

This section contains preliminary findings and recommendations related to infrastructure capacity, condition, and some anticipated infrastructure improvements associated with reuse of the Fort. The sources of the information contained in this report consist of an initial presentation by Fort personnel in 2006, multiple site visits and interviews with Fort personnel from 2006 to the present, a meeting with Fort Monroe's Department of Public Works in October 2008, and reviews of plans, reports, and mapping provided by Fort personnel. Additional studies are ongoing related to the capacity and condition of existing infrastructure elements as well as analyses regarding the ownership, operation, and maintenance of these various infrastructure elements after the Army leaves in 2011. These additional studies will be completed by the end of December 2008 after which this Technical Support Manual section will be updated as needed with more current information.

*This section was prepared by
Kimley-Horn & Associates, Inc.
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infrastructure

In general, Fort Monroe’s infrastructure appears to be in better condition than was expected based on what the Army has reported. Kimley-Horn’s experience with other base closures has been that the existing infrastructure, particularly utility infrastructure, is old and not well maintained and typically requires substantial rehabilitation and/or replacement. In 2003, Hurricane Isabel inflicted considerable damage to the Fort’s infrastructure and enabled the Army to secure \$90 million in funding for Hurricane repairs. This funding facilitated the replacement and upgrading of roads, some of the water distribution system, and some of the storm and sanitary sewer systems. Based on information provided by the Army, Figure 7B-1 summarizes the condition of the different infrastructure systems based on a presentation made in June of 2006.

Currently, most of the various infrastructure components – streets, drainage, water, sewer, gas, bridges, etc. - are owned, operated, and maintained by the Army. The water and sewer systems are owned by the Army but are maintained through privatization contracts. Once the Army leaves, the ownership of most of the infrastructure, with the exception of some the phone and cable communications infrastructure that is privately owned will be transferred to the Commonwealth of Virginia. These systems are large in size, old in age, and provide the backbone for the operations of Fort Monroe, similar to the infrastructure

function of a small City. The operation and maintenance of these systems once the Army leaves is critically important to ensure uninterrupted service to the Fort in facilitating a smooth transition for its reuse. Currently several options are being considered regarding the operation and maintenance of these systems. One option being considered is the City of Hampton providing operation and maintenance of these systems with the exception of the water distribution system. Since the City of Hampton’s water system is owned and operated by the City of Newport News Waterworks Division, Newport News Waterworks operation and maintenance of the water system is being considered. Discussions with the Cities of Hampton and Newport News are ongoing to identify the condition under which they would provide these services. As the current ongoing meetings and discussions are completed, a better understanding will be gained regarding the feasibility of this option and the Technical Support Manual will be updated accordingly.

EXISTING CONDITIONS

Roads/Bridges – Much of the roadway network has been resurfaced in the last few years. There are some roadway segments and parking lots that are in need of resurfacing; however, additional resurfacing is not planned at this time due to the base closure.

INFRASTRUCTURE COMPONENT	CONDITION
Roads	Very Good
Water	Fair to Good
Sanitary Sewer	Very Good
Drainage	Good
Electrical Power	Very Good
Natural Gas	Fair

Figure 7B-1: Infrastructure conditions on the Fort



Figure 7B-2: Cracked pavement requiring repair

The Mugler Bridge at the entrance to the Fort from Mellen Street as well as the two Mercury Boulevard bridges crossing Mill Creek are owned by the City of Hampton. According to city staff, the Mugler Bridge is approximately 45-years-old and the Mercury Boulevard bridges are approximately 18 to 20 years old. Conditional inspections are performed periodically and there are no known deficiencies with these bridges. Based on a meeting with City of Hampton staff in October 2008, it was reported that the Mugler Bridge had recently had its joints repaired on the bridge deck. Potential modifications to the Mugler Bridge, such as canti-levered sidewalks, utility connections, etc., might be prohibitive given the age of the bridge, the non-existence of drawings for the bridge, and the large quantity of utility lines that are currently connected to its sides.

The four bridges -three vehicular, one pedestrian only- providing access across the moat are inspected every two years and, based on a 2006 bridge inspection report, all appear to be in fair to good condition. The 2006 inspection revealed no structural problems but cited spalling of some of the concrete surfaces, rusting of some exposed rebar, and pedestrian railings that require replacement. Some repair work has recently been completed on one or more of these bridges based on the inspection report recommendations; however, the complete scope of work that has been completed is unknown at this time and that information has been requested of the Fort Monroe Department of Public Works.

Water – Water is supplied to Fort Monroe via a 10” water line located at the main entrance along Mellen Street and a 14” water line located at the entrance along Mercury Boulevard. The water is supplied by the City of Newport News Waterworks (NNWW) Division and is master metered at two locations outside of the Fort. The first location is at the foot of the south side of the Mugler Bridge and the second location is at the intersection of Old Buckroe Road and Mercury Boulevard, approximately 4,000’ north of the Mercury Boulevard bridge. There is a 300,000-gallon elevated storage tank on Fort Monroe that provides for increased water storage, particularly in the historically high-demand summer months. Currently this tank is not in service. The Virginia Department of Health has recently required that the Army make repairs and perform maintenance on the tank before it can become operational again. These improvements primarily consist of relining of the interior of the tank and the replacement of portions of the steps. It was reported in an October 2008 meeting with the Department of Public Works that these improvements have been completed and that the tank was expected to be returned to operation in early 2009.

A water distribution system study prepared by URS Corporation in May 2004 was reviewed. Based on that study, most of the water mains on the Fort have an average age of approximately 32years with some portions of the system having been installed prior to 1946. The



Figure 7B-3: Elevated water storage tank



Figure 7B-4: HRSD Willard Avenue Pump Station #225

study concluded that many of the Fort's fire hydrants could not deliver standard flows and pressures thereby diminishing the Fort's fire fighting capabilities. The study recommended three phases of substantial water line replacement improvements to the water distribution system to enhance the system's performance and Fort Monroe's fire fighting capabilities. Since the study, none of these improvements have been completed. However, Fort Monroe personnel indicated that a water pressure booster station is currently being constructed, which, with the water tank being put back into service, may alleviate the pressure deficiencies identified in the aforementioned report.

The long-term maintenance of the Fort's water distribution system was privatized in 2005 when a contract was awarded to American States Utility Services, now known as Old Dominion Utility Services (ODUS).

Sewer – Sanitary sewer service is provided to the Fort through a network of sanitary sewer systems, lift stations, and force mains that discharge to an existing pumping station located south of Harrison Street and identified as building 180. The pumping station then discharges the wastewater northward between Ingalls Road and McNair Drive and across the Mercury Boulevard Bridge to an existing 24" Hampton Roads Sanitation District (HRSD) gravity sewer main on Willard Avenue in the Phoebus section of the city. The gravity line flows west along Willard Avenue to the HRSD Willard Avenue Pump Station (#225). Based

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on interviews with City of Hampton and HRSD staff in 2008, this service area has a history of excessive infiltration and inflow and will be the subject of additional capacity related analysis.

The sanitary sewer system was damaged from Hurricane Isabel and has undergone some replacement and rehabilitation. Much of the rehabilitation work has included lining of some of the existing sanitary sewers to minimize inflow and infiltration, improving the integrity of the sewers, and enhancing hydraulic characteristics. Some manholes have been rehabilitated or replaced but the actual number is unknown at this time. Post-rehabilitation video inspections of the aforementioned sanitary sewers have been completed although they were not readily available for review as of the October 2008 meeting with the Fort Monroe Department of Public Works. It is recommended that these inspection tapes and logs be obtained and reviewed to further assess the condition of the sanitary sewer infrastructure. Fort personnel have reported that despite the rehabilitation projects, infiltration and inflow still exist, since the sanitary flows leaving the base exceed the metered water usage flows.

The long-term maintenance of the Fort's sanitary sewer systems was privatized in 2005 when a contract was awarded to American States Utility Services, now known as ODUS. In the past, combined sewer overflows (CSO) have existed on the Fort; however, these sanitary sewer overflows were removed several years ago according to Fort personnel.



Figure 7B-5: Infrastructure construction on the Fort.

The existing wastewater pumping stations were reported to be in good condition at the October 2008 meeting with the Fort Monroe Department of Public Works. Two separate investigative activities have been scheduled in November 2008 during which City of Hampton Wastewater Department personnel will perform a limited inspection of the wastewater collection system components at Fort Monroe. One inspection activity will focus on a review of manhole structures and pumping stations. The second inspection activity will include a close circuit video inspection of several sanitary sewer mains. The purpose of these investigations is for the City to better understand the condition of these infrastructure components as they consider providing operation and maintenance services to the FMFADA for these systems. The results of these investigations will be provided in a future update of the Technical Support Manual.

Drainage – Fort Monroe is comprised generally of low lying areas and consequently experiences flooding from time to time. Since Fort Monroe's drainage systems are tidally influenced, storm surges from the Chesapeake Bay and Mill Creek often result in flooding problems caused by water back flowing through the numerous storm drain outfalls throughout the base. Recent projects have been undertaken to increase capacities of the drainage system and minimize backflows and associated impacts from the Chesapeake Bay and Mill Creek. One of these recent improvement projects included the installation of a sluice gate system on one of the main drainage outfalls into Mill Creek

near the north end of the existing airstrip.

In May 2005, the ACOE conducted a flood evaluation and protection study to evaluate the flooding and develop measures to reduce future flooding from storms of similar strength to Hurricane Isabel. In 2007, Fort Monroe received partial funding for construction of some of the improvements recommended in the ACOE study and construction commenced. The study included recommendations for the installation of backflow prevention valves on the numerous storm sewer outfalls as a means of controlling flooding. These backflow prevention improvements were not funded with the current flood protection project that is under construction. However, the Army did receive some additional funding recently and has installed these valves on approximately 14 of 38 of the storm sewers that discharge into the Chesapeake Bay and Mill Creek as well as inflow and outfall pipes located in the moat. Funding has also been secured for the installation of two additional backflow prevention valves.

Given the age of the Fort, stormwater treatment on the Fort is essentially non-existent since its development generally predates state and local stormwater regulations. Furthermore, since it is a federal military base, the Fort is not necessarily required to comply with state or local water quality regulations.

Electric Power – Fort Monroe's electrical distribution system was completely converted from an overhead system to an underground

system in 1998. Based on information provided by Dominion Virginia Power's (DVP) base manager and Fort personnel at a meeting in October 2008, the system's ownership, operation, and maintenance was taken over by DVP in 2004 under a 50-year contract with the Army. Under this contract DVP purchased the electrical power system from the Army for an undisclosed amount. DVP's responsibilities under the agreement are to own, operate, and maintain the system to provide power service to the base facilities exclusive of the Wherry Quarter and the Chamberlin, both of which are metered separately. Aside from the Wherry Quarter and the Chamberlin, power service to the Fort is master-metered through a meter located at the existing sub-station.

The Army pays DVP a monthly fee for this service, which is separated into two categories—commodity service and privatization service. The commodity service fee covers power usage, while the privatization fee covers the costs associated with DVP's ownership, operation, and maintenance of the system. Under the contract, the Army has the option to buy out of the contract and would be required to do so when the Army leaves the base and the building tenants (customers) are no longer comprised of the Army or another federal entity.

According to information from the DVP base manager reported in the aforementioned October 2008 meeting, the infrastructure system is unique since it was originally constructed and maintained by the Army. The system ap-

parently does not meet DVP's standards and when the Army leaves DVP may decommission the power infrastructure and install a new electrical power infrastructure system to provide service to the Fort. DVP was not able to speculate on the cost for providing new infrastructure, including metering of existing buildings, since it is largely dependent on the tenants and proposed land uses. DVP did indicate, however, that it may be possible to transfer their contract to the FMFADA. DVP is currently reviewing the ability to transfer the existing contract and is expected to provide an update by December 2008.

Natural Gas – Natural gas is supplied to Fort Monroe by Virginia Natural Gas through a master meter. The gas system is owned, operated, and maintained by the Army and is relatively old with minor improvements made after Hurricane Isabel, mostly dealing with fixing leaks in the system. The Fort has experienced pressure problems in the past as the overall system's operating pressure is relatively low in the range of 5 to 7 pounds per square inch (psi). A solicitation from the Army for operation and maintenance of the system was advertised but no responses were received. A recent leak study was prepared by B. Knight Natural Gas Service, but that study has not yet been obtained from the Army. Once that study has been obtained, a better understanding of the system will be gained from which recommendations can be developed for upgrades or replacement to the system.

Communications – Communications networks are located in an underground system and provide state-of-the-art CAT6 communications technology to the various buildings around the Fort. The communications systems are owned by the Army and are maintained through a private contract. Most of the residences on Fort Monroe are provided with cable television service through Cox Communications.

INFRASTRUCTURE RECOMMENDATIONS

Roads/Bridges – The road systems on the Fort are generally in good condition and improvements to the existing roadway infrastructure, if any, should be minimal. Furthermore, the two city-owned bridges and four bridges on the Fort are in fair to good condition. As such, significant improvements are not recommended at this time. However, inspections of the Mugler and Mercury Boulevard bridges, as well as the four bridges crossing the moat, should continue on a periodic basis to monitor their condition and identify required future repairs.

While the City of Hampton considers providing operation and maintenance of the various infrastructure elements at Fort Monroe, including streets and bridges, it will be important to understand which streets and bridges may be eligible for inclusion in the City's inventory for allocation of maintenance funds from the Virginia Department of Transportation (VDOT). Each year the City receives maintenance funds from VDOT for



Figure 7B-6: Mugler Bridge.

street and bridge maintenance based upon the total number of lane-miles in the City that conform to VDOT's criteria for eligibility for funding. These criteria generally correspond to the width of the street, the width of the public right-of-way, and the year the road was constructed. It is expected that some of the roads at Fort Monroe will not meet the minimum street width criteria and hence would not be eligible for VDOT maintenance funds in the event that the City of Hampton becomes responsible for their maintenance. Furthermore, since public rights-of-way do not exist at Fort Monroe, none of the existing streets or bridges may become eligible for maintenance funding. A study is currently underway to inventory the existing streets at Fort Monroe and perform research and coordination with the city of Hampton and VDOT regarding eligibility constraints. This study will be completed by the end of December 2008.

Through redevelopment of the Fort, it is anticipated that a pedestrian linkage be provided to the neighboring Phoebus community and ultimately linking with a citywide trail system. However, the Mugler Bridge is not wide enough for the anticipated pedestrian volumes and widening of the bridge to accommodate increased pedestrian and/or bicycle traffic is likely not feasible given its age along with the numerous existing utility lines attached to the bridge that would require relocation. Therefore, a new bridge would likely provide this linkage. Further studies will be required to review alignments, cross sections, and actual design of such a bridge.

Water – At a minimum, the improvements specified in the URS study should be reviewed again and considered for implementation. In 2004, these improvements were estimated to cost a total of approximately \$1.5 million. The water system should be modeled again once the booster station is constructed and the water tank is operational to confirm that these original recommendations are still valid and new recommendations should be developed if needed. The tank and booster station are anticipated to be completed in the first quarter of 2009 after which it is unclear whether the Fort Monroe Department of Public Works plans to reevaluate the water system. If the Department of Public Works does not reevaluate the system, then it is recommended that the FMFADA undertake this evaluation since it is possible that additional improvements may be required to provide adequate fire fighting capabilities.

Infill development is proposed around the southern area of the Fort. With the implementation of the aforementioned improvements adequate water supply is anticipated to be available for this infill development.

The area identified for new development in the North Gate area is generally served by a network of six, eight, and ten inch diameter water mains. It is possible that these mains will not be entirely adequate to serve the new development and upgrades and extensions will likely be necessary. The potential new development areas in the Wherry Quarter area of the Fort are currently served through a network of mostly six and eight inch diameter water mains. Based on the potential for some limited new development and the anticipation of tourist demand for facilities, it is doubtful that the existing water distribution system can supply the required water supply and pressures; therefore, installation of a larger diameter water main will likely be required. This water main would likely be extended from the Wherry Quarter to the existing 14” diameter water main located along Patch Road, to the southwest of its intersection with Griffith Road. The size of this water main extension would be dependent on the mix of the development scheme that is implemented and also could be influenced by the type of buildings that are constructed. Fire flow requirements associated with the non-residential uses for this area will compound the need for water system upgrades given that fire suppression systems for non-residential buildings is likely. Once actual development plans are developed

upgrades to these systems will need to be identified.

With the proposed northern road connection to the Buckroe Beach area from Fenwick Road, consideration of a water main extension onto the Fort from the north should be considered. This could connect to the existing water system on the north of the Fort and could greatly enhance the overall system hydraulics on the Fort by providing another water source in a looped arrangement.

At one point, the Fort initiated a project to meter the distribution of water to the individual buildings on the Fort; however, with the 2005 BRAC closure announcement, that project was halted. There are few buildings that are currently metered. As redevelopment and private occupancy of existing buildings ensues, separate metering for the various buildings will likely be required and could represent a significant cost overall based on the quantity of buildings that would require metering. Estimated costs for water metering are included in Figure 7B-7. Note that these costs may not represent costs to the FMFADA since it is likely that water metering of the various buildings that are reused would be paid by the tenants or the landlords of those buildings.

Currently, the Fort’s water distribution system is owned by the Army. Throughout the City of Hampton the public water distribution systems are owned by NNWW. Hence, the City of Hampton does not own or maintain any of

these public water systems. Future ownership of the Fort Monroe water distribution system will need to be identified. Ownership, operation, and maintenance of the water system were discussed in an October 2008 meeting with NNWW. They were receptive to the possibility of owning and maintaining these systems; however, they have specific requirements that would need to be met before that could occur. They do not operate or maintain systems that they do not own; therefore, NNWW would require that they own the system. A detailed conditional assessment of the system would be required to identify deficiencies in the system and/or elements of the system that do not meet their standards. Any and all parts of the system determined to be deficient or that did not meet their standards would require replacement or upgrading. While NNWW ownership and maintenance would likely be the preferred alternative, other alternatives could include the establishment of an authority to own and operate the system or contracting with a private company to operate and maintain the system with the Commonwealth/FMFADA retaining ownership. These alternatives are currently being studied further from which formal recommendations and next steps will be identified. At the conclusion of this study, the Technical Support Manual will be updated. At a minimum, it is expected that a study will need to be undertaken to assess the condition of the systems and identify any deficiencies relative to current Newport News Waterworks, Virginia Department of Health, and/or regional standards.

Sanitary Sewer – Similar to the water distribution system, the sanitary sewer systems should be able to accommodate infill development around the southern end of the Fort in the Historic Village, Inner Fort, and North Gate areas. This will be based on the reuse of the existing buildings and the type and density of infill development and will require confirmation once the development schemes are better defined. The area identified for new development in the North Gate area is generally served by a network of four, six, and eight inch diameter gravity sewer mains. It is possible that these mains will not be entirely adequate to serve the new development and upgrades and extensions will likely be necessary. The Wherry Quarter area is generally served by a network of six and eight inch diameter gravity sewer mains that discharge to an existing pump station located south of the Fenwick Road and New Garden Street intersection. The existing pump station pumps the wastewater through a 12” force main located along Gulick Drive (Beach road) and Patton Road, ultimately discharging into the main pump station of the Fort. Given the new street network anticipated with new development in this area, it is likely that a new sanitary sewer system would be required to align with the new street network and a new pumping station would likely be required as the existing pumping station is likely not adequately sized to accommodate the additional flows with new development. Development scenarios with higher yields could typically require large mains and a larger pumping station. In general, the existing 12” force

main should be adequate to accommodate flows from development in this area. Once actual development plans are developed for the North Gate and Wherry Quarter, actual upgrades to these systems will need to be identified.

Currently, the Fort’s wastewater collection system is owned by the Army. Throughout the City of Hampton the wastewater collection systems are owned by the City of Hampton. Similar to NNWW, the City of Hampton has indicated that they too would require a comprehensive conditional assessment of the systems as well as improvements to conform to city standards before they would consider assuming operation and maintenance of the Fort’s system. While City of Hampton ownership and maintenance would likely be the preferred alternative, other alternatives could include the establishment of an authority to own and operate the system or contracting with a private company to operate and maintain the system with the Commonwealth/FMFADA retaining ownership. These alternatives are currently being studied further from which formal recommendations and next steps will be identified. At the conclusion of this study, the Technical Support Manual will be updated. At a minimum, it is expected that a study will need to be undertaken to assess the condition of the systems and identify any deficiencies relative to current City of Hampton, Virginia Department of Health, and/or regional standards. This study should also include an updated Infiltration and Inflow (I and I) study to determine the

extent of infiltration and inflow into the existing system along with recommendations to reduce or eliminate the infiltration and inflow. Furthermore, an analysis should be completed for the HRSD pump station #225 to determine the available capacity, if any, as well as recommendations to increase the station's capacity if needed.

As it relates to the assessment studies and analyses, it is important to note that each of the municipalities that comprise the Hampton Roads region, as well as HRSD, is currently under a Consent Order with the Virginia Department of Environmental Quality (DEQ). This consent order includes specific requirements that each municipality must meet concerning the condition, operation, and upgrading of their wastewater collection systems to eliminate and/or minimize the frequency of sanitary sewer overflows (SSO's). In general, the Consent Order's requirements represent a higher standard of operation and maintenance than the regional municipalities have typically conformed to and it is expected that significant capital projects across the region will be required to comply with the conditions of the Consent Order. Given the at the critical nature of pump station #225 and the City's sewer system discharging to it, as well as the known infiltration and inflow problems of the Fort Monroe system, it is very likely that the Consent Order requirements will influence the analyses and subsequent recommended improvements to the City's, HRSD's, and Fort Monroe's systems.

Drainage & Stormwater Management – Based on the recent improvements, the Fort's drainage system has been enhanced since Hurricane Isabel. However, in the areas proposed for the new development, additional storm drainage improvements will be required to at least provide drainage for the new street networks and the development blocks and lots. Since the Fort currently drains to the Chesapeake Bay and Mill Creek, there is ample stormwater capacity even at increased development densities. However, the design of these future systems will require careful consideration of the tidal influence from both the Bay and the Creek. Since much of the flooding from Hurricane Isabel was due to due to water backflow through the storm sewer systems, it is recommended that funding be sought to finish the installation of backflow prevention valves on the remaining 22 storm sewers.

Regardless of land ownership and/or governance of the Fort after it closes, new development or redevelopment will require compliance with the state and local stormwater quality requirements. With new development it is assumed that impervious coverages would increase thereby requiring a best management practices (BMP's) for the water quality treatment of stormwater runoff. Fortunately there is much land available on the Fort and around the areas proposed for new development to accommodate these BMP systems. In fact, in the case of a wet detention pond BMP (as is often used in the region), the BMP could actually be created to serve as an amenity to the

development. In any development scenario, several types of BMPs should be used to provide a low-impact design approach to the Fort property. For example, bio-retention areas, stormwater infiltration systems, or engineered water quality structures can be used in conjunction with retention basins to limit land disturbance and integrate stormwater management BMPs into the infrastructure and landscape design.

Electrical Power – In October 2008 a meeting was held with DVP to discuss the future disposition of the Fort's electrical distribution system. While nonconformance to DVP's traditional standards or equipment was noted in the meeting, DVP indicated that complete system replacement would not necessarily be required. It is possible, however, that some system upgrades may be required, particularly if the Fort's reuse represents an added demand or load to the system. DVP also indicated that it may be possible to transfer the current agreement with the Army to the FMFADA to continue DVP's contract to own, operate, and maintain the electrical distribution system. DVP is further reviewing the possibility to transfer this contract.

Since few of the existing buildings are metered separately, an analysis will be required to determine the feasibility and associated costs for individual building metering. However, until the building occupants are known, and more importantly the electrical demands, this analysis cannot be completed. Ongoing discussions with DVP will be

required to determine the feasibility and costs associated with building metering.

Natural Gas – At this time, it is difficult to determine the adequacy of the existing gas distribution system to support new development. A review of the aforementioned leak study will also need to be undertaken to better understand possible deficiencies in the system. Furthermore, the need for gas service for new development would have to be identified as heating types and fixture types in individual residential units can vary greatly. Based on our understanding of the relatively poor condition of the existing gas system, we would presume that the gas service provider would install new gas mains and services or would make significant upgrades to the existing systems to provide service. It is recommended that Virginia Natural Gas (VNG) be contacted to present the Reuse Plan and determine their willingness to assume ownership, operation, and maintenance of the gas system as well as their ability to continue to serve Fort Monroe including its new development areas. Discussions with VNG are planned in the first half of 2009.

Communications – Communications systems appear to be adequate to serve the reuse of Fort Monroe. In the case of new development, it is presumed that extension of the existing communications facilities for providing service is feasible. It is recommended that the primary communications providers at Fort Monroe, Cox Communications and Verizon, be contacted to present the Reuse Plan and

determine their ability to continue to serve Fort Monroe, including its new development areas. Discussions with Cox Communications and Verizon are planned in the first half of 2009.

INFRASTRUCTURE COSTS

Based on data collection, information provided by the Army and Public Works staff, and preliminary analyses, preliminary cost estimates have been developed for certain infrastructure components that appear to be under capacity for new development or require extension to the new development areas. Costs associated with the new development itself, such as roads, water, sewer, drainage, and street lighting to support new homes or other buildings are excluded as those costs would likely be included in the development costs for the new development.

The infrastructure components are representative of what would typically be public infrastructure (i.e., water, sewer, and stormwater). These costs also are exclusive of any upgrades to the existing infrastructure systems required to bring the infrastructure into compliance with standards of the eventual operator of these systems. These costs cannot be determined until it is known what the system requirements of the eventual operator include and an assessment is conducted to determine the deficiencies, if any, of that system. Infrastructure components that would typically be

considered private infrastructure (i.e., power, gas, and communications) are not included in these estimates since these costs would be developed by the eventual owners of these systems, such as DVP, Virginia Natural Gas, Cox Communications, and/or Verizon. The cost information is based on 2008 costs.

The cost data presented in Figure 7B-7 is very preliminary in nature and is certainly not all-inclusive. Further cost analysis for anticipated capital improvement costs will be required as additional studies are undertaken and more data is available.

Figure 7B-7: Estimated infrastructure costs (prepared in June 2008)

Improvement	Estimated Cost
Water System Improvements	
System Upgrade Recommendations from URS Study (2004 dollars)	\$1,500,000
Escalation to 2008 dollars	\$2,623,509
Northern Connection from Buckroe 10,000' length - assumed 12" diameter	\$1,000,000
Extension to new development area 4,000' length - assumed 12" diameter	\$400,000
Water meters for all non-metered existing buildings Assumes HRSD and NNWW SDC fees would be waived	
	Escalation
	Installation for Retrofit Total
30 - 5/8" meters	\$400 \$600 \$18,000
39 - 3/4" meters	\$500 \$750 \$29,250
22 - 1" meters	\$600 \$900 \$19,800
10 - 2" meters	\$800 \$1,200 \$12,000
10 - 3" meters	\$1,000 \$1,500 \$15,000
1 - 4" meter	\$1,500 \$2,250 \$2,250
14 - 4" detector checks	\$5,000 \$7,500 \$105,000
13 - 6" detector checks	\$8,000 \$12,000 \$156,000
8 - 8" detector checks	\$10,000 \$15,000 \$120,000
	Total Water Metering \$477,300
	SubTotal Water \$4,500,809
Wastewater Collection System Improvements	
New Pump Station in new development area	\$750,000
Extension to new development area Assumes pump station will move to central location 2,000' length - assumed 12" diameter sfm	\$200,000
HRSD Pump Station #225 Upgrade and off-site system upgrades (Allowance)	\$250,000
	SubTotal Wastewater \$1,200,000
Stormwater Quality Collection and Retention System	
New Regional Stormwater Management Basin (BMP) in new development area - assumed to be 5 acres total of a wet detention system (Allowance)	\$1,000,000
New outfall from BMP (Allowance) 600' length - assumed 42" diameter	\$120,000
New inflow pipe from new development area 2 pipes totaling 500' length - assumed to be 36" diameter	\$75,000
	SubTotal Stormwater \$1,195,000

Improvement	Estimated Cost
Flood Protection	
Cost from COE Study (2005 dollars)	\$26,400,000
Escalation to 2007 dollars	\$31,944,000
Minus Portion that was Funded in 2007	\$22,000,000
SubTotal	\$9,944,000
Escalation to 2008 dollars	\$10,938,400
	SubTotal Flood Protection \$10,938,400
Northern Connection Roadway and Bridge	
2-lane undivided roadway Right-of-way acquisition costs excluded Wetlands Mitigation costs excluded	
Length of new road (30' width) = 700' @ \$450 per l.f.	\$315,000
Length of road reconstruction (30' width) = 1,000' @ \$300 per l.f.	\$300,000
Length of bridge construction (30' width) = 300' @ \$175 per s.f.	\$1,575,000
	SubTotal Northern Connection \$2,190,000
Reconfigured Main Entrance	
Length of road reconstruction (24' width) = 1,500' @ \$250 per l.f.	\$375,000
New traffic signal	\$250,000
	SubTotal Reconfigured Main Entrance \$625,000
Moat Bridge Repairs	
Repair Costs from April 9, 2007 KCI Technologies Bridge Inspection Report (2007 dollars)	\$282,350
Escalation to 2008 dollars	\$324,703
	SubTotal Moat Bridge Repairs \$324,703
	TOTAL \$20,973,912