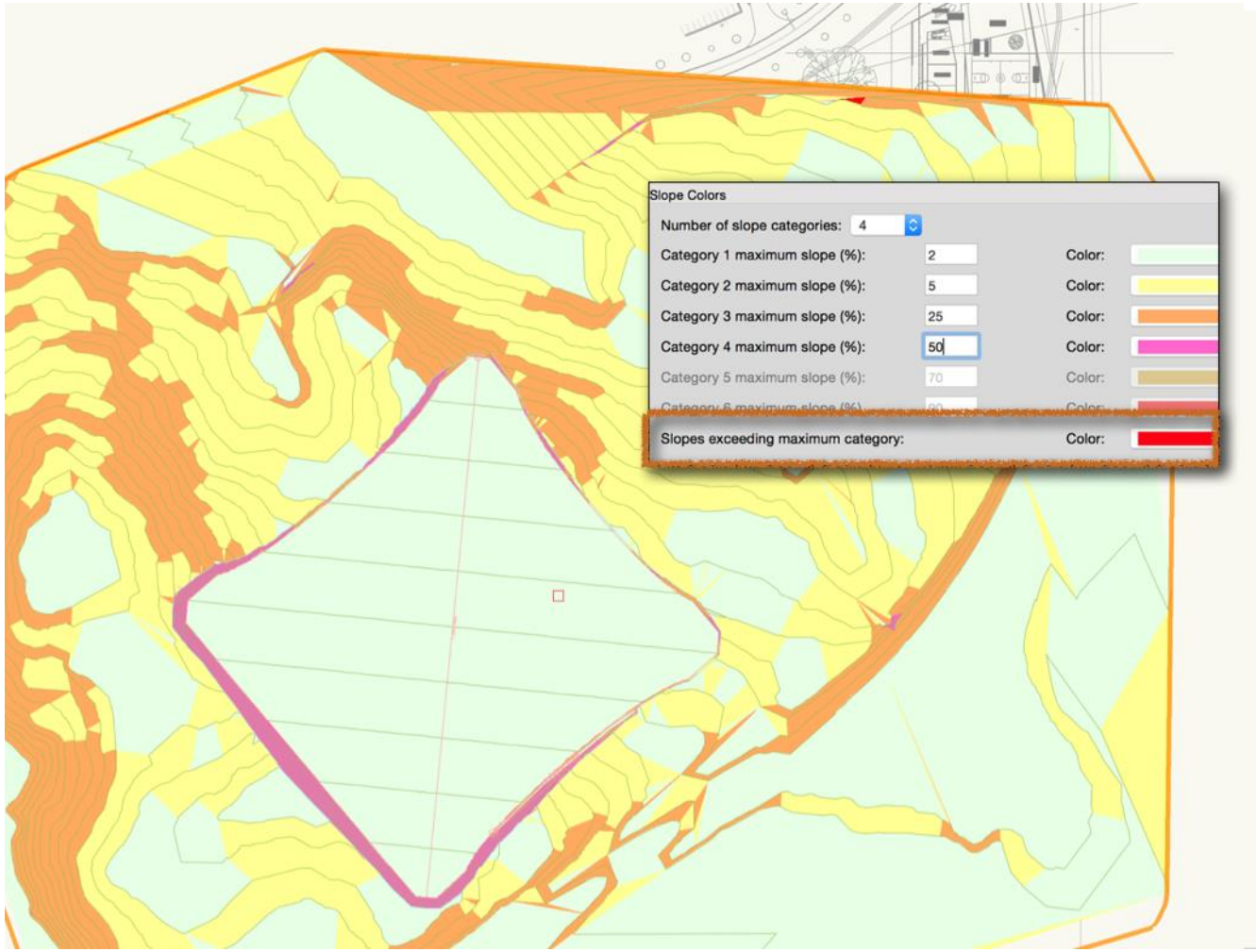
To raise the building pad:

- created a terrain model from survey
- proposed grade cut in area of new athletic field
- site modifier in shape of athletic fields adjusted elevation and position to attain 40,000 cu yd (30,582 cu m)
- analyze proposed changes for slope suitability



Images Courtesy of Holcombe Norton Partners

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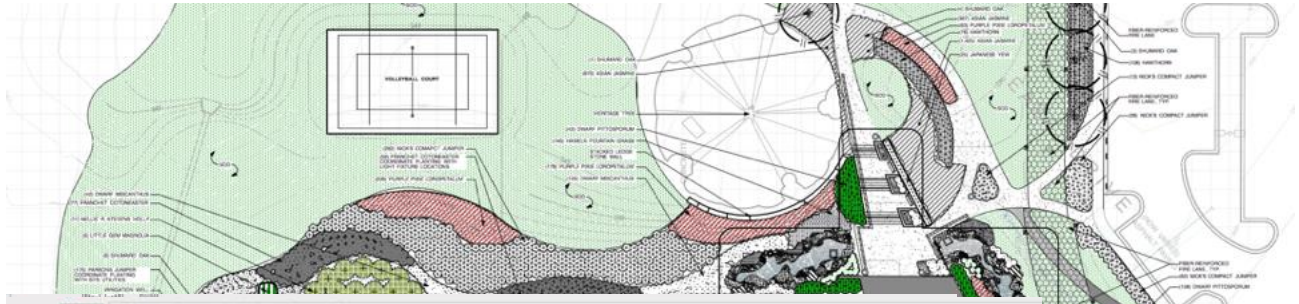

D33 ='Plant Record'.'Water Range')

	A	B	C	D	E	F	G	H	I	J
12.1	L-SHRUBS-HI	Shrubs	9,187.16	0.5	1.0	1.3	3.32	0.625	30372.61	
13	L-SHRUBS	Shrubs	3,728.91	0.5	1.0	1.0	2.55	0.625	9482.85	
13.1	L-SHRUBS	Shrubs	3,728.91	0.5	1.0	1.0	2.55	0.625	9482.85	
14	L-SHRUBS-LO	Shrubs	2,274.43	0.5	1.0	0.5	1.28	0.625	2892.01	
14.1	L-SHRUBS-LO	Shrubs	2,274.43	0.5	1.0	0.5	1.28	0.625	2892.01	
15	L-SHRUBS-HI	Groundcover	0.00	0.5	1.0	1.2	3.06	0.625	0.00	
15.1	L-SHRUBS-HI	Groundcover	0.00	0.5	1.0	1.2	3.06	0.625	0.00	
16	L-SHRUBS	Groundcover	0.00	0.5	1.0	1.0	2.55	0.625	0.00	
16.1	L-SHRUBS	Groundcover	0.00	0.5	1.0	1.0	2.55	0.625	0.00	
17	L-SHRUBS-LO	Groundcover	336.05	0.5	1.0	0.5	1.28	0.625	427.29	
17.1	L-SHRUBS-LO	Groundcover	336.05	0.5	1.0	0.5	1.28	0.625	427.29	
18	L-MIX-HI	Mixed	875.94	0.5	1.1	1.4	3.93	0.625	3430.46	
18.1	L-MIX-HI	Mixed	875.94	0.5	1.1	1.4	3.93	0.625	3430.46	
19	L-MIX	Mixed	2,245.03	0.5	1.1	1.0	2.81	0.625	6280.18	
19.1	L-MIX	Mixed	2,245.03	0.5	1.1	1.0	2.81	0.625	6280.18	
20	L-MIX-LO	Mixed	123.24	0.5	1.1	0.5	1.40	0.625	172.37	
20.1	L-MIX-LO	Mixed	123.24	0.5	1.1	0.5	1.40	0.625	172.37	
21	L-SOD-HI	Sod	0.00	0.0	0.0	0.0	0.00	0.000	0.00	
22	L-SOD	Sod	127,836.22	0.7	1.0	1.0	3.57	0.625	455133.97	
22.1	L-SOD	Sod	127,836.22	0.7	1.0	1.0	3.57	0.625	455133.97	
23	L-SOD-LO	Sod	0.00	0.0	0.0	0.0	0.00	0.000	0.00	
24		**Total Landscape Area**	**147657**	**sq. ft.**				**TWA**	**510,861.95**	**gal.**
25										
26				**Available non-potable water for re-use**					**0.00**	gal.
27										

Design Case

			Controller							
28	Sod Ks (0.6-0.8)	0.6	Density Fac							
29	Microclimate Laye	Planting Type	Area (sq. ft.							
30	L-TREES-HI	Trees	0.0							
31	L-TREES	Trees	1,050.0							
31.1	L-TREES	Trees	575.00	0.2	1.0	1.0	1.02	0.625	467.92	
31.2	L-TREES	Trees	475.00	0.5	1.0	1.0	2.55	0.625	966.36	
32	L-TREES-LO	Trees	0.00	0.0	0.0	0.0	0.00	0.000	0.00	
33	L-SHRUBS-HI	Shrubs	9,187.16	1.0	1.0	1.4	1.43	0.625	10466.87	

0.7	0.6	0.5	1.07	0.625	8.57	
0.2	0.6	0.5	0.31	0.625	12.98	
0.0	0.0	0.0	0.00	0.000	0.00	
0.6	1.0	1.0	3.06	0.750	243821.77	
0.6	1.0	1.0	3.06	0.750	243821.77	
0.0	0.0	0.0	0.00	0.000	0.00	
				TWA	**252,692.79**	**gal.**
				TPWA	**[illegible]**	**gal.**
			Percent Reduction of TPWA		**50.54 %**	
			Percent Reduction of TWA		**50.54 %**	

Images Courtesy of Holcombe Norton Partners

To meet water use reduction credit:

- use EPA's WaterSmart Water Budget
- establish allowance (baseline)
- identify non-potable source
- incorporate proposed planting areas (worksheet auto reports from hydrozones) and enter evapotranspiration factor
- water budget calculations with worksheets to verify adherence...then document.

Table 1. Landscape Factors

Vegetation type	Species Factor (k_s)			Density Factor (k_d)			Microclimate Factor (k_{mc})		
	Low	Average	High	Low	Average	High	Low	Average	High
Trees	0.2	0.5	0.9	0.5	1.0	1.3	0.5	1.0	1.4
Shrubs	0.2	0.5	0.7	0.5	1.0	1.1	0.5	1.0	1.3
Groundcover	0.2	0.5	0.7	0.5	1.0	1.1	0.5	1.0	1.2
Mixed trees, shrubs, groundcover	0.2	0.5	0.9	0.6	1.1	1.3	0.5	1.0	1.4
Turf grass	0.6	0.7	0.8	0.6	1.0	1.0	0.8	1.0	1.2

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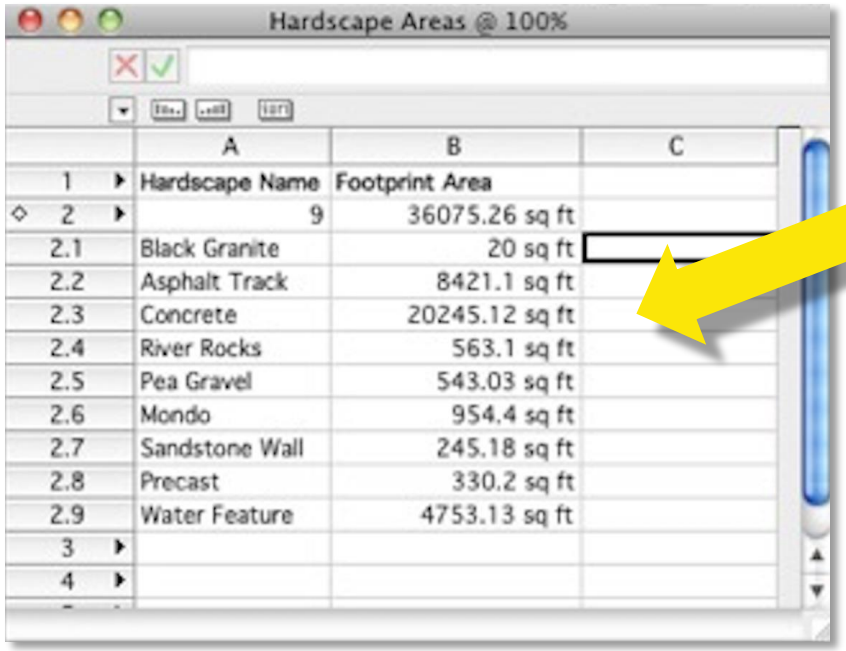
To reduce urban heat island effect:

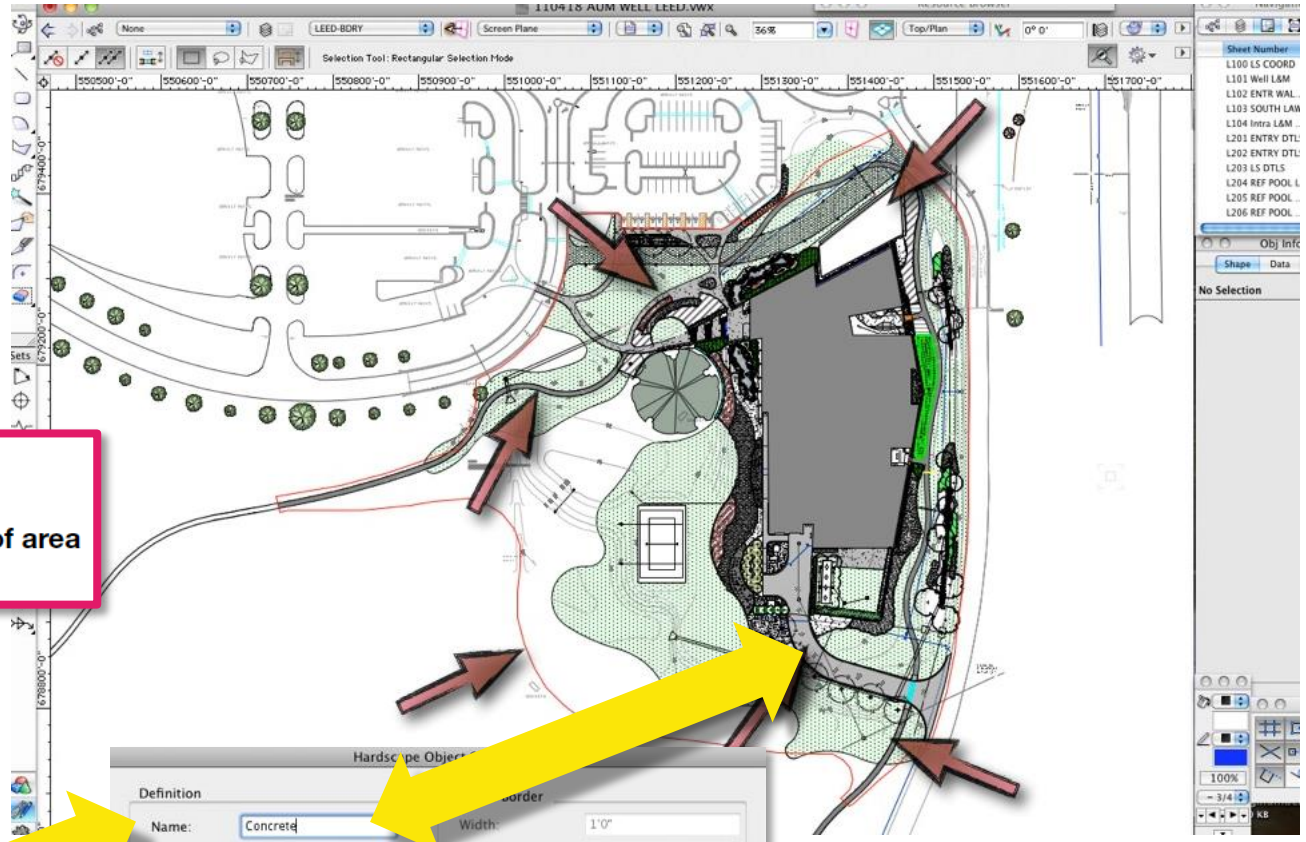
- created hardscape objects
- create report of hardscapes
- revise until objectives are met

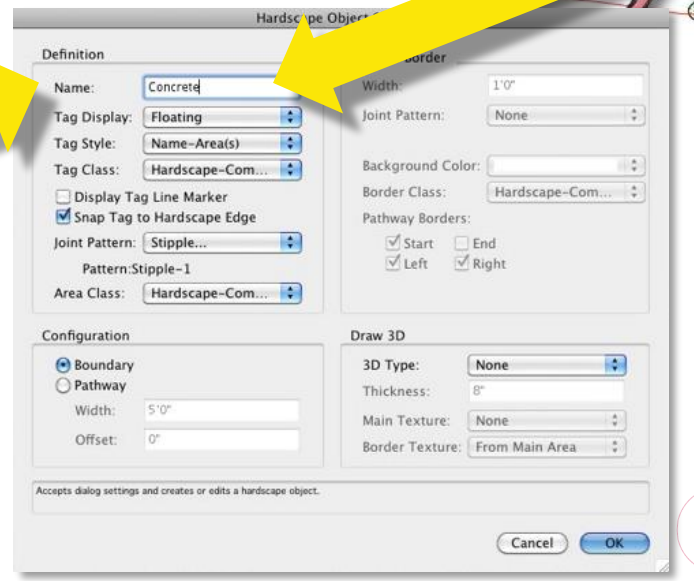
$$\frac{\text{area of non-roof measures}}{0.5} + \frac{\text{area of high-reflectance roof}}{0.75} + \frac{\text{area of vegetated roof}}{0.5} \geq \text{total site paving area} + \text{total roof area}$$

Image Courtesy of USGBC (LEED/SITES)



	A	B	C
1	Hardscape Name	Footprint Area	
2	9	36075.26 sq ft	
2.1	Black Granite	20 sq ft	
2.2	Asphalt Track	8421.1 sq ft	
2.3	Concrete	20245.12 sq ft	
2.4	River Rocks	563.1 sq ft	
2.5	Pea Gravel	543.03 sq ft	
2.6	Mondo	954.4 sq ft	
2.7	Sandstone Wall	245.18 sq ft	
2.8	Precast	330.2 sq ft	
2.9	Water Feature	4753.13 sq ft	
3			
4			





Images Courtesy of Holcombe Norton Partners

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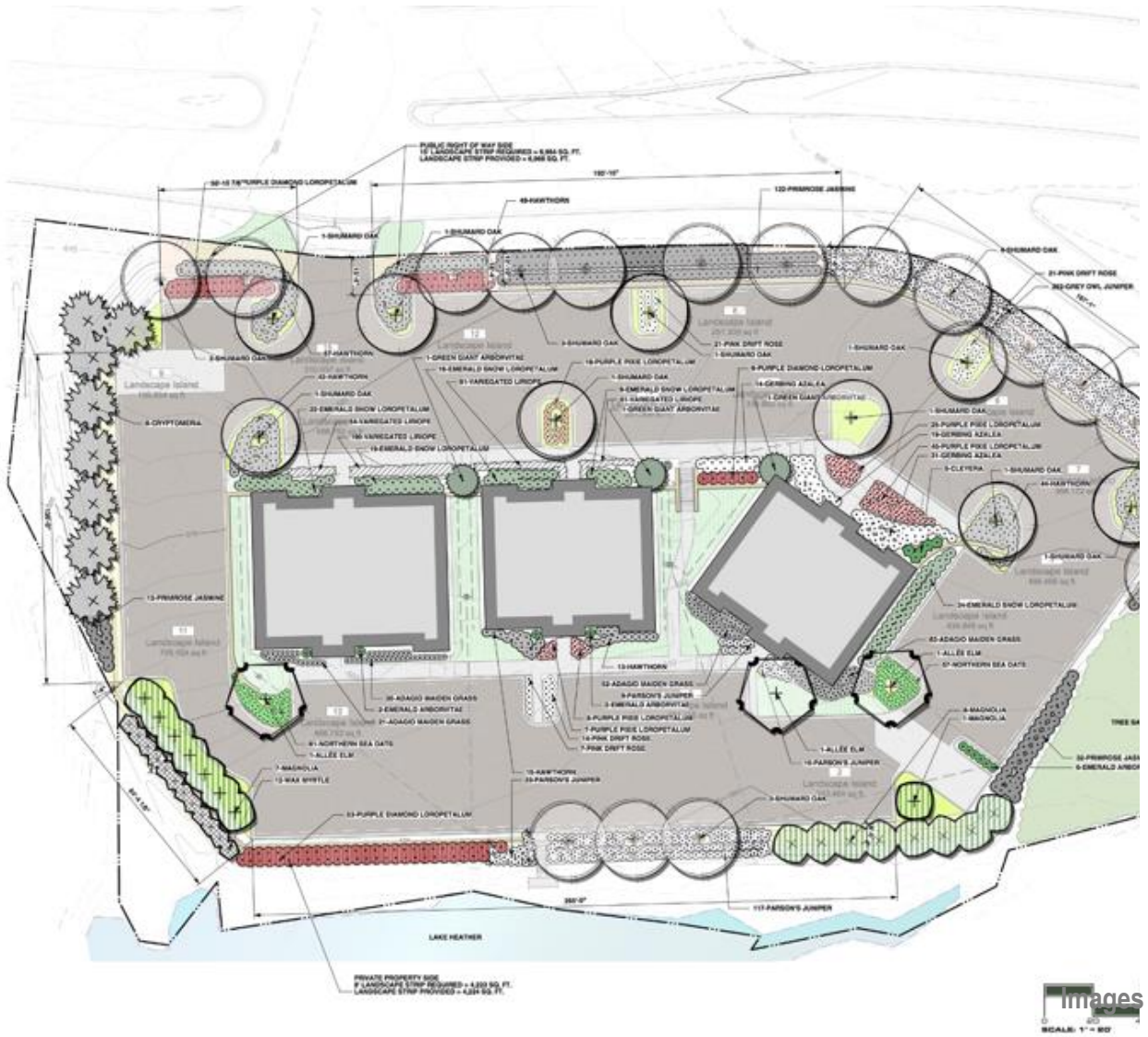

TREE CONSERVATION WORKSHEET				
SUBJECT PROPERTY ZONING				PO (INVERNESS)
ADJACENT PROPERTY ZONING				PO (INVERNESS)
ADJUSTED GROSS SITE AREA				
	TOTAL SITE AREA			122,369.22 sq ft
	BUILDING FOOTPRINT			-13,599.23 sq ft
	EASEMENTS			
	LAKES/WATER QUALITY PONDS			-922.84 sq ft
	ADJUSTED GROSS SITE AREA:			**107,847.15 sq ft**
REQUIRED TREE CANOPY				
	Enter required tree canopy percentage from zoning ordinance		10%	10,784.71 sq ft
PROVIDED TREE CANOPY				
	SAVED TREE CANOPY AREA			5,443.22 sq ft
	BONUS FOR TREE PRESERVATION			1,360.80 sq ft
	PROPOSED TREES:		CREDIT:	EXT.:
	3	ALLÉE ELM	250 sq ft	750.00 sq ft
	8	CRYPTOMERIA	125 sq ft	1,000.00 sq ft
	16	MAGNOLIA	250 sq ft	4,000.00 sq ft
	25	SHUMARD OAK	300 sq ft	7,500.00 sq ft
	12	WAX MYRTLE	100 sq ft	1,200.00 sq ft
	TOTAL PROPOSED CANOPY:			**21,254.02 sq ft**
	SURPLUS/(DEFICIT):			**10,469.30 sq ft**
REQUIRED PERIMETER TREES				
	REQUIRED PERIMETER TREES		31	
		CRYPTOMERIA	8	
		MAGNOLIA	8	
		SHUMARD OAK	16	
	PROVIDED PERIMETER TREES		**32**	
INTERIOR PARKING CANOPY CALCULATION				
PARKING/VEHICULAR USE AREA				52,276.26 sq ft
	REQUIRED INTERIOR PLANTING		10%	**5,227.63 sq ft**
	PROVIDED INTERIOR PLANTING AREA:			
		Landscape Island	**1**	434.846 sq ft
		Landscape Island	2	343.464 sq ft
		Landscape Island	3	184.115 sq ft
		Landscape Island	4	498.466 sq ft
		Landscape Island	5	334.882 sq ft
		Landscape Island	6	251.309 sq ft
		Landscape Island	7	368.172 sq ft
		Landscape Island	8	251.309 sq ft
		Landscape Island	9	195.654 sq ft
		Landscape Island	10	488.792 sq ft
		Landscape Island	**11**	748.454 sq ft
		Landscape Island	12	211.857 sq ft
		Landscape Island	13	468.783 sq ft
		Landscape Island	14	251.309 sq ft
		Landscape Island	15	310.037 sq ft
	TOTAL PROVIDED INTERIOR PLANTING AREA			**5,341.45 sq ft**
	SURPLUS/(DEFICIT):			**113.82 sq ft**
	PROVIDED INTERIOR TREE CANOPY AREA:			
	PROPOSED TREES:		CREDIT:	EXT.:
	3	ALLÉE ELM	250 sq ft	750.00 sq ft
	8	MAGNOLIA	250 sq ft	2,000.00 sq ft
	9	SHUMARD OAK	300 sq ft	2,700.00 sq ft
	TOTAL PROVIDED INTERIOR TREE CANOPY			**5,450.00 sq ft**
	SURPLUS/(DEFICIT):			**222.37 sq ft**

Images Courtesy of Holcombe Norton Partners

HNP uses BIM to meet jurisdictional codes, too:

- reducing developed cover
- required tree canopy
- accessible and preferred parking

DLA 2019

Westview Village

Project Location: Ventura, California

Project Type: Community Masterplan

Featured Firm: Pacific Coast Land Design

Reason for BIM: Model Water Efficient Landscape Ordinance (MWELO)

Image Courtesy of Pacific Coast Land Design

- 20-acre site master plan
- features more than 2 acres of programmed open space (+10%)
- achieve LEED Neighborhood Development (ND) certification
- meet/exceed Model Water Efficient Landscape Ordinance (MWELO)

Clients: **Housing Authority of San Buenaventura** and **BRIDGE Housing**

Image Courtesy of Pacific Coast Land Design

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PCLD worked with Jensen Design Engineering to:

- develop a **stormwater management system** that will **treat and infiltrate much of the runoff**
- use **drought-tolerant and low water use plants** to dramatically **decrease the irrigation water used**

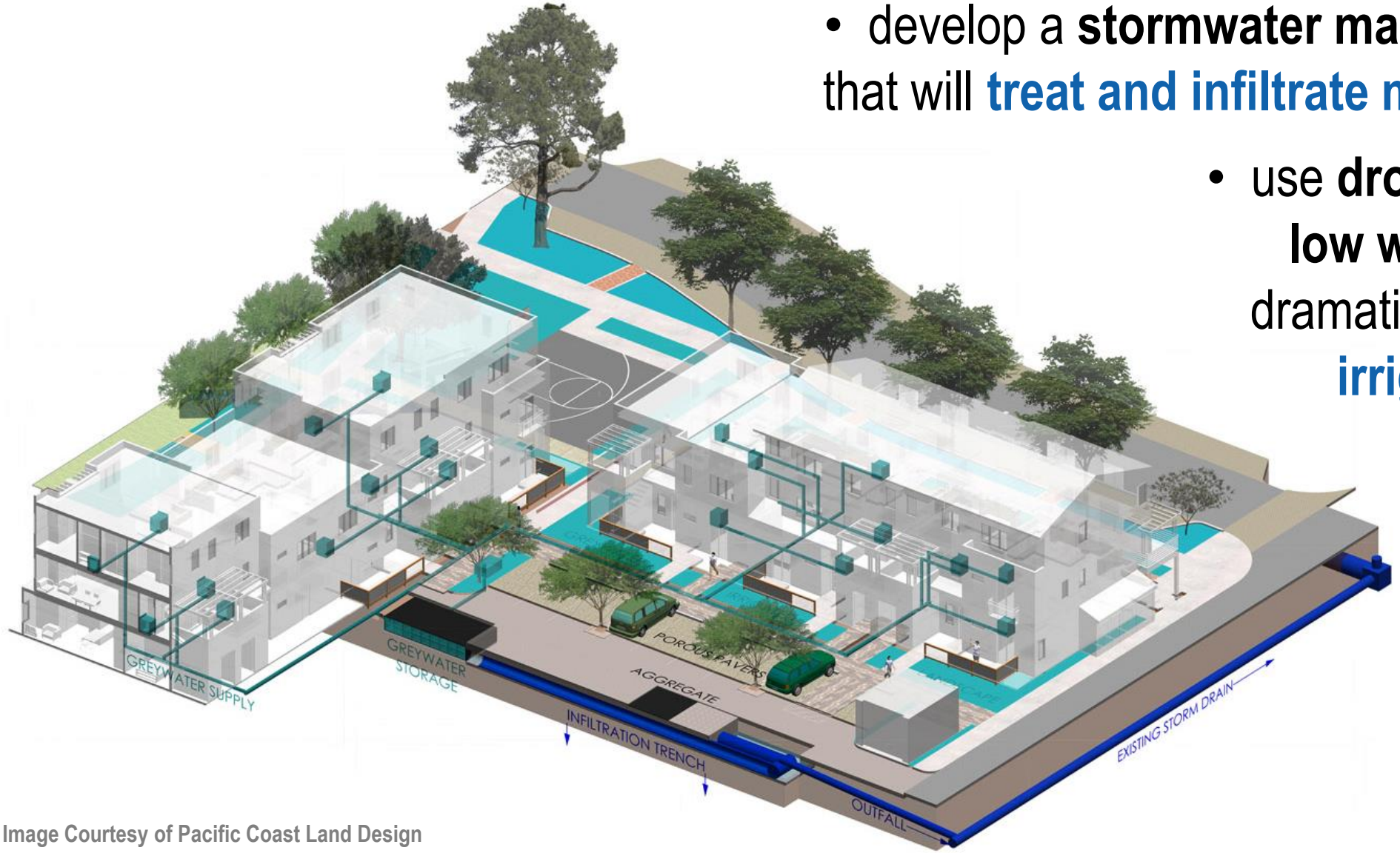

Image Courtesy of Pacific Coast Land Design

DLA 2019

3D modeled terrain and pavement

- Terrain model visualizes surface water movement.
- Hardscape object quantifies and visualizes surface coverage.
- Worksheets calculate with known impervious and pervious areas.
- Worksheets speed up runoff, infiltration and collection calculations.

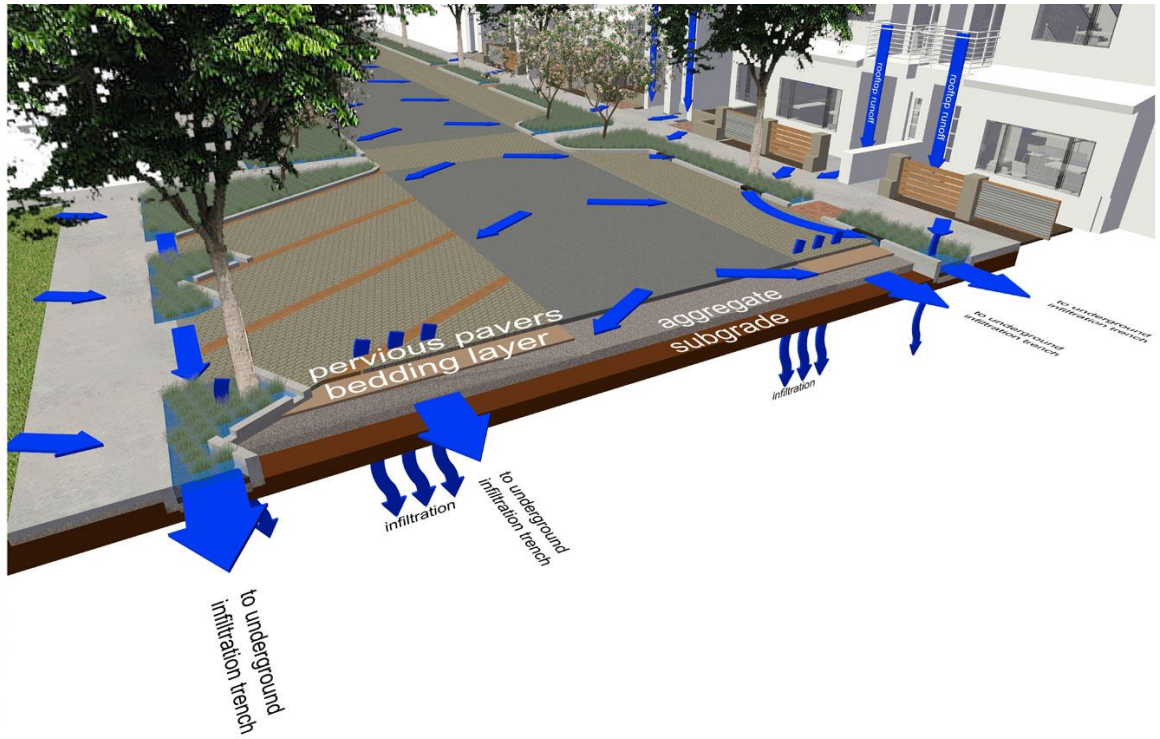

Image Courtesy of Pacific Coast Land Design

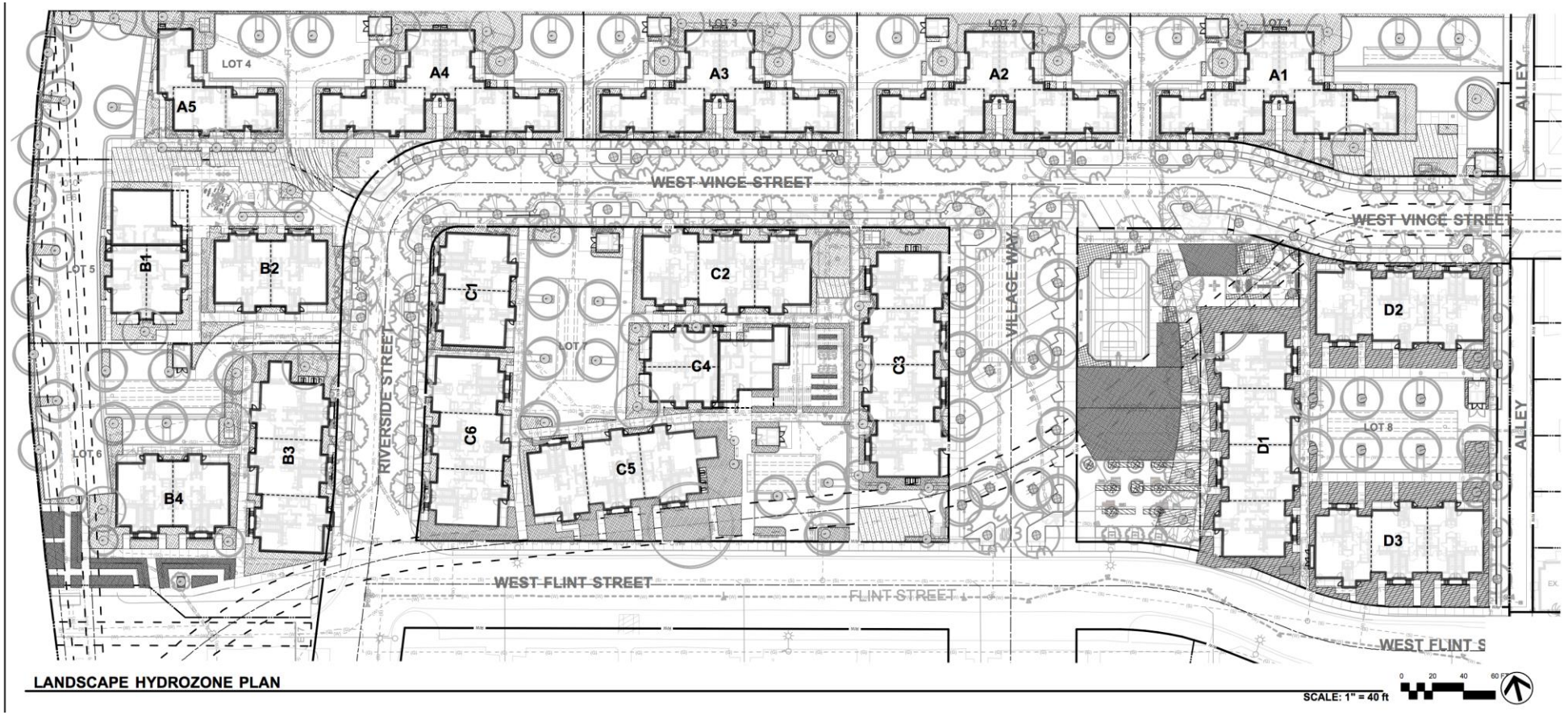

Image Courtesy of Pacific Coast Land Design

Area and volume data reports from:

- Roofs
- Hardscapes
- Hydrozones

DLA 2019

POC 'D' - POTABLE VS. GREYWATER USE

HZ#	HYDROZONE	ESTIMATED WATER USAGE PER MONTH (gallons)												
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
DEMAND - POTABLE SYSTEM STATIONS														
6	Park Edible	325	384	473	561	679	694	812	724	606	502	369	295	6,425
DEMAND - GREYWATER SYSTEM STATIONS														
3	Park Shrubs	685	809	996	1,183	1,432	1,463	1,712	1,525	1,276	1,058	778	623	13,542
4	Park Trees	73	86	106	125	152	155	181	162	135	112	82	66	1,435
5	Park Orchard Trees	273	323	397	472	571	583	682	608	509	422	310	248	5,398
7	Park Turf	5,980	7,068	8,699	10,330	12,504	12,776	14,951	13,320	11,145	9,242	6,796	5,437	118,247
8	Park No-mow Turf	997	1,178	1,449	1,721	2,084	2,129	2,491	2,219	1,857	1,540	1,132	906	19,704
10	Private Shrubs	4,036	4,770	5,871	6,971	8,439	8,623	10,090	8,989	7,522	6,238	4,586	3,669	79,805
12	Private Trees	82	97	119	141	171	174	204	182	152	126	93	74	1,615
SUPPLY - GREYWATER LAUNDRY COLLECTION*														
96	Block D Occupants	29,760	27,120	29,760	28,800	29,760	28,800	29,760	29,760	28,800	29,760	28,800	29,760	
SURPLUS														
	Greywater Surplus	17,635	12,790	12,124	7,857	4,408	2,897	-553	2,754	6,203	11,021	15,022	18,737	
	Potable Water Backup	0	0	0	0	0	0	553	0	0	0	0	0	
ESTIMATED WATER USE														
	TOTAL POTABLE USE	325	384	473	561	679	694	1,365	724	606	502	369	295	**6,978**
	% OF TOTAL USE	*3%*	*3%*	*3%*	*3%*	*3%*	*3%*	*4%*	*3%*	*3%*	*3%*	*3%*	*3%*	***3%***
	TOTAL GREYWATER USE	12,125	14,330	17,636	20,943	25,352	25,903	29,760	27,006	22,597	18,739	13,778	11,023	**239,192**
	% OF TOTAL USE	*97%*	*97%*	*97%*	*97%*	*97%*	*97%*	*96%*	*97%*	*97%*	*97%*	*97%*	*97%*	***97%***

*Assumed a daily wastewater generation rate of 50 gallons per day per person, based on typical text book generation rates (Metcalf and Eddy, 2014). The daily per capita generation rate of greywater that is only collected from washing machines would be approximately 20% of total wastewater generation (AWWA, 1999; EMBUD, 2010; DeOreo, 2011), or approximately 10 gallons per person per day.

POC 'D' - PRIVATE IRRIGATION

WATER EFFICIENT LANDSCAPE WORKSHEET

PROJECT NAME: Westview Village
PROJECT TYPE: Residential
PROJECT LOCATION: Ventura, CA
REFERENCE ETo: 43.5
TOTAL IRRIGATED LANDSCAPE AREA: 17,125 sf

Maxium Applied Water Allowance (MAWA)

MAWA = (ETo) (0.62) [(ETAF x LA) + ((1 - ETAF) x SLA)]

MAWA= Maximum Applied Water Allowance
ETo = Reference Evapotranspiration (inches per year)
0.62 = Conversion factor (to gallons per square foot)
ETAF = Evapotranspiration Adjustment Factor = 0.45 for Non-residential Areas
LA = Landscaped Area including SLA (sq ft)
SLA = Portion of Landsape Area identified as Special Landscape Area - see Definitions (square feet)

Applicant to fill in boxes below:

17,125 Irrigated Landscape Area including Special Landscape Area/SLA (square feet)
0 Portion of Landscape Area identified as Special Landscape Area (square feet)

	ETo		ETAF		AREA (sf)		Conversion	MAWA
MAWA for Total LA	43.5	x	0.55	x	17,125	x	0.62	254,019
MAWA for SLA*	43.5	x	0.45	x	0	x	0.62	0
Total MAWA								**254,019** *(gallons per year)*

Estimated Total Water Use (ETWU)

ETWU = (ETo) (0.62) [(PF x HA) / IE + SLA)]

ETWU = Estimated Total Water Use
ETo = Reference Evapotranspiration (inches per year)
0.62 = Conversion factor (to gallons per square foot)
PF = Plant Factor from WUCOLS (see Table A)
HA = Hydrozone Area (square feet)
IE = Irrigation Efficiency (see Table B)
SLA - Portion of Landsape Area identified as Special Landscape Area - see Definitions (square feet)

ETAF Calculations

Regular Landscape Areas	
B - Total ETAF x Area	*9,128*
A - Total Area	*17,125*
Average ETAF (B / A)	***0.53***
All Landscape Areas	
Total ETAF X Area	*9,128*
Total Area	*17,125*
Sitewide ETAF	*0.53*

Average ETAF meets requirement for this site type.

ETWU arrived from Hydrozone Table below = 246,170 gallons per year **ETWU meets MAWA requirement.**

HYDROZONE TABLE

hydrozone	plant water use	plant factor (PF)	irrigation method	irrigation efficiency (IE)	ETAF (PF/IE)	hydrozone area (HA) (sf)	ETAF X Area	% of landscape area	Hydrozone ETWU
POTABLE WATER IRRIGATED LANDSCAPE AREAS									
6 - Park Edible	mod	0.5	dripline	0.85	0.59	405	238	2%	6,425
					Regular Landscape Area Subtotal	*405*	*238*	*2%*	*6,425*
GREYWATER IRRIGATED LANDSCAPE AREAS									
3 - Park Shrubs	low	0.3	dripline	0.85	0.35	1,423	502	8%	13,542
4 - Park Trees	low	0.2	dripline	0.85	0.24	226	53	1%	1,435
5 - Park Orchard Trees	high	0.7	ECO-mat	0.89	0.79	254	200	1%	5,398
7 - Park Turf	high	0.8	ECO-mat	0.89	0.90	4,878	4,384	28%	118,247
8 - Park No-mow Turf	mod	0.5	ECO-mat	0.89	0.56	1,300	731	8%	19,704
10 - Private Shrubs	low	0.3	dripline	0.85	0.35	8,384	2,959	49%	79,805
12 - Private Trees	low	0.2	dripline	0.85	0.24	254	60	1%	1,615
					Greywater Landscape Area Subtotal	*16,720*	*8,889*	*97%*	*239,745*
SPECIAL LANDSCAPE AREAS (SLA) - GREYWATER IRRIGATION									
					Special Landscape Area Subtotal	*0*	*0*	*0%*	*0*
					Total	**17,125**	**9,128**	**99%**	**246,170**

Table A - PF (Plant Factor)

Cool Season Turf*	0.8	
Warm Season Turf**	0.6	
High Water Using Plants	0.8	can be between 0.7 - 0.9
Moderate Water Using Plants	0.5	can be between 0.4 - 0.6
Low Water Using Plants	0.2	can be between 0.1 - 0.3
Very Low water Using Plants	0.1	below 0.1

** species include tall fescue, ryegrass, bentgrass and kentucky bluegrass*
*** species include bermudagrass, zoysiagrass, st. augustinegrass*

Table B - IE (Irrigation Efficiency)

Overhead Spray	0.75
Drip	0.81
*Dripline	0.85
*ECO-mat	0.89

**note: adjustment can be made based on exact type of equipment, see irrigation legend*

Which Report to Worksheets:

- Non-potable Collections
- Hydrozone Table
- Water Budget

Image Courtesy of Pacific Coast Land Design

DLA 2019

POC 'D' - POTABLE VS. GREYWATER USE

HZ#	HYDROZONE	ESTIMATED WATER USAGE PER MONTH (gallons)												
		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
DEMAND - POTABLE SYSTEM STATIONS														
6	Park Edible	325	384	473	561	679	694	812	724	606	502	369	295	6,425
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12	Private Trees	82	97	119	141	171	174	204	182	152	126	93	74	1,615
SUPPLY - GREYWATER LAUNDRY COLLECTION*														
	96 Block D Occupants	29,760	27,120	29,760	28,800	29,7								
SURPLUS														
	Greywater Surplus	17,635	12,790	12,124	7,857	4,4								
	Potable Water Backup	0	0	0	0	0								
ESTIMATED WATER USE														
	TOTAL POTABLE USE	325	384	473	561	67								
	% OF TOTAL USE	*3%*	*3%*	*3%*	*3%*	*3*								
	TOTAL GREYWATER USE	12,125	14,330	17,636	20,943	25,3								
	% OF TOTAL USE	*97%*	*97%*	*97%*	*97%*	*97*								

*Assumed a daily wastewater generation rate of 50 gallons per day per person, base
typical text book generation rates (Metcalf and Eddy, 2014). The daily per capita ger
rate of greywater that is only collected from washing machines would be approximat
of total wastewater generation (AWWA, 1999; EMBUD, 2010; DeOreo, 2011), or
approximately 10 gallons per person per day.

606	502	369	295	6,378
3%	3%	3%	3%	3%
,597	18,739	13,778	11,023	239,192
97%	97%	97%	97%	97%

POC 'D' - PRIVATE IRRIGATION

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Maxium Applied Water Allowance (MAWA)

MAWA = (ETo) (0.62) [(ETAF x LA) + ((1 - ETAF) x SLA)]

MAWA= Maximum Applied Water Allowance
ETo = Reference Evapotranspiration (inches per year)
0.62 = Conversion factor (to gallons per square foot)
ETAF = Evapotranspiration Adjustment Factor = 0.45 for Non-residential Areas
LA = Landscaped Area including SLA (sq ft)
SLA = Portion of Landsape Area identified as Special Landscape Area - see Defi

Applicant to fill in boxes below:

17,125 Irrigated Landscape
0 Portion of Landscape

	ETo		ETAF	
MAWA for Total LA	43.5	x	0.55	x
A*	43.5	x	0.45	x

Water Use (ETWU)
.62) [(PF x HA) / IE + SLA)]

otal Water Use
potranspiration (inches per year)
ctor (to gallons per square foot)
m WUCOLS (see Table A)
(square feet)
cy (see Table B)
sape Area identified as Special Landscape Area - see Definitions (square feet)

d from Hydrozone Table below = **246,170 gallons per year** ETW meets MAWA requirement.

BLE

one	plant water use	plant factor (PF)	irrigation method	irrigation efficiency (IE)	ETAF (PF/IE)	hydrozo area (HA (sf)	ETAF X Area	% of landscape area	Hydrozone ETWU
R IRRIGATED LANDSCAPE AREAS									
	mod	0.5	dripline	0.85	0.59	405	238	2%	6,425
					Regular Landscape Area Subtotal	*405*	*238*	*2%*	*6,425*
GREYWATER IRRIGATED LANDSCAPE AREAS									
3 - Park Shrubs	low	0.3	dripline	0.85	0.35	1,423	5	8%	13,542
4 - Park Trees									
5 - Park Orchard Trees									
7 - Park Turf									
8 - Park No-mow Turf									
10 - Private Shrubs									
12 - Private Trees									
SPECIAL LANDSCAPE AREAS (S									

0.24	254	60	1%	1,615
a Subtotal	*16,720*	*8,889*	*97%*	*239,745*
a Subtotal	*0*	*0*	*0%*	*0*
Total	**17,125**	**9,128**	**99%**	**246,170**

ble B - IE (Irrigation Efficiency)

erhead Spray	0.75
o	0.81

Table A - PF (Plant Factor)

Cool Season Turf*	
Warm Season Turf**	
High Water Using Plants	
Moderate Water Using Plants	
Low Water Using Plants	
Very Low water Using Plants	

** species include tall fescue, ryegrass, bentgrass an*
*** species include bermudagrass, zoysiagrass, st. a*

cial Landscape Area/SLA (square feet)
Special Landscape Area (square feet)

ersion	*MAWA*
0.62	254,019
0.62	0
	254,019 *(gallons per year)*

ETAF Calculations
Regular Landscape Areas
B - Total ETAF x A

Total ETAF X Area	*9,128*
Total Area	*17,125*
Sitewide ETAF	*0.53*

ge ETAF meets requirement for this site type.

2 Things to note!

- Non-potable Collections
- Hydrozone Table
- Water Budget

Images Courtesy of Pacific Coast Land Design

DLA 2019

Summary

Future development of the practice will continue to describe how BIM for landscape will aid in planning, design and collaboration for site projects.

- General contractors are already implementing BIM...next will be the landscape contractors.
- Connecting design technical data to on-site fabrication and installation equipment will continue to develop.
- Energy and resource conservation can be integrated in BIM processes, especially with analysis tools...next will be evaluating and then planning for other aspects of better landscape performance.

Image Courtesy of
Ares Landscape Architects

Thank you!

Ares Landscape Architects: Ricardo Ares and Sam Bailey

Holcombe Norton Partners: Stephen Schrader

Pacific Coast Land Design: Eric Berg

Questions?

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