

**Report to J. P. Woodley, Jr.
Assistant Secretary of the Army
(Civil Works)**

*Project Assessment for 17th Street,
London Avenue, and Orleans
Flood Control Pump Stations
Project
New Orleans, Louisiana
Contract # W912HN-06-P-0319*

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Project Assessment for 17th Street, London Avenue And Orleans Flood Control Pump Stations Project

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Background

On August 29, 2005 Hurricane Katrina made landfall on the Gulf Coast near the City of New Orleans. At the time of the landfall it was rated as a Category 4 hurricane with wind speeds at up to 140 miles per hour. The initial storm damage was severe but the most significant damage came hours after the storm had passed when the storm surge in Lake Pontchartrain (the Lake) breached the levees on the Lake. This caused wide spread flooding through a large portion of the various New Orleans parishes.

The levees were repaired and enhanced in their design structure. It was also decided that the opportunity for levee breaching or topping from future storm surges should also be eliminated to the extent possible. To accomplish this, flood gates were to be installed on each levee near the Lake that would act as a barrier to these storm surges. The flood gates were deemed to be of the highest priority and construction was begun in late 2005. This however created another potential problem.

Large portions of the New Orleans area parishes lie below the adjacent sea level in the Lake. In order to remove storm water during rain events from these areas, the water must be gathered and pumped (lifted) and discharged to the Lake. Under normal conditions, this water is discharged into channels (levees) that flow directly into the Lake. However, during the threat of a hurricane event, the channel pathways to the Lake are to be closed off by the new flood gates. During the times when the flood surge gates are closed the water in the channels must be pumped again from the channels through or over the gate structures into the Lake. The Corps of Engineers is constructing pump stations on the Orleans, New London and 17th Street levees to serve this need for second stage pumping. The pump stations involve many large capacity pumps that will be brought online as the water collection rate in the channels dictate. The operational availability of these pump stations is critical to the security of the lower sections of New Orleans during a storm event when the flood gates will be closed.

This project experienced numerous schedule delays for the major expected milestones. The frequency and nature of the delays caused a high level of concern within the highest commands of the Corps that the project would be completed in time to provide this critical flood protection to New Orleans during the expected major storm events.

The Assistant Secretary of the Army (ASA) for Civil Works requested that a project assessment be undertaken to ascertain the root causes of the

schedule delays thus far and to analyze and project the likely of achieving the milestone dates through completion based on the information that was available. ERM was contracted to perform this service as a subcontractor to Advent Environmental, Inc. David Johnson of ERM's Richmond, Virginia office was selected to perform this task because of his extensive background in pump engineering and particularly with large pumping projects.

The ASA had become concerned that the information he was receiving indicated that the project was experiencing delays from pumping equipment defects as well as for other logistical reasons. In addition, he was getting conflicting information as to the pumping capacity that would be available during the course of the current hurricane season. Before beginning the project, ERM interviewed the ASA to ascertain the concerns and to better understand the issues.

Scope of Work

Based on the interview with the ASA, a scope of work was written for a project assessment that involved face to face interviews with general contractors, pump vendor personnel, architect and engineers, and USACE personnel involved in all aspects of the project management. These interviews were all conducted in New Orleans during the time period between July 31 and August 11, 2006. In addition, various documents were reviewed to understand the status of the current project as well as to review the progress of projects expected in 2007 and 2010. Since that time, ERM has been in telephone contact with the Project Manager to discuss the project status and to provide engineering advice on the pumping system problems.

In addition to the interviews and document reviews, ERM spent a significant amount of time at the job sites involved in ongoing troubleshooting efforts regarding the pump operations. The project was clearly in need of on site pump expertise. This need caused the scope of work to be enhanced to include providing engineering consulting services that were more urgent. In addition, the information the ASA had received was erroneous in some cases which also caused the scope of work to shift somewhat as will be explained.

During the interviews the various decision points were reviewed. In each case the questions related to: What was the decision ; How was the decision arrived at/determined; and What documentation exists to support the decision? In many cases, the decisions were made using the

best information available at the time and in an accelerated time frame but the supporting documentation appears to be minimal. During the A&E interviews, one engineer remarked “We were at war” to explain the decision atmosphere.

Pump Stations Construction - Project Overview

Each levee currently has two pump stations, one on either side of the levee that function independent of the other. The pump stations for each levee is being constructed by a different contractor. The 17th Street Stations are being constructed by Boh Brothers of New Orleans. The London Ave stations are being constructed by the Pittman Group of New Orleans. The Orleans stations are being constructed principally by the Kiewit Corporation which is a national firm based in Houston. In addition, the stations were not all designed by the same architect and engineering firm. The London and Orleans stations were designed by the architect and engineer (A&E) firm of URS supported by Audubon Engineers. URS is a large multinational firm with a broad engineering skills. The 17th Street station was designed by the joint work of two New Orleans firms, Linfield, Hunter and Junius; and N-Y Associates. At the time of the on site project assessment, London and Orleans were considered virtually operational whereas the 17th Street station was only partially operational and even that portion may not be reliably operational. It was clear that the focus of attention by the Corps was on the 17th Street stations construction.

The pump systems were supplied by one vendor, Moving Water Industries (MWI) located in Deerfield Beach, Florida. The pump systems were competitively procured at a very accelerated pace. Bids were received from MWI and FPI (formerly Farmers Manufacturing Co.). FPI is a similar type company to MWI and is located near MWI in Pompano Beach, Florida. FPI was not chosen as it could not guarantee the required delivery and also stated that they would likely have to use various suppliers of diesel engines. Another firm, D&D expressed interest but did not bid as it could not make pumps with the needed capacity. The A&E firms stated that they had polled several named pump vendors and determined that hydraulic powered vertically mounted pumps typically used in the irrigation industry was the only design that would provided the maximum flow capacity in the time frame required.

The designed pump systems consists of vertical axial flow pumps with an hydraulic motor as the prime mover. The hydraulic motor receives the needed hydraulic oil flow and pressure from paired Caterpillar diesel

engines that drive Dennison hydraulic pumps. The hydraulic pump and motors are linked by several hundred feet of high pressure welded steel pipe and hoses. This presents a very complex operating system with many more moving mechanical parts than would be expected for pump system where the prime mover is directly coupled to the water pump.

The original project conceived after Katrina and promised for June 1, 2006 involved only the flood control gates. It was determined by late December 2005 that the pump stations needed to be added to deal with the storm water from rain. The design for the structures and systems commenced at that time. The design criteria was determined by the first week of January. The RFP for the pump systems was issued January 13, 2006 and was due on January 18 at noon. The contract was awarded that day and the commitment to the impeller foundry (critical path item) was issued on the 20th. The diesel engines were ordered on the 18th. On January 20, MWI produced a project timeline that showed shipment of the pump systems during April 12 to May 4. The MWI contract had a bonus/penalty provision on a per system basis.

The pump station platforms began design in January for 17th Street and early February for the other two locations. The 17th Street platforms were designed with partial pump bays and the other two locations' platforms were designed without pump bays. The difference in design approach was related to the fact that one engineering firm designed the 17th Street platforms and another designed the other platforms. Each firm said their design would minimize potential flow pattern problems. Both firms advised the USACE that modeling should be done but it was not initiated at that time nor did the USACE seek a consistent design approach for the platforms.

MWI started exhibiting the beginning of a long litany of problems during factory testing. The factory testing facility was inadequate and had to be re-configured. There were many issues exposed during testing, some of which were normal for pump manufacturers but some of the issues were not usual and customary. The Dennison hydraulic pumps were determined to be inadequate as initially provided and they were retrofitted with new parts that corrected the deficiency. A USACE inspector that was on site during the factory testing had expressed serious reservations about the quality and reliability of the MWI pump systems. Notwithstanding her reservations, the pumps passed the testing procedure and were shipped.

Once on site, the USACE noticed that many of the welds in the MWI supplied 60 inch discharge pipe were very substandard. MWI advised

that the welds were adequate for the intended use but the USACE initiated weld repairs.

Sometime later, the pump hydraulic systems were filled with an hydraulic oil as recommended by the MWI operator's manual but with a different oil than it was initially filled with. This combination of different oils in the presence of water from condensation caused a gel like substance to form which concerned the USACE. MWI advised that their research indicated that the substance did not present an operational integrity issue but the USACE felt differently and contracted to have the hydraulic systems for all the pumps thoroughly flushed and refilled with new oil.

During the time of the assessment, several of the pumps were started up to check operation. Many of the pumps, particularly at 17th Street experienced significant system vibrations that were especially visible in the piping system. At that time there were several potential causes. Possible cavitation in the pump was eliminated through field testing. The diesel engines did not appear to be the source. Piping resonant frequency was to be investigated. It was highly suspected that the Rineer hydraulic motors were the source. This was later confirmed and MWI and Rineer were working to resolve the issue when the assessor last communicated with the USACE project manager.

Interviews Conducted During the Assessment

- USACE project manager Jim St. Germain, Hurricane Protection Office
- USACE assistant project manager Dan Bradley, Hurricane Protection Office
- USACE project field construction supervisor Randy Persica
- USACE project field operations, Ray Newman
- USACE site construction engineers and managers
- Jim Enders, senior engineer, S. Eller, field technician of MWI pumps
- Kevin Stolzenthaler, project manager, Boh Brothers Construction

- Mike Pittman of M. R. Pittman Construction
- Walter Baummy, Jr ., Chief Engineer for the New Orleans District, USACE
- Fred Young, project manager, Hurricane Protection Office, USACE
- Joe Hendrix, project manager, Hurricane Protection Office, USACE
- John Morton, Contracting Officer, Hurricane Protection Office, USACE
- Representatives of the U. S. Army Corps of Engineers' Engineer Research and Development Center (ERDC), Vicksburg office
- Colonel Jeff Bedey, Commander, Hurricane Protection Office, USACE
- Architect and Engineer team members during a joint meeting at the New Orleans District office:
 1. Ralph Junius and Frank Newell – Linfield, Hunter & Junius, Inc
 2. Mike Housey, Barry Fehl, Ariel Buenano – URS Corporation
 3. Denis Taylor – Audubon Engineers
 4. Cecil Soileau – BCG
 5. Constantine Nicoladis, Frank Nicoladis – N-Y Associates

It should be noted that Jim St. Germain accompanied Mr. Johnson for most of the time he was at the District office or at the project sites so much of the “interview” time was conducted in informal discussions. It should also be noted that Mr. Johnson spent the majority of his time at the three project construction sites (especially 17th Street) during which several of the interviews were conducted as well as informal discussions with site personnel. Mr. Randy Persica was especially helpful in providing on-site observations and project construction details.

Documents Reviewed During the Assessment

- Various contract documents related to the contract with MWI including the original Request for Proposal and the original contract;
- USACE register of the three General Contractors' contract modifications (Mod) summary spreadsheets which shows the many contract modifications, costs and schedule impact;
- USACE documents related to the June 2007 additional temporary pump station project (17th Street and London Ave.);
- USACE documents related to the 2010 permanent pumping station solution including pump vendor proposed pump selections; and
- Project schedule documents.
- Documents related to the May 2006 pump RFP that was protested by a potential vendor. The USACE decided to withdraw the solicitation and negotiated with the protesting vendor to be able to add six additional pumps to the current contract.

Assessment Findings

The following findings are based on the persons interviewed, the documents reviewed, and professional judgment of the assessor. These findings were presented in an out-briefing meeting on August 11 at the Hurricane Protection Office with Mr. St. Germain and several other senior Corps of Engineer project managers. The findings are presented in bullet form for ease in reading. They are presented in no particular order.

- The pump design and vendor selection process was compromised by the urgency of the construction. In order to meet the publicly promised June 1, 2006 completion date, the pumps and diesel engine drive units for this project had to be designed, built and tested in 12 weeks or less. Pumps of this design have been in use in New Orleans for flood control with good results but the pumps on this project are the largest made for hydraulic motor drive. These pumps should be reliable for this service once all the technical issues are resolved.

- Hydraulic driven pumps are more complex than direct (electric or combustion engine) driven pumps. There are many more moving parts involving diesel engine, hydraulic pumps, and hydraulic motors. Complexity in mechanical systems generally leads to more trouble shooting requirements during installation and start-up.
- Axial flow design impellers have the unique characteristic of the highest brake horsepower occurring at the highest head condition of the pump curve. This would normally only be seen by the pump during the priming stage during initial start up and would pass quickly. The drivers were sized for this condition. Further, the hydraulic motor design is inherently a variable speed drive system which allows the pump to run over a wide range of speeds including speeds greater than the design speed. This combination of factors affords the USACE to possibly capture additional pump flow capacity by increasing the operating speed above the design speed once the pump is primed and the pump is running at the low head (lift) condition. Upon checking with MWI, the pump system should be able to pump up to 20% more capacity at a similar increase in pump speed with no detrimental effect on the system components.
- This installation involves hundreds of feet of high pressure pipe for the hydraulic working fluid. Most installations for this design pump use flexible hose which is less subject to the effects of pipe resonance.
- Boh Bros never “bought into” the June 1 publicly stated goal. Boh Bros approach to Contract Modifications (Mods) was less aggressive towards completion than exhibited by the other two general contractors. Boh Bros approach to Mods was to minimize financial risk. Boh Bros accomplished this by letting Mods be completely approved before commencing work. The other general contractors would “get a head start” before all the paperwork was completed. In addition, Boh Bros had not had full night crews on site at 17th Street since around July 4.
- Boh Bros is primarily a civil works firm with over 50 projects currently being worked in Louisiana. This contract was originally for only the flood surge gate construction but has been modified over time to be a large scale civil/mechanical project with a significant portion being mechanical. There was some question within the Corps as to whether Boh had the

depth of experience with a project that contained as much mechanical work as this one. This would also add to Boh Bros' risk aversion as mentioned in the previous finding.

- Kiewit and Pittman fully embraced the June 1 goal and worked 24/7 up until approximately June 30 when their respective pumping stations were considered operational. USACE particularly praised Kiewit (they were also the most costly contractor)
- The measure of MWI as a good supplier will be determined by how they respond to problems. MWI is not only responsible for the proper function of its own water pumps but is also the guarantor of the entire pump package. This includes the Caterpillar diesel drives, the Dennison hydraulic pumps, the interconnecting piping, the Rineer as well as the MWI axial flow pumps. MWI has had several design and operational issues since the MWI pump packages went to shop testing through the time of this assessment. It should be noted that up until the time of shop tests, it was felt by the Corps contracting and project managers that MWI was fulfilling their contract very well. The MWI equipment has experienced the following significant issues since the beginning of the shop tests through August 15:

1. The Dennison hydraulic pumps had repeated failures during the shop tests. Pump components were changed out that re-rated the pumps for a higher capacity. This permitted the drive units to pass inspection. MWI to date cannot give the USACE assurance that these pumps will be operationally reliable. At the time of the assessment, the pumps experienced an unusual noise at the rated performance conditions which must be investigated and resolved as soon as possible.
2. The pump main 60 inch piping above the pumping element had very substandard welds. These defects were corrected in the field at the USACE expense. It should be noted that the USACE had two inspectors at MWI during shop testing and did not make note of the weld issue. This should have been caught at this point. Releasing the pumps without comment at the factory potentially reduces the USACE's ability to recoup these costs from MWI.

3. The lubrication oils became contaminated due to a mixing of oils, manufactured by different vendors, in the presence of water. This formed a jell like material that may have effected operational reliability even though MWI advised the USACE that it was of no real concern. Notwithstanding MWI's opinion, the USACE had an independent firm flush all pump hydraulic oil systems on site and replace with new oil. This was done at the expense of the USACE.
 4. The Rineer hydraulic motors are vibrating due to an apparent clearance problem between the motor rotor and stator. This will require that the existing motors be removed and sent back to the factory in Texas for remachining to fix this serious problem.
- MWI is small company with limited technical resources. MWI has not been engaging their vendors with the vigor needed to resolve these problems quickly. Likewise, they have not sought outside technical resources to supplement their own capabilities.
 - The USACE Hurricane Protection Office has not consistently described the pumping stations' capacities in USACE and public documents. For instance, the same installation will be described as having 2400 cfs, 2600 cfs or 2800 cfs depending on who is talking when in fact all three represent the same number of operational pumps. This is a function of which point on the pump curve the spokesman uses. (Recommendation: pick one and be consistent; eliminate this inconsistency).
 - The project has been missing a higher level of management consciousness. The flood gates lowering issue during a predicted high wind situation illustrated this point. There seemed to be a management disconnect on being able to understand the larger (and sometimes political) consequences of decisions, even when the decision is technically supportable.
 - The Public Affairs Office (PAO) has not trained project managers on news media interfacing, particularly in the area of consistency of message. Further, the PAO does not have a system of reporting whereas the content of interviews is relayed to senior management levels so that the message and knowledge are consistent.

- **There is an general reduced level of urgency for the this project. This can be seen in the return of certain standard USACE paperwork processes (which were abbreviated during Task Force Guardian), A&E production of construction documents, USACE release of Mods to the contractors, and the contractors' general attitude. Most particularly troubling is a reduced level of urgency within the body of the whole USACE District office system. The other USACE districts are no longer providing this project with the needed resources. This is an issue that needs high level attention.**
- This change in the level of urgency seems to have some relationship to the project change from Guardian to the HPO. This is not a reflection on the unit Commanders but is resultant from a program with the "sense of emergency" to a program with the "sense of urgency". Though both are important, the later is consigned to the same status as the urgencies experienced in other Districts.
- It is normal practice in projects with large pump intakes (large removal capacities) to have hydraulic flow models performed to determine and demonstrate if the flow patterns into the pump are stable. The consequence of unstable inlet flow patterns is the creation of vortexes which can cause operational problems for the pumps and lead to reduced pump life. Because of the time element, these models were not performed for the stations until at the time of the assessment. This could have significant operational integrity impacts if the models found that the pump station structures need modifying. It should be noted that 17th Street structure was designed differently that the other two. ERM noted vortexing at one pump inlet during high speed testing at the London station. The USACE ERDC Vicksburg office was conducting this modeling for this project.
- At the time of the assessment, the USACE project management and construction staff had been working seven days a week for over 12 hours a day since the Storm. There is a general fatigue amongst these personnel that is evident to all. To offset this, recognition of these extraordinary work efforts should be made by Pentagon level officials. In addition, these same USACE staff have hit their overtime "cap". This is a major issue within the staff and correcting this would help morale a great deal.

- There is no evident process for projects of this nature (similar construction at different sites with different contractors) for contractors to collaborate on finding solutions to common problems. It was noted that the three contractors on this project did meet with the USACE project managers in conference but that collaboration was not encouraged. For instance, the assessor was advised that during the height of the hurricane season, the flood gates would have to be lowered by crane far in advance of any predicted hurricane which would likely cause localized flooding from rain accumulation. Boh Bros had determined that the wench pulley blocks was the critical path issue to resolve this potential problem and had also determined that the suppliers could not meet the needed delivery time. Boh Bros decided to fabricate the blocks themselves to save months of time. Pittman was unaware of this issue and would have spent the same time themselves researching the matter instead of collaborating with Boh Bros to procure the same pulley blocks from the same fabricator.
- The potential flow into the 17th Street Canal from the New Orleans storm water gathering system is approximately 7300 cfs yet the design capacity of the pumps to be installed by October 2006 was 5,200 cfs. The potential flow into the London Ave. Canal from the New Orleans storm water gathering system is approximately 5,000 cfs yet the design capacity of the pumps to be installed by October 2006 was 2,800 cfs. This disparity was recognized by the A&E firms and USACE. It was determined in January 2006 that MWI did not have the capacity to build additional pumps before May 2006. It was decided to bid the additional pumps in May for installation in October 2006. In May, the USACE issued an RFP for 25 additional pumps in order to meet the potential flow capacity needs. A potential vendor in Maryland protested the RFP saying that the pump design was proprietary and that the delivery requirements were unrealistic. The District legal department counseled the contracting office that defense against the protest would take 60 days which would have the effect of postponing the pump delivery past the current hurricane season timeframe. At the same time, the safe water levels in the levees were being re-evaluated which would likely cause a re-engineering of the pump operating procedures. It was decided to cancel the RFP in light of the protest. The USACE was able to purchase 6 additional pumps for the 17th Street stations through an agreement from the protesting vendor not to object to that purchase. The pumps needed to

meet the full capacity will be added before the 2007 hurricane season. The installation will involve the construction of additional pump stations for these pumps. It should be noted that the District did not contact Pentagon level command management to confirm that the decision to withdraw the RFP was supported. It should also be noted that the Project Manager indicated that the USACE felt that some of the capacity gap could be accommodated using portable pumps.

- The assessor was advised by USACE personnel that the pumps were not able to prime during operational testing. The assessor noted that the existing discharge pipe exit configuration prevented priming when the Lake was not elevated as an air gap would not allow the establishment of a priming condition. The assessor recommended that the discharge pipes be turned 180 degrees to correct this situation.
- At the time of the assessment (and before), the USACE staff on site did not appear to have adequate mechanical engineering support for the degree of mechanical equipment involved. This situation was improved by the end of the assessment time frame. Pump expertise with large complex systems was particularly lacking.
- The assessor noted that there were several issues outside of the pump related problems that have delayed the construction of the flood control system. At the 17th Street Canal, the underwater soils in the area of the gate and pump stations had to be strengthened beyond expectations and significant debris in the canal had to be removed. At the beginning of the project, the availability of sheet pile steel was an issue. Chappell Steel in Petersburg, VA supplied all the sheet pile steel and the rail shipment cost the project two weeks of project time.
- The assessor noted that the pump stations did not have the EPA required Spill Prevention Control and Countermeasures Plan as the sites had stored oil capacity in excess of 1320 gallons. During the assessment a small oil release occurred at the 17th Street site during a pump testing. The U. S. Coast Guard was notified and the oil booms were deployed.
- The pump stations were noted and described as “temporary” stations as “permanent” stations were envisioned some years

from now that would have larger, higher quality pump systems. The USACE should evaluate if it is likely that these stations will likely actually dismantled and why. Considering the expected usage, these pumps could be valuable infrastructure that could act as back up systems for the permanent systems or supplemental in the event that more unforeseen capacity is needed in the future.

- It is the assessor's understanding that the USACE will operate these systems at least for the near future. The USACE should ensure that adequate spare parts are on site for reliable operation.

Opportunities for Improvement to Current and Future Conditions

- As stated in the Findings, the perceived reduced sense of urgency could be mitigated by re-instituting a sense of emergency for the New Orleans flood control project. The Guardian heightened state of urgency concluded at the beginning of the 2006 (June 1) hurricane season. However, this reduction occurred at the same time that the risk to New Orleans of another devastating hurricane had began. Recommendation: Communicate to the various USACE districts that the level of emergency still exists through the remainder of the 2006 season and possibly until the beginning of 2007 season and that the other districts should offer their fullest support.
- The current status of multiple on-going technical problems needs the fullest commitment from the contractors and vendors to resolve the issues ASAP. Though there is no direct evidence that they are not addressing these issues with urgency, direct encouragement from high level Pentagon officials to the vendors which are experiencing the critical technical problems would be very helpful to insure that the vendors' highest management personnel are engaged and committed to finding solutions to the problems immediately and with full dispatch. Recommendation: The Secretary of the Army or the ASA should contact the highest management person at each vendor that is experiencing the most critical operational problems in order to make the current stations fully

operational. These vendors include at the time of the assessment: Rineer (hydraulic motors), MWI (water pumps and system design) and Dennison (hydraulic fluid pumps). This recommendation was communicated to the Assistant Secretary of the Army (Civil Works) verbally during the course of the assessment and the assessor was advised that contacts with these vendors had been accomplished by the end of the assessment.

- The USACE should establish collaboration protocols where multiple contractors are engaged in similar projects at different locations. Project managers should be trained to facilitate collaboration where multiple contractors are involved in similar projects.
- As stated in the Findings, the pump intake modeling was not begun until the pump stations had been built and was not part of the A&E design contracts. This illustrates a potential flaw in USACE project management where the normal linear progression of a project must be broken into parallel processes for the sake of urgency. The parallel process should only be used when urgency is the critical issue such as in the case of existing or impending national security issues. The USACE should develop training and protocols for project managers that details the decisions to engage in parallel engineering. In this situation, parallel engineering would have commenced the modeling several months earlier.
- The emergency conditions that prevailed under the Guardian status allowed the USACE command structure to “cut red tape” to address the emergency conditions. Under the current Hurricane Protection Office, these same expedited conditions appear to have been eased to a return of more normal procedures even though this is the time of highest hurricane risk. Recommendation: The USACE should establish formal protocols for future emergency conditions. These protocols would establish criteria for the establishment and continuation of emergency conditions. There could be several levels of “emergency” conditions that would trigger different levels of the relaxation of standard operating procedures including modifications of required processes under the Federal Acquisition Regulations (e.g. protest of bid results). The protocols would also facilitate more decision making in the field.

- Recognition of USACE personnel who have worked extraordinary hours is needed. Several USACE personnel expressed sentiments that they felt that their hard work was going unnoticed. The existing overtime cap was perceived as a confirmation of this feeling. Recommendation: The USACE should remove or modify the overtime cap on this project at least through the current hurricane season. Further, key individuals should be sought out and given special personal recognition by high level Pentagon officials for the extraordinary efforts that have been put forth.
- The pumps design conditions were chosen to maximize the flow for the driver horsepower available. However, preliminary discussions with MWI by the assessor indicated that the pumps and its package components could be operated such that at least 20% additional capacity could be utilized at no compromise to the integrity of the pump mechanical system. Potentially, this could be accomplished by increasing the pump speed once it had been primed. This would be the equivalent of adding over 600 cfs to the pumping capacity at 17th Street at no additional cost to the USACE as well as similar increases at the other stations. Recommendation: The USACE should formally evaluate whether this additional potential capacity enhancement is feasible and under what conditions and include the procedures to capture this capacity in their operations manual.
- The USACE is planning to issue a “design/build” contract for the next phase (June 2007 completion) of hurricane protection pumping stations. This has worked well in other Department of Defense contracts for large projects. It appears that the USACE is not fully experienced in the use of this acquisition tool. Recommendation: The Pentagon should encourage the use of the design/build tool and ensure that the New Orleans district receives any needed support to properly implement this Federal Acquisition Regulations process.
- This project has had various technical consulting needs during the course of the project. There have been times where the expertise for certain functions was not available within the New Orleans district. Yet at the same time, the USACE does not currently have a Corps wide data base of expertise that other districts could utilize and draw upon.

Recommendation: The USACE should establish a Corps-wide searchable data base of skills and expertise's the various Corps professional staff. The New Orleans district is developing such a data base for its own professionals but this should be part of larger enterprise data base.

- The decision by the District legal department to withdraw the RFP for the additional pumps needed to meet the full capacity needs was made without Pentagon collaboration and concurrence. The District decision had potential significant impacts if a severe storm had occurred in the 2006 season. The legal departments should establish protocols to triage when collaboration between the Districts and the Pentagon on decisions is needed.

Developments Since the Assessment

Mr. Johnson has had several telephone contacts with Mr. St. Germain since the assessment was conducted through October 2006. Mr. St. Germain initiated some of these calls to seek engineering advice on the pump operational problems that persisted through that time. Other times, Mr. Johnson initiated the conversation to ascertain the current status or to seek additional information on findings from the assessment. Significant issues were still outstanding as of the last conversation. These include:

- The Corps' Engineering Research and Development Center in Vicksburg, Mississippi model testing showed some modifications would be needed to some or maybe all of the pump stations. At the time of this report, the likely modifications to stabilize the inlet flow paths do not appear to require major rework to the pump station structure.
- The discharge pipes exit configuration was turned 180 degrees as recommended by the assessor. This resulted in the ability for all pumps to prime even when only one pump was running. This also allowed the pumps to under go full operational testing at full loads.
- The constant vibration noticed during the assessment was determined not be from piping harmonics.
- The same vibration source was determined to be from the Rineer motors. The motors were to be retro fitted with new parts to eliminate this serious issue.

- The safe water levels within the levees were being re-evaluated with potential impacts on the pump station operations.
- The pumps systems for the additional needed capacity at London Ave and 17th Street were in the process of being procured.
- MWI was conducting more shop testing. The pumps' ability to meet design conditions were being evaluated with potential contractual consequences.
- Mr. St. Germain advised that the EPA required Spill Prevention Countermeasures and Control Plans were being developed for the pump stations.