

Appendix C

**Preliminary Infrastructure Assessment  
University of the Nations Master Plan Update  
Kona, Hawai'i  
G70, February 2020**



# MEMORANDUM

111 S. King Street  
Suite 170  
Honolulu, HI 96813  
808.523.5866  
www.g70.design

<b>TO:</b>	Mr. Paul Childers, Campus Director University of the Nations, Kona 75-5851 Kuakini Highway Kailua-Kona, HI 96740		
<b>ATTENTION:</b>	Mr. Tom Waddle, Project Manager		
<b>DATE:</b>	February 28, 2020	<b>EMAIL/FAX:</b>	
<b>PROJECT:</b>	University of the Nations Master Plan Update		
<b>SUBJECT:</b>	Preliminary Infrastructure Assessment	<b>NO. OF PAGES:</b>	11

## Introduction

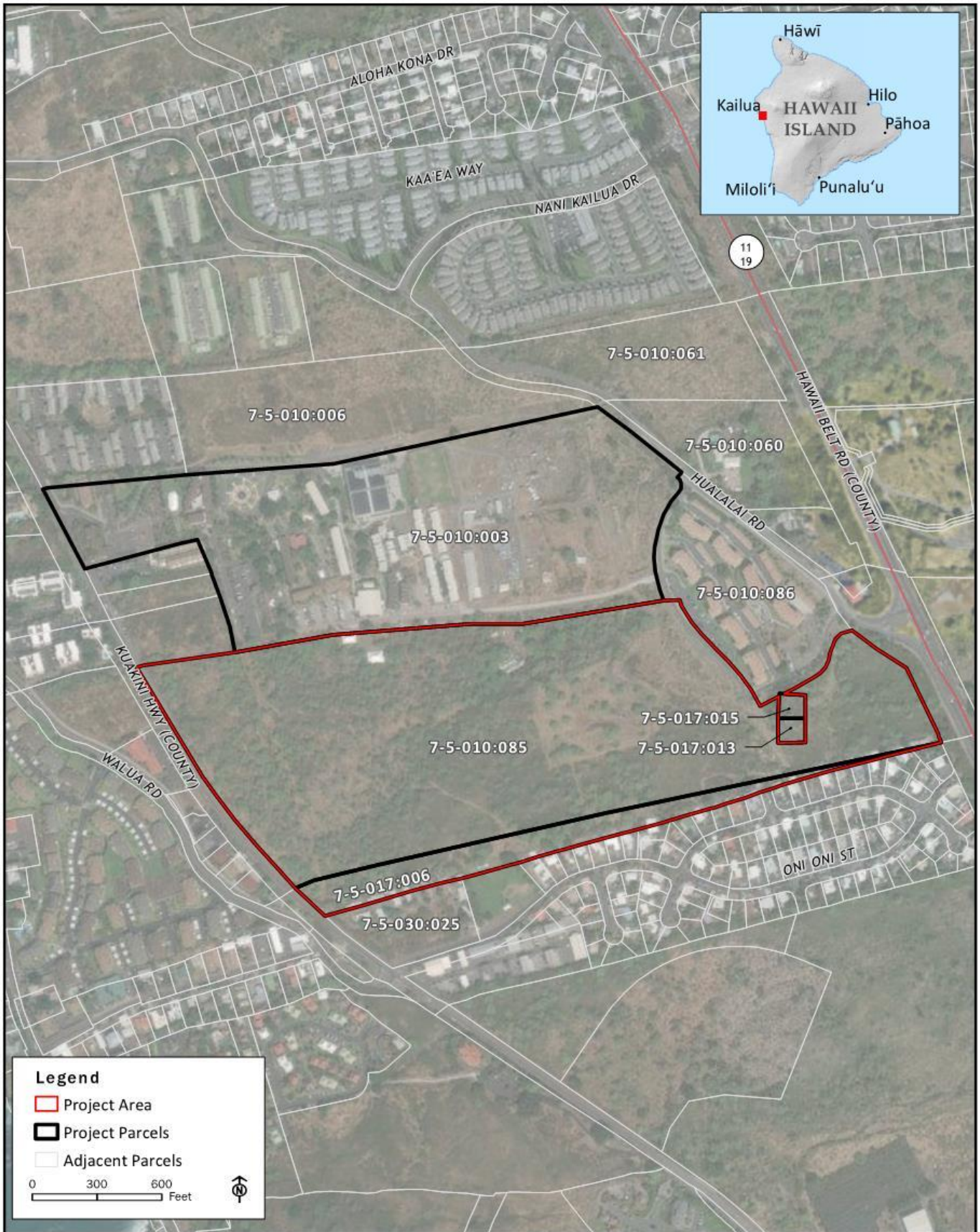
The University of the Nations, Kona (UoNK) is located in Kailua-Kona on the island of Hawaii on TMK (3) 7-5-010:003. UoNK also owns the adjacent TMKs (3) 7-5-010:085 and (3) 7-5-017:006 that lay directly south of the existing campus and plan to develop these TMKs to expand their existing campus.

The existing UoNK campus is located just south of the town of Kailua-Kona, approximately 9-miles south of the Kona International Airport. The current campus encompasses 40 acres, bounded by privately-owned, undeveloped land to the north, County-owned Kuakini Highway to the west, County-owned Hualalai Road and privately-owned condos to the east, and undeveloped land owned by UoNK to the south that is the site of the proposed campus expansion as shown on **Figure 1**.

UoNK is proposing to develop 62 acres of land (**herein referred to as the "Project Site"**) on the property (TMKs (3) 7-5-010:085 and (3) 7-5-017:006) directly south of the existing campus to expand their current operations. The proposed improvements include the development of an elementary, middle, and high school, expansion of their university, student and faculty dorms and housing, athletic facilities, a language center, food supply and maintenance equipment storage, and a chapel. Roadways, parking, walkways, and infrastructure will be installed onsite to support the development. Because of the scale of the proposed improvements, the Project Site will be developed in phases as funding becomes available. See **Figure 2**.

UoNK has contracted G70 to prepare a preliminary engineering study of the campus infrastructure in support of the 2020 UoNK Master Plan Update, as well as entitlement approvals, including a State Land Use (SLU) boundary amendment granted by the Land Use Commission (LUC) in 2003. G70 analyzed record plans and topographic information provided by the UoNK, met with UoNK staff and County of Hawaii officials, and performed a site visit to better understand how the existing campus operates and its future needs.

Using this information, G70 has prepared this memorandum summarizing the campus' existing infrastructure conditions, identified impacts to the existing infrastructure systems due to campus expansion on the 62-acre parcel (Project Site), and described new infrastructure proposed to support the development of the Project Site.



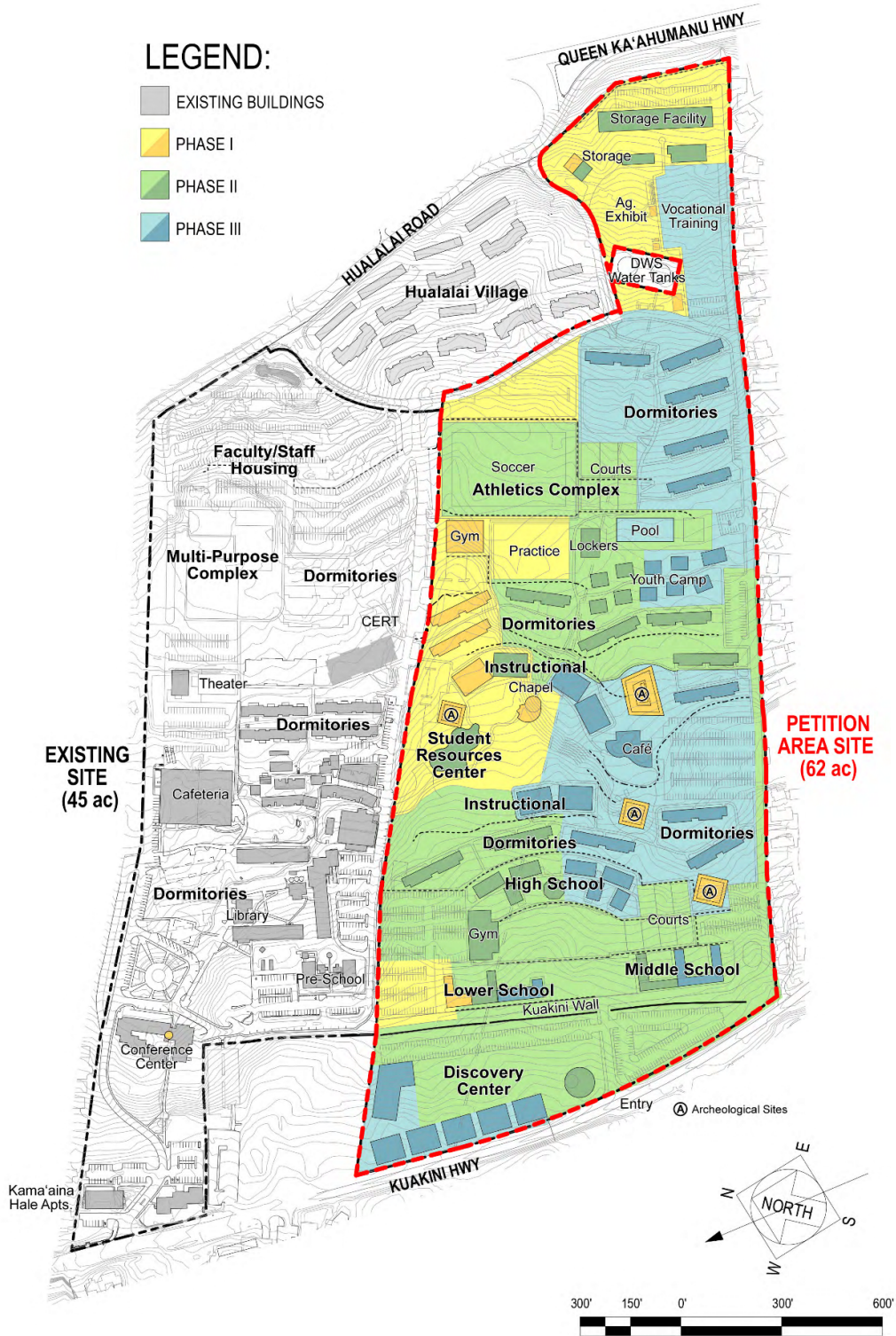
219061-01  
 University of the Nations, Kona

Figure 1: Location Map



**LEGEND:**

- EXISTING BUILDINGS
- PHASE I
- PHASE II
- PHASE III



## **Existing Infrastructure**

### ***Existing Roadways and Vehicular Access***

The existing campus is accessed from Kuakini Highway through several driveways along the makai side of the campus property. The campus has a series of onsite roadways and parking lots connecting the campus' different areas of interest that are linked by a spine road. The spine road is located along the along the existing campus' southern property line (between TMK (3) 7-5-0010:003 and TMK (3) 7-5-010:085 - the Project Site) and extends from Kuakini Highway to Hualalai Road.

The privately owned Hualalai Village condominiums located just mauka of the existing campus have privately-owned perimeter roads that abut the UoNK campus. UoNK has only limited rights to these roads.

### ***Existing Drainage Systems***

The campus is located in Kailua-Kona on the slopes of Hualalai below Hualalai Road. The existing campus and Project Site generally slopes from mauka to makai in the east to west direction. Elevations onsite range from approximately 360 to 90 feet above mean sea level (MSL) with the lowest point located at the main campus entrance along Kuakini Highway.

According to the USDA Natural Resources Conservation Service (NRCS), the campus is comprised of two soil groups; Waiaha-Punaluu-Lava flows complex and Kainaliu cobbly silty clay loam. Both soils are silty clay loams that formed in volcanic ash and are underlain with pahoehoe lava flows. Both soil groups are identified in Hydrologic Soils Group B and are typically well-drained.

UoNK has not reported any drainage issues onsite. It is anticipated that stormwater generated on the existing campus currently overland flows to the undeveloped parcels to the south where it is slowed by heavy vegetation and ultimately infiltrates into the ground. Additional site investigation will be required to confirm existing drainage patterns and flows.

A drainage report prepared by Ross Engineering, Inc. for U of N Bencorp was completed in September 2002 to analyze the offsite stormwater drainage conditions that affect the project site. Concentrated stormwater run-on enters the various campus properties at four different locations from the mauka direction. Three culverts discharge runoff onto the Project Site; an 84-inch pipe culvert crosses Hawaii Belt Road and discharges runoff at the southeastern corner of the existing campus and a 36-inch & 30-inch culvert located at the intersection of Hawaii Belt Road and Hualalai Road discharge runoff onto the 62-acre expansion parcel. On the existing campus (TMK (3) 7-5-010:003), stormwater run-on sheet flows across Hualalai Road and enters the existing campus north of the Hualalai Village Condominiums.

No drainage report was found for the Hualalai Village Condominiums, but during a site visit, multiple dry wells were identified along the private road along the makai edge of the condo property adjacent to the existing campus. It is assumed that these dry wells dispose of all runoff generated and collected on the condominium site and no runoff flows onto the project site.

The runoff that flows onto the site from the culverts flows through the undeveloped 62 acres toward Kuakini Highway or is infiltrated into the ground. At Kuakini Highway, there is an existing 24-inch culvert which conveys runoff across of the highway. Immediately downstream of the culvert, there is a series of six (6)

dry wells located on TMK (3) 7-5-018:094 (Owner: Walua Professional Center). No other culverts or drain structures were identified along Kuakini Highway. It is assumed run-on as well as runoff at the project site is either disposed of by on-site or off-site drywells (across Kuakini Highway) or is slowed by heavy vegetation and the natural terrain as it infiltrates into the ground.

The runoff that enters onto the parcel with the existing campus (TMK (3) 7-5-010:003) continues to flow overland through the undeveloped area mauka of the existing campus before flowing off of the property onto the neighboring undeveloped property to the north.

The Federal Emergency Management Agency's Flood Rate Insurance Maps indicate that the campus is within Zone X, which represents areas with minimal flood hazards. Zone X is defined as areas determined to be outside the 500-year flood limits.

### ***Existing Water System***

The campus' water is supplied by the County of Hawaii Department of Water Supply (DWS) off of the DWS 325 reservoir. Its service zone limits are from 0 feet to the 225-foot elevation (while the existing campus is approximately 90 feet to 360 feet above sea level). There are no onsite water sources or sources of recycled or non-potable water.

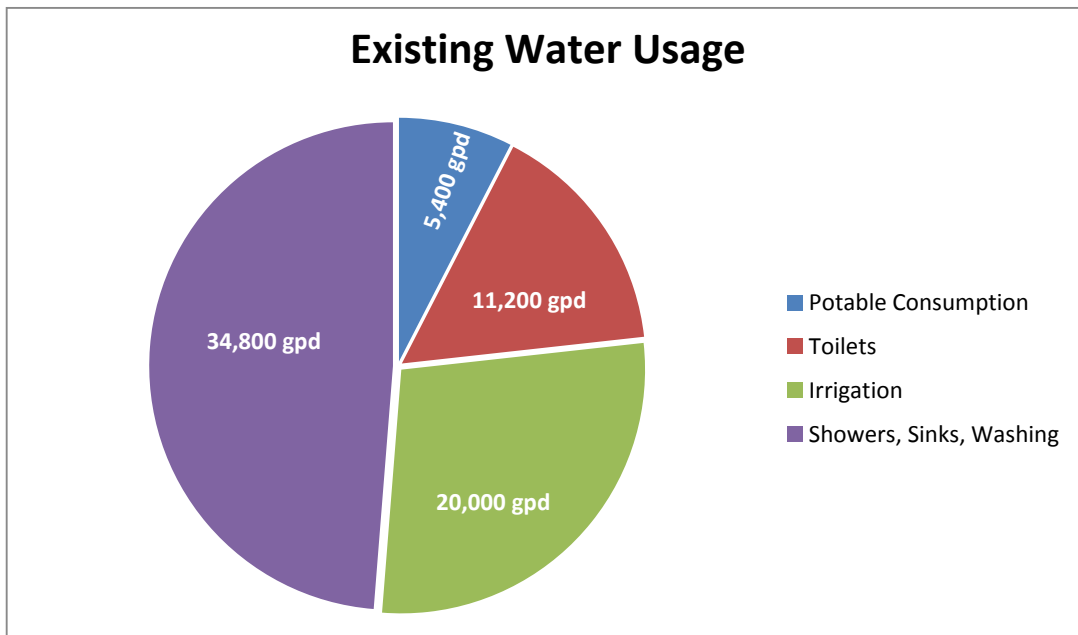
The campus is served from two DWS meters: a 6"x3" master FM meter located near the main campus entrance along Kuakini Highway which connects to a 6" DWS main in Kuakini Highway and an 8"x2" master FM meter located near the top of the spine road which connects to an 8" DWS main in the Hualalai Village lower driveway. The 6"x3" meter is assigned to the TMK for the current campus and the 8"x2" meter is assigned to the Project Site, although currently both meters are servicing the existing campus only. The water system is looped and the master meters reflect two service connection points to the existing DWS system.

Past the water meters, the water is distributed onsite via a system of private water lines. The age of the existing onsite system is currently unknown. The UoNK campus was founded in 1978 and therefore it is assumed that the infrastructure onsite was initially developed no later than 1980, but likely has been expanded over the years.

The average daily water use at the existing campus was analyzed using meter data from the two DWS meters serving the property. The entire existing campus is averaging a daily water use of 70,341 gallons per day (gpd) based on records from 2017 to 2019. This is in excess of the DWS water allocation for the existing campus of 45,200 gallons per day. DWS issued a letter to UoNK in August 2018 stating that actual water use is substantially in excess of what is allocated and DWS has requested that UoNK to pay facility charges for the overuse. Additionally, the letter states that there is no additional water available for future development.

Over the past year, UoNK has assessed the existing water system, added flow metering and initiated an intensive leak repair program that has resulted in a reduction in water use. The repairs have already resulted in a decrease in average daily water usage for the months of January and February of this year to approximately 54,000 gpd. This reduction in water use brings UoNK much closer to the current DWS water allocation. As further repairs are completed, it is expected that water usage as measured through the water meters will normalize to more closely match the actual demand, and move closer to the DWS allocated amount.

The existing campus is an active university campus with an average daytime population of 1,340 people (students and staff) utilizing approximately 30 buildings, associated parking and infrastructure. The existing water use on the campus has been submetered by UoNK staff to determine the quantities and types of water use throughout the existing campus. A breakdown of the different types of water use was provided to G70 and is summarized in the graphic below and includes: an average of 20,000 gallons of water per day for irrigation, approximately 5,400 gpd for drinking and cooking, 11,200 gpd for toilet flushing, and 34,800 gpd for showers, sinks, clothes washing, and vehicle washing. Based on the current student and staff daytime populations, the average per-capita consumption is 53 gallons per capita per day. This volume of gallons per capita day is typically higher than standard daytime population usage because approximately 670 of the 1,340 students and faculty are housed onsite.



The existing water usage onsite can be further reduced by incorporating efficient water fixtures and replacing replanting landscape areas with native plants that require less irrigation.

### ***Existing Wastewater Systems***

The existing campus is connected to the County of Hawaii Department of Environmental Management's wastewater system. There is an existing 8" private sewer main onsite along the spine road that collects wastewater from the individual campus buildings and discharges it to an existing municipal 18" gravity sewer main within Kuakini Highway. The County gravity sewer main flows to the Kealakehe Pump Station and continues to the Kealakehe Wastewater Treatment Plant (WWTP) in Kailua-Kona.

There is existing wastewater infrastructure only on the existing campus at this time, and there is no wastewater infrastructure on-site at the Project Site. The existing 18" County sewer main is assumed to continue fronting the Project Site within Kuakini Highway.

### ***Existing Power and Communication System***

Electrical service to the campus is currently provided by Hawaiian Electric (HE) and communication services are provided by both Hawaiian Tel (HTCO) and Spectrum. As State Public Utility Commission (PUC) regulated public utilities, HE and HTCO are responsible for the development of off-site facilities that meet island-wide needs, such as power generating plants and power and signal transmission lines, and facilities that serve regional needs of Kailua-Kona. Presently, the campus is served by these utilities off of Kuakini Highway. The HE electrical service is at the primary distribution voltage of 12.47kV, three phase, through a single metering point. The power is further distributed at 480/277v, 208/120v, three and single phase, to the campus buildings and facilities. This electrical infrastructure is owned and maintained by UofNK.

Spectrum is a State Department of Commerce and Consumer Affairs cable television franchisee that is the sole land-line provider of cable television service to Hawaii Island. Although not a PUC regulated utility, Spectrum's off-site facility construction policy is to provide such facilities where the anticipated revenue from the prospective service connections warrants the expenditure. HTCO has a similar policy with regard to new developments.

## **Proposed Infrastructure**

### ***Proposed Roadway and Vehicular Access Improvements***

The proposed expansion of campus on the 62-acre Project Site, as well as improvements to the existing campus, is phased to allow for incremental development of the campus extending from the existing spine road. Three major phases of improvements are anticipated. Additional roadways and parking facilities will be constructed in each phase of the project. This approach will allow for the new development to be integrated into the existing campus and for more holistic circulation and operations onsite. The proposed development and phasing are shown in **Figure 2** and **Attachment 2**.

Along its mauka boundary, the Project Site is adjacent to Hualalai Road and Hawaii Belt Road. The State of Hawaii Department of Transportation (HDOT) has not confirmed if there are any mapped access restrictions along the campus' property lines adjacent to Hawaii Belt Road, but the campus is located within 250 feet of the Hualalai Road intersection and this limited distance makes a connection from the campus to Hawaii Belt Road infeasible. Additionally, there is steep bank separating the highway and the campus and this considerable elevation change makes a driveway undesirable.

A traffic consultant has been hired to prepare a Mobility Analysis Report (MAR) for the future phases of the campus developments. The MAR will evaluate traffic flows for each phase of the project and provide analysis and recommendations for new vehicular access points at Kuakini Highway and Hualalai Road.

It is anticipated that two-way, two-lane paved access roads will loop around the expansion area to provide both vehicular and fire/emergency access throughout the campus.

### ***Proposed Drainage Systems***

Stormwater management for the campus expansion will focus on both the adequate conveyance and disposal/retention of stormwater runoff generated by the proposed development and increase in impervious areas, but will also prioritize maintaining predeveloped hydrologic conditions through the utilization of best management practices (BMPs) that focus on protecting and restoring natural ecosystems near the source



of runoff generation. A Low Impact Development (LID) approach to development will be utilized in developing a stormwater management plan for the campus.

Additional and increased stormwater runoff resulting, due to project development and addition of impervious area, will be mitigated with the introduction of BMPs and other drainage infrastructure such as infiltration trenches, drywells and detention/retention basins in or to attenuate any increases in peak flow to prevent adverse impacts downstream of the campus.

Integration of LID Best Management Practices (BMPs) can also minimize detrimental downstream stormwater impacts by working to treat and retain runoff generated from a range of storm events. The LID BMPs are typically microscale in size and distributed throughout the development area and designed to treat runoff, reduce erosion, protect habitats, recharge groundwater. A well designed and integrated LID strategy may reduce infrastructure costs by reducing the need of larger more costly traditional stormwater drainage systems.

LID BMPs should be incorporated into the site, building and landscape designs. Examples of LID practices and techniques are listed below:

- Permeable pavements, sidewalks and hardscape
- Rain gardens
- Biofiltration including vegetated swales, planters, filter strips
- Rainwater harvesting such as cisterns and irrigation systems
- Green roofs
- Infiltration trenches and basins
- Infiltration sumps and drywells

An effective LID strategy will need to be developed in conjunction with the proposed water and wastewater infrastructure so that stormwater can be harvested and reused for non-potable water uses throughout the campus. Offsetting irrigation demand by rainwater capture and xeriscape design, will result in significant reduction in demand for potable water which is very limited in allocated quantity, and will reduce the size of additional infrastructure needed to serve the campus expansion.

### ***Proposed Water System***

The existing campus is currently using more water than it is allocated, and no additional water is available from the county water system for future development of the Project Site. Simultaneously, the UoNK has expressed a desire to show their commitment to green infrastructure and a sustainable future by aiming to be as self-sufficient as possible. To support the development and expansion of the campus, water management strategies incorporating water re-use and repurposing will be included in the infrastructure development program and additional source development will be needed. The goals of the water resource management strategies will be to:

1. Reduce the water demand by introducing water efficient fixture units, promote conservation measures, and introduce native and climate appropriate landscaping
2. Develop non-potable water sources onsite by capturing stormwater runoff
3. Develop additional potable water sources by drilling and developing one or more groundwater wells
4. Match source water quality with end-user requirements to minimize potable water use

5. Promote groundwater recharge by maximizing infiltration across the campus

While the Project Site is being developed in three phases over 30 years, a new water source(s) will be needed to support buildout of each phase. Source development should be planned to meet the immediate needs of each phase but also plan for the full buildout and expansion of the entire campus.

The project is located within the Keauhou Aquifer System. This aquifer currently has an existing usage of 15.4 million gallons per day (mgd) and a sustainable yield of 38 MPD. New wells may be drilled and treated to provide additional potable water onsite. The project team has contracted a hydrogeologist to study the feasibility of developing wells onsite. UoNK has also been in discussions with neighboring landowners to potentially form partnerships to develop new wells and water sources offsite. Any offsite water source improvements would likely be dedicated to the County and additional DWS water unit credits would be secured for the expansion campus.

To help reduce the potable water needed, potable water on the new development will be used primarily for domestic purposes with limited irrigation use. Non-potable water will be used for irrigation and be supplied by treated grey water from the different buildings onsite and harvested stormwater runoff.

Anticipated escalation in water costs, the environmental impacts of pumping and “over-treating” water in relation to its end use, and climate change and its effect on the availability of groundwater are all drivers for water resource management goals. A full water master plan is being developed for the campus to model the anticipated water demands and required water source and supply improvements required to meet those demands and is being done in conjunction with the development master plan.

The anticipated additional water demands attributable to the development of the 62-acre Project Site, are shown below:

Use <sup>4</sup>	Phase 1	Phase 2	Phase 3
P-12 Students (FTE) <sup>1</sup>	30,000	45,000	60,000
University Students (FTE) <sup>1</sup>	7,800	20,700	56,400
P-12 & University Students (Dorm) <sup>2</sup>	20,000	110,000	140,000
<b>Total</b>	<b>57,800</b>	<b>175,700</b>	<b>256,400</b>
DWS Water Units <sup>3</sup>	145	439	641

<sup>1</sup> 60 gallons per capita day (DWS Water System Standards)

<sup>2</sup> 100 gallons per capita day (DWS Water System Standards)

<sup>3</sup> 400 gpd per water unit (DWS Water System Standards)

<sup>4</sup> Population Counts shown in Attachment 1

These additional water demands identify the additional water supply requirements needed (also in DWS Water Units) for expansion and are based upon the anticipated population attributable to the 62-acre Project Site. See detailed calculations in **Attachment 1**.

Additional water infrastructure improvements may be required to serve the upper reaches of the campus above the 225' service elevation of the DWS 325 reservoir. In lieu of pumps, a new service connection to the existing DWS water main in the Hawaii Belt Road is proposed to extend water service from the DWS

595 shaft to the upper elevations of the existing campus and Project Site situated above the 225' service elevation.

#### ***Proposed Wastewater Systems***

The onsite wastewater system will continue to be connected to the existing County wastewater system. A wastewater service request has been submitted to the County of Hawaii Department of Environmental Management Wastewater Division for the campus expansion. The County has noted that the Kealakehe WWTP has a committed capacity of 3.8 mgd, while the rated capacity is 5.3 mgd, indicating that there is available capacity at the treatment plant.

It is expected that the existing wastewater conveyance system could accommodate some level of increase in flows, but that at some point in the future, offsite improvements to the County wastewater conveyance system may be required. Once those requirements are identified, proposed design and construction budgets and phasing will be developed and included in an infrastructure master plan.

In conjunction with the proposed water system sustainability planning effort, the reductions in water use will likely result in a reduction in wastewater generation. Water management strategies incorporating onsite treatment of wastewater into grey water re-use will further reduce the contribution of wastewater flows to the County system. In particular, grey water use in irrigation of landscaping is an alternative that will likely be pursued.

#### ***Proposed Power and Communication System***

As State Public Utility Commission (PUC) regulated public utilities, HE and HTCO are responsible to provide utility service to the public with reasonable requirement to those in their service area. Presently, the campus is served by these utilities off of Kuakini Highway. Once utility demands are established, service requests to each utility can be submitted to determine cost and requirement to upgrade existing services to the campus. Service upgrades or new services are likely required.

The development of renewable energy sources is feasible based upon the proposed development plans and will likely consist of photovoltaic panels over covered parking and building rooftops, and will consist of battery storage. It is possible the campus could have its own micro-grid. In addition, the installation of energy monitoring equipment and controls are recommended to better identify areas for conservation and optimization. Energy conservation measures will be implemented throughout the campus for both existing and proposed systems.

Spectrum is a State Department of Commerce and Consumer Affairs cable television franchisee that is the sole land-line provider of cable television service to Hawaii Island. Although not a PUC regulated utility, Spectrum off-site facility construction policy is to provide such facilities where the anticipated revenue from the prospective service connections warrants the expenditure. Once utility demands are established, a service request to Spectrum can be submitted to determine cost and requirements to upgrade existing services to the campus.

**Table 1: Projected Water Demand**

	Phase 1 Population (persons)	Phase 2 Population (persons)	Phase 3 Population (persons)	Average Daily Demand <sup>1</sup> (gal/person/day)	Phase 1 Water Demand (GPD)	Phase 2 Water Demand (GPD)	Phase 3 Water Demand (GPD)
P-12 Students (FTE)	500	750	1,000	60	30,000	45,000	60,000
University Students (FTE)	130	345	940	60	7,800	20,700	56,400
<b>TOTAL</b>	<b>630</b>	<b>1,095</b>	<b>1,940</b>	<b>SUBTOTAL</b>	<b>37,800</b>	<b>65,700</b>	<b>116,400</b>
P-12 and University Students (Dorming)	200	1,100	1,400	100	20,000	110,000	140,000
				<b>TOTAL</b>	<b>57,800</b>	<b>175,700</b>	<b>256,400</b>
				<b>WATER UNITS</b>	<b>145</b>	<b>439</b>	<b>641</b>

<sup>1</sup> Average Daily Demand value taken from DWS Water System Standards



University of the Nations Kona - Petition Area  
Central "Spine" Road Phase 1 Infrastructure Plan - Attachment 2

LEGEND:

-  PHASE I
-  PHASE II
-  PHASE III

