# University of Cyprus

## Masterplan

University of Cyprus

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# Contents



University of Cyprus

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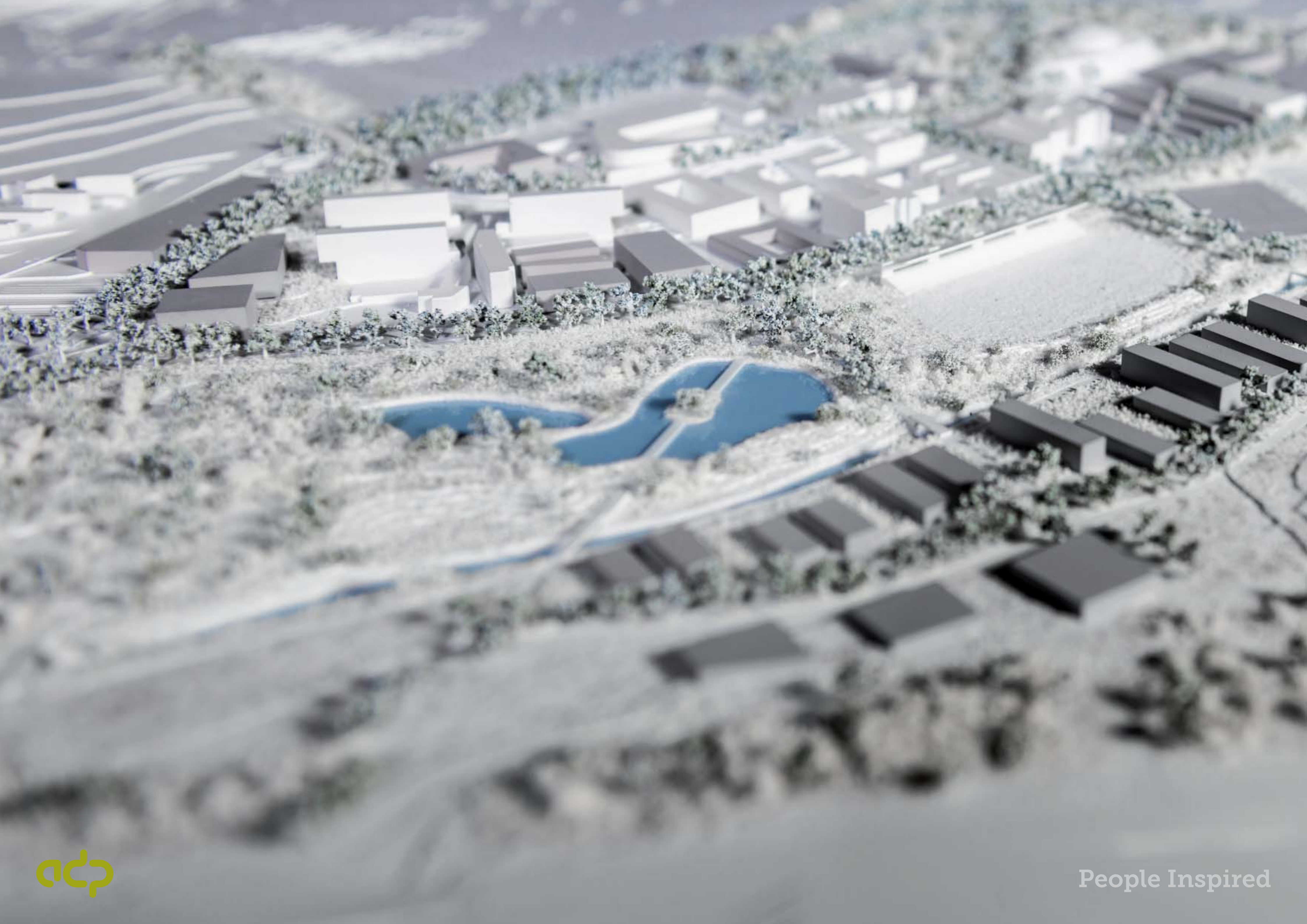
# 0.0 Introduction



People Inspired

This booklet covers the proposals for the Masterplan of the University of Cyprus Athalassa campus.

It is the final step in the Masterplanning process undertaken by ADP and its team of experts, following the Evaluation of the University of Cyprus estates and campuses and the Estates Strategy report .

Taking the conclusions reached at the evaluation stage, ADP and all expert consultants developed strategic proposals for the Masterplan, establishing the vision for the Athalassa campus and proposals at a high level.

Initial ideas were presented in February 2017 in the UK to the CDO team for discussion. Initial feedback during the meeting, and following (with meetings to discuss in Cyprus on 26/5/17), was addressed, and the Estates Strategy developed accordingly.

The Estates Strategy document set out the framework around which detailed Masterplan proposals were developed for the Draft Proposals presented to the UCY in October 2017. This document incorporated the comments received from UCY dated 19/10/17 following the report presentation. Revised Draft Proposals were presented to the UCY Senate in December 2017. This Masterplan proposals booklet includes architecture, landscaping, car parking and routes, infrastructure, sustainability, civil engineering and the cost plan for the Athalassa campus.

Indicative Masterplan phasing has been used for the purposes of the proposals document but this could be revised as and when necessary following the changing needs of the UCY.

# 1.0 Executive Summary

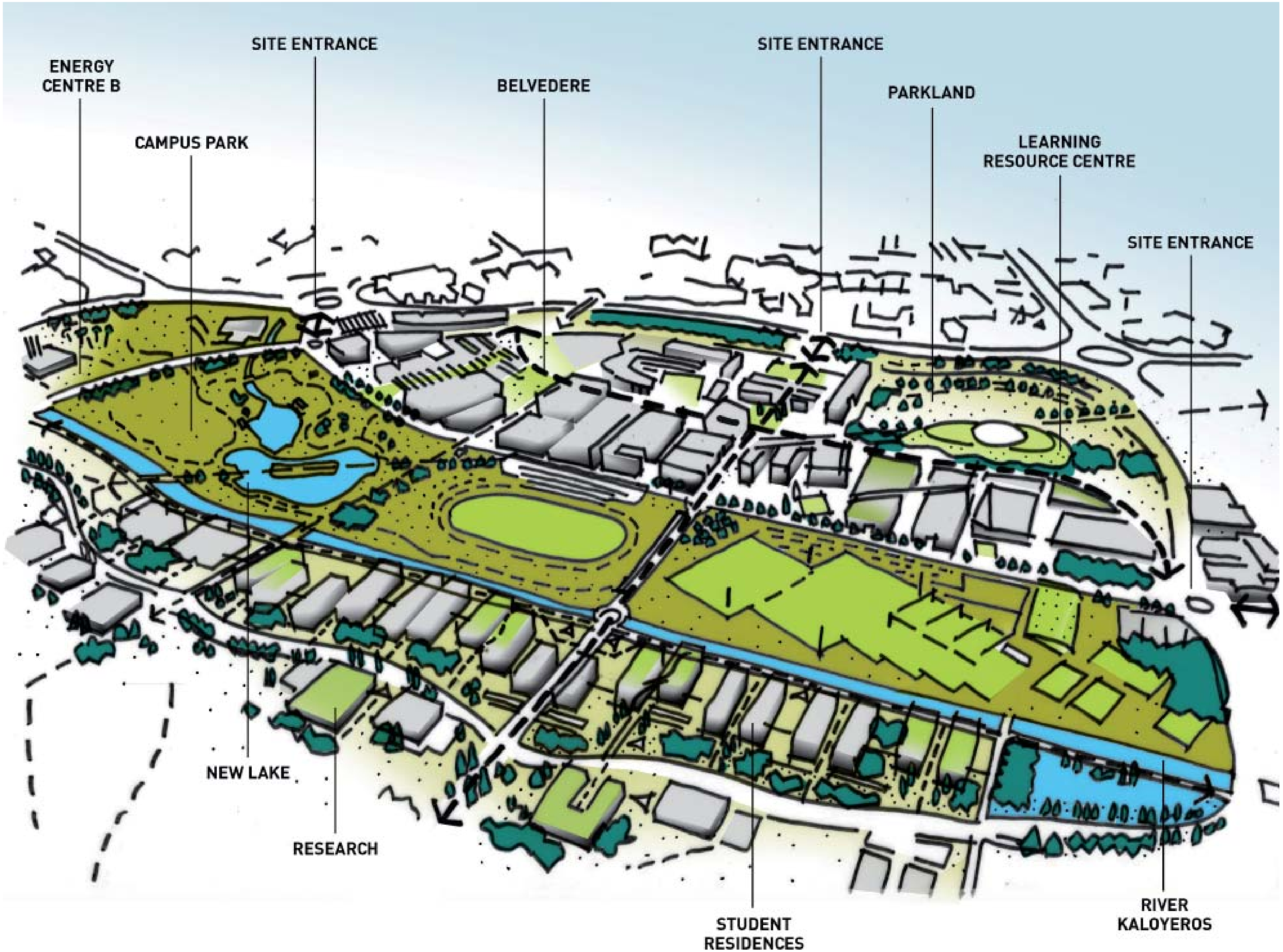
# Masterplan Vision

A Masterplan provides a long-term vision as to how the campus should grow to meet future needs while preserving the University's vision and culture. The University of Cyprus has been developing, updating and re-evaluating it's Masterplan for the last 20 years.

ADP's Masterplan will enable the University of Cyprus to achieve its ambition, to provide cutting-edge education and research in a sustainable environment for its staff, students and the wider community.

Future growth on Athalassa site will be directed to maximise the potential of the spectacular location and local climate, with low-energy environmentally-responsible principles embedded into long-term planning for the campus to achieve a nearly zero energy emission Green campus.

Athalassa will remain the main campus, whilst the University will retain its physical presence at Academia and continue to promote its cultural profile at Axiothea in the centre of Nicosia.



# Masterplan Principles

Zoning controls site allocation but allows diversity of architectural approach.

Passive and sustainable design to minimise energy usage combined with use of renewable energy sources and storage and re-use of rainwater.

Belvedere (main pedestrian route) enhanced to give greater sense of place through cafes, break-out areas for social learning.

Formal pedestrian routes extended south of river Kaloyeros to connect new student residential area.

Improved pedestrian and cycle connections into Athalassa Forest.

New student residences on campus and increased social activity to reduce car movement to and from site.

Campus Park landscape forms green focus of the campus.

New lakes and indigenous planting to create new natural habitats and a campus integrated into its landscape setting.

Favourable climate and landscape exploited to create opportunities for students and staff to benefit from exercise and well-being.

Car parking rationalised and reduced, with improved public transport and encouragement of cycling and walking.

### » Number of locations:

Athalassa will be the main academic campus of UCY with 90% of its academic activities on campus. University of Cyprus (UCY) intents that the Academia site will accommodate the department of Architecture with a possibility of accommodating Art in the future. It is important that UCY retains its presence in the old city via promoting cultural activities at the Axiothea centre.

### » Athalassa campus capacity:

The evaluation process concluded that the Athalassa campus has significant capacity to expand beyond 10,000 FTE students. The design team has primarily focussed on achieving the target of 10,000 students by 2025 as identified by UCY.

The Masterplan proposal presented here, shows indicative phasing for the allowable development (phases 1-3) as set out in the planning authority's co-efficient for the campus, and explores a future Masterplan option of going beyond the allowable development (phase 4). The student capacity of the Masterplan is estimated at 13,820 students and capacity for the Future Masterplan is estimated at 20,000 students. Enrolment numbers might be lower based on the educational consultant's (ECS) growth model.

### » Zoning:

The Masterplan and Future Masterplan proposals retain the main zoning principles of the 2008 Masterplan ('Social', 'Academic', 'Green') and incorporate a new Residential zone south of the river followed by a future Research zone. The area to the north boundary of the campus will be used as parking within landscaped areas.

### » Green campus:

The aspiration of UCY to become a 'nearly zero' energy University has affected all aspects of the Masterplan proposals. Green policies and targets, based on a Lean, Clean, Green approach, have been set up. On campus residential accommodation for 1920 students, improvements to public transport, reduction of vehicular movement to and from University sites and phased rationalisation of the use of private cars, are proposed and will have a great impact in moving towards a Green campus.

### » Relationship between campus and city:

The northern boundary of the campus is the main frontage of UCY to the city of Nicosia. Along with the landscape improvements proposed at the north-west boundary, the Masterplan proposes that the north-east boundary is enhanced via landscape to be designed in a way to promote the landmark building of the LRC and allow views towards the campus. Distinct gateways are proposed to identify all three main vehicular entrances to the campus.

### » Relationship between campus and Forest:

The Masterplan proposes the enhancement of existing visual links and new routes and vistas towards the Forest of Athalassa. In order to strengthen the connection between the campus and its natural environment, a new trim trail route is proposed to go through the south of the site and connect to the Forest routes at the south-west of the campus. Landscape proposals include the physical link of the Forest to the Residential zone by extending the Forest footprint to the landscaped areas of the residences.

### » Transport policies:

The University considers existing car usage as the main concern in the process to achieve the target of a Green campus. The Masterplan transport policies take this into consideration and propose a parking provision, adopting a ''reduce and rationalise'' strategy. Reducing the parking provision despite the increase in number of students, would support the approach of encouraging more sustainable travel behaviour, public transport, cycling and walking. Measures such as students' discounts with buses, and providing more accessible and safe walking and cycling paths are proposed.

### » Car parking:

As part of the "reduce and rationalise" approach of car usage on campus, the large areas of ad-hoc parking will be phased out and replaced during the Masterplan phases. A strong parking management strategy and enforcement is recommended to avoid overspill parking on the surrounding roads, inside and outside the University.

### » Infrastructure:

Infrastructure strategies take into account firstly the target of 10,000 students but allow for future expansion of the campus. A new Service Road south of the river will primarily service the student residences but can be used for future research units or academic development south of the residences should it be required in the future. A new energy centre has been designed with the capacity to service the allowable development and the opportunity to expand in the future to service future phase 4 development.

» Student accommodation:

In addition to the 208 student residences already on campus, the Masterplan proposes that 1920 new student residences are located south of the river Kaloyeros creating a new residential zone. A new road will service the student residences south of the river. The residences are envisaged to be developed in phases with the majority of these developed under phase 2 as from the evaluation report the location of student residences on campus was identified as urgent to promote the community feel and sense of place on campus.

» Learning environment:

During the evaluation stage, it was identified that the Athalassa campus lacked informal learning spaces. New commercial outlets and break out spaces are proposed to form a new social hub in the heart of the campus between social and academic facilities. A continuous network of social learning areas along the Belvedere is proposed to create a stronger bond between academic and social uses.

» External spaces:

The Masterplan is based around the concept of a Green campus which not only addresses principles of sustainable travel, materials from a sustainable source, use of renewable energy and capture of rainwater for reuse; but is also visually evident from the extent of proposed planting around and through the campus within which the buildings will sit. Tree planting in particular will provide screening functions to perimeter car parks, shade to parked cars and habitat corridors. The planting would extend from the Athalassa Forest Park to the west and from Aronas Hill to the north as well as providing a setting for the proposed student accommodation – conceiving these as buildings in a Forest clearing. The existing tree planting across the campus would be enhanced to provide greater shade and setting to buildings whilst using trees to frame key views and vistas to and from the campus.

» Architecture department in Academia:

The Academia campus is currently being upgraded as part of the EU funded projects and is expected to provide UCY with modern facilities that can be used for academic use. It is understood that the Academia campus will accommodate the Architecture department of UCY and potentially the new Faculty of Fine Arts in the future. The UCY's initial intention was that Architecture would be located in Nicosia Old Town, however, following confirmation from UCY, the Architecture department will be relocated to the Academia campus. Our strategy for the Academia campus is to cluster all parking spaces to the west of the campus and provide new landscaped key spaces / courtyards to be used by students and visitors for events, taking advantage of the great views to the Academia Forest.

» Old city:

UCY's premises in the city centre should be promoted as the "shop front" of the University. Cultural events and other activities should be promoted at the Axiothea cultural centre as a direct link between the University and the city.

# Masterplan Proposal

| | |
|---|---|
| **EXISTING DEVELOPMENT:** | 85,700m$^2$ |
| **PHASE 1** | |
| **LRC:** | 15,940m$^2$ |
| **ENG:** | 30,110m$^2$ |
| **MED:** | 8,600m$^2$ |
| **CTF03:** | (as below) |
| **FST03;** | 12,600m$^2$ |
| **ENE02:** | 1,600m$^2$ |
| **PV PARK:** | 290m$^2$ |
| **ADM02:** | 500m$^2$ |
| **PHASE 2** | |
| **LTR01:** | c.5,000m$^2$ |
| **HUM01:** | c.5,500m$^2$ |
| **SCE01:** | c.7,500m$^2$ |
| **LAW01:** | c.2,400m$^2$ |
| **SRB:** | c.20,700m$^2$ |
| **SRC:** | c.15,975m$^2$ |
| **SPF21:** | c.1,500m$^2$ |
| **INV:** | c.7,000m$^2$ |
| **AC1:** | c.5,000m$^2$ |
| **NONAC1:** | c.2,500m$^2$ |
| **MNT01/STR01:** | c.500m$^2$ |
| **PHASE 3** | |
| **CLC:** | c.6,500m$^2$ |
| **AC2:** | c.3,500m$^2$ |
| **SRD:** | c.10,800m$^2$ |
| **SRE:** | c.7,425m$^2$ |
| **SPF06:** | c.500m$^2$ |
| **TOTAL (EXISTING AND PROPOSED PHASES 1,2,3):** | 257,640m$^2$ |
| **ALLOWED DEVELOPMENT:** | 257,650m$^2$ |

# Future Masterplan Proposal

**EXISTING DEVELOPMENT:** 85,700$m^2$

**MASTERPLAN DEVELOPMENT:** 257,640$m^2$

**PHASE 4**

| | |
|---|---|
| FD1: | 6,000$m^2$ |
| FD2: | 5,000$m^2$ |
| FD3: | 5,000$m^2$ |
| FD4: | 4,500$m^2$ |
| FD5; | 5,000$m^2$ |
| FD6: | 2,000$m^2$ |
| FD7: | 15,000$m^2$ |
| AC3: | 30,000$m^2$ |
| AC4: | 7,000$m^2$ |
| AC5: | 7,000$m^2$ |
| AC6: | 7,000$m^2$ |

**TOTAL PHASE 4:** 93,500$m^2$

**TOTAL (EXISTING AND PROPOSED PHASES 1,2,3,4):** 351,140$m^2$

# 2.0 Masterplanning and Architecture

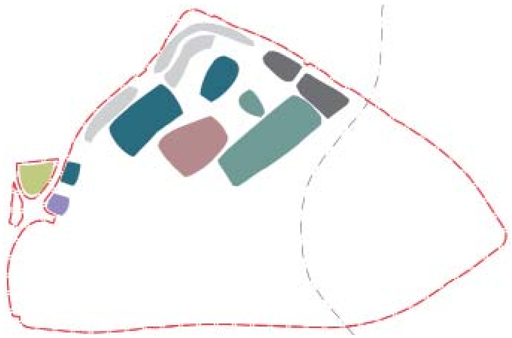
# Zoning

The key concept of the Masterplan is to have a central landscaped space, a focus around which all other activities are organised. The site is zoned into areas of different uses, with the academic areas occupying one side of the central green space, and residential to the other side. Zoning areas are defined by the site's natural features and enscarpment.

Our zoning proposals show the intent to retain the main zoning principles of previous Masterplans, the adjacency of social and academic zones, but allowing more flexibility in terms of building locations, to allow the prioritisation of the completion of the academic buildings within the campus core area.

A new residential zone is proposed south of the river Kaloyeros. The large Green Zone shown between the academic zone and the river will be the main green heart space of the campus in the Masterplan. Open air sports facilities will be located within the Green Zone, with indoor sports buildings like the Olympic sized swimming pool are proposed to be kept adjacent to the indoor sports hall.

The area to the north boundary is proposed to be landscaped parking areas. By doing this, vehicular movement and the majority of private cars can be clustered to the north boundary and release the heart of the campus for pedestrians.



EXISTING ZONING


PROPOSED ZONING DIAGRAM

# Land Use

The current development at the Athalassa campus has large gaps between buildings that create empty sites some of which are currently used as ad-hoc parking spaces by students and staff. The campus does not create a “sense of place”. This is partly the result of the very specific locations of faculties and other activities given at the 1994 Masterplan, followed by the 2008 Masterplan review which located buildings on specific plots, remote from one another.

This Masterplan prioritises the development and completion of the building grain within the Academic zone and locates buildings such as the Innovation Centre and the Cultural Centre to key areas of the campus. This will complete the “urban grain”, create a greater “sense of place”, and create opportunities for activity and social learning.

The student residences will attract students and generate activity focussed on the Green Zone and will help identify and animate the south edge of the campus.


PROPOSED LAND USE DIAGRAM

# Expansion of Campus

The capacity of the Athalassa site has been evaluated, and it has significant capability to accommodate future growth, first to meet the target of 10,000 undergraduates, and beyond: sufficient for the University's foreseeable future needs.

Future growth will be phased, initially within the area of allowable development outlined in existing planning policies, and then (subject to permission) in addition to this amount.

**Current Development:**

» The completion of the Library Resource Centre (LRC) and the under construction Engineering School (ENG) will define the central academic/social space of the campus further, as these are located to the north east and south west boundaries of this central area respectively.

» The Medical School (MED), Department of Biology (FST03), Common Teaching Facilities 3 (CTF 03) and multistorey car park (PRK04) are currently under design or tender.

**Development In Design:**

» With the progression of the above projects, the main academic zone of the campus will be enhanced and the south boundary of the Belvedere will be clearly defined by a continuous building frontage. It is anticipated that this, combined with the increased number of students, will lead to higher utilisation of the social facilities north of the Belvedere and subsequently increased demand of social areas. The Masterplan includes recreational and social learning areas in existing buildings "breaking out" onto the Belvedere.

» At the same time, the construction of the Campus Park, Infrastructure B, Energy Centre B (ECB) and the Apollo PV Park will provide the necessary infrastructure and open area to support the new development.


Current Devlopment Diagram


Next Steps Diagram

# Expansion of Campus

**Masterplan Development:**

- Provides a coherent academic/social central zone within the boundaries of the peripheral Service Road by locating academic buildings in between existing buildings to strengthen the routes and the relationships between academic buildings;
- Develops 1,920 new student residences in close proximity to the academic facilities and the natural environment of the campus south of the river;
- Provides active frontages to the Green Zone and encloses landscaped areas promoting their use;
- Clearly identifies the main north-south axial routes/vistas between new buildings;
- Enhances the Belvedere frontage by adding academic buildings to the east end and non academic buildings to the west end.

**Future Masterplan Development:**

- Provides additional space at the west boundary of the campus to act as the campus frontage to the main road;
- Allows space for more academic development adjacent to the Engineering School to increase the student capacity of the campus to 20,000;
- Provides a zone for research units close to the residential zone and the Forest of Athalassa, to satisfy demand for future research spaces and further enhance the activity, vitality and prestige of the campus.


Masterplan Development Diagram


Future Masterplan Development Diagram

# Computer Generated Image
# Future Masterplan view from south of campus

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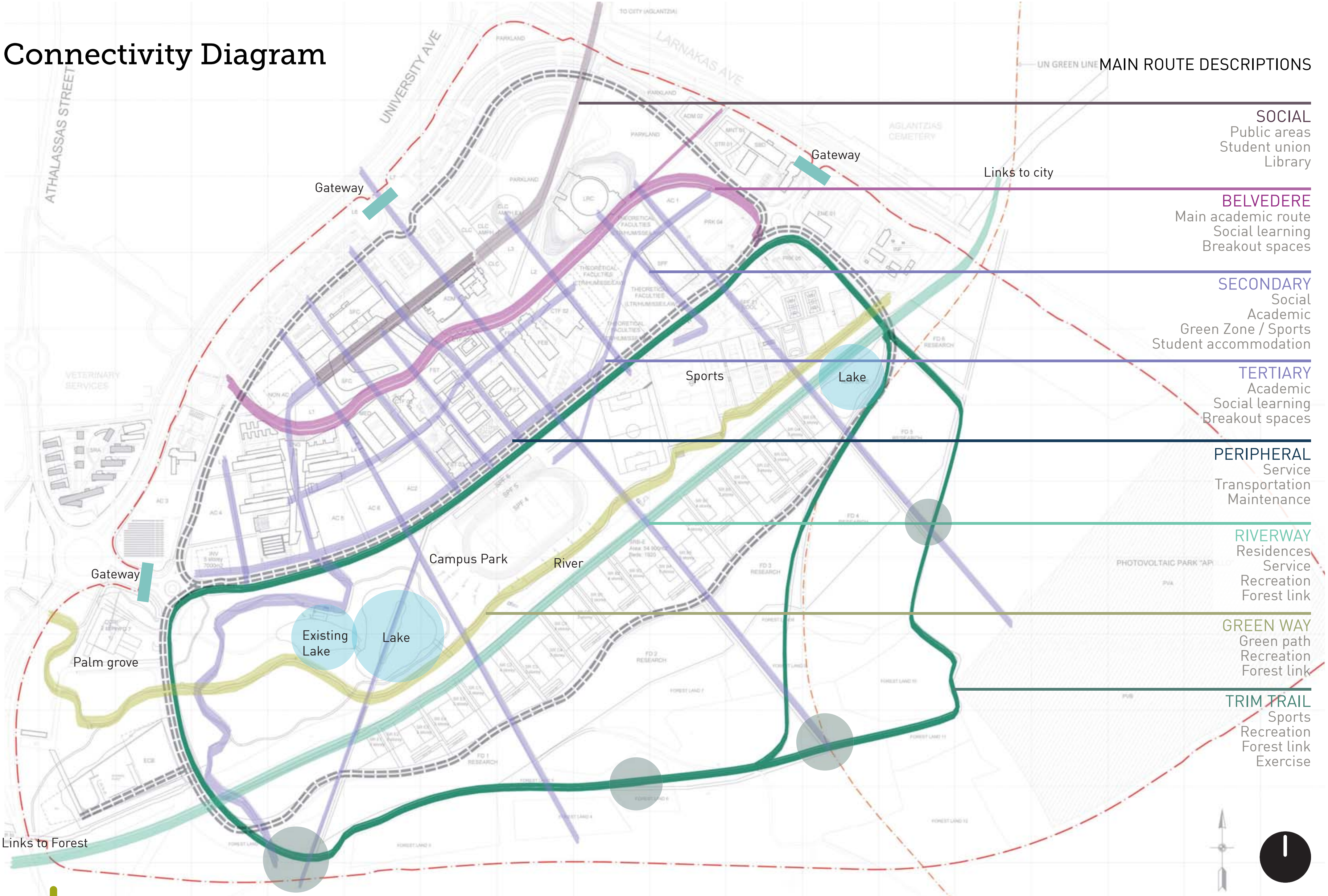
Computer Generated Image
Future Masterplan view from east of campus

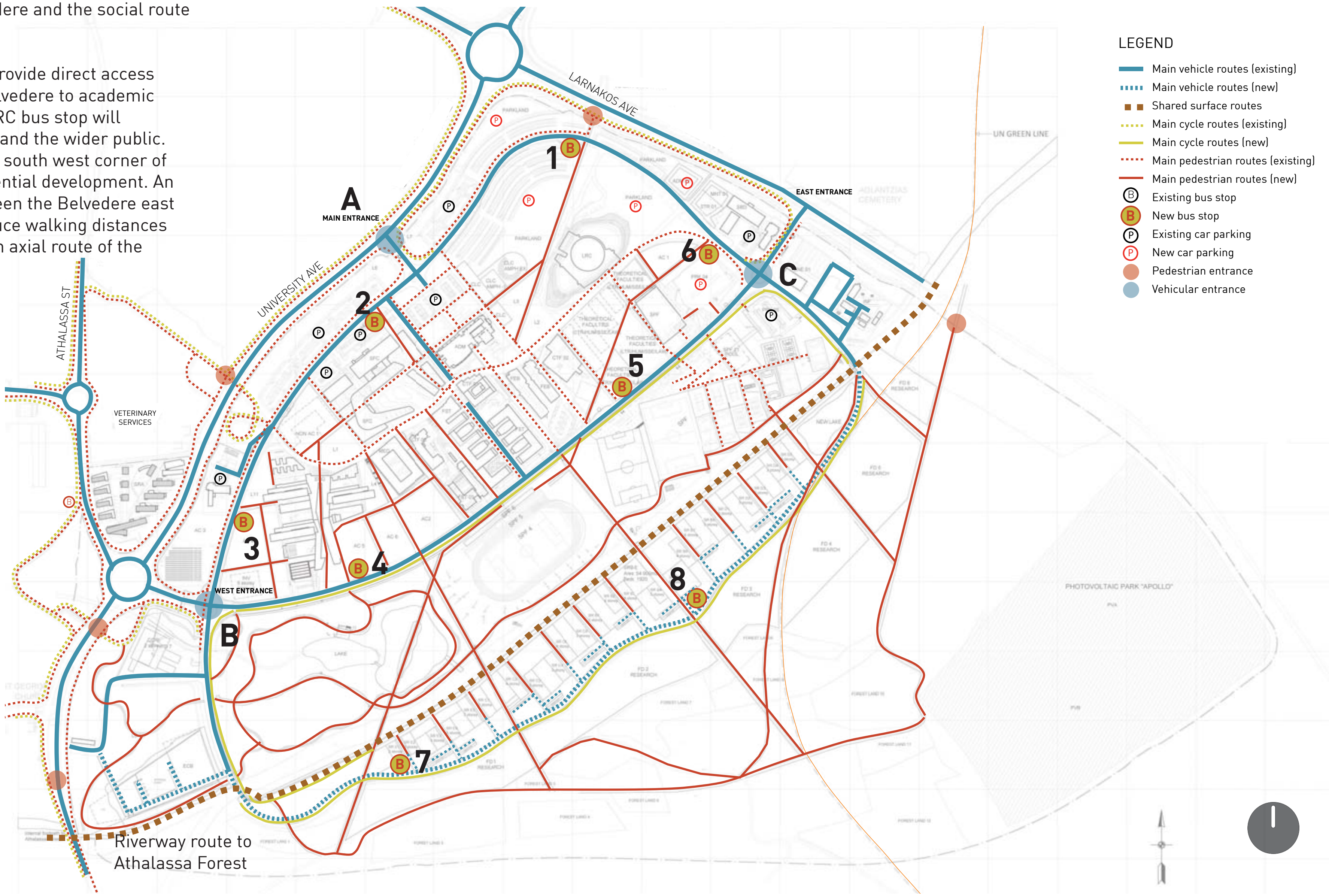
# Connectivity Diagram



# Network Diagram

Due to the “reduce and rationalise” concept of car parking proposed, the transportation modes used on campus change from car to bus. As indicated below, new bus stops are to be located at the junctions of the Belvedere and the social route with the peripheral Service Road.

Belvedere east and west bus stops provide direct access to the Belvedere and through the Belvedere to academic buildings and social facilities. The LRC bus stop will primarily be used by Library visitors and the wider public. The Engineering bus stop serves the south west corner of the campus including the new residential development. An additional bus stop is provided between the Belvedere east and the Engineering bus stop to reduce walking distances and provide direct access to the main axial route of the University House.



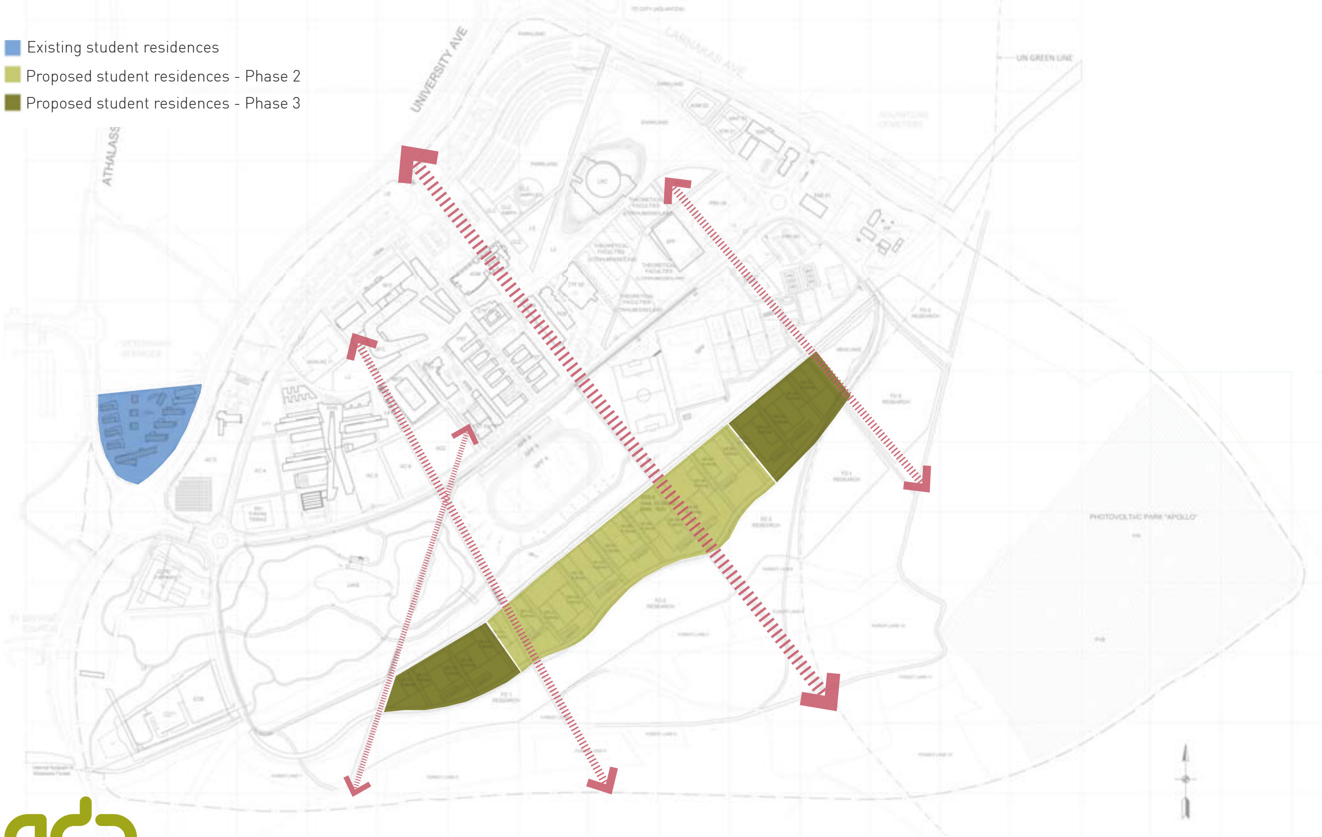

**BUS STOPS:**

1 Library
2 Central North
3 Belvedere West
4 Engineering
5 Central South
6 Belvedere East
7 Residences West
8 Residences Central

# Student Accommodation

The new residential zone is located to the south of the campus as a Riverside development adjacent to the green zone Campus Park. A new residential zone by the river will take advantage of all the benefits of this prominent location. Since the area south of the river is not developed, it will help to create a clearly defined residential zone with many opportunities for large, open, green public spaces which can be integrated into the Campus Park and promote it's use by students.

The main advantage of this proposal is that it is clearly identifying a residential zone south of the river, that can be developed in phases, based on the University's needs in the future. Development away from existing buildings reduces the impact of construction. Indicative phasing is shown below.




The exact mix of accommodation will depend on evaluation of target student requirements. A blend of clustered study-bedrooms, individual micro-flats, and larger units for academic researchers and visitors could be provided. Approximately 54,900m² will be required for student residences.

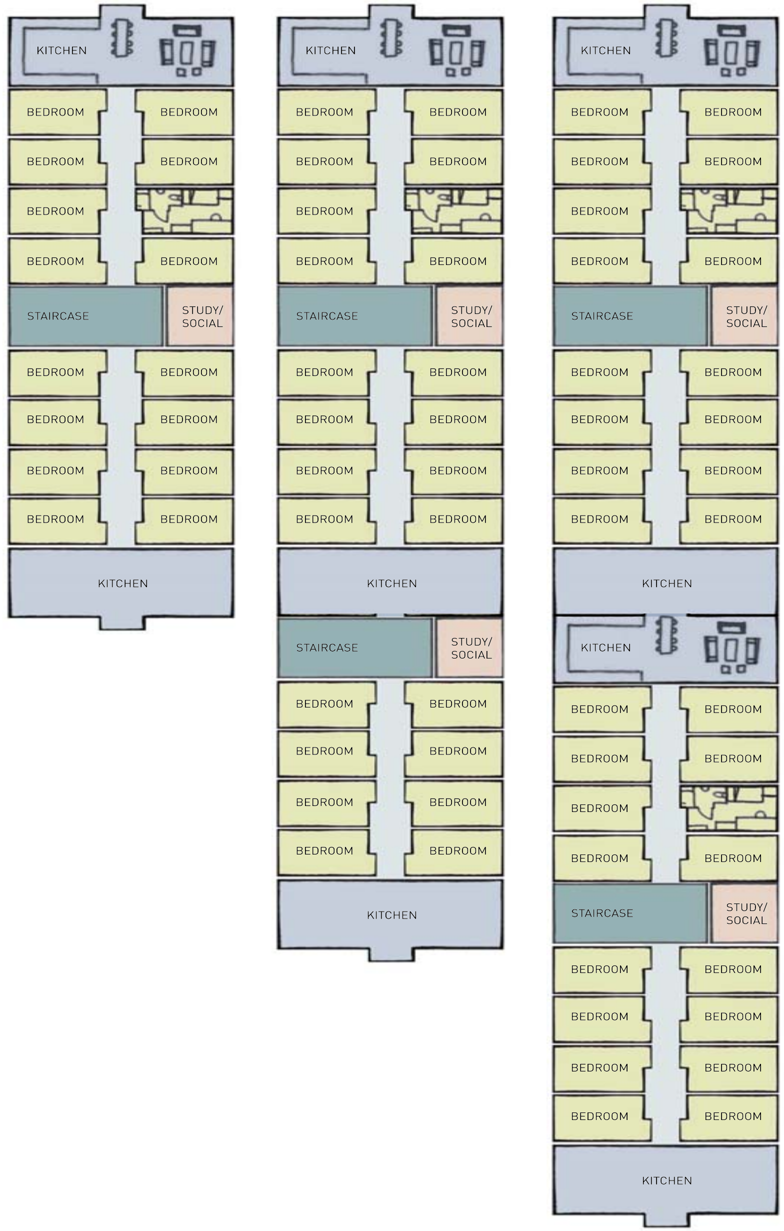
The student residence size used for the Masterplan is be based on approximately 28m² (gross). This is based on an analysis of precedent studies.

The 16 bed block allows for 16 ensuite rooms per floor with a central staircase with a study/social area and two kitchen/social spaces at the ends overlooking the Green Zone and the Forest. This forms the modular unit used to create the 24 bed block and 32 bed block.

16 bed block 15x30m

24 bed block 15x45m

32 bed block 15x60m



# Student Accommodation

MAIN CONCEPT PRINCIPLES:

- Orientation of the blocks takes full advantage of the great views towards the Forest of Athalassa to the south and the new Campus Park to the north. Social areas of the blocks are positioned to take advantage of the views and student residences will be positioned along the long side of the blocks.
- Landscaped/feature gardens are provided between blocks to be used mainly by residents.
- The ends of blocks are not aligned with the river but move closer or away from it in different locations to create activity spaces that can be used in conjunction with the Campus Park to promote use along the Riverway.
- The area surrounding the blocks is landscaped to bring the Forest within the residential zone.
- The Service Road to the south of the zone is to be used for service vehicles, drop off and pick up of students. Only few disabled and visitors parking spaces are provided.

PHASING:

Phase 1 residential development provides a total of 1,272 new rooms to the campus and together with the existing development will increase the on campus student residences to 1,480. The total area for Phase 1 residences is 36,675m².

Phase 2 residential development will provide a total of 648 new rooms to the campus and together with the existing and phase 1 development will increase the on campus student residences to 1,920. The total area for Phase 2 residences is 18,225m². P

After the completion of phase 2, both the residential and the Campus Park would be fully developed and the area south of the campus should become more vibrant and regularly used by students.


**SRB**
- Completed by 2024
- 704 Residences
- 28m² gross per unit
- 20,700m² area

**SRC**
- Completed by 2026
- 568 residences
- 28m² gross per unit
- 15,975m² area

| | |
|---|---|
| Total new rooms: | 1,272 |
| Existing rooms: | 208 |
| **Total rooms:** | **1,480** |


**SRD**
- Completed by 2028
- 384 Residences
- 28m² gross per unit
- 10,800m² area

**SRE**
- Completed by 2030
- 264 Residences
- 28m² gross per unit
- 7,425m² area

| | |
|---|---|
| Total new rooms: | 648 |
| Existing rooms: | 1,480 |
| **Total rooms:** | **1,920** |

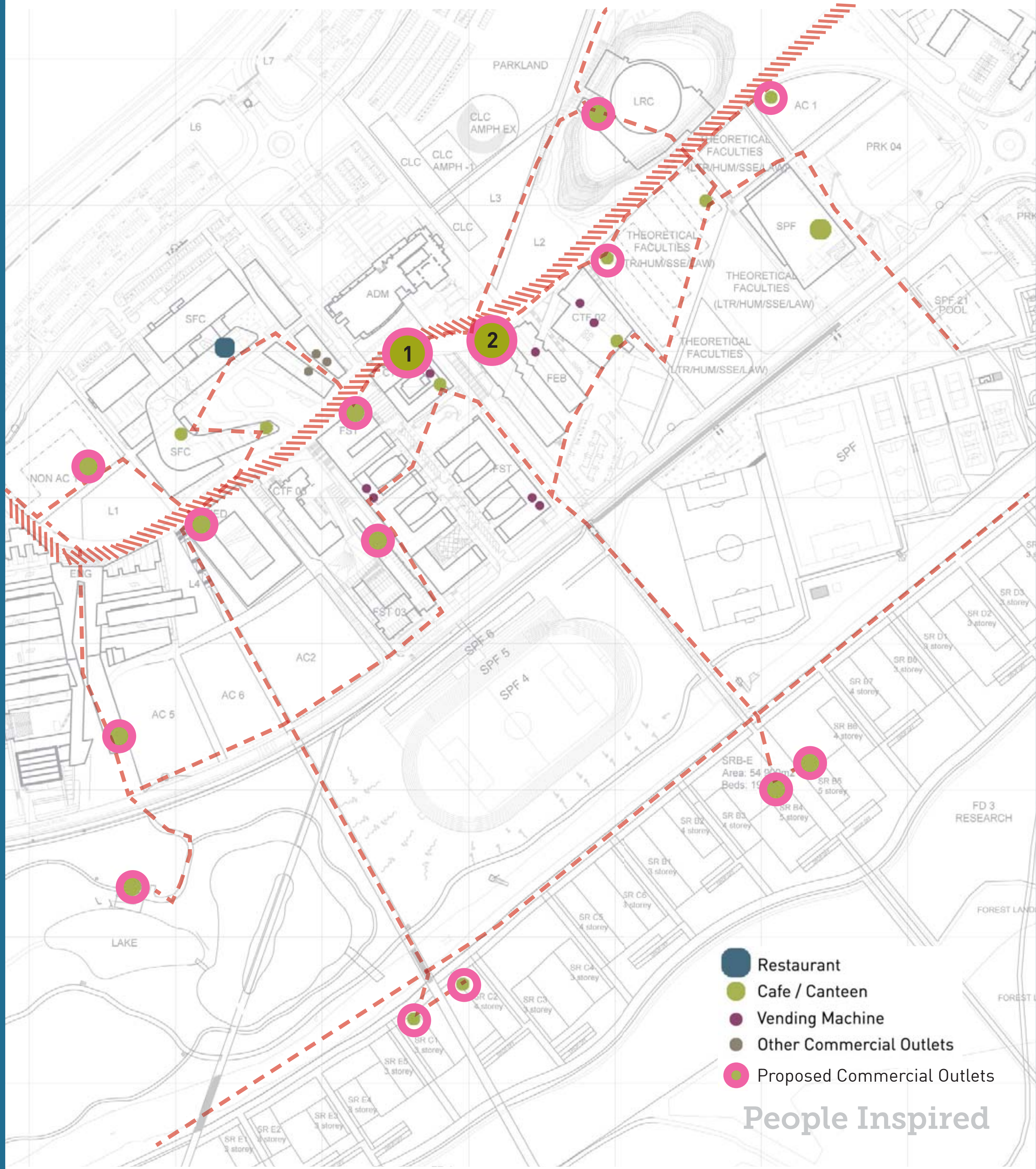
# Commercial Outlets

» The increased number of FTE students anticipated on campus in the future (10,000 by 2025) and the new residential zone proposed, will increase demand for commercial outlets.

» The commercial outlets proposal is influenced primarily by the desire to promote the use of the Belvedere and the social area created between the Belvedere and the social route by incorporating more outlets along this route. These can be used to also provide landscaped and shaded informal learning spaces.

» In conjunction with this main social area, commercial outlets are spread in other areas of the campus to promote movement to and from outlets and the use of new central routes/axes. New outlets are also indicated around the new residential zone and a Kiosk is located in the Campus Park area in close proximity to the existing lake.

» The routes created among the outlets connect the social, academic, green and residential zones of the campus.



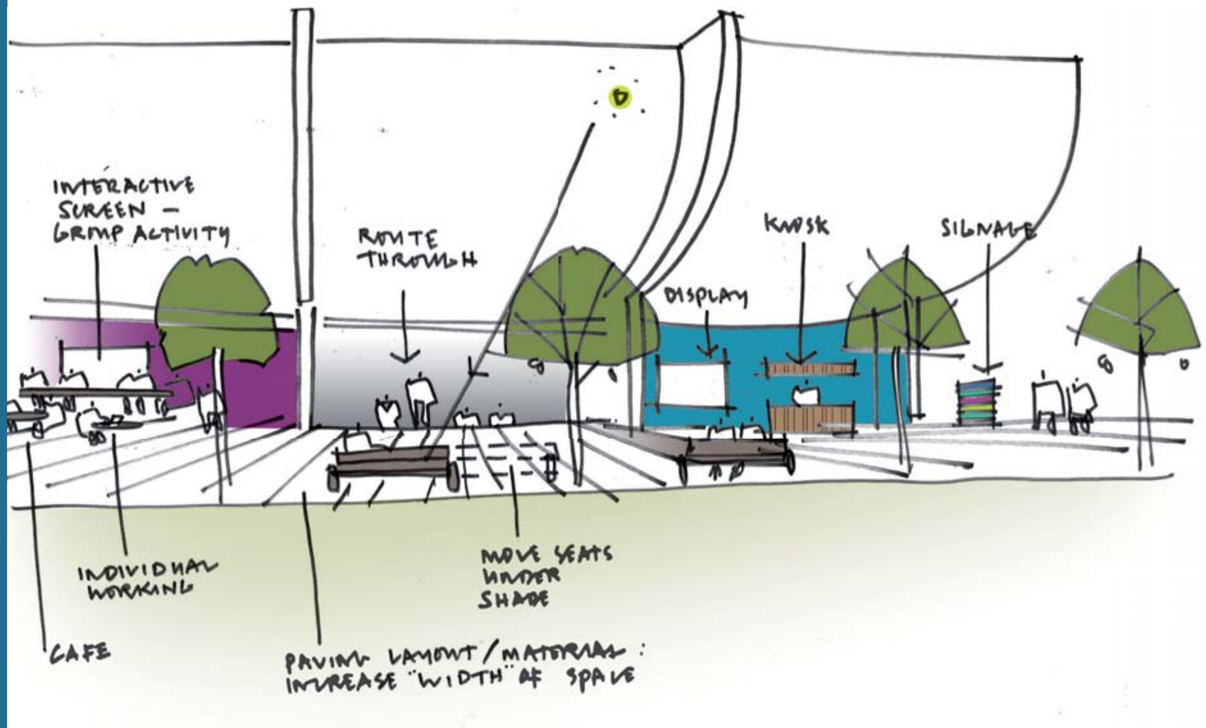
# Social Areas

» Area 1 - CTF 01 Breakout space

The Belvedere and the intermediate zone between this and the new social route is envisaged to be the most vibrant area of the campus with all faculties and social activities breaking out at this common public space.

The aim is to open up the inward-facing Academic buildings towards the Belvedere by minimal layout changes to the existing buildings.

The area shown here is below the amphitheatre canopies of CTF01. This area has nice shaded spots that could be developed into social learning areas for group study and external learning. It has the opportunity for the creation of a new cafe area and a viewing platform overlooking the Forest. This area is anticipated to blend into the Belvedere and promote student use.

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» Area 2 - FEB Breakout space

The frontage of FEB to the Belvedere is currently inward looking, and even though there is a viewing platform between FEB 1 and FEB 2 it is rarely used by students. This is mainly due to the fact that there is no destination at this location.

The proposal includes the creation of social learning/seating areas blending into the Belvedere to the frontage of the building and also promoting the use of the link bridge for seating. The bridge is naturally shaded by the adjacent buildings and provides great views towards the Forest and Aronas Hill.


2

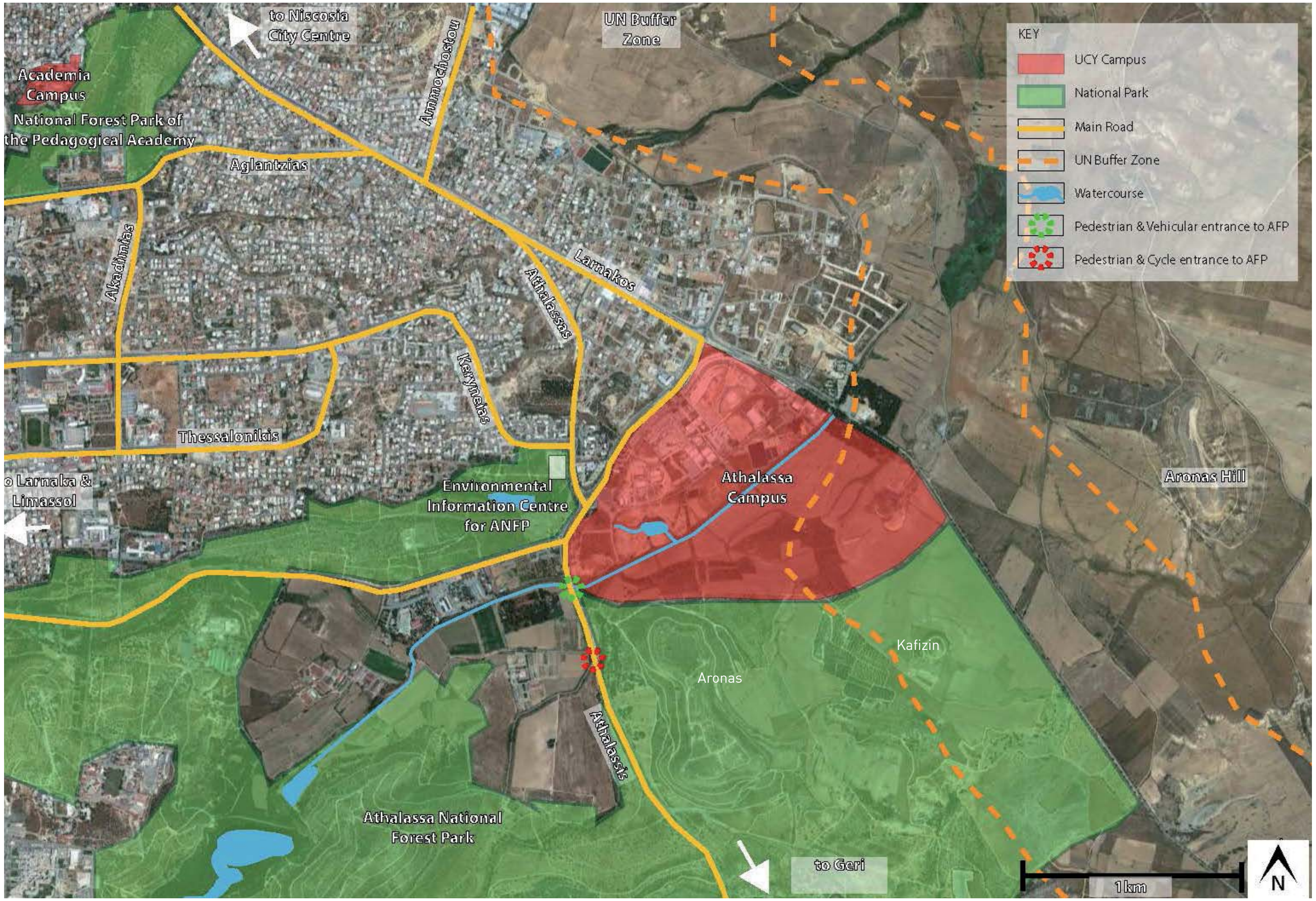
# 3.0 Environment and Landscape

## » Overall Landscape Masterplan Context

The campus is located to the south of Nicosia on the edge of existing development and partly within open space. To the immediate west lies the Athalassa Forest Park, an extensive recreational facility with footpaths, cycle tracks and picnic facilities.

To the south lies agricultural land dominated by the Aronas and Kafizin hills setting the background views from the campus.

The landscape Masterplan seeks to build on these natural features and thread the woodland, green space and path networks from outside in to the campus to create a green and accessible campus.



# Concept Landscape Strategy

The Masterplan is based around the concept of the Green campus which not only addresses principles of sustainable travel, materials from a sustainable source, use of renewable energy and capture of rainwater for reuse, but is visually evident from the extent of proposed planting around and throughout the campus within which the buildings will sit.

The Masterplan is also based on the requirement to attract and support greater student numbers as well as use by the general public. Tree planting in particular would provide screening functions to perimeter car parks, shade to buildings and parked cars, habitat corridors through which wildlife could travel from the surrounding landscape of Athalassa Forest Park to the west and from Aronas Hill to the south as well as provide a setting for the proposed student accommodation. Footpaths and cycleways would be created to link with those that emerge from the Athalassa Forest, see context plan. Tree planting would also be used to create spaces for active and passive recreation, to frame views across the campus and provide shade along walkways. The existing areas of tree planting across the campus would be enhanced to also fulfil these criteria.

The design philosophy for the green spaces across the campus is based upon enhancing the more informal space at the far western end of the site with the layout and function of the other key spaces becoming more formal towards to the centre of the campus in a response to the proposed uses.

### Area 1 - Palm Grove

The space forms a key boundary and frontage to the university. The proposed landscape will therefore provide a strong boundary and be visually interesting. It will also frame views from the adjacent highway in key locations and also from within the site to the church. The planting along the boundary will also screen the utilitarian substation building and the proposed energy centre.

### Area 2 - Pine Grove

The focal point of the area is the existing lake which is currently surrounded by cane grass and is not visible. It is proposed to control the perimeter vegetation to open up access and views to the water body, add aquatic planting, locate two timber viewing decks and provide a kiosk with refreshment and toilet facilities, a seating space with shade structure and cycle racks. The southern deck will provide a focus for an events space to the south.

A second, bigger lake, will be created to provide water storage for irrigation as well as increasing the biodiversity of the campus and a visual amenity within the parkland. This will be set within the avenue of existing trees and retained as an island, linked by two pedestrian timber footbridges. The lakes will be aerated through an aerator/fountain feature to maintain water quality. Both lakes will be planted with marginal and aquatic planting to enhance the biodiversity.

### Area 3 - The Arboretum

The tree planting will comprise a mix of native species showing the diversity of trees from across Cyprus. Larger canopy species will be used nearest the stadium to provide shade to spectators of the athletics.

The excavated material from the lake will be used to create a mound around the south of the stadium from which spectators can sit and watch the events. It is proposed that the area will be seeded and irrigated to provide stability to the earthworks as well as a more appropriate finish for sitting.

The main axis from the teaching facilities will continue across the park into the student accommodation zone. It will be partly shaded and will have trees on either side that can seasonally bloom and provide scent, such as Almond and Cherry trees. They will create a strong visual feature when viewed from the Belvedere. The trees will also provide a sense of place when sitting under the canopies when watching the sports, particularly when combined with other species such as Silk, Pepper and Mastic trees.

### Area 4 - Central Plaza

This area is the termination of the central axis and vista through the campus from the administration building. Framed by an avenue of trees and a bridge across the river, the plaza is an introductory space to the residences along the river.

The space would comprise an area of hard paving with feature shade canopies and shade trees for both formal and informal gatherings and events. It will comprise formal and ornamental shrub planting beds that will provide year round interest. These will be set at grade to allow the capture of any surface water run-off.

### Area 5 - Cultural Quarter

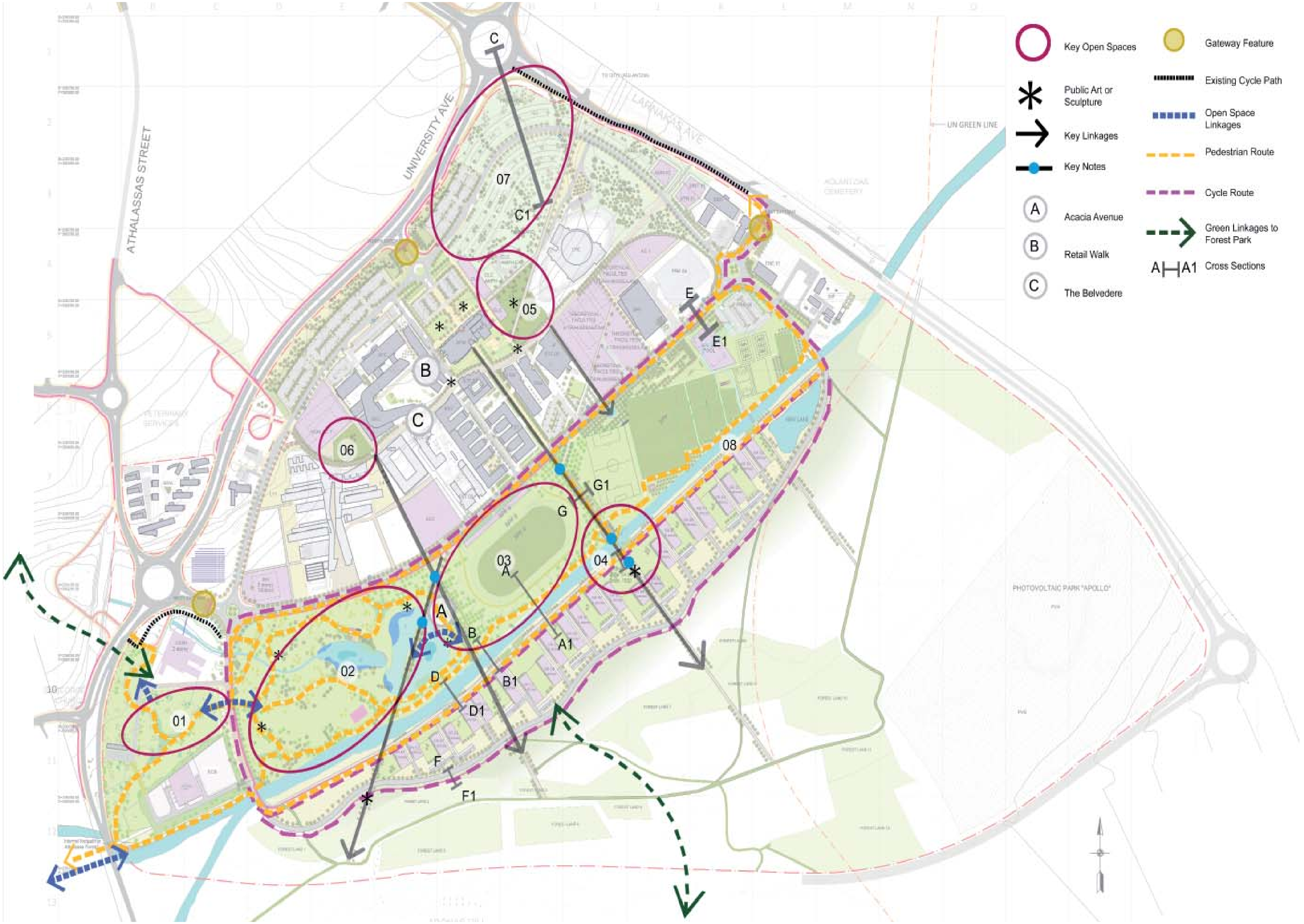
The Belvedere is the currently the main social axis of the campus where a series of spaces provide different opportunities. Three significant new areas would be created following development. The first area is located between the administration building and the learning resource centre which would provide a space for outdoor learning. A series of small gardens with sculpture pieces within the spaces would break down the scale of the buildings and increase the carrying capacity for the projected growth in student numbers. The second area would be outside the proposed culture learning centre building in the form of an outdoor amphitheatre constructed in hard landscape materials.

### Area 6 - Engineering Plaza

This is an important space located off the Belvedere immediately opposite the engineering building and located between a proposed non-academic building and the student activity zone. It is proposed to create an outdoor lecture space, and an area for displaying innovation in engineering. The area would be partially hard surfaced but bordered by shade tree planting, ornamental shrubs and irrigated lawn.

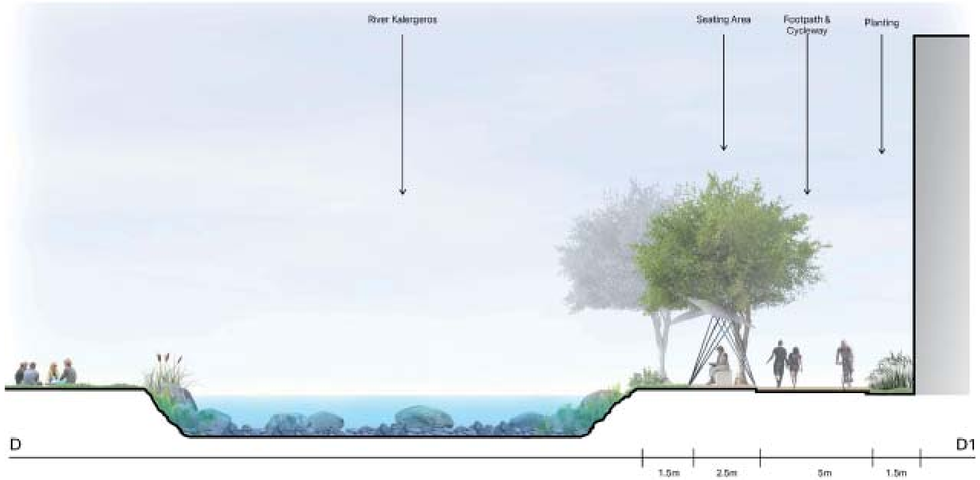
### Area 7 - Woodland Parking

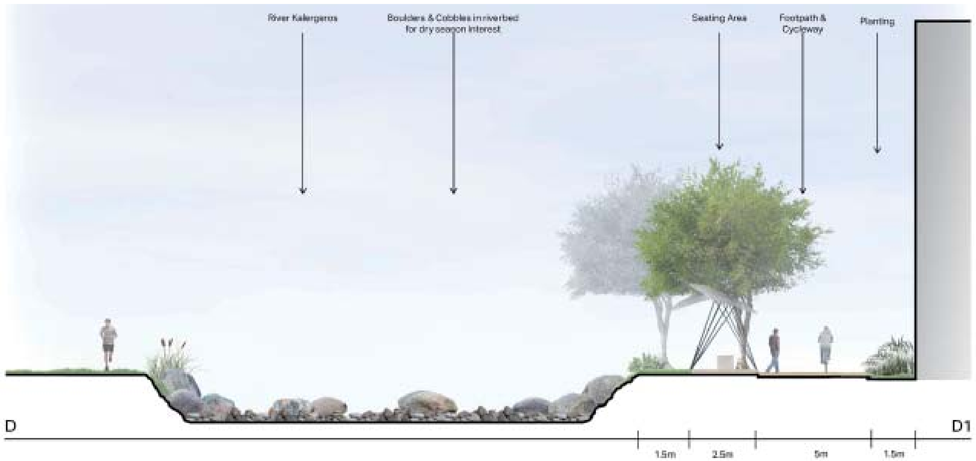
The existing area of parking in the northern quadrant of the campus would be retained and formalised with concrete paving blocks and spaces marked out in contrasting colour blocks. Extensive tree planting would be set within the car park bays to create the impression of woodland. The trees would assist in screening the cars from outside the campus as well as framing views to the learning resource centre by using taller growing species at the edge of the view cone.


Key Open Spaces
Public Art or Sculpture
Key Linkages
Key Notes
Acacia Avenue
Retail Walk
The Belvedere
Gateway Feature
Existing Cycle Path
Open Space Linkages
Pedestrian Route
Cycle Route
Green Linkages to Forest Park
Cross Sections
UNIVERSITY AVE
ATHALASSAS STREET
LARNAKAS AVE
UN GREEN LINE
PHOTOVOLTAIC PARK "APOLLO"
01
02
03
04
05
06
07
08

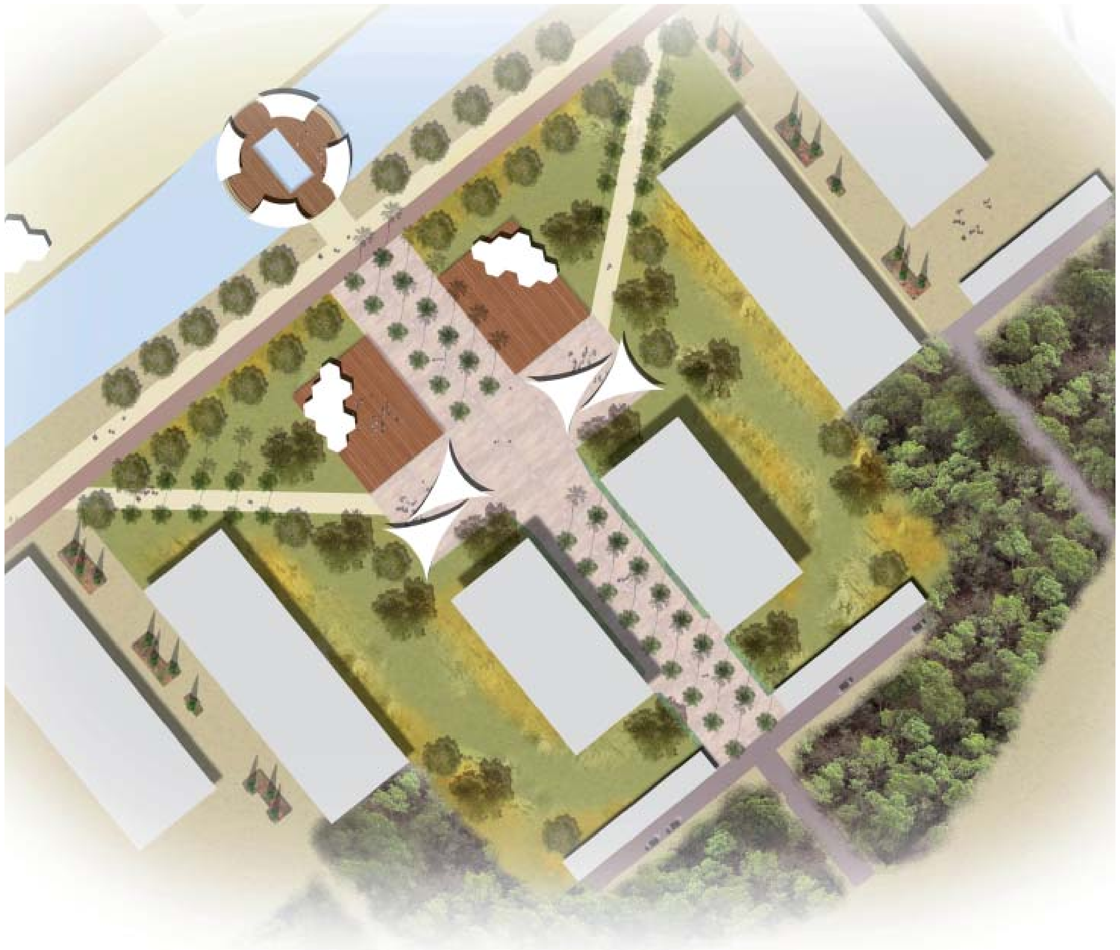
# Concept Landscape Drawings

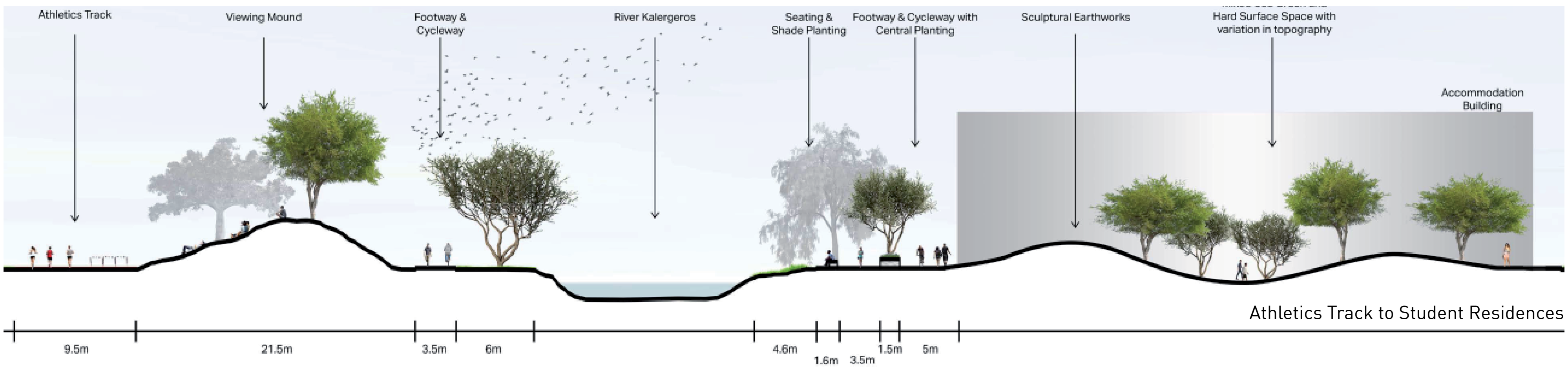
River during Wet and Dry season

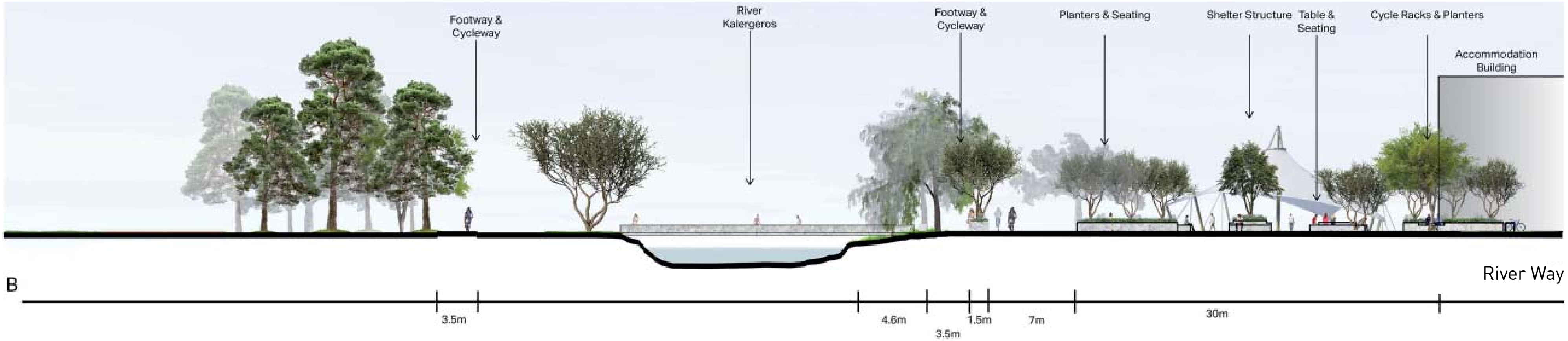


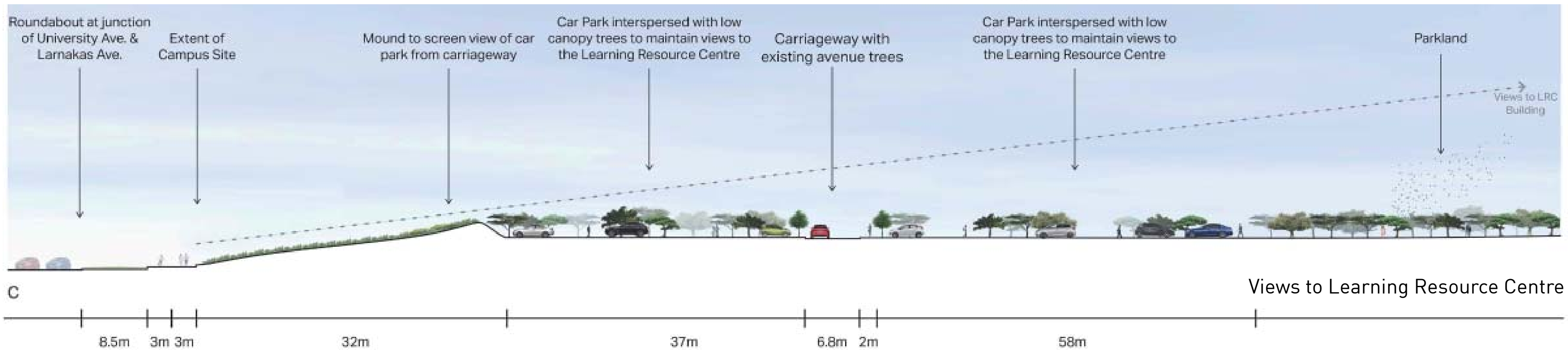




Area 7 - Central Plaza




Athletics Track
Viewing Mound
Footway & Cycleway
River Kalergeros
Seating & Shade Planting
Footway & Cycleway with Central Planting
Sculptural Earthworks
Hard Surface Space with variation in topography
Accommodation Building
Athletics Track to Student Residences
9.5m
21.5m
3.5m
6m
4.6m
1.6m
3.5m
1.5m
5m


Footway & Cycleway
River Kalergeros
Footway & Cycleway
Planters & Seating
Shelter Structure
Table & Seating
Cycle Racks & Planters
Accommodation Building
B
River Way
3.5m
4.6m
3.5m
1.5m
7m
30m


Roundabout at junction of University Ave. & Larnakas Ave.
Extent of Campus Site
Mound to screen view of car park from carriageway
Car Park interspersed with low canopy trees to maintain views to the Learning Resource Centre
Carriageway with existing avenue trees
Car Park interspersed with low canopy trees to maintain views to the Learning Resource Centre
Parkland
Views to LRC Building
C
Views to Learning Resource Centre
8.5m
3m
3m
32m
37m
6.8m
2m
58m

# Student Accommodation Area

The student residences would be located on the south side of the river arranged in pairs of blocks that would have a pedestrian only street between them.

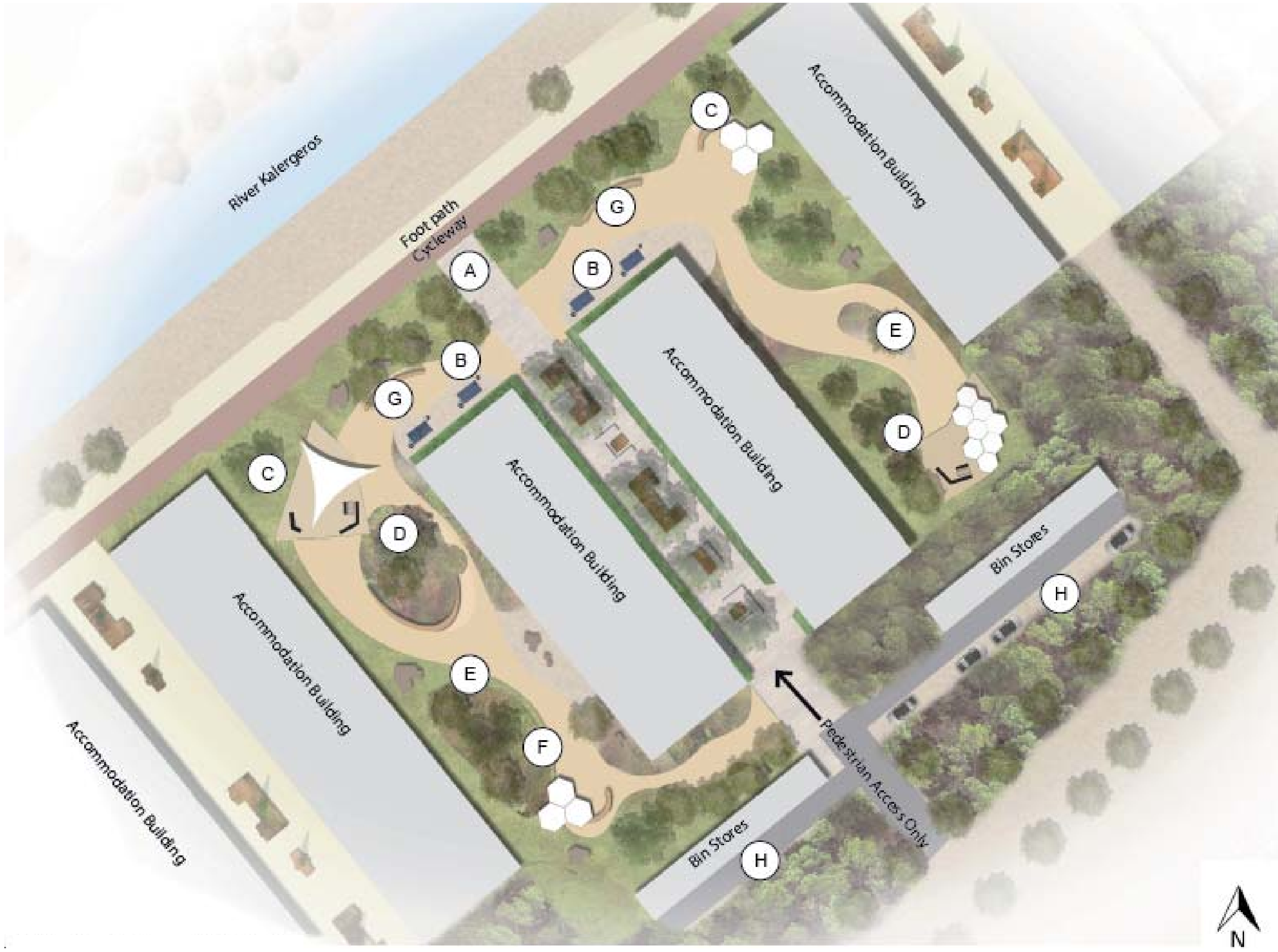
The surfacing would either pre cast concrete blocks or exposed aggregate concrete with banding across the space to break up the linearity. Limiting the mix of paving materials would assist in maintaining the simplicity of the design and enable the building façades to be more animated.

The space would support raised planting beds with shade trees, integral seating, bicycle storage, free standing seats, opportunities for sculptural features and possible water features to create a sense of cooling. The spaces could be formal whilst others could have a more organic layout as illustrated in the indicative layouts as long as they complied with means of escape and access for disabilities.

Material excavated from the building foundations could be used to create interesting landform to articulate the space.

Planting would be located as a strip around the ground floor, essential in the vicinity of bedrooms, to provide an area of defensible space for the residents.

A Pre cast concrete block paving with banding to pedestrian only street areas between student accommodation
B Local activity area for block residents comprising outdoor table tennis tables and shade
C Informal native planting emulating local landscape
D Large canopy native shade trees to reduce surface heating, cool local environment and encourage the use of outdoor space
E Informal native planting emulating local riverside/stream side landscape with native species mix set among gravel and locally sourced boulders and rocks
F Informal social gathering area located next to large canopy native shade trees
G Seating Bays
H Loading Bays/Temporary Drop Off Zone




Typical Space Behind Residential Blocks

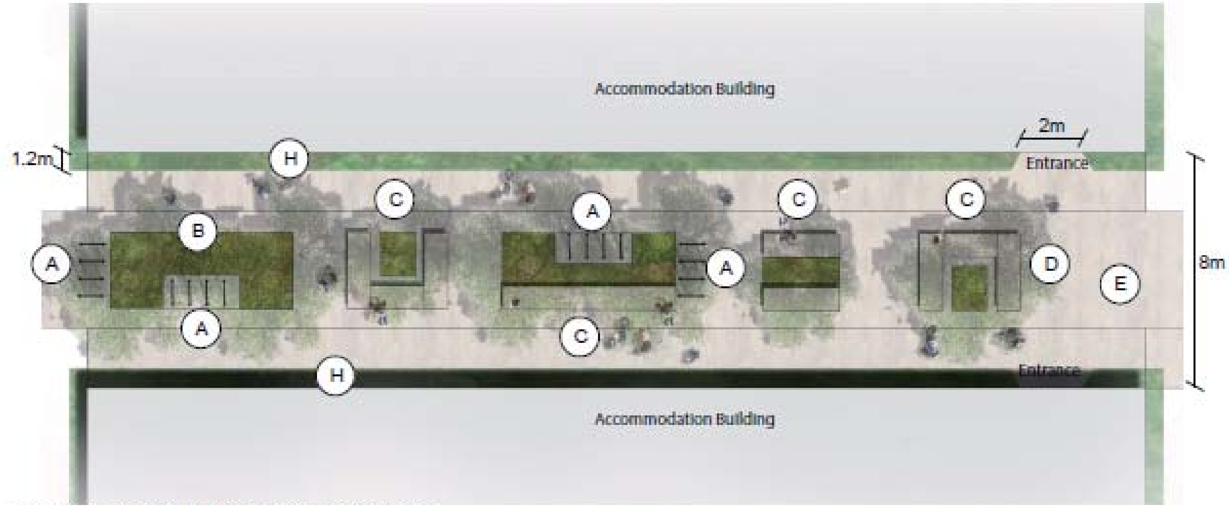
# Student Accommodation Area

The planting would continue through the built form and link with the existing woodland currently developing in the farmland zone and situated around the foot of the Aronas Hill. This planting
would provide visual and physical connectivity i.e. creating corridors by bringing in the trees from outside through and across the campus to provide settings to the buildings, shade for buildings and people, and wildlife habitats.

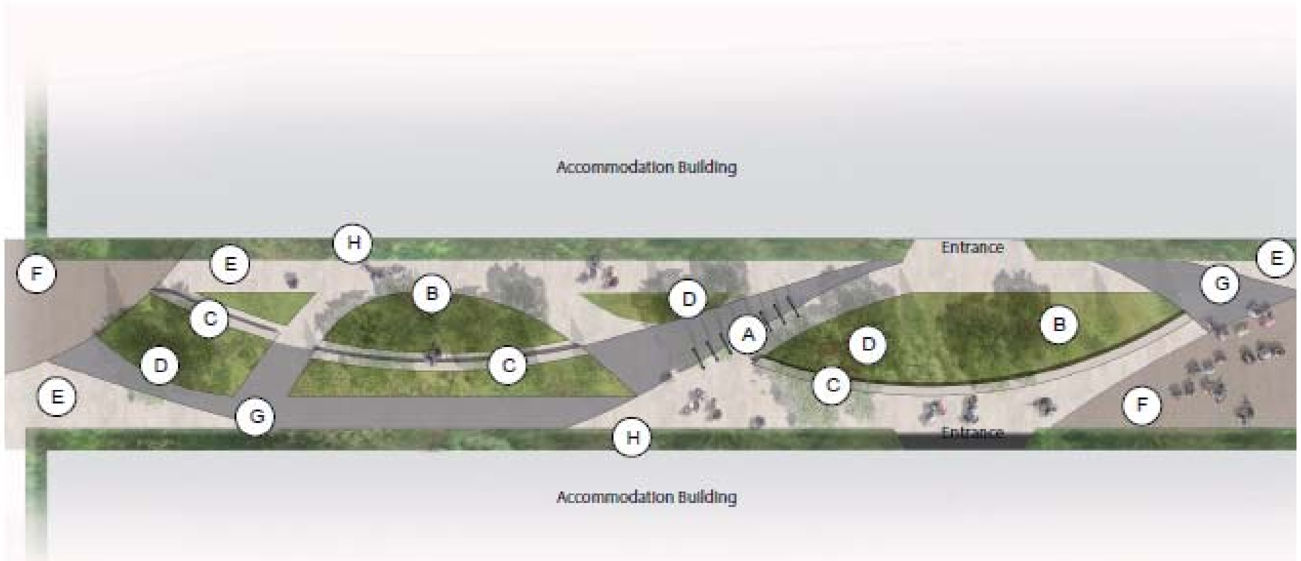
To the rear of the blocks larger open spaces would comprise a mix of uses and layouts. In order to minimise irrigation requirements the spaces would comprise areas of boulders, cobbles and gravels with native specimen trees and shrubs through to small areas of irrigated lawn for sitting, along with shade structures and timber decks and permanent barbecues and table tennis tables.

The ground form could vary, introducing changes in levels to bring interest, sense of enclosure and relief to a flat landscape.

A Simply designed bicycle racks placed within the vicinity of large canopy native shade trees and located to prevent interference with pedestrians
B Ornamental planting of native species and ornamental cultivars of native species, introducing colour and textural variation to the space while emphasising local distinctiveness and sense of place
C Stone topped seating located within shadow of large native shade trees to reduce surface heating
D Large canopy native shade trees to reduce surface heating, cool local environment and encourage use of outdoor space
E Pre cast concrete block paving with banding to pedestrian only street areas between student accommodation
F Exposed aggregate surface to entrances to pedestrian only areas
G Ornamental surface design of contrasting concrete blocks and/or exposed aggregate concrete to create locally distinctive spaces within campus
H Planting to create defensible space in front of ground floor bedrooms




Typical Courtyard Between Residential Blocks




Typical Courtyard Between Residential Blocks

# Connectivity

## Visual Connectivity from Outside In:

The university is looking to increase the student numbers and one of the means to achieve this is through first impressions when looking from the outside in.

» The construction of the learning resource centre will create a dominant landmark within the campus that is visible from the outside. In order that this building commands respect and attention it will be viewed across the frontage and therefore this perimeter landscape needs to be of a high quality and designed such it draws the viewers eye to the building and doesn't detract but complements the setting. The building would be framed by tree planting integrated into the car park.

» The northern frontage to the campus includes the main entrance to the campus with direct access to the administration building and internal access roads. The entrance needs to be made visually stronger through the removal of the redundant security gate house structure, or alternatively turning into a gateway feature signing the entrance to the campus, introduction of contemporary signage and planting zones full of seasonal colour and drama and would require permanent irrigation and intensive maintenance.

» Beyond this zone the boundary would change significantly; planted with native trees towards the top of the slope to screen the car parking and to ultimately provide shade and cooling to proposed buildings that maybe constructed over the ground level parking. Shrub planting would be introduced mid slope with ground cover planting on the lower slope adjacent the perimeter footpath. This would bring a high quality and well maintained frontage that would create a strong and good impression to the outside world.

» The frontage to the western boundary is weakened by the dilapidated building and the utilitarian substation which will be further compounded by the proposed energy centre and associated 24m high stacks. In order that visual cohesiveness can be brought to this edge substantial blocks of planting are proposed to screen these buildings. This could be enhanced through the use of mounding to provide initial height to the planting. The core of the earth mounds could be reused from the excavated material of the engineering building.

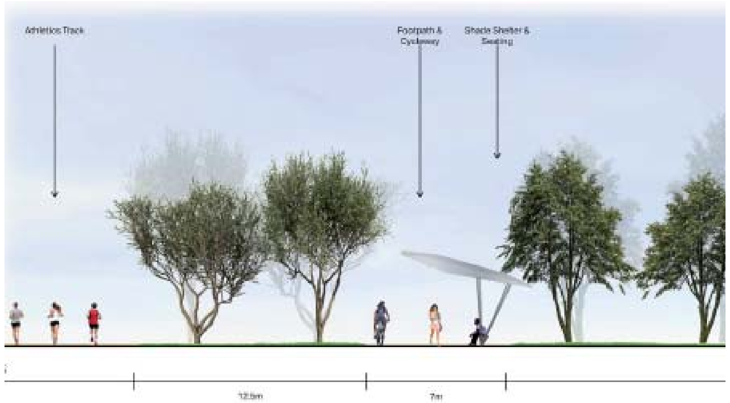
» Views from the western roundabout, at the junction of Athalassas and Panepistimiou roads, includes the solar panel site and an area of undeveloped land, with more distant views across land being used to store excavated soil. There is an opportunity to remove the solar panels and locate a key building that will articulate the entrance to the university and complement with another on the opposite side of the road, creating a gateway into the campus which will frame a view down the palm lined service road.

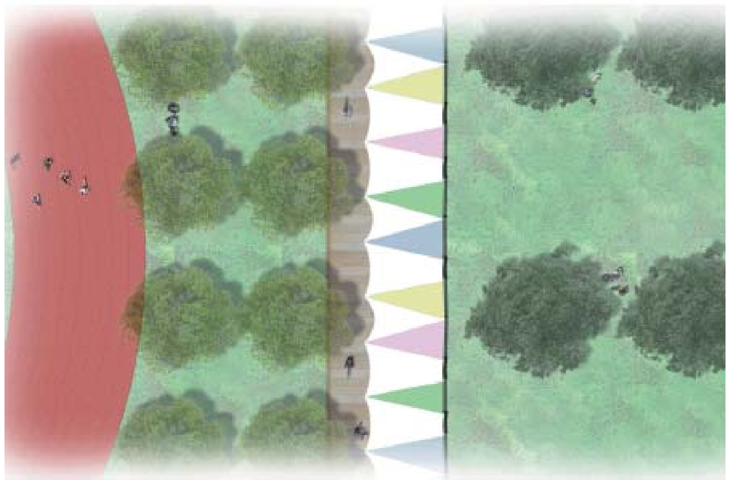
## Visual Connectivity from Inside Out:

» The main vista within the campus is from the rear of the administration building which has an elevated position and looks down and through the teaching buildings across the open farmland to the edge of Aronas Hill. This would be reinforced through the introduction of the three storey accommodation buildings either side of the axis.

» The Belvedere provides the main area from which views across the southern part of the campus can be obtained. Vistas between existing and proposed buildings are maintained to create a sense of location and to frame the impressive views of the landscape beyond, dominated by the Aronas Hill and the belts of woodland planting that has started to cross the farmland and the Masterplan seeks to continue into the campus, creating and developing the green links.

» The existing avenue of acacia trees across the farmland provides a strong axis to the eastern edge of Aronas Hill. The avenue is truncated so it is proposed to extend this to the edge of the river where it would continue into the landscape beyond.





People Inspired

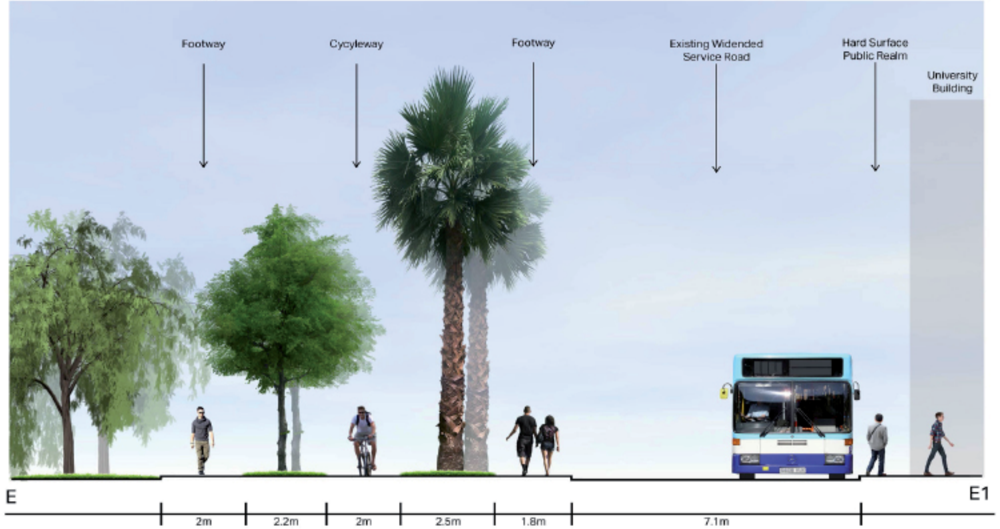
# Connectivity

## Physical Connectivity:

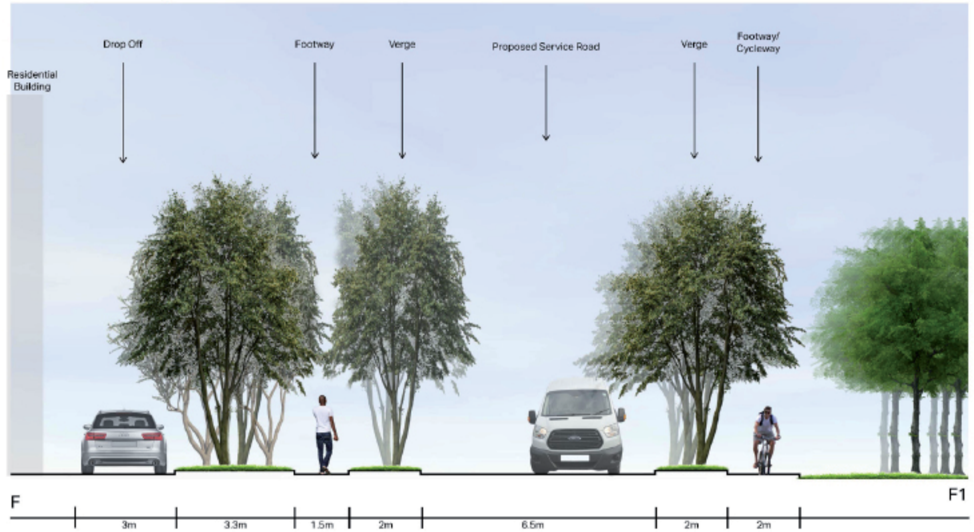
With the need to reduce to car borne traffic and encourage use of buses, cycling and walking, connectivity is critical to the success of this modal shift.

- The River Way: Improved connectivity through the campus to serve the student accommodation would start by providing a second link from the existing footpath cycleway route from Athalassa Forest on the Athalassas road by providing a safe crossing point into the campus all the way along the existing river bank.
- The Belvedere: The Belvedere is the principle means of connectivity through the campus. From its central axis through the campus springs a number of existing routes to the teaching blocks and sports zone. It would be extended at its north eastern end to continue directly to the edge of the campus, between three new buildings and connect with the perimeter footpath beyond the boundary.
- Trim Trail: This would be an informal circular route through the farmland and planting belts and would cross the river via a new road and footbridge adjacent the beach volleyball court at the eastern end of the campus. At the western end it would also cross a footbridge and enter the pine woodland zone and then connect with the Palm Grove across the service road.
- Existing Footpath/Cycleway along Service Road: The existing route along the service road comprises a combined 1.1m wide cycleway and 1.8m wide footpath. In order to enable two buses to pass successfully then the existing 6.0m wide road would need to be widened to 7.1m. This would be achieved by removing the existing cycleway and relocating to the south side of the existing tree planting as a segregated route, creating a circuit incorporating the River Way.

Section E-E1 Existing Widened Service Road




Section F-F1 Proposed Service Road



# Campus Park

The Campus park has been identified in the University's Masterplan as the heart of the campus; providing a place for active and passive recreation away from the formal spaces of learning for both students, local residents and visitors throughout the year.

The park is divided into character zones;

The Palm Grove at the western end which will provide a visual link to the forest park and hence will be set out in an informal layout.

The informality will continue to the east into the Pine Zone, which responds to the various groups of existing pines located around the existing lake.

The planting and path network would become more formal in the adjacent zone (sports stadium) as a response to the existing diagonal avenue of trees. The area will be laid out as an arboretum with a range of native tree species and shade species for spectators of the athletics.

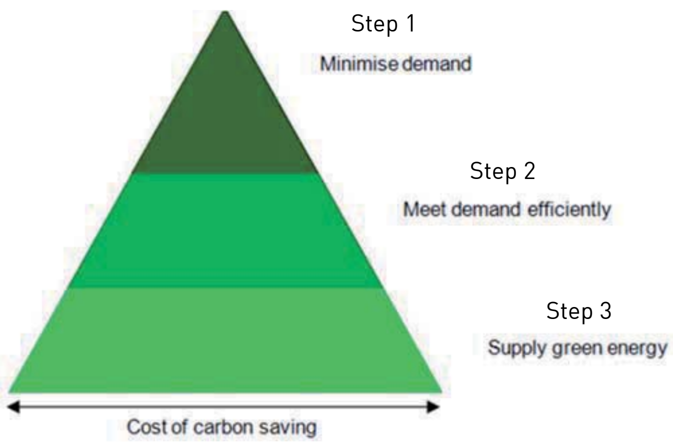
It will become more of an urban parkland as the hard landscape materials will extend from the teaching area to provide visual continuity.

# 4.0 Energy and Sustainability

## » Energy Hierarchy

The energy hierarchy defines the principle of a "Lean, Clean, Green" approach to energy efficiency, so that the benefits of less expensive methods of energy use reduction are maximised first, and renewable energy is used to meet only the remaining demand after demand reduction has been employed:

1. Minimise energy demand – Consider passive design measures and optimise building envelope in terms of orientation, air tightness, and insulation.
2. Meet demands efficiently – Specify energy efficient plant, heating, ventilation, lighting and system controls to facilitate efficient operation.
3. Supply green energy – Where required, specify low and zero carbon technologies to meet remaining energy demands, and ensure that building systems are well integrated to make effective use of these technologies.




## » Energy Efficiency

After considering the potential energy savings that may be achieved through the adoption of various passive and active energy efficiency measures, the following package is recommended for the University of Cyprus:

- Additional insulation to all buildings
- Energy efficient boilers and chillers
- Energy efficient lighting and automatic control strategy
- Energy efficient IT equipment

| Proposed Energy Efficiency Measures | Primary Energy Saving over Baseline Scenario (%) |
|---|---|
| Optimised Orientation | 0.7% |
| Optimise Glazing Design | 1.2% |
| Night Cooling | 1.4% |
| Additional Insulation | 1.6% |
| Improved Air Tightness | 0.6% |
| Energy Efficient Lighting | 7.3% |
| Automatic Lighting Control | 2.2% |
| Energy Efficient IT Equipment | 9.6% |
| Energy Efficient Boilers | 6.0% |
| Energy Efficient Chillers | 12.0% |
| Energy Efficient Fans and Pumps | 2.1% |
| Combined Package of Energy Efficiency Measures:<br>• Optimise orientation<br>• Optimise glazing design<br>• Incorporate night cooling<br>• Additional Insulation<br>• Energy efficient boilers and chillers<br>• Energy efficient lighting and automatic control strategy<br>• Energy efficient IT equipment | 37.3% |

## » Low and Zero Carbon Technologies

Initial analyses have been carried out to consider the viability and relative performance potential of several low and zero carbon (LZC) technologies. Calculations have been based on the modelled energy use of the campus with the energy efficiency measures discussed above. It is recommended that further detailed analysis (preferably using hourly energy demand data from the current campus) is carried out for the following technologies:

- Combined Heat and Power (CHP);
- Combined Cooling Heat and Power (CCHP);
- Solar water heating;
- Solar cooling;
- Photovoltaics;
- Photovoltaics with ice storage;
- Photovoltaics with battery storage.

| Proposed LZCs | Primary Energy Saving over Scenario with Energy Efficiency Measures (%) |
|---|---|
| CHP | 12.9% |
| CCHP | 17.3% |
| STHW | 7.2% |
| Solar Cooling | 21.6% |
| Biomass Boilers | 10.9% |
| Ground Source Heat Pump | 6.9% |
| 10MW PV Array | 74.0% |
| 10MW PV Array with Ice Storage | |
| 10MW PV Array with Battery storage | |

# Energy Policies and Drivers

Sustainability drivers for the University of Cyprus range from European legislation through national Cypriot legislation down to the University's own energy and sustainability policies.

The key aims of the University of Cyprus' Environmental Policy are:

- Contributing to improve the quality of the wider local, national and global environment.
- The growing environmental awareness amongst students and staff of the Foundation.
- The reduction, as far as possible, of the impact of the operation of the University on the environment.
- Active contribution and compliance with environmental policy and general actions at international, European and national level.
- Defining specific objectives, which will focus on gradual and continuous improvement of various environmental parameters, such as reducing the consumption of energy and water, the application of green public procurement policy, the management of solid and liquid waste and limiting air emissions in indoor and outdoor areas of the University.

The University has the following environmental goals:

- Reduce energy consumption with direct energy saving measures and moving with short, medium and long term measures. Define specific targets for the consumption of fuel and electricity and systematic monitoring. Improving the energy efficiency of new and existing buildings.
- Use of Renewable Energy. Promoting use of Renewable Energy Sources and investigation of the potential grant of such systems at the University.
- Policy for Green Procurement. Promotion of a new purchasing policy whereby preference is given to purchase products and services that cause less as far as possible damage to the environment. Avoid purchasing equipment containing hazardous substances. Recording suppliers, service providers or contractors who have complied with environmental laws / regulations and / or that have implemented environmental management schemes (e.g. ISO 14001, eco-label) and determination of environmentally friendly criteria for the selection stage.

The University's "Action Plan to Promote Green Public Contracts" includes a range of measures to enhance the sustainability of University buildings; the following points are of particular relevance to this energy Masterplan:

New/Renovated Buildings

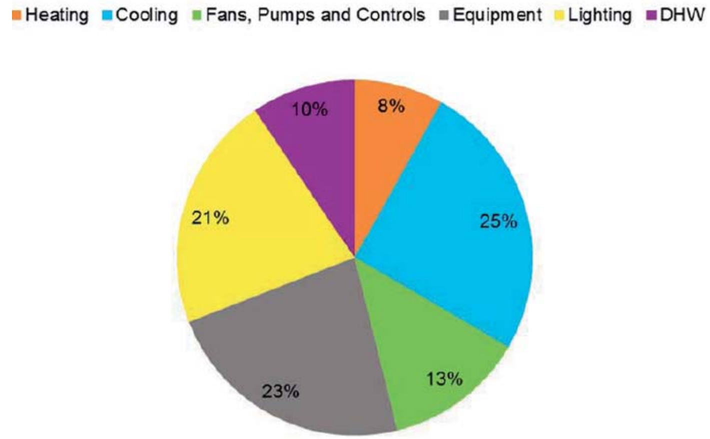
- Use modern building materials: All privately owned buildings of the University of Cyprus either being renovated or planned to be built will be use modern building materials, requiring less maintenance. A list will be prepared of environmentally friendly materials, which will be specified in the tenders.
- Photovoltaics on the roofs of campus buildings: suggested for installation in all buildings.
- Heating buildings with solar systems: suggested for installation of solar panels for preheating of the central heating systems.

# Campus Energy Demand 2015-2035

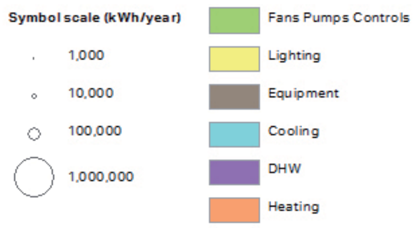
Future energy demands from the University of Cyprus Athalassa Campus have been modelled based on metered data provided for existing buildings on site, and extrapolated to account for the proposed new buildings on campus.

The chart to the right shows the distribution of energy consumption across all end uses.

Cooling represents the largest demand, followed by equipment and lighting. Therefore, focussing on these end uses presents the greatest opportunity to make energy and carbon savings across the campus.




Annual Energy Demand by End Use in 2036




Energy Demand of Athalassa Campus Buildings 2015.
Note, existing buildings are blue, future buildings are green

Energy Demand of Athalassa Campus Buildings 2025.
Note, existing buildings are blue, future buildings are green

Energy Demand of Athalassa Campus Buildings 2035.
Note, existing buildings are blue, future buildings are green

# Step 1 - Minimise Demand

Through adopting passive energy efficiency measures the energy demands of both new and refurbished buildings can be dramatically reduced. Passive efficiency measures are those which reduce energy demand.

Orientation:

» The building orientation and the location of glazing, needs to be carefully designed such that light is provided where it is needed and in appropriate amounts. Solar gain is easier to control on the South façade (with an overhang) than on the East and West facades, so as a general rule East and West-facing glazing should be minimised. Daylight factors should be maximised whilst ensuring that the building is not at risk of overheating and the heating and cooling requirements of the building are not increased.

» Using results from the modelling undertaken, the effect of optimising building orientation has been assessed. The effect of orientating a building so that the glazing faces East and West, has been compared to orientating a building so that the glazing faces North and South. Over the analysis period (i.e. from 2017 to 2036), it has been calculated that optimising the orientation of future buildings could achieve a 0.7% primary energy saving over the baseline.

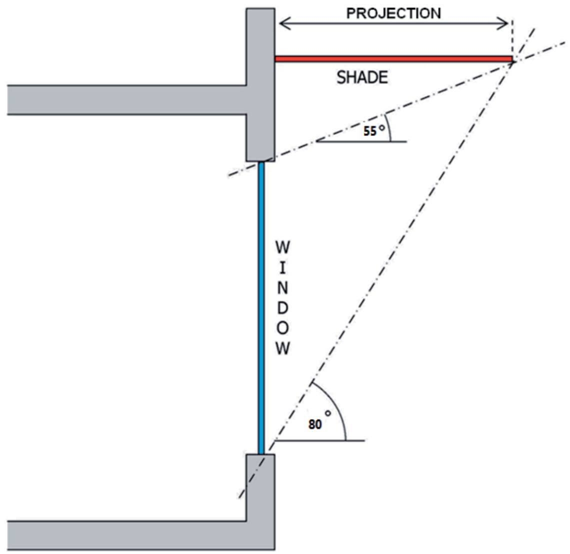
Shading and Solar Control:

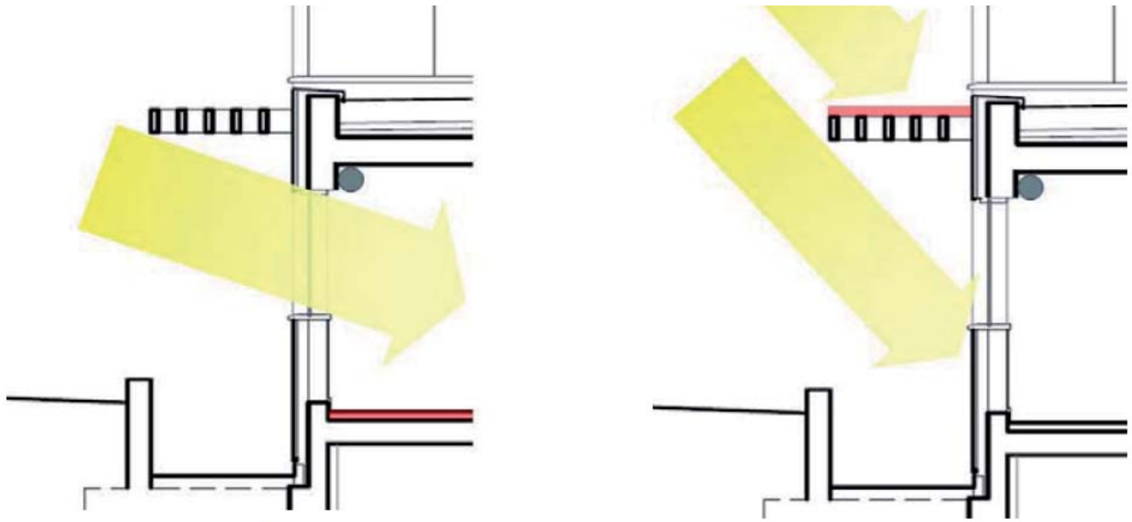
» Energy efficient glazing should be carefully sized and located to provide appropriate amounts of light where it is needed. Excessive glazing can achieve high daylight factors but increases the heating and cooling requirements of the building.

» Shading devices control the amount of direct solar radiation that can enter through a window. In winter this solar gain is desirable as it reduces the amount of energy required to heat the building. This saves money and reduces the carbon dioxide emissions of the building. However, in summer, excessive solar gains can cause the building to become uncomfortably hot. This can be overcome by making use of the fact that the angle between the sun and the horizon is greater in summertime than it is during winter. A projection above a window can be designed to make use of this effect to block high-angle sun in summer whilst allowing low-angle winter sunshine to pass below the projections. This effect can be achieved to greatest effect on south-facing facades as the sun is highest in the sky and strongest when in the south. When the sun is in the east or the west it is lower in the sky and so solar gains are harder to control; on these orientations vertical fins may provide a more effective form of external shading. These are the principal reasons that glazing orientated north or south is preferred.

» AECOM's extensive experience of facade engineering of buildings suggests that an optimal shading device in Cyprus will block all direct radiation when the sun is higher than approximately 80° and allow all direct radiation when the sun angle is below 55°.

» Over the analysis period (from 2017 to 2036), it has been calculated that an improved glazing design could achieve a 1.2% saving in primary energy over the baseline scenario; this is based on an average saving from solar control measures across all orientations.



(a) Winter

(b) Summer

# Step 1 - Minimise Demand

Insulation:

» A U-value, or heat transfer coefficient, is the measure of heat loss through an element. The lower the U-value of a building element, the better its ability to resist the transmission of heat through it, and so the better it performs as an insulator. The use of insulation to achieve low U-values helps to reduce the heat energy required to keep buildings warm in cold weather and reduce the cooling energy required to keep buildings cool in hot weather. In the Cypriot climate the annual cooling energy requirement is greater than the annual heating requirement.

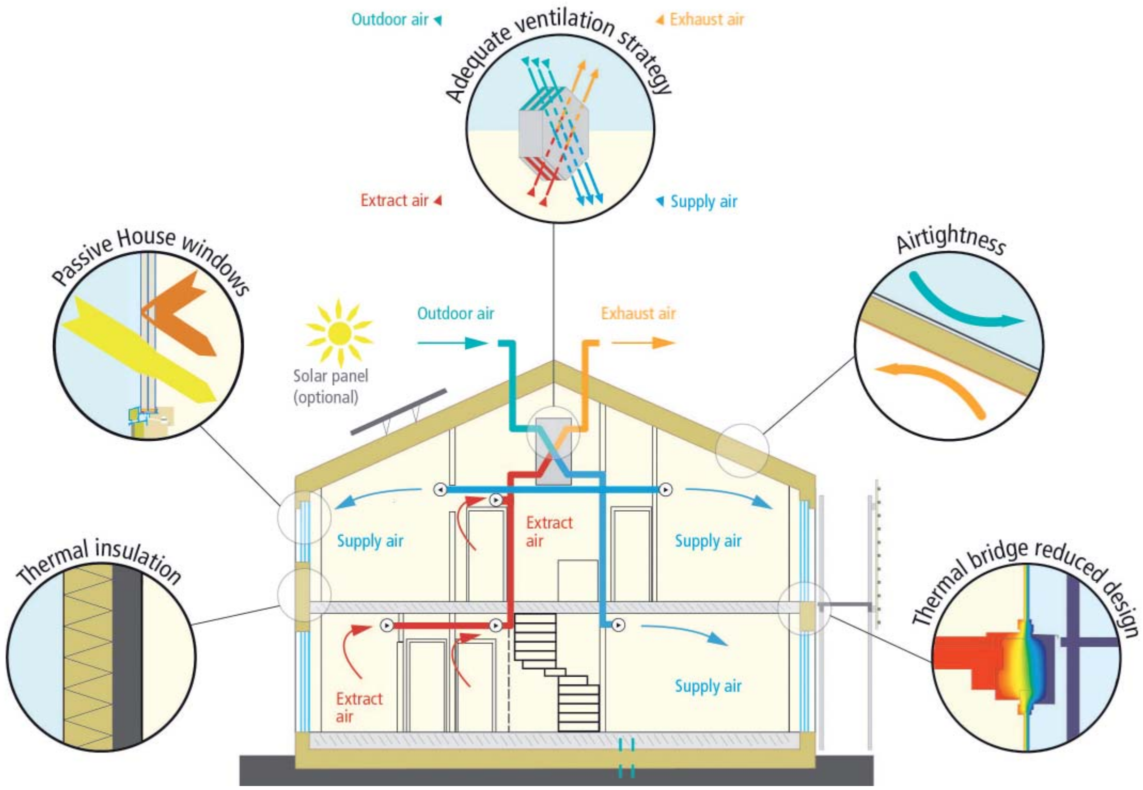
» Over the analysis period, it has been calculated that improved insulation levels could achieve total primary energy savings of 1.6% over the baseline scenario. This is a small improvement which reflects the close balance between the energy requirements for heating and cooling systems.

Air Permeability:

» The uncontrolled leaking of air between inside and outside a building causes unwanted heat transfer and so increases the heating and cooling requirements of the building.

» Reducing the air permeability of a building reduces air leakage and so can save energy. Reduced air permeability can also increase the thermal comfort of occupants and decrease the accumulation of moisture within the building fabric. However reduced air permeability increases the importance of controlled ventilation to ensure adequate air quality.

» It has been assumed that no improvement can be made to existing buildings to reduce their air permeability. Should it be possible to retrofit existing buildings to reduce their air permeability, additional energy savings could be made. Over the analysis period, it has been calculated that reduced air permeability in future buildings could lead to a total saving of 0.6% in primary energy consumption.

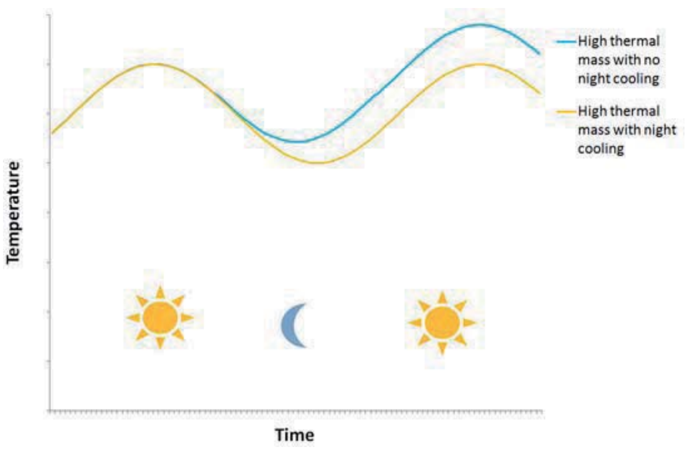


# Step 2 - Meet Demand Efficiently

The following sections describe a number of active energy efficiency measures that may be adopted at the University of Cyprus, including (where appropriate) calculations as to the likely energy savings that could be made through their adoption.

Night Cooling:

- Buildings with a high thermal mass are constructed from materials which have a large capacity to absorb and store heat. Careful utilisation of this effect can help to achieve a more stable internal temperature than might be achieved using lightweight structures.
- If thermal mass is not permitted to cool overnight then the building will get hotter each successive day. This can be avoided through the use of night cooling.




There are three ways night cooling can be implemented:

- Passive night cooling - Opening windows or vents at night to allow wind or buoyancy driven airflow to cool the building fabric.This option provides low operational and maintenance costs but can cause problems with security.
- Active night cooling - Running mechanical ventilation systems at night to cool the building fabric. This way can be more targeted and controllable than natural systems with no security issues. However, fan operation requires electrical power.
- Mixed-mode night cooling - A combination of natural ventilation and mechanical ventilation, by using fans to assist the natural night airflow.
- It is recommended that the University of Cyprus' specification for new buildings includes the requirement for the effectiveness of night cooling to be investigated. Over the analysis period, it has been calculated that providing night cooling to future buildings could achieve a 1.4% primary energy saving over the baseline.

Energy Efficient Lighting and Automatic Lighting Controls:

- Increasingly energy efficient lighting offers the opportunity to achieve the same levels of illumination within spaces, whilst consuming less energy. Further energy savings can be achieved through the implementation of an automatic control strategy on artificial lighting, such that lights are only turned on when a room is occupied and there is insufficient natural daylight available.
- It is recommended that all T5 lamps are replaced with energy efficient LED lamps (with high lumen/watt values), and that the University of Cyprus' building specification requires all future buildings to use energy efficient lighting.
- it is recommended that all future buildings adopt automatic lighting controls to minimise the use of artificial lighting.
- Over the course of the analysis period, it has been calculated that moving from T5 to LEDs could achieve primary energy savings of 7.3%.

IT Equipment:

- Over the last 30 years the use of IT equipment has increased dramatically. The energy used by IT equipment is often the largest single energy demand in modern office or educational buildings. Reducing the energy use of IT equipment can be addressed in a number of ways.
- Server rooms can be positioned to the north of the building so that they need a minimum of mechanical cooling by avoiding high solar gains.
- Thin client computer systems are generally more efficient, but can restrict functionality for high computing power demand users.
- IT managers can make a huge difference to the amount of energy used by their systems by specifying efficient machines and integrating energy saving software which shuts down unused computers.
- Research indicates that turning computers off at night and using power management features, such as automatic shut down when a computer is idle, can save up to 82% of a computer's energy consumption. To account for non-IT equipment in use at the University of Cyprus, as well as computers that cannot be power managed, it has been assumed that the overall equipment energy can be reduced by 42%.
- Over the analysis period, it has been calculated that energy efficient IT equipment could achieve a 9.6% saving in primary energy over the baseline.

# Step 2 - Meet Demand Efficiently

Improved Plant Efficiencies:

» The linear relationship between plant efficiency and energy consumption is such that increasing the efficiency of plant leads to a corresponding reduction in energy consumption, and therefore associated carbon dioxide emissions; i.e. doubling the plant efficiency halves the energy consumption.

» However, increasing plant efficiency has other impacts that must be considered. High efficiency plant is often larger than low efficiency alternatives. This is especially true for items such as air handling units or chillers. High efficiency plant also generally costs more to purchase although in most cases this extra cost is offset by the subsequent energy savings throughout the plant's lifecycle.

» Plant efficiency can also be enhanced through the consideration of HVAC distribution routes; for example minimising the number of bends in ventilation ductwork reduces the pressure drop that the air handling plant must overcome, and therefore allows the fan to work more efficiently. Similar benefits could also be achieved for pumps in wet distribution systems.

» A typical existing boiler in Cyprus is 60% efficient, with the potential to improve the efficiency to approximately 90% with a new installation. Over the analysis period, it has been calculated that improved boiler efficiency could achieve a 6.0% saving in primary energy over the baseline.

» A typical chiller in Cyprus has an EER of 2, with the potential to improve the EER to approximately 3.77 with a new installation. Over the analysis period, it has been calculated that improved chiller efficiency could achieve a 12.0% saving in primary energy over the baseline.

» Fan and pump efficiencies could achieve a 2.1% saving in primary energy over the baseline.

UCY Recommendation Package:

After considering the potential energy savings that may be achieved through the adoption of various energy efficiency measures, the following package is recommended for the University of Cyprus:

» Optimise building orientation;

» Incorporate thermal mass (including consideration of thermal labyrinths);

» Optimise solar control measures including shading and solar control glazing;

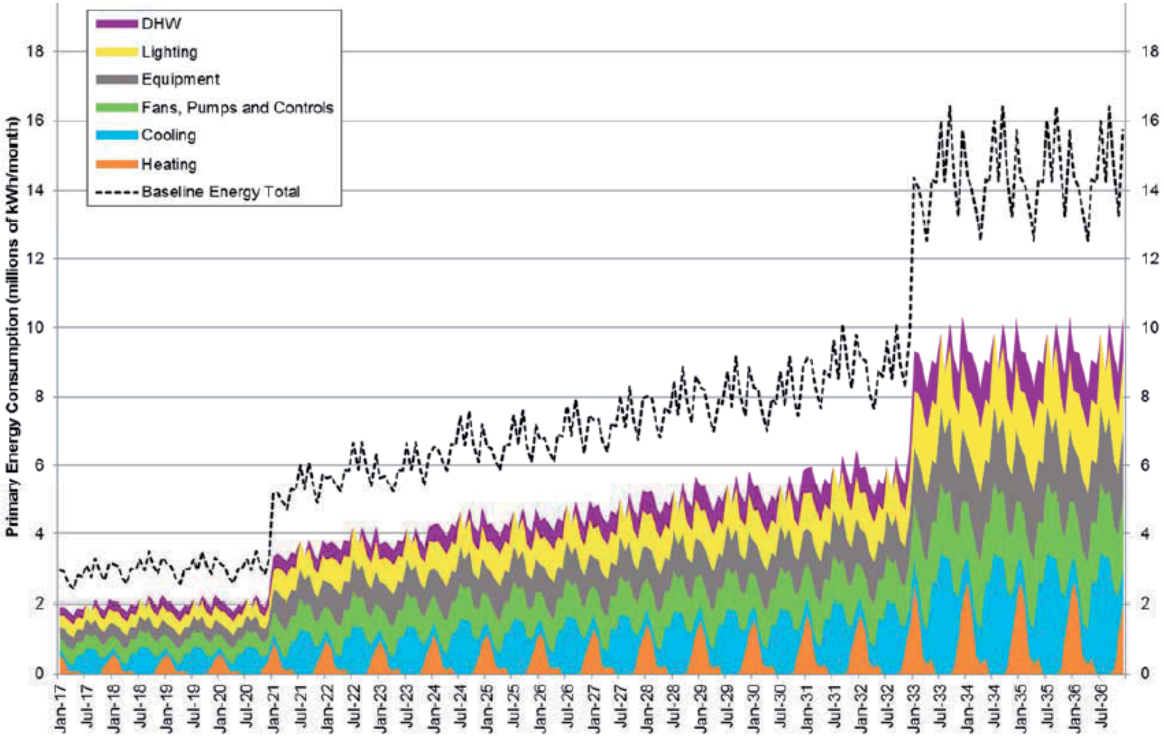
» Additional insulation to all buildings;

» Energy efficient boilers and chillers;

» Energy efficient lighting and automatic control strategy;

» Energy efficient IT equipment.

The above package of measures could achieve around a 37.3% saving in primary energy over the baseline scenario.



# Step 3 - Low and Zero Carbon (LZC) Technologies

There are a range of low and zero carbon technologies that may be appropriate for the University of Cyprus, as listed below:

» Combined Heat and Power (CHP)

» Tri-Generation (Combined Cooling, Heat and Power (CCHP))

» Solar Thermal Hot Water (STHW)

» Solar Cooling

» Photovoltaic Panels (PV)

» Wind Turbines

» Biomass Boilers

» Ground Source Heat Pump (GSHP)

» Energy from Waste

Combined Heat and Power (CHP) and Tri-Generation (Combined Cooling, Heat and Power (CCHP)):

» Combined heat and power (CHP) systems at the large commercial size is now fairly common in premises which have a simultaneous demand for heating and electricity for long periods. Compared with using centrally generated electricity supplied via the grid, CHP offers a more efficient and economic method of supplying energy demand, due to the utilisation of the heat which is normally rejected to the atmosphere from central generating stations, and by reducing network distribution losses due to local generation.

» It is not a renewable energy technology, but installed in the appropriate manner there is potential for overall energy and carbon savings. Heat generated will be used for space and water heating, and additional heat storage may be used to lengthen use periods, to assist in warm-up and to improve overall energy efficiency.

» Tri-Generation, or Combined Cooling, Heat and Power (CCHP), is broadly similar to CHP but in addition to providing heat and electricity, CCHP provides chilled water for cooling. This chilled water is generated by an absorption chiller, where the generation of chilled water is driven by the waste heat from electricity generation.

» It is preferable to avoid employing combinations of LZCs that will compete with each other to serve the same building energy demands; for example both CHP and solar water heating will compete to provide the hot water demand

Solar Thermal Hot Water (STHW):

» Solar water heating systems use the energy from the sun to heat water. The systems use a heat collector, mounted on a roof or façade, in which a fluid is heated by the sun. This fluid then heats the domestic hot water supply or central heating system.

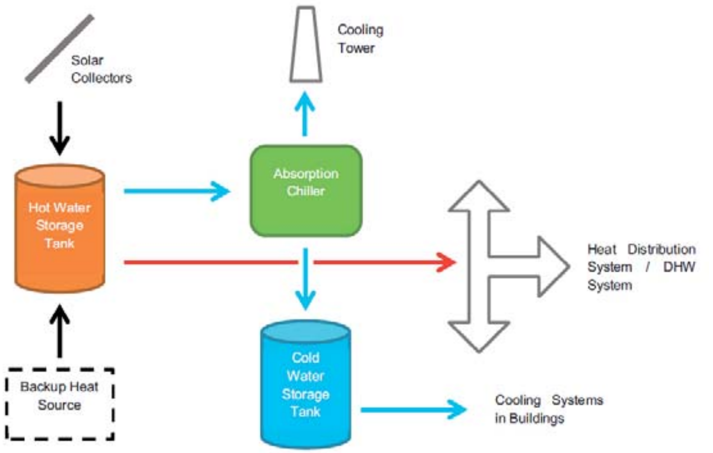
» If a solar thermal array is sized to provide 70% of the annual hot water demand then it is calculated that this may reduce the primary energy demand of the Athalassa Campus by 7.2%.

Solar Cooling:

» The components required for a Solar Cooling system are broadly similar to those required in an STHW system; solar collectors, storage tank, controls, pipes and pumps, but with the addition of a thermally driven cooling "machine".

» Incident solar radiation on the solar collectors is used to generate a high temperature fluid, usually water, which is stored in a tank. This hot water can then be used to generate cooling, via an absorption chiller, or can be used directly in the heat distribution or Domestic Hot Water (DHW) system. The hot water storage tank acts as a buffer, and allows cooling to be generated at a different time to the incident solar radiation. Similarly, the back-up heat source allows heating and cooling to be generated regardless of the availability of solar radiation.

» If a solar cooling array is sized to provide 70% of the annual hot water and cooling demands then it is calculated that this may reduce the primary energy demand of the Athalassa Campus by 21.6%



# Step 3 - Low and Zero Carbon (LZC) Technologies

Photovoltaics (PV):

- Photovoltaic modules convert sunlight into DC electricity and can be integrated into buildings. PV is distinct from other renewable energy technologies since it has no moving parts to be maintained and is silent. PV systems can be incorporated into buildings in various ways; on sloped roofs and flat roofs, in facades, atria and as shading devices.
- The University of Cyprus is planning to build a 10MW photovoltaic array on the south eastern side of the Athalassa Campus.
- As Cyprus receives large amounts of solar radiation, the buildings at the University of Cyprus are considered to be well suited to the installation of PV. Buildings that would be particularly suited to the installation of PV will have a large area of unshaded roof; ideally either flat (allowing optimal orientation and pitch of panels using supporting structure), or south facing at approximately 28° pitch. It may be possible to integrate PV panels into shading elements, such as overhangs or brise soleil, if roof space is limited.
- Considering the 10MW PV array proposed for the Athalassa Campus, it has been calculated that this could save 74.0% of the primary energy consumption when compared to the baseline.

Wind Turbines:

- Wind technology is currently one of the most cost-effective renewable energy technologies, which is attributable to the large scale of installations reducing the unit output cost.
- The average annual wind speed in Cyprus at 10m height, showing that the majority of the island experiences average wind speeds of between 3 and 4m/s with a few areas achieving 5 to 7m/s. Sites with average wind speed below 5m/s are generally considered to be low speed for the purposes of wind turbines, and therefore this technology may not be a preferred renewable energy for the University of Cyprus campus.

Biomass Boilers:

- Biomass is an alternative solid fuel to the conventional fossil fuels and has close to neutral carbon emissions impact providing it is sourced locally. Biomass is converted into a manageable form (either chips or pellets) that can be directly fed to the boiler plant thus replacing fossil fuel.
- It has been calculated that over the period 2017 to 2036, that a biomass fuelled heating and hot water system for future buildings could save 10.9% of the primary energy consumption over the baseline scenario.

Ground Source Heat Pumps (GSHP):

- The technology makes use of the more stable temperatures of the ground compared to the air above. Below a few meters depth the ground temperature will be warmer than the air above in winter and cooler in the summer. Heat pumps take up heat at a certain temperature and release it at a higher temperature.
- GSHPs will be particularly well suited to those building's which use lower temperatures for their heating system, such as those for underfloor heating, as this will allow the greatest efficiencies to be achieved.
- A GSHP system could save 6.9% of the primary energy consumption over the baseline scenario.

# Recommendations

- » The orientation of buildings to be arranged so that the areas of glazing on east and west facing facades is minimised and the areas of glazing facing north and south are optimised.
- » The location of buildings with particularly high demands for heating and cooling to be close to one of the energy centres to minimise the costs of distribution pipework and the associated losses.
- » The internal layout of buildings to be arranged so that spaces with high internal heat gains are located on the north façade or away from high solar gains.
- » The use of thermal mass coupled with a night cooling strategy to be investigated.
- » Insulation levels to be optimised to minimise the total primary energy demand of heating and cooling.
- » Energy efficient lighting systems to be employed including lighting with a high efficacy and a well-designed lighting control system.
- » The energy efficiency of IT systems to be carefully considered.
- » The efficiency of heating, cooling and pumping plant for the new energy centre and the refurbishment of the existing energy centre to be carefully considered.

# Sustainability Vision Statement

Relatively young, the University of Cyprus (UCY) is the largest higher education institution on the island. It aspires to be at the forefront of the sustainable agenda in Cyprus and to become an institution that fosters environmental consciousness in its staff and students.

A strong and focussed vision for a sustainable University of Cyprus supported by holistic and forward thinking sustainability strategy is considered essential to demonstrate the university's leadership and to provide a framework against which progress performance can be measured. Reflecting this driver the University have included sustainability as a key consideration in their draft strategic plan for 2016-2025. This is a clear indication of how sustainability is being prioritised in the University's future activities and development.

Sustainability comprises three core pillars:

Environmental sustainability – the ability to maintain rates of consumption of renewable resources at a level that can be maintained indefinitely.

Economic sustainability – the ability to support a specific level of economic output indefinitely. For the university this implies the indefinite operation of the university in the provision of education and research.

Social Sustainability – the ability of a social system, such as the island of Cyprus, or as a, microcosm, the university estate, to function at a defined level of social wellbeing indefinitely.

As an Educational institution the University is keenly aware of its role in installing the understanding of the imperative for sustainability in its current and future staff and students.

"The University of Cyprus will take an active approach to sustainability and through our commitments and targets will embed the principles of sustainability in our growth, learning, teaching and research.

In ENERGY we aim to be a net zero energy University,

In TRAVEL we seek to transition from private to effective public transport and on campus living.

In WATER we will minimise our use and maximise our reuse of this precious resource.

For our ENVIRONMENT we will increase our planting of native species to provide shade and help local cooling.

And through all of these themes we will EDUCATE and share our learning with our students, staff, and our wider community"

# Sustainability Strategy

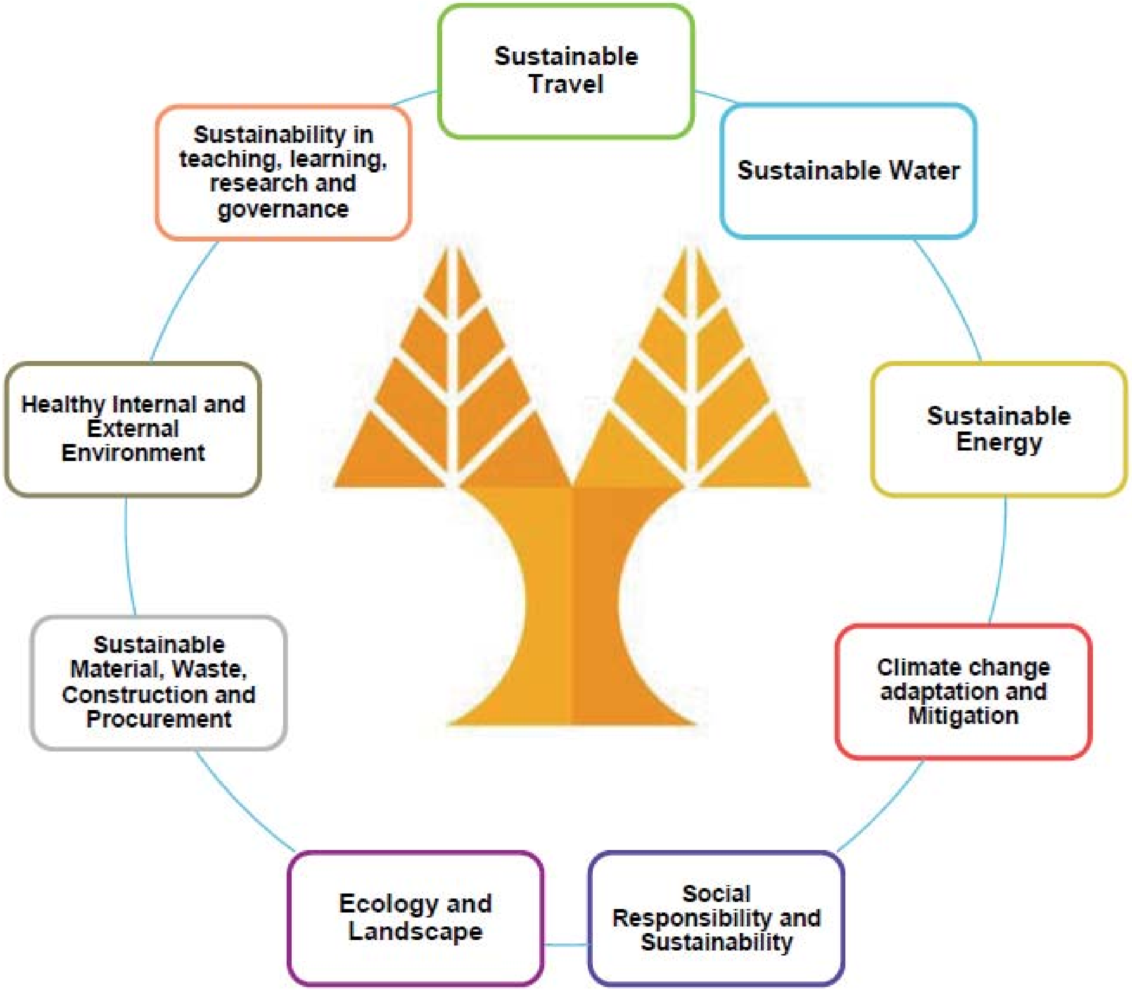
The University objectives are:

1. Awareness of staff and students. Organization of training seminars on issues of ecological practices, energy conservation and environmental management.
2. Reducing energy consumption
3. Renewable energy
4. Implementing green procurement policy
5. Reduction in Water Consumption
6. Waste Management
7. Solid waste management and recycling system
8. Protecting the environment
9. Encourage use of public transport
10. Indoor air quality improvement
11. Research activities for environmental protection

UCY have an opportunity now to lead the way in sustainable development in Cyprus through the expansion and growth of the Athalassa campus, UCY can integrate sustainability into campus life and thus foster and nurture environmental consciousness and behaviour change. UCY has a responsibility in Cyprus to innovate and guide future development with climate change resilience, preparedness and adaptation in mind.

At a Building Scale an evaluation of BREEAM and LEED Environmental assessment methods is recommended.

UCY will also establish forums to raise awareness of the new vision and policy statement and to receive feedback. To ensure the policy is effective it is vital that the measures are endorsed at all levels.



# 5.0 Mechanical and Electrical Services

### Heating and Cooling:

Provisional heating and cooling load estimates at the Athalassa Campus (Aug 2017) have indicated an overall anticipated rise in site wide loads of 20.1MW (cooling) and 17.9MW (heating) and on this basis the development strategy and the provision of a second Energy Centre on the site has been proposed.
During the optioneering period a number of pipework configurations were considered and the development of the below strategy has been adopted:

The upgrading (if necessary) of various parts of the complete district heating/cooling pipework system to fully utilise the spare capacity of the existing plant. This would require the provision of a new energy centre to accommodate the remaining loads. This also considers the interconnection of the existing and new pipework systems to provide a degree of system resilience.

Space planning of the proposed Energy Centre (EC2) has been developed and the strategy is to develop the energy centre as the site grows. Modular installation of the boilers and chillers in phases is proposed.

### Electrical Power:

The existing site demand for the Athalassa campus has been previously advised as 3.8MVA. Electrical load analysis calculations for the future developments at the Athalassa Campus (Aug 2017) identified an increase in site demand of 15.5 MVA. Based on the Masterplan Proposals the total site load is in the region of 19.3 MVA.

In addition to the future developments at Athalassa Campus the construction of a new 10MW photovoltaic park is proposed and the output generated from this new facility be utilised to supply the proposed development site as proposed in the body of this report.

To accommodate the additional electrical load imposed by the future developments and the construction of the 10MW photovoltaic park 3 options were considered for the reinforcement of the electrical infrastructure:

Option 1 – The extension of the existing University of Cyprus (UCY) substation to accommodate 100% of the campus load (existing and future development). For this option the photovoltaic park shall be connected directly to the Electricity Authority of Cyprus (EAC) network.

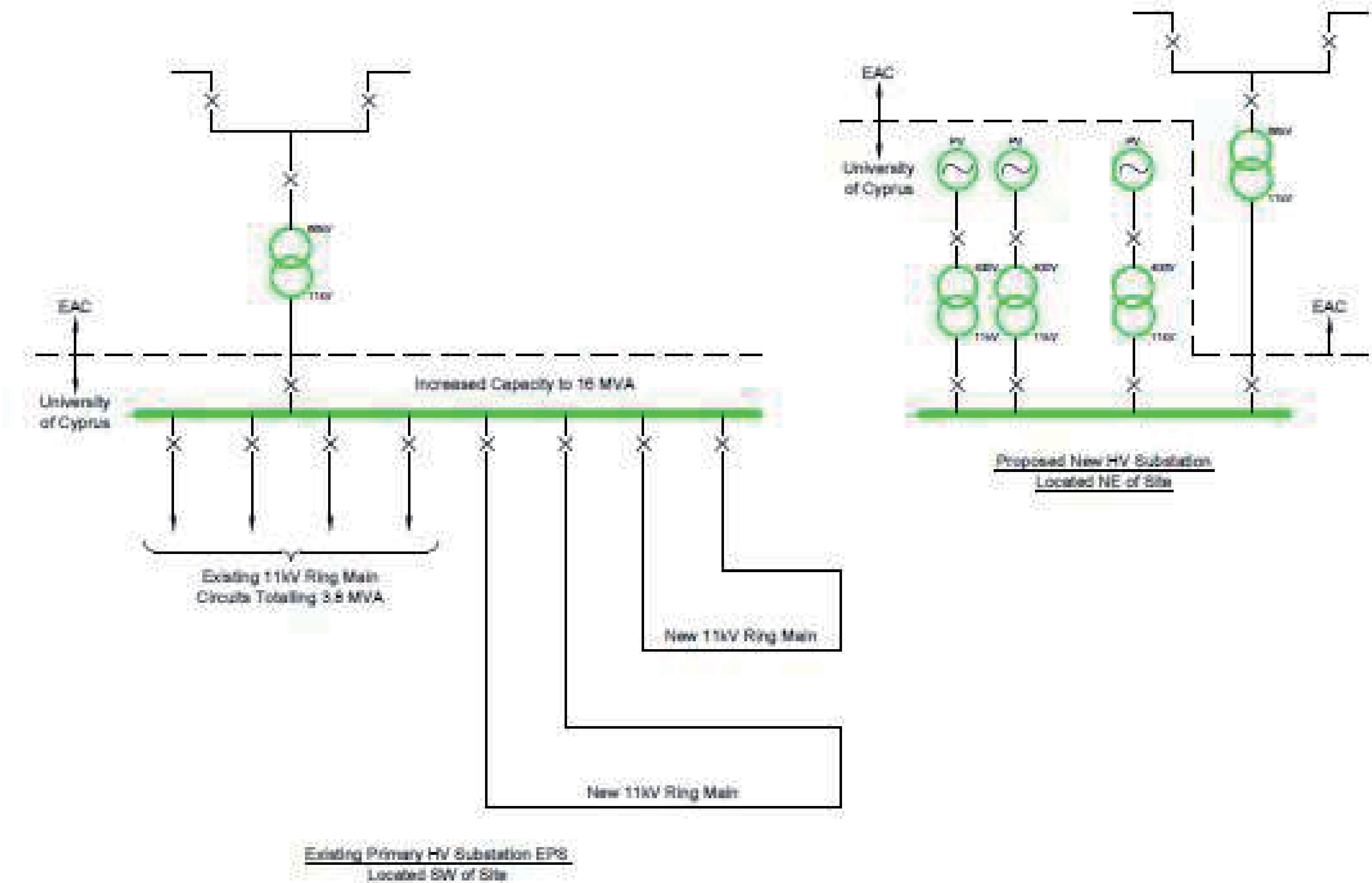
Option 2 – The extension of the existing UCY substation to accommodate approximately 40% of the campus load (existing and future development) and the construction of a new substation on the east side of the site to accommodate the remaining approximate 60% of the campus load. For this option the photovoltaic park shall be connected directly to the new East side substation.

Option 3 – The extension of the existing UCY substation to accommodate 100% of the campus load (existing and future development). For this option the photovoltaic park shall be connected directly to the existing substation.

Option 1 is currently the only viable option as suggested by the University.

# Mechanical Services Strategy

# Electrical Services Strategy




People Inspired

# 6.0 Traffic and Transport

# Car Parking

In order to understand how the transport and traffic might help the ambitions of the UCY, it is vital to understand the University's target of having a 'Green campus'. From a traffic and transport perspective, having a 'Green campus' places a focus on a sustainable transportation strategy which would help to reduce social and environmental impacts.

Traffic and Transport objectives include:

- Demand management;
- Car Parking management;
- Public transport planning;
- Cycling;
- Walking;
- Travel planning / Transport strategy.

The current travel behaviour; relying mainly on cars as the main travel mode is one of the main issues the University growth is facing, as it does not meet the University aspirations.

The Masterplan includes four indicative phases during which the University capacity would grow from 7,000 to 11,423 by 2030 as below:

- Indicative phase 1: Student enrolment of 10,000 (Current - 2022)
- Indicative phase 2: Student enrolment of 10,280 (2023 – 2026)
- Indicative phase 3: Student enrolment of 11,423 (2027 – 2030)
- Indicative phase 4: Student capacity of 20,000 (2031 –TBC)

The method of 'Reduce and Rationalise' is proposed for parking provision. This would lead to the parking provision being maintained at around a similar number of spaces as there are today, management of the supply of spaces and demand for parking, and would provide more enhanced sustainable transport alternatives. The construction of the multi-storey car park (PRK04) prior to any further development is deemed necessary to prevent parking demand pressure to use the Campus Park.

New measures which can help control parking numbers and provide more attractive alternative travel modes, such as walking, cycling, car-sharing and much improved public transport are proposed.

Based on the parking survey for the Athalassa campus undertaken in November 2015, 2,661 parking spaces were available on campus.

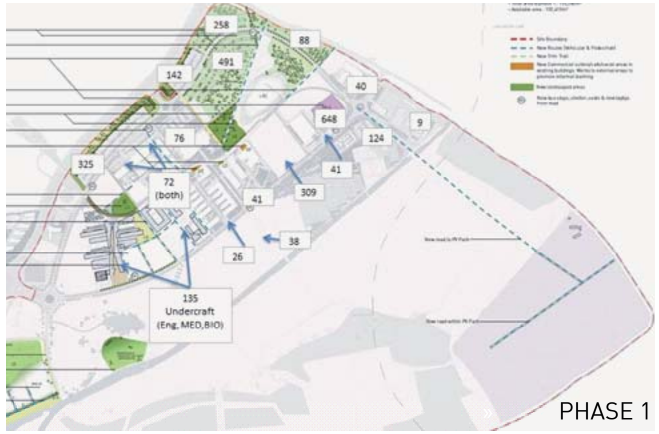
Phase 1 indicates 2,863 parking spaces including the new multi-storey car park (MSCP), new parklands, and under-croft parking attached to new buildings: the Engineering faculty (currently under construction), Medical school and Biology Department.

Phase 2 indicates 2,516 parking spaces. It would provide lower number of spaces compared with 2015 l (2,661 spaces) due to new buildings that would be located on the unsurfaced parking areas. Phase 2 would include new on-campus student accommodation; providing a total of 1,272 beds.

Phase 3 has 2,510 parking spaces and it would include new on-campus student accommodation providing a total of 1,920 beds.

Phase 4 does not suggest any additional parking provision, and it is considered to be only aspirational future development

The analysis for all phases forecasts a potential parking demand excess of 54% - 67% based upon the parking provision proposed for the Masterplan in line with the adoption of the ''Reduce and Rationalise'' approach. The students/ staff numbers who cannot find parking spaces would need to shift their travel mode to public transport, car-sharing, walking or cycling.




PHASE 1


PHASE 2


PHASE 3

# Public Transport

Four public bus routes serve the university campus commencing daily at 05:25 and finishing at 20:00.

The bus service routes are route 150, 210, 214, 259. The campus is currently operating three bus stops, one at East Gateway east of the campus, and two other stops, one each direction located near the main entrance (North Gateway).

Currently only 10% of the students and 2% of staff use the buses as their travel mode. Reducing the parking spaces on the campus would encourage students and staff to consider alternative travel modes; public transport being one of them.

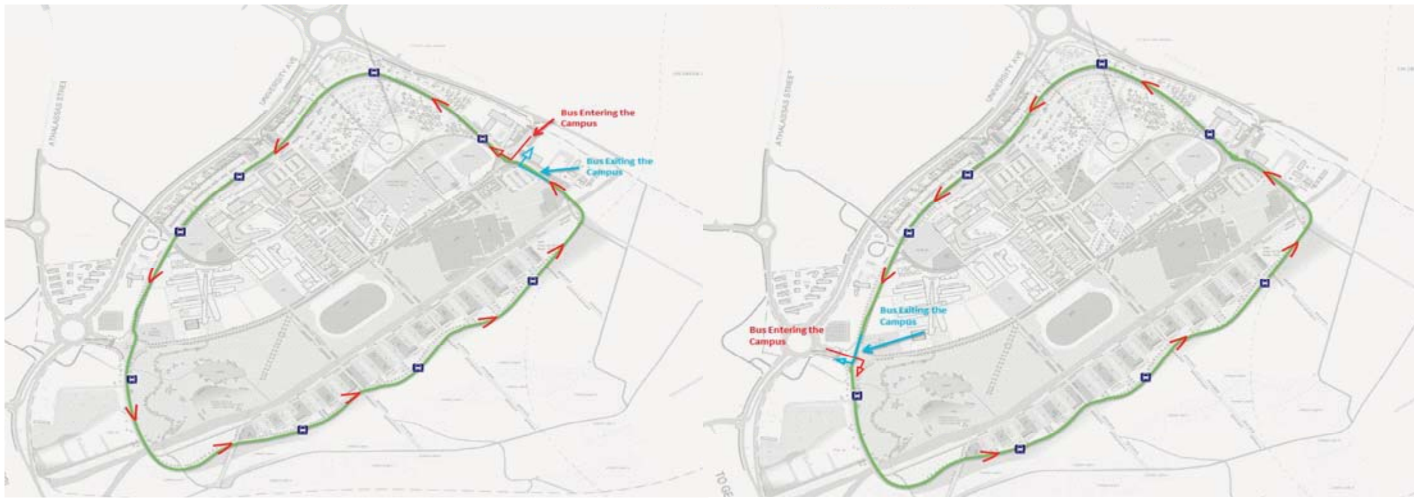
There would be a requirement for more routes to cover the main catchment areas of the future students, and to have more frequent services, especially to cover the university peaks of arrivals and departures.

The internal road which would serve the student accommodation would not be completed until the end of phase 3 (2030). Therefore, two bus stop phases options are proposed. The circulation of the buses should be anti-clockwise; all passengers would be dropped off the buses on the footpaths near the campus to minimize the need to cross roads, which would increase the safety of the bus users.

It is also proposed that lay-by bus stops are installed to provide safer accessibility for the bus users and less disruption for the vehicular traffic on the local roads.

| Bus services required – Phase 1 | | |
|---|---|---|
| Scenario | AM (0800-0900) | PM(1700-1800) |
| High efficiency | 12 | 10 |
| Low efficiency | 23 | 19 |
| Bus services required – Phase 2 | | |
| Scenario | AM (0800-0900) | PM(1700-1800) |
| High efficiency | 18 | 15 |
| Low efficiency | 35 | 29 |
| Bus services required – Phase 3 | | |
| Scenario | AM (0800-0900) | PM(1700-1800) |
| High efficiency | 17 | 14 |
| Low efficiency | 34 | 29 |


Proposed Bus Stop Locations and Bus Circulation (Phase 1-3) – East and West Access




Proposed Bus Stop Locations and Bus Circulation (Phase 3 onwards) – East and West Access (Bigger Loop)

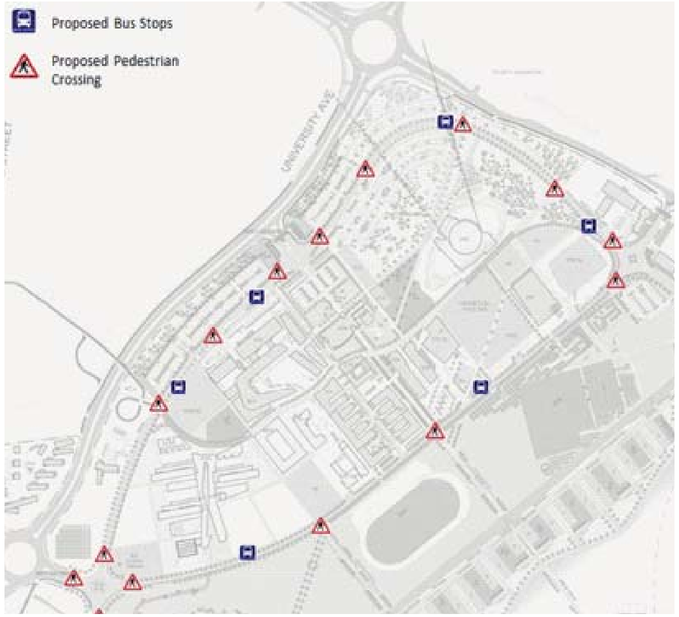
# Walking / Cycling

Walking:

As the number of students on campus increase, safe pedestrian crossing facilities will need to be implemented on pedestrian routes leading to/from the university and the surrounding areas.

Within the site, a network of accessible and safe routes will be needed. However, with the proposed student accommodation, and the proposed bus stops, it is important to note that safe pedestrian crossing facilities are required to provide safety, accessibility and connectivity.

The key locations where pedestrian crossing facilities need to be implemented are shown in the diagram. The proposed pedestrian crossings are located where it is expected to have high pedestrian movements, and on the desirable walking routes.




Cycling:

The level of cycle use is low and, due to the topography, temperature/ weather conditions and general traffic/safety issues in Nicosia will likely remain relatively low in future, despite the fact that the PWD is already implementing some cycling schemes within Nicosia.

The city-wide cycle hire scheme is waiting a new operator, which would bring the scheme back to the university.

Cycling should still be encouraged as it fits with the 'Green campus' target and is good for physical fitness and health benefits.  The Masterplan includes cycle routes, safe/secure cycle parking, lockers and showers for cyclists.

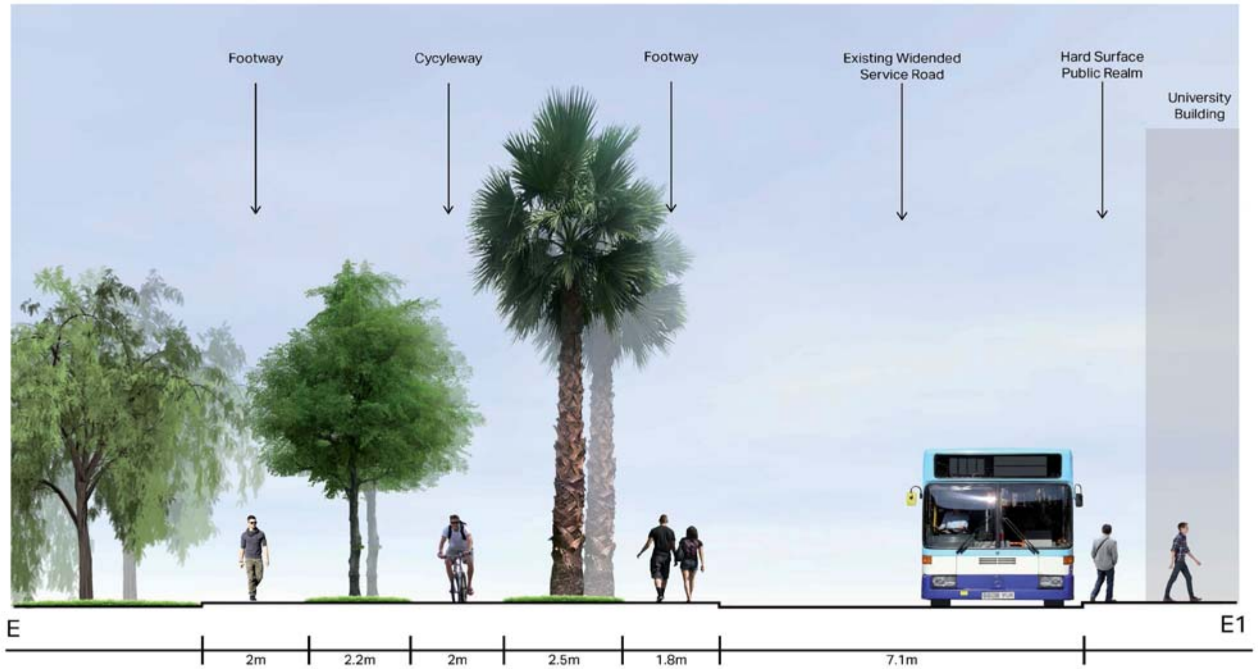
All the proposed cycle routes are connected with the external cycle routes via crossing points, either at grade at traffic signal points, or through a grade-separated crossings.

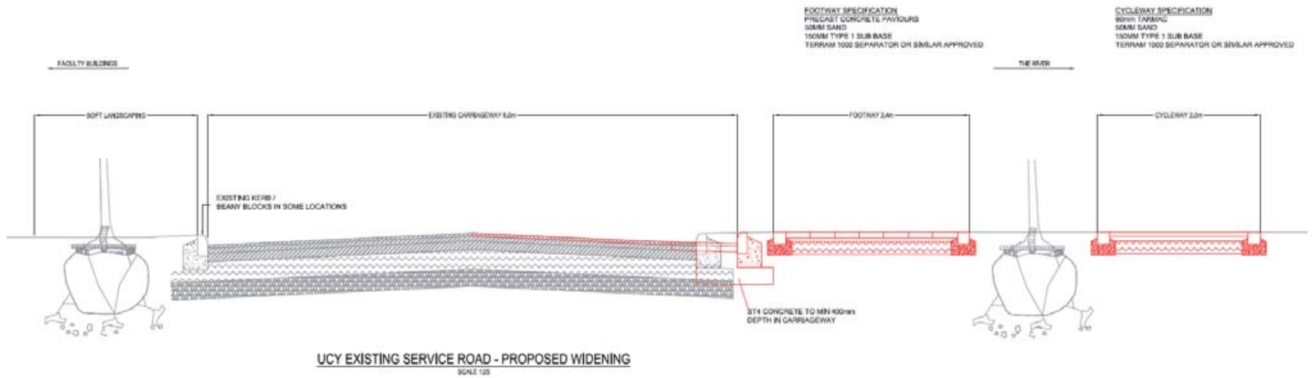
No cycle lane is provided on the north-east section of the university main road, as it is forecast to have higher vehicular traffic movement and would not be safe for the cyclists to share the space with the traffic that head to and from car parking areas, taking into consideration the proposed alternatives which are still able to provide safe and acceptable connectivity and accessibility to and from the campus.

# Service Road

The existing service Road located to the south of the campus, between the green belt and the academic buildings has no bus stops along it, and it serves most of the unsurfaced existing car parks. The road length is around 870m and has a carriageway with 6m width, which was considered to be ''fit for-purpose'' at the current level of use. It is anticipated that with the removal of the unsurfaced car parks and associated traffic, this road would free-up some capacity for other uses. Adding bus stops on it would increase the public transport accessibility significantly for the students attending at the university buildings.

This road, however, might be considered ''tight'' should in future two-way bus services be allowed/required, in addition to service vehicles and/or emergency use. It is therefore recommended to widen the service road so it would become safe and have sufficient capacity to accommodate all movements and possible future bus strategies. The existing road width has a 6m carriageway, 1.1m cycle lane and 1.8m footpath. To accommodate bus services, it was agreed a wider carriageway is required. It is therefore recommended relocating the cycle lane to the other side of the line of trees to provide a 7.1m carriageway (i.e. 6m + 1.1m).



# Travel Plan

The idea of the Green campus, from a transport perspective, is to encourage more sustainable travel behaviour. The travel plan framework sets the objectives and targets of UCY, establishes how it should be managed, and plans a strategy for monitoring the process.

## Objectives

The main objectives of the travel plan framework are:
- Reduce single occupancy car journeys for trips to and from the university campus;
- Manage travel to / from the university for all modes of travel;
- Ensure accessibility by sustainable modes;
- Promote healthy community; and
- Improve the safety for all travel modes.

## Targets

The objectives will be promoted through the Travel Plan targets:
- Support and encourage active travel behaviour (cycling and walking) for all staff, students, and visitors;
- Travel behaviour changes (e.g. car-sharing);
- Adopt the '' Reduce and Rationalise'' parking strategy;
- Encourage the attractiveness of the public transport;
- Work closely with the bus operators in order to find the most attractive and easy way to promote bus usage; and
- Discourage the single car occupancy through the parking management strategy.

In order to set realistic targets regarding the University Travel plan, there is a necessity to gradually adopt changes, so students and staff can be introduced to the new strategies with steps. Intermediate stages (Sub-Phases) were analysed, in order to set gradual targets for the mode split. These intermediate phases were based on gradual increases of the student numbers related to the completion of new buildings.

The targets forecast for the University travel plan show gradual shifts, which would help the university implementing this travel plan in consecutive stages.

**Mode split targets for Phase1 – Stage A (2018)**

| | New Mode Split - Phase 1 - Stage A | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Car (driver) | Car (Passenger) | Bus | Motorcycle | Bicycle | Walk | Other | Car Occupancy |
| Students | 72% | 5% | 10% | 0% | 2% | 10% | 1% | 1.1 |
| Staff | 92% | 1% | 2% | 0% | 1% | 2% | 2% | 1.0 |

**Mode split targets for Phase1 – Stage B (2019)**

| | New Mode Split - Phase 1 - Stage B | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Car (driver) | Car (Passenger) | Bus | Motorcycle | Bicycle | Walk | Other | Car Occupancy |
| Students | 63% | 5% | 19% | 0% | 2% | 10% | 1% | 1.1 |
| Staff | 92% | 1% | 2% | 0% | 1% | 2% | 2% | 1.0 |

**Mode split targets for Phase 1 – Stage C (2020)**

| | New Mode Split - Phase 1 - Stage C | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Car (driver) | Car (Passenger) | Bus | Motorcycle | Bicycle | Walk | Other | Car Occupancy |
| Students | 47% | 5% | 35% | 0% | 2% | 10% | 1% | 1.1 |
| Staff | 92% | 1% | 2% | 0% | 1% | 2% | 2% | 1.0 |

**Mode split targets for Phase 1 – Stage D (2021)**

| | New Mode Split - Phase 1 - Stage D | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Car (driver) | Car (Passenger) | Bus | Motorcycle | Bicycle | Walk | Other | Car Occupancy |
| Students | 30% | 5% | 52% | 0% | 2% | 10% | 1% | 1.2 |
| Staff | 92% | 1% | 2% | 0% | 1% | 2% | 2% | 1.0 |

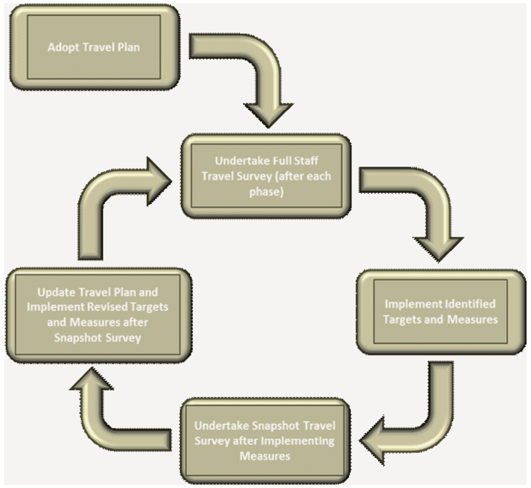
**Mode split targets for Phase 2 (2026)**

| | New Mode Split - Phase 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Car (driver) | Car (Passenger) | Bus | Motorcycle | Bicycle | Walk | Other | Car Occupancy |
| Students | 9% | 5% | 73% | 0% | 2% | 10% | 1% | 1.6 |
| Staff | 92% | 1% | 2% | 0% | 1% | 2% | 2% | 1.0 |

**Mode split targets for Phase 3 (2030)**

| | New Mode Split - Phase 3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Car (driver) | Car (Passenger) | Bus | Motorcycle | Bicycle | Walk | Other | Car Occupancy |
| Students | 7% | 5% | 75% | 0% | 2% | 10% | 1% | 1.7 |
| Staff | 92% | 1% | 2% | 0% | 1% | 2% | 2% | 1.0 |

Travel Plan Implementation



# 7.0 Civil Engineering

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# Foul Sewer Drainage

The existing foul sewerage infrastructure will not have sufficient capacity to accommodate the proposed future increase of student population, therefore we propose that a new foul sewer network is provided for the newly constructed buildings in Phases A and B. The proposed foul sewer will serve the new developments along and near the riverside as well as the new academic zones to the north west boundary of the campus. This sewer will discharge into the existing public foul sewer located to the west of the campus boundary, serving a proposed ultimate population of up to 20,000.

Sewerage Board of Nicosia (SBN) have advised that there is sufficient capacity in the existing foul sewer network to accommodate a new connection for a total population of 10,000. SBN also advised that there is a provision for a new connection to be established at the south west boundary of the campus, near St George's Church. The existing roads in this area have some provision of spare ducting crossing the carriageway for a future rising main to be threaded through allowing a new connection to be established. Acknowledging that the total population of the University Campus may reach 20,000 at the end of Phase B, we propose to establish a suitable larger foul connection, subject to formal consultation and agreement with SBN.

The proposed sewer network serving the campus is designed to avoid any clashes with the existing buried services infrastructure.

For the residential area south of the campus, a foul sewer will run beneath the new road to the rear of the residential blocks to a pumping station close to the river (opposite the tennis courts). This sewer follows the natural fall of the land. A rising main from this pumping station will follow the cycle path and run in the opposite direction crossing the river on the new road bridge to connect to the existing foul drainage system in the road close to St George's' Church.

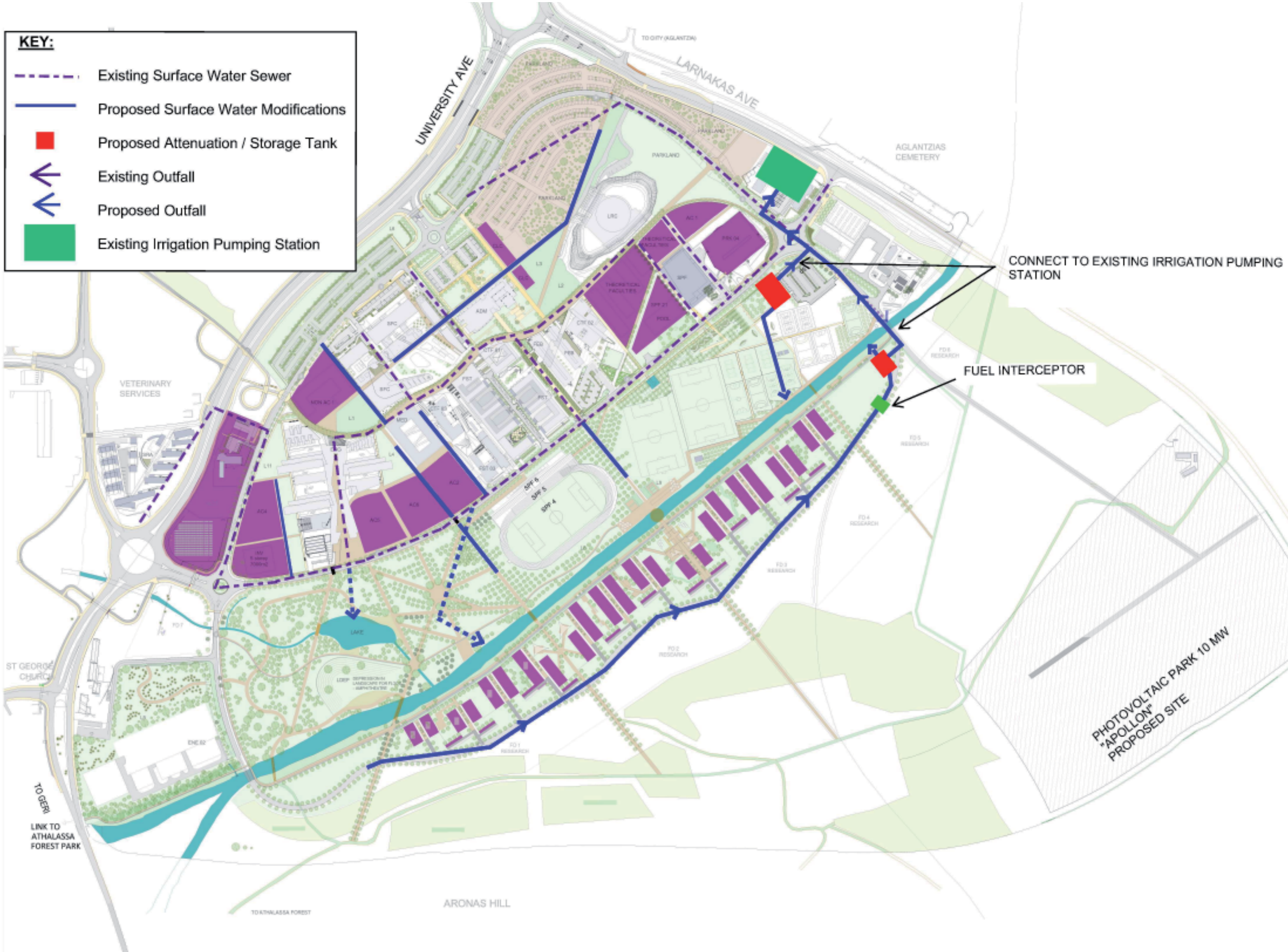
# Surface Water Drainage

The existing man-made lake could be re-profiled to create a wider flood plain which would act as temporary water attenuation in heavy rainfall events. With a hydrobrake installed at the outlet from each underground attenuation tank in order to control the rate of discharge to the receiving watercourse. The surface water sewers will be provided with a bypass separator tank before discharging into the receiving watercourse to capture any heavy contaminants or accidental spillages from roads and traffic. We are proposing that the run-off captured in the attenuation tanks be pumped to the existing irrigation water pumping station for re-use.

Furthermore, there may be benefits in modifying the existing surface water attenuation system such that this could also feed into the irrigation system.

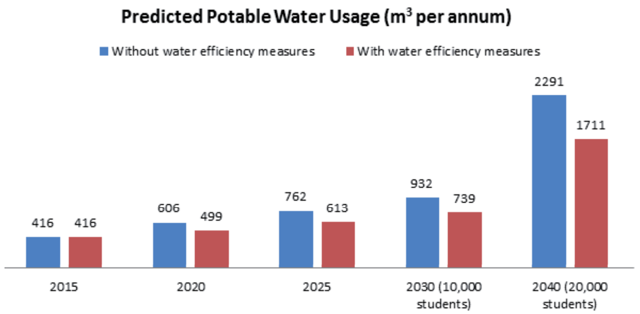
In order to capture the rainwater run-off the attenuation tanks should operate as set out below:
Rainwater is captured in the tank and pumped to the existing irrigation water storage tank for distribution around the site.

Existing drainage from the current and ongoing development works will remain operational, however, a proposed new surface water system will be located south of the Kaloyeris River to serve this area of the campus. The surface water will collect run-off from the impermeable areas, roofs, the road and pedestrian/cycle route adjacent to the river and hard landscaped areas.  This will be collected by conventional surface drainage; gulleys, slot drains, channels and conveyed in pipes beneath the road to discharge by gravity into a proposed attenuation storage tank or pond.  It is intended that the rate of discharge into the river will be limited based upon green field run-off rates. We propose that the run-off stored within the attenuation tank will be pumped to the existing irrigation pumping station and the discharge to the river will only happen when there is no demand for irrigation water or levels in the tank are rising (ie the inflow is greater than the irrigation requirement).  In this event, discharge to the river will occur.



# Potable Water

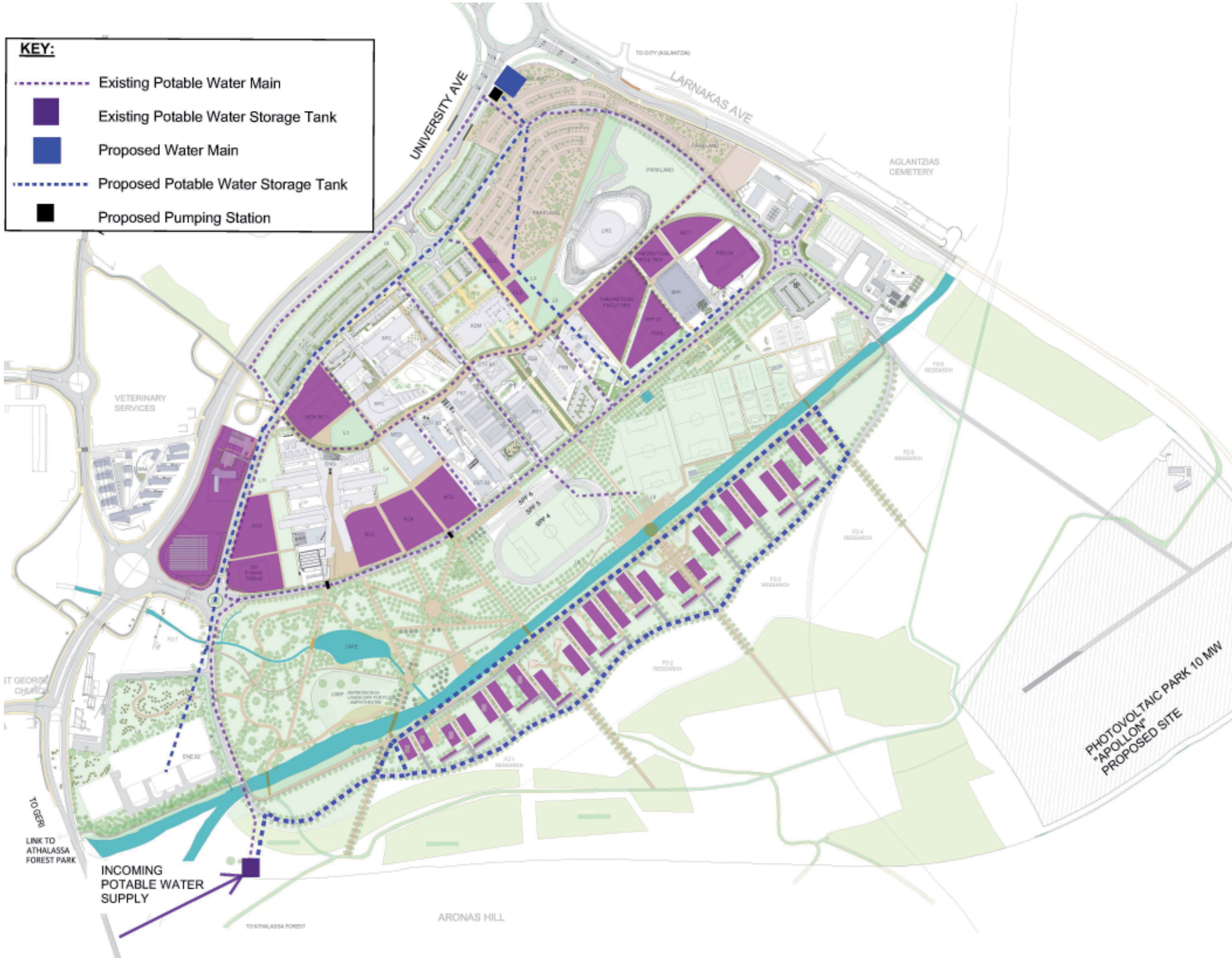
Future water demand assuming by 2030 there is accommodation for 10,000 students on site (and total student numbers by 2040 are 20,000) is anticipated:




Measures in order to achieve water savings:
1. Retrofit dual flush to all WCs;
2. Reduce WC cistern volumes to 4l by the use of displacement devices;
3. Reduce shower flow rates to max 8l/min;
4. Reduce hand-basin tap flow rates to max 6l/min;
5. Reduce run time on push-operated taps to maximum 10 seconds
6. Install individual flush controls to all urinals;
7. Information campaign and improved signage to engage key staff in water efficiency
8. Insulate all local hot water distribution pipework to reduce dead legs.

With water efficiency savings a new storage tank of 550m3 capacity will be required for a population of 10,000 students and 980m3 capacity for a population of 20,000 students.

In order to accommodate a tank of such capacity, a plan area of roughly 20m x 40m area would be required. This area is available at the north boundary of the site currently used for car parking, where the proposed tank could be buried. This area is also elevated above the rest of the campus, providing a hydrostatic gradient for the distribution network, thus reducing the overall pumping requirement.



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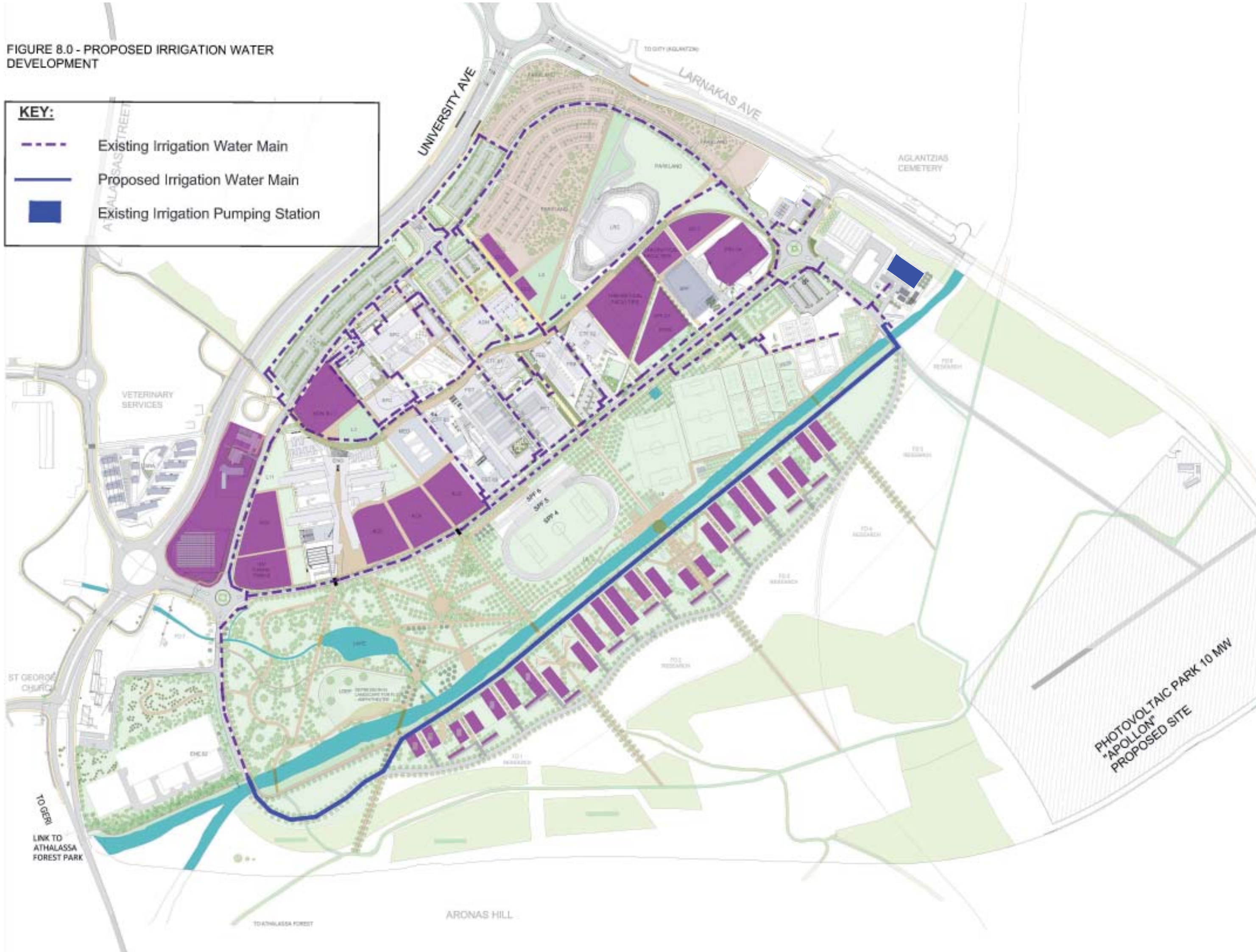
# Irrigation Water / Rainwater

Currently the irrigation demand is met by imported treated wastewater effluent from the municipal WwTW, which falls within the jurisdiction of the Water Development Department, thus making the irrigation system wholly depended on the municipality. In order to improve water security and reduce dependence on the municipality, the campus should identify opportunities which will ensure a more efficient use of the alternative irrigation water sources available from within the campus and rationalise water use.

A system combining rainwater harvesting, stormwater attenuation and dewatering of building basements can provide a viable source of water for irrigation, thus reducing demand on imported greywater. The existing surface water drainage layout could be modified to divert most of the stormwater into temporary storage tanks which would then feed into the existing irrigation storage tank supplying the irrigation pipe network. A pumping station with a rising main will be required to feed the stormwater storage tanks into the central irrigation supply. The existing distribution network will have to be expanded to capture all new landscaped areas and the residential area, which will require some upgrades to the existing distribution mains and, possibly, the pumping station.

The proposals for the irrigation water comprise a simple extension to the existing system creating a loop running immediately in front of the proposed residential zone directly adjacent to the river.

To ensure optimal rainwater storage, a rainwater storage pond with 10,000m3 capacity would be required. This storage capacity could be achieved through upgrading the existing pond to the required size or alternatively by upgrading the existing pond to 3200m3 capacity and creating two additional ponds. The surface water drainage system will need to be modified to drain equal catchment areas into each pond. The rainwater storage ponds) will need to be lined with impermeable membrane to eliminate any water losses to infiltration.



# 8.0 Acknowledgements

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University of Cyprus

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