US Army Corps of Engineers®

Assessment of Health Care Infrastructure and Services
Lyndon Baines Johnson Tropical Medical Center
Pago Pago, American Samoa
22-24 April 2019

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In response to a directive associated with the Consolidated Appropriations Act, 2019, the U.S. Department of the Interior, Office of Insular Affairs, requested the assistance of the U.S. Army Corps of Engineers (USACE), Honolulu District with producing a report to Congress addressing the condition of the Lyndon Baines Johnson (LBJ) Tropical Medical Center in Pago Pago, American Samoa and estimating the cost of renovating and modernizing the current facility, constructing a new facility, and whether a renovated facility will have sufficient capacity to meet American Samoa's needs.

The appropriations committee report language from Senate Bill 115-276 reads:

"American Samoa.--The Committee is concerned about the long term impact of Cyclone Gita on American Samoa, particularly as it relates to impending increase in the minimum wage and how that will impact American Samoa's economy and its ability to recover. Additionally, given the state of the Lyndon B. Johnson Hospital, the Committee directs the Office to provide information, within 90 days of enactment of this act, to the Committee on the condition of the hospital; the estimated cost of building a new hospital; the estimated cost of completing all renovations necessary to modernize the hospital; and estimates of whether a renovated facility has sufficient capacity to meet American Samoa's needs."

On 22-24 April 2019, the U.S. Army Corps of Engineers (USACE), Honolulu District (POH) and Huntsville Engineering Center (HNC) Medical Center for Expertise and Standardization (MX), along with the U.S. Army Health Facilities Planning Agency (USAHFPA) conducted a clinical mission review and facilities infrastructure assessment survey of the LBJ Tropical Medical Center (TMC). The LBJ Tropical Medical Center is a 50 year old single story 150,000 square foot (SF) facility, consisting of eighteen (18) buildings in a campus setting, which resides in a harsh environment of constant high temperature and humidity. Since its original construction, the facility has been repaired, renovated and expanded (an ongoing project will add an additional two story building).

The current infrastructure of the LBJ TMC hospital is in a state of failure due to age, environmental exposure, and lack of preventative maintenance. Extensive repair and/or replacement of facility sections is required to ensure compliance with hospital accreditation standards and to ensure the life, health, and safety of staff, patients, and visitors. While the facility structure has held up relatively well, it is not in compliance with current seismic and

wind requirements and retrofits would be expensive and disruptive. The electrical and mechanical systems are in poor condition and in need of immediate repair. Architectural deficiencies have led to mold and mildew growth in critical areas, exposing staff and patients to significant health risks. The nurse call system is inoperable in key locations, plumbing, water treatment and medical gas systems are all in failed or failing condition.

Based on an extensive review of clinical capabilities, the existing facility is incapable of providing enough space to meet the long term needs of the patient population. The facility is dependent upon funding from the Center for Medicare and Medicaid Services (CMS), further degradation of the infrastructure will result in non-compliance with standards and will result in denial of accreditation. LBJ TMC is the only full-service healthcare facility in the territory and further degradation of the plant infrastructure will hamper the delivery of care to American Samoa's population.

The following options are proposed for facilities infrastructure capital investment.

Option A: Repair the infrastructure of the current facility (150,000 SF) with no additional space expansion. The estimated construction cost is $161.4M. This involves retrofitting all infrastructure to meet current building code and hospital accreditation criteria, to include immediate deficiencies in the architectural, electrical, fire protection, mechanical, and structural systems. This however will require numerous utilities outages and interim life safety measures that could impact the delivery of immediate patient care services. While individual systems could be brought up to current code standard through such a repair, this does not address the existing clinical space deficiencies nor meet the future end-state of clinical services.

Option B: Construct a new multi-story hospital (150,000 SF) on a proposed site on the western side of the island. The estimated cost for a new hospital is between $325-390M. This would entail the construction of a new facility in compliance with current building code and hospital accreditation criteria. The site location for a new facility would require land transfer, upgrade to island infrastructure, and would increase travel distance from Pago Pago and the eastern side of the island, potentially impacting the delivery of immediate care. Further analysis is required to determine additional infrastructure costs. While individual systems can be repaired by replacement, this course of action does not address the existing clinical space deficiencies nor meet the future end-state of clinical services.

Option C: Construct a new multi-story hospital (150,000 SF) on the current LBJ campus. The estimated cost for this option varies from $375 to $425M, depending upon the course of phasing to ensure minimal disruptions to the current facilities and accessibility. This would entail the construction of a new facility in compliance with current building code and hospital accreditation criteria. This would require interim life safety measures and continual coordination with the existing operations to minimize impacts to clinical delivery. While individual systems could be

brought up to current code standard, this does not address the existing clinical space deficiencies nor meet the future end-state of clinical services.

Option D: Construct a new multi-story hospital (370,000 SF) on a proposed site on the western side of the island. The estimated cost for a new hospital is $700M. This would entail the construction of a new facility in compliance with current building code and hospital accreditation criteria. The facility would also be properly sized to support the clinical needs of American Samoa for the next 20-30 years. The site location for a new facility would require land transfer, upgrade to island infrastructure, and would increase travel distance from Pago Pago and the eastern side of the island, potentially impacting the delivery of immediate care. Further analysis is required to determine additional infrastructure costs.

Option E: Construct a new multi-story hospital (370,000 SF) on the current LBJ campus. The estimated cost for this option varies from $750 to $900M, depending upon the course of phasing to ensure minimal disruptions to the current facilities and accessibility. This would entail the construction of a new facility in compliance with current building code and hospital accreditation criteria. The facility would also be properly sized to support the clinical needs of American Samoa for the next 20-30 years. This would require interim life safety measures and continual coordination with the existing operations to minimize impacts to clinical delivery. A further site assessment is required to ensure space is available for a multi-story facility on the existing campus. This is the preferred option of the American Samoa Government.

Course of Action	**Estimated Construction Cost ($M)**	**Estimated Sustainment Cost/Year ($M) UFC 3-701-01 (FY18) ($8.03/SF X 211%) Cost Factor (American Samoa)**	**Risk to Clinical Delivery**
Option A: Renovate all failing infrastructure with no clinical expansion (150K SF Facility)	$161.4 (FY19 Funding), excluding swing space and other temporary infrastructure to retain services.	$2.5	Very high risk due to patient exposure to construction in active clinical areas.
Option B: Construct a new hospital with the same footprint (150k SF Facility) with no clinical expansion on a new location on the western side of the island	$325-390 (FY20-24 Funding)	$2.5	Low risk

Course of Action	Estimated Construction Cost ($M)	Estimated Sustainment Cost/Year ($M) UFC 3-701-01 (FY18) ($8.03/SF X 211%) Cost Factor (American Samoa)	Risk to Clinical Delivery
Option C: Construct a new hospital with the same footprint (150k SF Facility) allowing for no clinical expansion on the existing LBJ TMC site.	$375-425 (FY 20-24 Funding)	$2.5	Medium risk, new construction adjacent to existing facilities.
Option D: Construct a new hospital with a complete footprint (370k SF Facility) to fulfill future mission growth on a new location on the western side of the island.	$700	$6.3	Low risk
Option E: Construct a new hospital with a complete footprint (370k SF Facility) to fulfill mission growth on the existing LBJ TMC site.	$750-900 (FY 20-24 Funding)	$6.3	Medium risk, new construction adjacent to existing facilities

The state of current facilities infrastructure and the need for enhancement of clinical services to support the present and future health care needs of American Samoa support the replacement of the existing facility. Repairs to the infrastructure alone in the existing facility without properly supporting space expansion is not a complete solution and will introduce a higher level of risk to patients and staff with exposure to mold, dust, and other harmful contaminants during construction. Interim Life Safety Measures and enhanced Infection Control Management is critical now to ensure the life, health, and safety of patients, staff, and visitors.

Congressional Response
Assessment of Health Care Infrastructure and Services
Lyndon Baines Johnson Tropical Medical Center
Pago Pago, American Samoa

1. **Background.** On 22-24 April 2019, the U.S. Army Corps of Engineers (USACE), Hawaii District (POH) and Huntsville Engineering Center (HNC), along with the U.S. Army Health Facilities Planning Agency (USAHFPA) conducted a clinical mission review and facilities infrastructure assessment survey of the Lyndon Baines Johnson (LBJ) Tropical Medical Center (TMC) in Pago Pago, American Samoa. This survey was in support of the Office of Insular Affairs (OIA). The Committee of Appropriations, for the Department of the Interior (DOI), Environment, and Related Agencies, in the 2019 Appropriations Bill addressed specific concerns over the facilities conditions at the LBJ TMC. The exact concern as published in the appropriation committee language associated with the 15 February 2019 Bill signed by President Trump and as follows:

   "American Samoa.—The Committee is concerned about the long term impact of Cyclone Gita on American Samoa, particularly as it relates to impending increase in the minimum wage and how that will impact American Samoa's economy and its ability to recover. Additionally, given the state of the Lyndon B. Johnson Hospital, the Committee directs the Office to provide information, within 90 days of enactment of this act, to the Committee on the condition of the hospital; the estimated cost of building a new hospital; the estimated cost of completing all renovations necessary to modernize the hospital; and estimates of whether a renovated facility has sufficient capacity to meet American Samoa's needs."

   The LBJ Tropical Medical Center (LBJ TMC) is a 128-bed general acute care hospital, with an approximate footprint of 150,000 square feet, constructed into six (6) separate linear buildings connected by two primary corridors bisecting each, in a grid pattern. The facility was originally constructed in the mid 1960's and attained full operation in 1968. The facility is a single story concrete bent frame, sloped roof and wood framed structure which has undergone a number of minor renovations over the years. The facility is certainly approaching the end of its serviceable life cycle (50 years).

2. **Assessment Team Qualifications.** In order to meet the requirements of the above, the USACE assembled a team of subject matter experts. These individuals included senior architect and engineers from the USACE Medical Center of Expertise and Standardization (MX) under the Command of HNC along with specialized support for seismic analysis and cost estimation from HNC. The team also consisted of a senior clinical planner from the USAHFPA and a clinical and equipment field officer from that organization. All team

members have professional licensure and have established personnel competencies through direct participation in the Department of Defense Medical Military Construction (DODM MILCON) Program and the Department of Veterans Affairs Major Project Execution Portfolio. The individual team members are identified in Appendix A.

3. **Technical Approach.** The assessment team spent three days at the LBJ TMC with two critical focal areas. The technical team of architect and engineers conducted a complete facilities assessment of the LBJ TMC Complex to include interstitial areas and occupied clinical and administrative areas. The visual tour was an assessment of facilities compliance with governing building criteria, to include, but not limited to, compliance with such standards as recommend by the Centers for Medicare and Medicaid Services (CMS), the American Society for Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), the Facilities Guideline Institute (FGI) for Architectural Standards, and the National Fire Protection Association (NFPA). At the same time, the clinical planning team conducted staff interviews with the LBJ leadership and department leaders to assess current patient care delivery capacities, capabilities, and shortfalls that could support future clinical mission growth. This information was vital to developing a Plan for Design (PFD), a document that calculates building square footage to support clinical platforms, to assess the costs of a replacement facility.

   The Unified Facilities Criteria (UFC) 3-701-01, Department of Defense (DoD) Pricing Guide and UFC 3-730-01, Programming Cost Estimates for Military Construction were used as guidance in the development of estimated cost for new construction and renovations to modernize LBJ TMC. Unit cost reference in the determination of estimated cost included UFC guidance and table, PAX Newsletter 3.2.2 dated 30 May 2018, and Defense Health Agency (DHA) guidance. The three references provided a variation or range of cost.

   Individual assessment of the various fire protection, life safety, architectural, mechanical, electrical, and structural systems was evaluated and the current condition is discussed within each section. Currently small projects (<$5M) are ongoing to enhance clinical services and are not considered in this portion of the evaluation. Based on information gathered during interview and document examination, is was determined that the recent standalone construction (Mental Health Faculty) and "phased renovations" are being constructed for approximately $400-600/sf (dependent on space and clinical mission). These projects are small in nature when compared to the overall area of the hospital. Further major capital investments, to include repair of the existing campus infrastructure, will escalate the construction cost/sf. The use of temporary facilities to house services during major repair, the use of temporary equipment to support infrastructure replacement, projected escalation in materials costs, enhanced life safety and infection control containment, and enhanced project management will direct increased cost of future construction efforts.

- The interior rooms, layout, construction and medical equipment are outdated and showing signs of significant wear. From obsolete multiple bed (3 bed per room) inpatient wards and OR/ LDR rooms to insufficient sterile processing layout; the size of these rooms are small and inadequate for patient care which does not meet current standards. Other issues observed were inefficient patient flow with department adjacencies and travel distances. The interior construction lacks life safety separation/smoke compartments, insufficient building or room pressurization and Sound Transmission Coefficient (STC) rating between spaces. This does not meet current code criteria to include the Facilities Guidelines Institute Standards (FGI) and the National Fire Protection Association Standard for Health Care Facilities (NFPA 99) and Life Safety Code (NFPA 101). The building equipment is antiquated which parts are hard to find, equipment is failing rapidly, beyond repair and pose significant safety risks to patients, staff and maintenance personnel. The team encountered 10-20 year old radiology equipment, compressors and other equipment located in confined spaces which do not have the proper maintenance clearances. Requires major modernization or repair by replacement.

- The hospital interior finishes throughout (floors, walls, base, doors, door frames, ceilings, corner guards, handrails, crashrails, etc.) are all in fair to poor condition showing signs of significant wear, damage and age. This critically affects the unique cleanability, durability, and maintainability of facility surfaces. The current state of the hospital's interior with the accumulation of harmful microorganisms along with dust and moisture, is directly impacting patient care and exposing them to a high risk of infection. Finishes must be modernized through repair by replacement.

Electrical Observations. Overall assessment of current infrastructure: Poor.

- The hospital's electrical power system is a combination of very old and relatively new equipment and wiring. A project (2007 drawings) provided new service transformers, switchgear, and panelboards. The entire facility's normal and emergency loads were to be transferred to this new system, but the project's scope did not include the transition. Only three wards – Dialysis, Maternity, and Mental Health – have been placed on the system to date. The remaining wards are still fed from the very old, hazardous distribution system. Replacement of the system is required to meet NFPA 70, National Electrical Code.

- There are two emergency generators – an old 900kW and a fairly old 600kW – that provide backup power to the old power system and the new power system, respectively. The 600kW generator was intended to be temporary, was installed outdoors, has experienced a great deal of degradation from the elements, and has reportedly had

The estimated current Plant Replacement Value (PRV) was calculated for the existing hospital based on a 150,000 SF Current Area. Based on the formulas provided in UFC 3-701-01 (2018 Version) the current LBJ TMC replacement value is $192M. This estimated PRV does not take into account the valuation of any current projects that are now ongoing at the facility to include the Operating Room and Intensive Care Unit Modernization that will increase square footage. Typically, when renovation cost exceed 70% of the PRV (approximately $140M for this analysis), new construction is programmed. The cost to repair the current infrastructure in the facility is 72% of the PRV.

4. **Response to Congressional Request.** After extensive site investigation and interview encounters with the entire staff of the LBJ TMC, the team has established the following conclusions in response to the request from the Committee on Appropriations under the leadership of the honorable Senator Murkowski:

   a. ***Condition of the Existing LBJ TMC Hospital.*** The current infrastructure of the LBJ TMC hospital is in a state of failure due to age and environmental exposure. This infrastructure assessment includes, but is not limited to the following.

   Architectural Observations. Overall assessment of current infrastructure: Fair

   - Architectural features such as the building exterior cladding, doors and wood windows are all in fair condition. Significant evidence of mold, decay, rot and/or deterioration of these exterior components was observed, primarily due to the corrosive nature of a tropical environment (humidity, moisture, etc.) and lack of maintenance. The standing seam metal roofing appears to be in fair condition, but is showing significant signs of wear. Excessive areas of surface rust, numerous areas of patch work to significant fastener replacement was observed throughout. Without adequate regional exterior construction and maintenance program, failure of components is inevitable, which can lead to leaky buildings, mold growth and infection control issues. The exterior facade requires major modernization or repair by replacement.

   - The building envelope is severely compromised with numerous penetrations, open joints, failed caulk/sealant to openings not sealed. In addition, the lay-in ceiling system is utilized as a horizontal barrier between the unconditioned space and the conditioned (occupied) spaces. Many locations have been observed where the ceilings were stained, warped or corroded from moisture infiltration or condensation. Air or water infiltration results in larger HVAC loads or the need for additional supply air for pressurization of spaces impacting HVAC equipment longevity, utility failures and maintenance costs. The building envelope requires major modernization or repair by replacement.

- There was no defined separation of buildings with smoke or fire barriers. Upon inspection of the interior walls in the hospital structure separating the wards, the walls are constructed of 1-hour equivalent construction and the doors meet the criteria for smoke tight construction. However, there were numerous unsealed penetrations of these walls which would allow smoke migration between buildings in the event of a fire emergency. Smoke barriers must be repaired and maintained in compliance with NFPA 101.

- There was excessive storage in the hallways of the Dialysis clinic that blocked the emergency means of egress. This condition would be remediated with the introduction of space savers in the larger storage rooms or reduced stockpiling of supplies to ensure compliance with NFPA 101.

- There was no fire separation between the existing central utility plant and the adjacent laundry area. The plant is the location of the (2) diesel-powered boilers and other equipment that could promote the ignition of a fire. Without a proper 2-hour firewall separation between this high hazard area and the laundry area, a fire could propagate quickly putting building occupants at risk.

- There was no evidence of Interim Life Safety Measures in place to protect occupants in lieu of facilities deficiencies and ongoing hospital construction as required by accreditation agencies such as the CMS and Joint Commission. Additional safeguards to promote fire safety must be in place to support providing adequate levels of life safety to include but not limited to: additional fire drills, temporary smoke detectors, additional fire extinguishers, and additional training of staff in evacuation protocol in the event of a fire emergency.

Health Care Delivery/Clinical Observations.

- Configuration of Inpatient Units: The current configuration of the inpatient units is based on 1960's model of care. Of the inpatient units (Pediatrics, Maternity, Surgical, Medicine, Nursery/Neonatal Intensive Care Unit (NICU), and Intensive Care Unit (ICU), the Pediatric, Maternity, Medicine and Surgical units are configured for two or three patient beds in each room with one bathroom. Research supports that providing single patient rooms contributes to: shorter lengths-of-stay; fewer medication errors; lower rates of hospital-acquired infection; fewer patient transfers; increased privacy; less noise, therefore fewer sleep disturbances; more patient control; and higher patient satisfaction. Additionally, the cultural dynamic of the American Samoa includes frequent family member support/care giving on the inpatient units.

- The location of the nursing stations on Pediatric, Medicine, and Surgery is centrally located and offers limited visibility of the patient rooms. Research supports that

performance problems. The two systems are completely separated, so each is susceptible to a complete loss of power if a generator did not start when utility power is lost. The new distribution system described above was built to accept multiple generators, but cannot be utilized in this way until the remainder of the hospital's loads are transitioned to the new system.

- Over the 50+ year life of the facility, many projects have made modifications to the branch circuit wiring systems (from panelboards downstream to equipment, lighting, and receptacles) in various areas within the hospital. In a great majority of the areas, however, the branch wiring and the equipment or outlets it serves is in very poor condition, and countless code violations exist. Modernization of the wiring systems is required in order to comply with NFPA 70.

- Nurse Call System: There is no Nurse Call system in the Operating Room Suite. The Nurse Call System in the Labor and Delivery Suite is inoperable. These systems must be replaced in compliance with NFPA 99.

- The hospital's main Telephone Rack and main Data Rack are relatively new and in adequate condition, but the telephone system horizontal cabling and data system horizontal cabling wire management is very poor. Old abandoned cables remain throughout the hospital, and the new and abandoned cables are routed without proper support or orderly grouping. There is a cable tray system only down the main corridors, but the number of cables greatly exceeds the tray system's capacity, and many of them are routed outside of the tray.

Fire Protection Observations. Overall system of current infrastructure: Fair.

- Overall, the level of life and fire safety in the facility is in fair condition. Approximately 95% of the facility is protected by an automatic sprinkler system with 50 PSI of water pressure constant through the hospital complex. Due to the recessed beam construction in some of the perimeter areas throughout the campus, sprinkler pendants are obstructed and do not meet the minimum coverages as defined by NFPA. Renovation of the Operating Room Building will provide total facilities coverage.

- The master fire alarm panel has reached life expectancy and needs replacement, to include replacement of notification devices, all cabling, and all imitation devices. The panel is approximately 20 years old and replacement parts to sustain the system are difficult to acquire. The current system had multiple troubles identified but remained operational. Failure to replace the system will result in continued degradation that will eventually impact the safety of building occupants and lack of compliance with NFPA 72, Fire Alarm Code.

providing the proper combination of decentralized and centralized nurse centers within the patient care environment contributes to the following: reduction in errors when nurses are close to patients; decreased nurses' travel time/distance; increased nurses' time spent caring for patients/families; and improved job satisfaction for nursing staff. Lastly, the current location of the nursing stations is centrally located, but offers limited visibility to patient rooms. The lack of visibility to the patient rooms creates disadvantages for staff, limited already, to monitor patients and family/visitor activities.

- Inpatient rooms lack hand-washing sinks making compliance with hygiene and infection control procedures difficult if not impossible and may contribute to/or increase morbidity and mortality.

- The ICU, an open-bay unit, offers limited visual or auditory privacy for patient or family members. Research supports that an excessive or persistent noise within patient care areas contributes to the following: sleep disruption; confusion; impediment to healing; creation of stress and anxiety; potential increase in the use of prescription medications; and the possibility of increasing staff errors.

- The size of outpatient exam/treatment rooms limit patient care capabilities to support the patient population and family care-givers during appointments. The standard exam/treatment rooms in the current hospital ranged from 84 SF to 110 SF. These room sizes limit the medical staff capabilities to provide care due to the large bariatric patient population in American Samoa. Furthermore, multiple family members accompany patients for standard medical appointments limiting space to provide medical care in the exam rooms. The DoD and Veterans Administration size standard exam rooms range from 120 to 125 SF.

- Negative/Positive pressure isolation rooms are completely absent from the existing facility. The lack of these specific rooms make compliance with infection control and procedures impossible and may contribute to or increase morbidity and mortality.

- The morgue/autopsy suite is grossly undersized for the current workload demand. This department serves the entire population for American Samoa. The space for body storage is significantly limited by over 50%; while body preparation and viewing spaces are absent from the morgue.

- Physical therapy is significantly undersized to support both inpatient and outpatient operations. The clinic lacks adequate equipment and patient care spaces to support the physical therapy/rehabilitation mission.

- The pharmacy is the sole distributor for medication for all of American Samoa. The pharmacy lacks space for all compounding requirement and results in nursing staff performing compounding on the inpatient units. Compounding in the pharmacy minimizes if not prevents potential patient harm or death that could result from microbial contamination, chemical and physical contaminants; large content errors in the strength of correct ingredients and the mixing of incorrect ingredients. Furthermore, the pharmacy is significantly undersized to support the current mission for distributing medications to the entire population of American Samoa.
- The dental clinic is the sole provider for dental services for all of American Samoa. The dental clinic is undersized for specialty and general dental workload demand. The dental laboratory is inadequately sized to support prosthodontics.

Mechanical Observations. Overall assessment of current infrastructure: Poor.

- The central heating ventilation and air conditioning (HVAC) systems are in a failed condition with ramped mold, rust and decay, directly impacting patient care and exposing the most susceptible patients (surgical recovery, pediatrics, OB, etc.) to a high risk of airborne infection. Most buildings no longer have any functional outside air supply system and are far outside the required temperature and humidity standards. Several breakouts of nosocomial airborne infectious diseases have already occurred in the inpatient wards. The space conditions are in clear violation of Joint Commission criteria and the HVAC systems must be repaired through replacement.
- HVAC System failure has led to a lack of temperature and humidity control in most areas and most building have no functional fresh air supply. Even the newest air handling units (~2 years old) in Dialysis show evidence of mold and contamination of the airstream. The facilities must be upgraded with conditioned mechanical and plenum spaces as mentioned in the Architectural section requiring major modernization or repair by facilities replacement.
- The central mechanical systems (chillers, boilers, cooling towers, controls etc.) as well as many air handling units are directly exposed to the marine climate and have been operating for years with untreated make-up water which is known to be hard and aggressive towards the piping materials. Most all equipment and systems are showing advanced signs of corrosion and failure and are in need of replacement. These capital infrastructure systems must be repaired by replacement.
- The location of the central utility plant and particularly the location of the cooling towers is placing susceptible dialysis patient at direct risk of legionella exposure as it is within 10ft of the Dialysis outside waiting area. The two cooling towers must be repaired by replacement in new locations.

- The degraded building envelope and lack of continuous air barrier and vapor retarder allow excessive outside air and moisture infiltration. This is resulting in severe mechanical equipment degradation as well as higher HVAC loads, utility failures and maintenance costs. The existing 1960's building design was intended for passive cooling and open windows but cannot meet modern FGI and ASHRAE 170 criteria for temperature and humidity control and outside air filtration known to be critical for infection control and patient care.

- The medical gas systems are in a constant state of alarm (at the Local and Area Alarm levels) plus have no functional Master Alarm Panel placing patients at risk. The central medical gas systems (compressors, vacuum pumps, manifolds) are severely degraded due to direct exposure to the marine climate. The medical gas system must be repaired by replacement to ensure compliance with NFPA 99.

- A single vacuum system is being utilized to serve Medical Vacuum, Waste Anesthetic Gas Disposal and Dental Oral Evacuation, not meeting the pressure requirements of any individual system and posing a risk of fire due to the oxidizers in the presence of system contaminants. Combining Oral Evacuation with Medical Vacuum is not permissible and risks damage to the dry vacuum pumps with exposure to liquid and amalgam. Amalgam separation, required by Federal law, is not provided. Systems must be repaired to be in compliance with NFPA 99.

- The Medical Air System has not been functional for years resulting in a significant increase in the use of bottled oxygen to support patient ventilators and the use of non-medical grade air for some anesthesia machines which could pose a risk to the patient.

- The Dental Air system has no dew-point control and inadequate filtration placing patients at risk of exposure to a contaminated air stream.

Structural Observations. Overall assessment of current infrastructure: Fair.

- The overall structure is in fair condition, the roof is in fair condition with no evidence of sagging or structural failure and some water damage, the concrete frames are in fair condition exhibiting some cracking and spalling (structural deterioration of surface concrete), and the foundation appears to be in good condition with no cracks or differential settlement problems.

- The design of the facility is deficient and does not provide adequate resistance to the maximum anticipated seismic and wind loads for American Samoa as found in ASCE 7, the International Building Code, and the current version of UFC 3-301-01 as applicable.

In its current state, the concrete frames are insufficient to resist the maximum seismic event and the roof and windows are insufficient to resist the maximum wind event as defined in the aforementioned codes.

- As an emergency facility the ability for the hospital to not only remain standing, but also to maintain functionality is imperative. This is the only hospital for the island, and critical failure would lead to excessive loss of life.

b. Estimated Cost of Building a New Hospital.

The **Base** estimated cost of construction for a new hospital **similar in size to the existing facility** (150k SF) is estimated to be between **$250M-300M** based on current clinical operations and based on the current PRV and inflation cost factors associated with 5-year future construction costs. The estimate has no consideration for potential obstacles that could be present on the current site location, does not include facilities demolition, and would be for a more typical "clear" or "green field" construction using a design-bid-build acquisition strategy.

A green field option (Option B) was considered in a 2016 report provided by the facility on the western side of the island near the airport. A western location would be a hindrance for population near Pago Pago, lead to increased ambulance response time, and the potential for negative clinical outcomes. It should be noted that any green field site would need to include separate costs for land acquisition, site grading, enhanced utilities infrastructure to include a redundant power from the eastern island power plant, and civil work to include new roadways and parking areas. This external cost associated with construction outside of the structure of the facility will increase the base replacement cost by 30% to a new estimated **cost for a "green field" site to $325-390M**.

The current hospital is on Government owned land and could potentially require further land negotiations prior to construction and demolition. If a new hospital is to be built on-site, to be referred to as Option C, (and current services are to be operational during construction), then a phased design-bid-build acquisition strategy would likely be implemented. If this is the solution, then additional phased construction cost and time will be incurred, approximately up to 24 months in duration, and will increase **the estimated cost to replace the hospital on the existing grounds to a range between $375-425M** based upon the number of phases in the project, movement of personnel between old and new buildings, utilities upgrading and demolition of failing facilities. Optimization of phasing and efficiencies in the time associated with moving staff into new facilities will direct costs to the lower end of the scale.

Current operational funding for the hospital is provided primarily through Center for Medicare and Medicaid Services (CMS) reimbursement and is approximately $50M annually. Traditionally, operational funding has been inadequate to support optimal delivery of patient care. It is also important that any facility on the island be appropriately sized to respond to any mass casualty event, to include tsunamis, earthquakes, and man-made disasters. Based on interviews with the hospital Engineering staff it was also understood that annual maintenance and sustainment budget (including salaries, benefits, and small repair projects) is allotted is $2M annually but is often subject to reductions based on the level of reimbursement received. Based on the current facility, the space allocation, and calculations based on DoD guidance, it is estimated that sustainment cost for this facility would be approximately $2.5M annually for a 150,000 SF hospital in American Samoa (Cost Factor: 2.11). Enhanced sustainment funding is critical to avoid premature degradation of new facilities infrastructure.

c. Estimated Cost of Completing all Renovations Necessary to Modernize the Hospital.

The estimated renovation cost necessary to restore the hospital is $161.4M, referred to Option A; the rough order of magnitude calculation is provided in this section. These costs represent the amount to restore the facility infrastructure and do not consider exterior site modifications or additional square footage growth with the exception of the construction of a new Central Utility Plant (CUP). Based on the assessment of the current site conditions and the documents provided in support of this report, $161.4M renovation to modernize the hospital is basis of estimate for further cost development and the starting point for the remainder of this discussion. This cost does not account for space reprogramming and subsequent modernization to enhance clinical delivery.

The CUP has reached failing status. In order to properly replace all equipment and maintain operability of the hospital, a new footprint for a CUP must be initiated. This will pose significant phasing challenges and require additional cost to commission all new equipment. The replacement of the CUP is critical to ensure safe operation of the facility. Based upon the programming guidance in UFC 3-701-01, the replacement unit cost (RUC) for a CUP is $1,263/per square foot if scope can be determined during planning. Otherwise, 20% of Primary Facility PRV cost is historically used. Given the state of the current CUP and the synchronization of equipment replacement to retain facilities operability, the 20% PRV factor must be considered. This equates to a CUP replacement cost of $38M.

The roofing system is suspect in regards to is ability to withstand a cyclone event. The majority of the mechanical and electrical distribution systems through the hospital are attached to the roofing's structural support systems. A complete removal of roofing elements and full replacement of the roofing structure is required to eliminate unconditioned attic

spaces. The cost to replace the roof would be complicated by this and is estimated to be $20M.

The replacement of a fire alarm and upgrade to the construction of the 1-hour firewall barriers separating buildings in the hospital campus is estimated to be $10M. This figure also includes complete fireproofing of all unsealed penetrations.

The replacement of electrical systems, to include the 2 current generators reaching end of lifecycle and all subsequent main panels and subpanels, to ensure compliance with current National Electrical Code Standards throughout the 150k square foot facility is estimated to be approximately $15M, with a 30% phasing factor to ensure phasing to retain electrical operations, totaling $19.5M.

The installation of new cooling towers, air handling units, ductwork, and insulation to eliminate the mold propagation throughout the facility is complex under a renovation project without elimination of unconditioned above ceiling areas as mentioned in the discussion about the roofing system. The level of magnitude to replace the two cooling towers, failing air handling units, replacement of all ductwork, insulation, and complete commissioning of the system in order to ensure optimal climate control alone can be estimated at $35M, based on similar costs to replace these systems in other military hospitals; including a 30% phasing factor to ensure phasing to retain mechanical operations, the estimate to repair all HVAC systems is $45.5M.

The medical gas system is dependent upon an oxygen delivery service only utilizing cylinders at supply manifolds. These manifolds are at the end of lifecycle and need complete replacement in accordance with NFPA standards. Also, separate storage areas must be ensured to prevent the mixing of used and unused tanks. The cost to upgrade the oxygen system, to include removal and repair of all distribution piping, zone valves, and the replacement of medical air and vacuum systems throughout the hospital is estimated to cost $5M, including a 30% phasing factor for phased replacement, totaling $6.5M.

The patient nurse call systems are also approaching end of line cycle and need to ensure compliance with NFPA standards. The cost to replace the system, to include new distribution equipment is approximately $3M based on costs associated with replacement at similar military hospitals of these systems.

Plumbing systems to include hot water distribution, conditioning, and sanitary systems are also reaching end-of-lifecycle and must be considered for restoration. Replacement of these systems is estimated to be $3M, including a 30% phasing factor for phased replacement, totaling $3.9M.

Architectural systems are also reaching end-of-lifecycle and must be restored to assist in ensuring a clean environment. These restorations include but are not limited to ceiling grid

replacement to ensure smoketight construction, restoration and painting of corridor and room walls, Replacement of failing floor tile to include abatement. Replacement of these systems is estimated to be $10M, including a 50% phasing factor for hazardous material abatement and phased construction, totaling $15M.

Summary of Renovation Costs:

System	Estimated Cost ($M)
Central Utility Plant	$38
Roofing / Attic Crawlspace	$20
Fire Protection / Life Safety	$10
Electrical	$19.5
Mechanical	$45.5
Medical Gas	$6.5
Nurse Call	$3
Plumbing	$3.9
Architectural/Seismic	$15
TOTAL Replacement of Major Systems	**$161.4**

These replacement costs are representative of infrastructure only and equate to approximately 84% of the plant replacement value. The impact to clinical operations cannot be ignored in a renovation and the level of work required will require enhanced infection control safeguards and interim life safety measures that may incur additional costs. These renovation costs are with current space "as-is" and do not account for additional costs incurred to enhance clinical care delivery through additional space growth.

d. The Ability of a Renovated Facility to Provide Sufficient Capacity to meet the needs of American Samoa.

Based on the analysis of the current state of the facilities infrastructure and the limitations of the current footprint to provide optimal clinical delivery, a replacement facility is required to ensure modern healthcare delivery in lieu of renovation to the existing facility.

There are two courses of action for a replacement facility with clinical expansion capabilities on the island of American Samoa. The first option is a replacement facility to be constructed on a "green field" location (Western Side of Island), referred to as Option D, and the other option consists of location on the existing LBJ campus, referred to as Option E.

A Plan for Design (PFD) was constructed after extensive interviews with all staff to predict future requirements for clinical services on the island. Anticipated growth in combating the

epidemic of Type 2 Diabetes will spawn the need for facilities growth, along with enhanced infrastructure and inpatient space for single-bed patient rooms.

Based on the initial PFD, a new facility meeting all projected clinical needs will need to be approximately 370,000 Gross Square Feet (GSF) in area, supporting a staff operation of 750 personnel. The only way to achieve this vision will require 2-story construction on either site. This increase in square footage requires refinement of the projected cost analysis in Section 4b. A Department of Defense Form 1391, Request for Military Construction was prepared to project the cost of a 370,000 SF facility.

Based on the 30% escalation factor for a new site location as mentioned in Section 4b, the cost for a new 370,000 SF hospital on the western side of the island is $700 M. Based on the escalation range for construction of a new hospital on the grounds of the current LBJ TMC, the cost for a new 370,000 SF hospital is $750-900 M, dependent upon the number of phases. To eliminate risks and costs associated with the option to construct a 370,000 SF hospital on the existing site, the land currently occupied by the Public Health Department across from the existing facility is available for construction phasing. This land is approximately 3/4 acres in area. This land is under the control of the Government and the LBJ TMC. The Governor of American Samoa, the Director of Health, and LBJ leadership agreed to utilize this land if LBJ needs it for expansion. The Public Health Office of American Samoa currently has several other clinics to serve the public throughout the island and can initiate movement of services from this location at minimum on a temporary basis.

5. **Cost Summary of Renovation and Replacement Options.** The following table is a summary of items as requested by the Committee based on all options available to improving the quality of facilities and the quality of care to the citizens of American Samoa. These options ensure full compliance with applicable building codes and standards. These estimates include design, construction, and supervision costs required to complete facilities renovations or replacement, but does not include replacement and installation of new medical equipment and furnishings (see Medical Equipment and Furnishings below).

Course of Action	Estimated Costs ($M)	Risk to Clinical Delivery	Advantages	Disadvantages
Option A: Renovate all failing infrastructure with no clinical expansion (150K SF Facility)	• $161.4 (FY19 Funding), excluding swing space and other	Very high risk due to patient exposure to construction in active	Improves immediate infrastructure conditions.	Does not account for clinical space requirements and would create

Course of Action	Estimated Costs (SM)	Risk to Clinical Delivery	Advantages	Disadvantages
	temporary infrastructure to retain services. • $2.5/yr. sustainment (FY18 costs)	clinical areas.		numerous risks to clinical delivery.
Option B: Construct a new hospital with the same footprint (150k SF Facility) with no clinical expansion on a new location on the western side of the island	• $325-390 (FY20-24 Funding) • $2.5/yr. sustainment (FY18 costs)	Low risk	Provides a facility in full code compliance without working on an active care site.	Unknowns with island infrastructure capabilities, remoteness from eastern island, and does not account for clinical space requirements.
Option C: Construct a new hospital with the same footprint (150k SF Facility) allowing for no clinical expansion on the existing LBJ TMC site.	• $375-425 (FY 20-24 Funding) • $2.5/yr. sustainment (FY18 costs)	Medium risk, new construction adjacent to existing facilities.	Provides a facility in full code compliance.	Increased congestion on current site will require phasing. Does not account for clinical space requirements.
Option D: Construct a new hospital with a complete footprint (370k SF Facility) to fulfill future mission growth and clinical expansion on a new location on the western side of the island.	• $700 • $6.3/yr. sustainment (FY18 costs)	Low risk	Provides a fully compliant facility with clinical capacity.	Unknowns with island infrastructure capabilities and remoteness for eastern island patients.

Course of Action	Estimated Costs ($M)	Risk to Clinical Delivery	Advantages	Disadvantages
Option E*: Construct a new hospital with a complete footprint (370k SF Facility) to fulfill mission growth and clinical expansion on the existing LBJ TMC site.	• $750-900 • $6.3/yr. sustainment (FY18 costs)	Medium risk, new construction adjacent to existing facilities	Provides a fully compliant facility with clinical capacity.	Increased congestion on current site will require phasing and real estate acquisition.

* It is the preference of the American Samoan Government and LBJ Administration to pursue Option E as a complete, permanent solution to the delivery of health care services on the island for the next 50 years.

Equipment and Furnishings. The above estimates do not include equipment and furnishings costs. A comprehensive lifecycle analysis of equipment must be made upon the initiation of a course of action as listed above. The initial outfitting costs for new equipment and transition costs, to include moving and installation of equipment can be estimated to be 15-20% of the construction cost for the project. Equipment procurement planning should commence upon solicitation for construction of the new facility.

6. **Conclusion.** The state of current facilities infrastructure and the need for enhancement of clinical services to support the present and future health care needs of the territory, support American Samoa considering the replacement of the existing facility. Repairs to the infrastructure alone in the existing facility without properly supporting space expansion is not a complete solution and will introduce a higher level of risk to patients and staff with exposure to mold, dust, and other harmful contaminants during construction. The enactment of Interim Life Safety Measures and enhanced Infection Control Management is critical now to ensure the life, health, and safety of patients, staff, and visitors. Based on the criticality of the repairs to the existing structure, immediate repairs must be undertaken to address all infrastructure deficiencies unless an option is directed for a new facility. Immediate repairs to the life safety, electrical, mechanical, medical gas, and replacement nurse call systems should be considered as interim measures with an estimated cost of $80M while other courses of action are reviewed to provide an acceptable environment of care for the hospital population.

7. The United States Army Corps of Engineers and the United States Army Medical Command can provide technical support to include planning, design, construction, and patient care

delivery requirements to continue the partnerships with the staff of the Office of Insular Affairs and the LBJ Tropical Medical Center.