REPORT TO CONGRESS

For

P.L. 110-28, Chapter 3, SEC 4303

17th Street, Orleans Avenue

and London Avenue Canals

Permanent Protection System

Hurricane Protection System

New Orleans, Louisiana

By:

U.S. Army Corps of Engineers

August 30 , 2007

US Army Corps of Engineers

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1.0 EXECUTIVE SUMMARY

The purpose of this Report is to provide information to Congress as required in Chapter 3, Section 4303 of Public Law 110-28, "U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007." This Section states:

> "SEC. 4303. The Chief of Engineers shall investigate the overall technical advantages, disadvantages and operational effectiveness of operating the new pumping stations at the mouths of the 17th Street, Orleans Avenue and London Avenue canals in the New Orleans area directed for construction in Public Law 109–234 concurrently or in series with existing pumping stations serving these canals and the advantages, disadvantages and technical operational effectiveness of removing the existing pumping stations and configuring the new pumping stations and associated canals to handle all needed discharges to the lakefront or in combination with discharges directly to the Mississippi River in Jefferson Parish; and the advantages, disadvantages and technical operational effectiveness of replacing or improving the floodwalls and levees adjacent to the three outfall canals: *Provided,* That the analysis should be conducted at Federal expense: *Provided further,* That the analysis shall be completed and furnished to the Congress not later than three months after enactment of this Act."

For ease of the analysis, the requested investigations are described as "options" in this report, as follows:

- Option 1: "operating the new pumping stations at the mouths of the 17th Street, Orleans Avenue and London Avenue canals in the New Orleans area directed for construction in Public Law 109-234 concurrently or in series with existing pumping stations serving these canals"
- Option 2: "removing the existing pumping stations and configuring the new pumping stations and associated canals to handle all needed discharges to the lakefront"

  Option 2a: "or in combination with discharges directly to the Mississippi River in Jefferson Parish"

- Option 3: "replacing or improving the floodwalls and levees adjacent to the three outfall canals"

Each of these options would provide hurricane storm surge protection for the three outfall canals: 17th Street, Orleans Avenue and London Avenue. The technical advantages, disadvantages, and operational effectiveness[1] of the three options were evaluated, and the results of that evaluation described herein.

Prior to the subject Congressional technical analysis requirement, engineering concept studies were performed by the Corps to determine the most technically effective means of accomplishing the dual purpose of storm surge protection and simultaneous evacuation of storm water. A collaborative process was established and many technical review meetings were held for exchange of ideas. Following the legislative directive, the Corps of Engineers expanded and formalized the collaborative process with external stakeholders that included the Sewerage and Water Board of New Orleans, Jefferson Parish, New Orleans Business Council, Louisiana Department of Transportation and Development, Southeast Louisiana Flood Protection Authority – East, and Regional Planning Commission; and independent groups to develop and evaluate the technical advantages, disadvantages and operational effectiveness of each option using the results and recommendations of multiple reports completed since Hurricane Katrina as well as reports still in draft stages, as referenced. These reports provided much of the background technical data required to perform the evaluation in an expedited manner and meet the Congressional requirement. Over 30 professional engineers, representing academia, the Federal government, State government, levee authorities, parishes, private architect-engineer firms and other stakeholders, provided input to the process to include consultation of experts through a Senior Review Panel. The nature and composition of the Senior Review Panel is provided in Section 2.2.

[1] Operational effectiveness in this analysis was assumed to describe how well the system performed at reducing flooding from hurricane storm surge and rainfall runoff, without regard to cost or environmental considerations.

Projection of cost (operational, program and construction), general public perception and consideration of impacts to the human environment, as required under the National Environmental Policy Act (NEPA), were not considered in the technical evaluation provided herein. Neither cost nor general public perception were considered technical criteria for determining technical advantages, disadvantages, and operational effectiveness. Further, the NEPA process could not be fulfilled in the time period provided.

Based on the information compiled for this document, three preliminary observations regarding the technical advantages, disadvantages, and operational effectiveness of the three options have been identified. Definitive conclusions / recommendations related to the three options remain subject to completing further technical engineering analyses, developing construction and operational costs, and fulfilling environmental compliance considerations.

The preliminary observations are:

(1) Options 1 and 2 appear more technically advantageous over Option 3 because they are more effective in reducing risk of flooding. Option 3 results in a much longer line of protection against hurricane storm surge and therefore has more exposure to hurricane storm surge and a higher risk of overtopping.

(2) Option 1 could be more advantageous considering the engineering challenges and construction complexity of Option 2.

(3) Option 2 is generally more technically advantageous and may be more effective operationally over Option 1 because it would have greater reliability and further reduces risk of flooding.

A drainage system analysis, directly related to the three outfall canals, should be pursued to determine the inflow amounts to the outfall canals, and if a reduction in required canal discharge capacity during a hurricane event can be achieved. Such a reduction in capacity requirements has the potential to improve the technical operational

effectiveness and reduce the technical and construction complexity of the options. Examples of potential benefits of this analysis are described in Section 3.2.3. Further engineering, environmental and cost analyses are continuing.

2.0 INVESTIGATIVE ANALYSIS

2.1 Background Information

Much of the storm water from the New Orleans Metro Area ("Area") is pumped into three outfall canals at 17th Street, Orleans Avenue, and London Avenue. Figure 2-1 indicates the various drainage basins within New Orleans Metro Area. All areas except areas 12 and 19 contribute flow to the three outfall canals. The outfall canals connect pump stations located on the interior of the Area to Lake Pontchartrain, where the storm water is discharged. Since water levels in the canals coincide with lake level and are thus always higher than adjacent ground, levees and floodwalls were previously constructed on both sides of the outfall canals. The levees and floodwalls, known as the Parallel Protection System, were constructed to a height required to prevent the design storm surge from Lake Pontchartrain from entering the Area. During Hurricane Katrina, breaches in floodwalls and levees along the outfall canals contributed to a portion of the flooding in the Area. Subsequently, Public Law 109-234 was passed, which provides both authority and funding to "modify the 17th Street, Orleans Avenue, and London Avenue drainage canals and install pumps and closure structures at or near the lakefront."

The new closure structures, as authorized, will provide permanent storm surge protection by preventing hurricane storm surge from Lake Pontchartrain from entering the canals. The pumps will take flood water from the canals around the closure structures so that the interior drainage system can continue to function when the closure structures prevent direct discharge to Lake Pontchartrain.

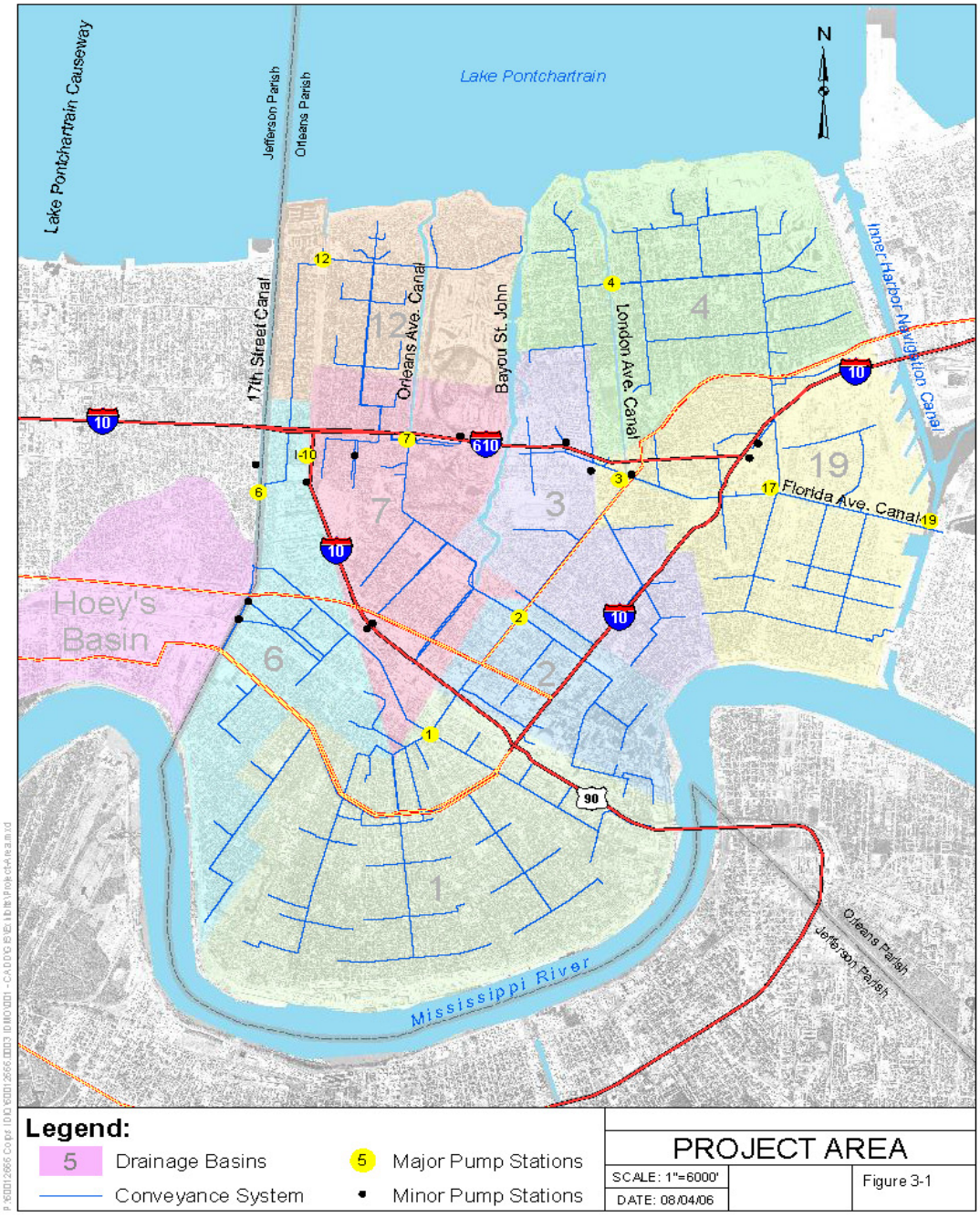

Figure 2-1 Area Under Consideration

2.2 Evaluation Process

In the aftermath of Hurricane Katrina, the Army Corps of Engineers, in concert with local stakeholders, began to explore options to address the hurricane storm surge and evacuation of water in the area. Immediately after Congressional authorization (P.L. 109-234) to design and construct permanent pumping stations for 17th Street, Orleans Avenue and London Avenue Canals, the Corps of Engineers entered into a collaborative process with the local stakeholders to evaluate different options. Stakeholder involvement for the project began in June 2006 and solidified in January of 2007 with a formal Partnering Session. To support the collaborative process the Corps of Engineers consulted existing reports, and initiated new reports to further investigate the options. In the midst of this collaborative process, Congress, in PL 110-28, requested the Corps of Engineers to evaluate the technical advantages and disadvantages of three options.

To respond fully to Congress, the Corps of Engineers developed a process for evaluating the technical advantages, disadvantages and operational effectiveness[2] of the options. This process is graphically depicted in a flowchart presented in Appendix B. As shown, the Corps of Engineers utilized as input to the process the results of numerous engineering concept reports, Interagency Performance Evaluation Task Force (IPET) reports, canal inspection reports, and other technical evaluation reports either previously completed, or ongoing at the time of Congress' request. A list of the reports consulted throughout the process is contained in 5.0 REFERENCES[3]. The evaluation and report process was integrated into the ongoing collaborative process of stakeholder involvement through partnering and also used consultation with experts through a Senior Review Panel.

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[2] Operational effectiveness in this analysis was assumed to describe how well the system performed at reducing flooding from hurricane storm surge and rainfall runoff, without regard to cost or environmental considerations.

[3] This report references documents containing information that may have been reviewed. References in this document by the United States Army Corps of Engineers (USACE) in this report, whether the referenced document was created by a contractor of the USACE or by a local stakeholder, should not be interpreted as an endorsement or adoption of this document, or any part thereof, by the USACE.

Stakeholder involvement continued for the purpose of evaluating technical advantages, disadvantages, and operational effectiveness described in PL 110-28. Interface with the stakeholders is predominately with their senior engineering and experienced staff. Ongoing stakeholder participation has included bi-weekly progress meetings, various USACE senior leadership board meeting presentations and most recently direct involvement (during two partnering sessions held in July 2007), which assisted in the development of the analysis of technical advantages and disadvantages presented herein.

The Senior Review Panel was convened by the Corps of Engineers and its members were provided with information to ensure compliance with the Federal Advisory Committee Act.[4] The Senior Review Panel met in late June 2007 with the following mission: to propose and evaluate potential solutions for the three outfall canals that would (a) reduce the risk of flooding in the Area from storm surge, and (b) maintain the ability of the Area's internal drainage system to function. The panel included twelve (12) members, three (3) were from Academia, six (6) from private Architect/Engineering firms, two (2) from USACE, and one (1) from the public sector. Of the twelve members, four (4) have doctorates and ten (10) are professional engineers. This panel reviewed more than twenty-five (25) alternatives and suggested seven (7) alternatives for further consideration. These seven (7) were all variations of the options stated in PL 110-28.

[4] The purpose of each member of the Senior Review Panel is to give individual advice, thoughts, observations, concerns, suggestions, and/or recommendations on the Permanent Pumps Project. Such individual advice or recommendations are non-binding and merely presented for consideration by the Permanent Pumps Project Development Team, which may either accept, reject, modify, or set aside for future consideration, any such individual advice or recommendations.

The purpose of the Senior Review Panel is to convey information, and/or advice or recommendations, and to aid in the discussion of ideas and "brainstorming" between the Framework Development Team members. It is recognized that neither a consensus nor any agreement by, between, or among the Senior Review Panel members is either being requested or sought from the Senior Review Panel members. It is further recognized that neither this Senior Review Panel, as a group, nor the individual Senior Review Panel members, have any oversight, directing, controlling, or decision making authorities for the Permanent Pumps Project.

2.3 Cost and Environmental Compliance Considerations: Not Included

The investigation, information provided, comparisons, and summary in this report are technical in nature and do not analyze nor consider lifecycle costs, or environmental impacts and alternatives as required by the National Environmental Policy Act of 1969. (Public Law 91-190, 83 Statute 852). A final recommendation and selection as to the Corps of Engineers' preferred alternative can only be made upon completion of the cost estimates and full environmental compliance. Monthly public meetings are being held to inform the public on the USACE planning process and gather public input on the full range of alternatives to be evaluated under the National Environmental Policy Act process.

3.0 OPTIONS

For ease of analysis and discussion, the investigations requested in Chapter 3, Section 4303 of Public Law 110-28 are described as "options", as follows:

> **Option 1: …** ***operating the new pumping stations at the mouths of the 17th Street, Orleans Avenue, and London Avenue canals in the New Orleans area directed for construction in Public Law 109–234 concurrently or in series with existing pumping stations serving these canals and ….***
>
> **Option 2: …** ***removing the existing pumping stations and configuring the new pumping stations and associated canals to handle all needed discharges to the lakefront…***
>
> > **a) …*****or in combination with discharges directly to the Mississippi River in Jefferson Parish; and ...***[5]
>
> **Option 3: …** ***replacing or improving the floodwalls and levees adjacent to the three outfall canals …***

[5] This report interprets the wording of Section 4303 to imply that sub-option (a) is to be evaluated with Option 2 only. However, it should be noted that sub-option (a) could be linked to Option 1, as well, since it may provide additional operational flexibility to Option 1.

Each of these options is discussed in greater detail in the following sections. The advantages and disadvantages of each have been developed through multiple reports and input from local stakeholders. Advantages and disadvantages were compiled and discussed in numerous forums including a Senior Review Panel and various Stakeholder Partnering meetings. Advantages and disadvantages are grouped based on five evaluation criteria. The evaluation criteria include: 1) Risk reduction and flood damage reduction capability, 2) Engineering challenges, 3) Operational flexibility and effectiveness, 4) Adaptability to higher levels of protection as a comprehensive, integrated system, and 5) Construction complexity. The advantages and disadvantages provided below highlight the differences among the options. There are inherent sources of risk that apply to all options, such as the reliability of backup energy sources, the consequences of failure of one or more pumps, and the potential for underseepage problems given the significant sand substrata in this area. These issues will be further developed as our engineering, cost, and environmental analyses are completed.

3.1 Option 1: New Pumping Stations … Concurrently or in Series with Existing Pumping Stations

This option was part of a previous engineering concept analysis described in a *Conceptual Report for Permanent Flood Gates and Pump Stations* (Ref. 1) dated July 31, 2006. This option consists of construction of new permanent pump stations with closure structures at or near the mouths of the three outfall canals. For purposes of this report the term “closure structure” is interpreted to mean operational gates. The existing Sewerage & Water Board of New Orleans (S&WBNO) pump stations that discharge into the canals would remain in service (See Figure 2-1 for the locations of existing pumping stations.). The canals would continue to convey storm water from the existing pump stations to the new pump stations and closure structures. Some canal modifications (floodwall improvements or repairs) will be required to provide adequate factors of safety under the expected canal flow conditions and to provide additional operational flexibility for the system.

During normal conditions the gates in the closure structures would remain open, and the flow from the canals would discharge directly into Lake Pontchartrain. During

these conditions the existing system would operate in the same manner as it did prior to Katrina. When a combination of lake stage and discharge flow from the existing pump stations creates a condition where the water in the canals would exceed the safe water elevation in the canals, the gates in the closure structures would be closed, and the new pump stations would operate. Safe water elevations are defined to equal the maximum allowable canal water surface elevation at any point along the canal. When the gates are closed, the new pump stations would operate in series with the existing pump stations. The purpose of the new pump stations is essentially to convey storm water around the closure structures and into Lake Pontchartrain and to prevent the water level in the canals from exceeding the safe water elevation.

The final size and configuration of the pump stations and the ancillary facilities will depend on several factors, including the type, number, and size of pumps; the type of pump drive; and the location of the gated closure structures. One of the most significant aspects of this option is that the intake elevation (invert elevation) of the new pump station will be only a few feet below the bottom of the existing canal. This configuration will require minimal excavation, will allow a lighter foundation to be used since the uplift pressures are less, and will minimize the horsepower required for the pumps to lift the water from the canal elevation to the Lake elevation.

Figure 3-1 shows the centerline profile of 17th Street Canal if this option is implemented. This Figure shows the centerline profile from the existing pump station through the drainage canal and through the new pump station to Lake Pontchartrain. This demonstrates the relative elevation of the intake of the new pump station in comparison to the current elevation of the bottom of the canal and the existing pump station.

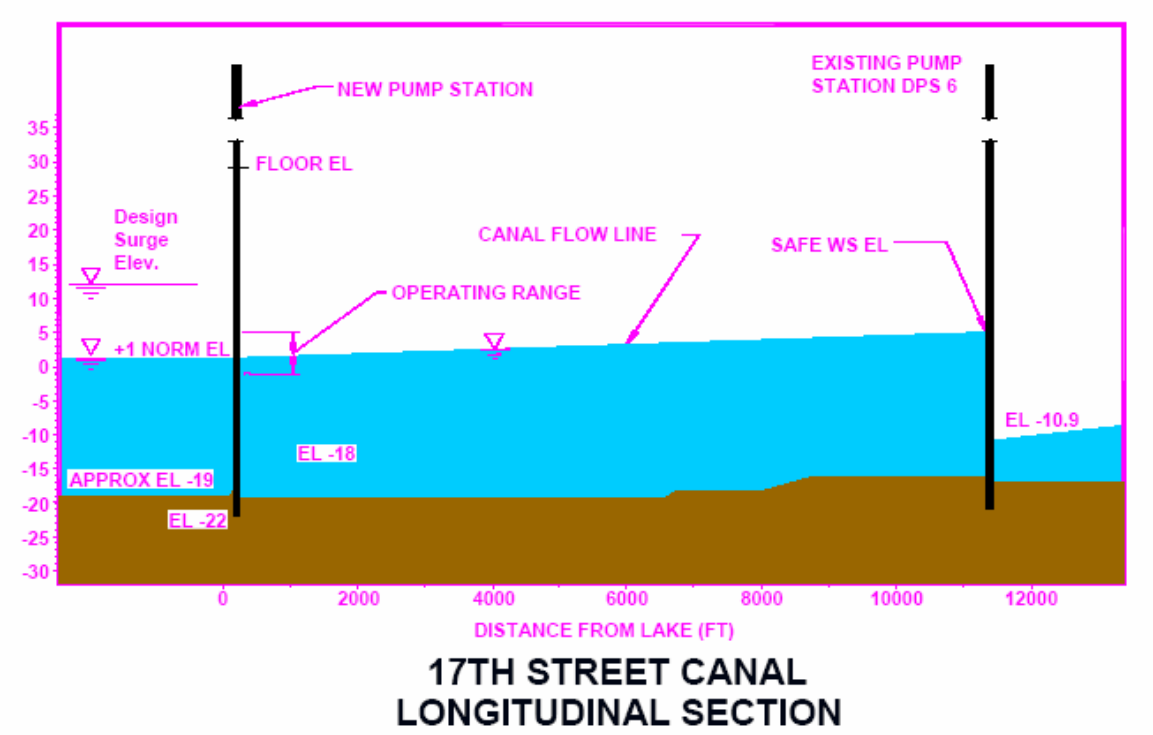


Figure 3-1 Option 1, 17th Street Canal Profile

Option 1 canals are considered "above-grade" canals because canal water levels are higher than the adjacent protected properties. This is shown schematically in Figure 3-2.

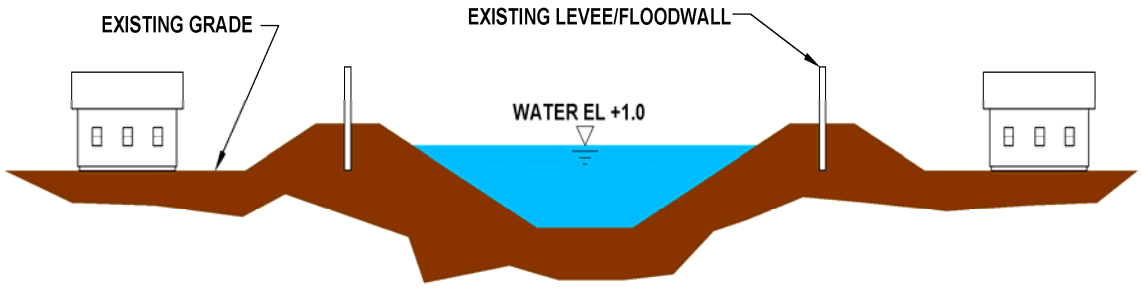


Figure 3-2 Option 1 – Typical Canal Cross Section

3.1.1 Option 1: Technical Operational Effectiveness

The system has two objectives: to reduce risk in the area from storm surge and to maintain the ability of the area's flood damage reduction system to function. During normal conditions, the gates at the new pump stations are open; allowing the storm water to flow through the closure structures into Lake Pontchartrain, and the new pump stations would not be operated. When storm surge on Lake Pontchartrain is predicted, the gates would be closed and the new pump stations would be operated to match the flow from the existing pump stations. To accomplish this under Option 1, the existing and new pump stations have to operate in series.

The closure structures would always be in a "ready" state so that they could be staffed and operated when conditions warrant. The decision to staff the new pump stations, close the gates, and operate the pump stations would be made by the Non-Federal Sponsor(s) in coordination with the Corps of Engineers based on the actual or predicted lake water surface elevation. When the gates are closed, the new pump stations would discharge water out of the closed canal system into Lake Pontchartrain and maintain water levels in the canals at or below safe water elevations. The need to control the water surface elevation within the canals will require additional flexibility in capacity and a sophisticated control system which has to be designed into the system to match the widely varying inflow conditions from the existing pump stations. The operating methodology will also have to consider the transient (wave) conditions in the canals produced by starting and stopping of pumps in the existing and new pump stations. The new pump stations would have to be operated in a manner to prevent the water from exceeding the safe water elevation in the canals.

When the lake surface elevation is below the elevation that would trigger closure, the current interior drainage system will operate as it did prior to Hurricane Katrina. Improvements or repairs to increase the safe water elevation in some portions of the existing floodwalls will be required to accommodate maximum discharge capacity of the existing pump stations when the closure structures are open and the canals discharge directly into the Lake.

3.1.2 Option 1: Advantages and Disadvantages

Advantages and disadvantages of Option 3 are grouped based on the five evaluation criteria discussed previously in Section 3.0. The advantages and disadvantages of Option 1 are provided in Table 3-1

Table 3-1 Option 1, Advantages and Disadvantages

Evaluation Criteria	
1. Risk Reduction and flood damage reduction capability	***Advantages***
	Relocates the primary line of protection for the Area to or near the lakefront. This protects the outfall canals from lake storm surge. Remaining repaired floodwalls provide partial compartmentalization (sub-division of the protected Area) which could reduce overall flooding risk.
	Disadvantages
	Relies on existing Sewerage & Water Board of New Orleans (S&WBNO) pump stations with older equipment and technology resulting in a less reliable flood damage reduction system. Increased risk of exceeding safe water elevations in the canals through equipment malfunction or operator error. Higher risk of interior flooding from an above-grade canal.
2. Engineering challenges. [6]	***Advantages***
	Utilizes existing infrastructure including pump stations, canals and floodwalls. Most of right-of-way is available minimizing delays from land acquisition. Provides additional drainage capacity by reducing the water surface elevations on the downstream side of the existing pump stations during a storm surge event.

[6] The existing drainage system is complex and consists of a multitude of conveyance structures and pump stations. Water is not efficiently transported to the existing pumping stations, there is no gravity flow from the drainage basin and water has to be lifted to the outfall canals.

	Disadvantages
	Does not address current drainage problems and flow conveyance upstream of existing pump stations. Working within the existing canal right-of-way limits the alternative canal improvement methods that can be utilized to increase the safe water elevation.
3. Technical Operational flexibility and effectiveness	***Advantages***
	None
	Disadvantages
	Requires synchronized operation of multiple pump stations in series during a variety of combinations of storm surge and/or high flood flow events which increases operational complexity. Infrequent operation of the lakefront pump stations will result in an operational hardship for the operating entity. Multiple operation staffs will be required, but on infrequent intervals. Requires operations and maintenance of more pump stations than required for the existing system. Floodwall modifications are required to increase safe water elevations in order to provide additional operational flexibility.
4. Adaptability to higher levels of protection as comprehensive, integrated system.	***Advantages***
	Increasing future storm surge protection at the lake is limited to improvement at the lakefront only, which alleviates the need for additional modification to the interior floodwalls and levees.
	Disadvantages
	Increasing interior drainage capacity in the future may require significant modifications to the existing and new pump stations and canals.
5. Construction	***Advantages***

Complexity	Utilizes existing infrastructure including pump stations, canals, and flood walls. The new pump stations can be constructed utilizing conventional construction methods. Excavations required are not expected to produce significant contaminated sediments requiring special handling and disposal. Shorter time to construct.
	Disadvantages
	Construction required for safe water elevation improvements and/or repairs for the walls will require construction techniques which will maintain the continuity of operations of the existing system during construction.

Participants in the Senior Review Panel and the collaborative workshops observed that some of the advantages and disadvantages identified were not as important as others. The most important were retained and are included in Table 3-1. The consolidated list of advantages and disadvantages developed is provided in Appendix A.

3.1.3 Option 1: Additional Considerations

One of the observations made both by the Senior Review Panel and from previous reports is that the advantages and disadvantages do not hold to the same degree for all of the outfall canals. For the Orleans Avenue Canal, the existing canal levees and floodwalls will not require significant upgrading or repair to provide sufficient operational flexibility for this option. The flow in Orleans Avenue Canal is small enough and the storage capacity in the canal between the two pump stations is large enough to avoid unusual operating constraints. While it is true even for the Orleans Avenue Canal that operating the existing and new pump stations in series produces some complexity, the lower flow and higher storage capacity substantially mitigate those concerns. For Option 1 on Orleans Avenue Canal, additional work will be required to connect the floodwall to Drainage Pump Station No. 7 and to improve the back wall of the pump station to accommodate the safe water elevation of the canal. The conditions on Orleans Avenue Canal would result in less frequent operation of the closure structure and new pump station when compared to London Avenue and 17th Street Canals.

The intended operation of the closure structures is that the gates would remain open except when storm surge is expected. This requires that the existing canals be capable of carrying the maximum flow that the existing pump stations can discharge (with future increases) without exceeding the safe water elevation in the canals. Due to the volume of water and the size of the canals on 17th Street and London Avenue, operational or physical changes will have to be made to meet this criterion. One means of addressing this issue is to improve or repair the floodwalls to increase the safe water elevation in the two canals. The improvements should be designed to provide additional operational flexibility when the gates in the closure structures are closed.

3.2 Option 2: Removing Existing Pumping Stations and Configuring the New Pumping Stations to Handle All Needed Discharges to the Lakefront

This option includes constructing new pumping stations at or near the lakefront and necessary canal modifications that allow gravity flow of storm water to the pump station. Canal modifications may include deepening, widening, lining, etc. In this scenario, the existing S&WBNO pump stations would no longer be required. The deepened canals would allow the water that is currently pumped by the existing pump stations to flow by gravity all the way to the new, deeper pumping stations at the lakefront. With the canals deepened the need for levees and floodwalls along the existing canals from the existing pump stations to the lake would be eliminated. The canal would no longer be elevated above the surrounding ground level, but would be a normal, below-grade canal. Some portions of the existing system could remain in place to provide additional compartmentalization of the drainage basin. In other words, compartmentalization sub-divides the area and reduces the risk of the entire basin being flooded if a flood control component in some particular reach of a sub-basin were to fail.

Closure structures (gates) would no longer be required since there would be no condition under which the lake water would be allowed to flow up the outfall canals past the pump station.

The primary difference between Option 2 and Option 1 is depicted in Figure 3-3 Option 2, 17th Street Canal Profile. This Figure shows the water level in the canal at a

much lower elevation than shown in Figure 3-1 Option 1, 17th Street Canal Profile and shows existing Drainage Pump Station (DPS) 6 bypassed. This option, therefore, eliminates the need to double pump the water. However, the water would have to be lifted higher from the deepened canal into the lake. This would have a significant impact on the type and size of pumps to be used. Required pump capacity remains the same as Option 1; only the motor would have to be larger to provide for the additional lift.

Option 2 includes both the opportunity and the necessity for making improvements and/or modifications to the major components of the drainage system.

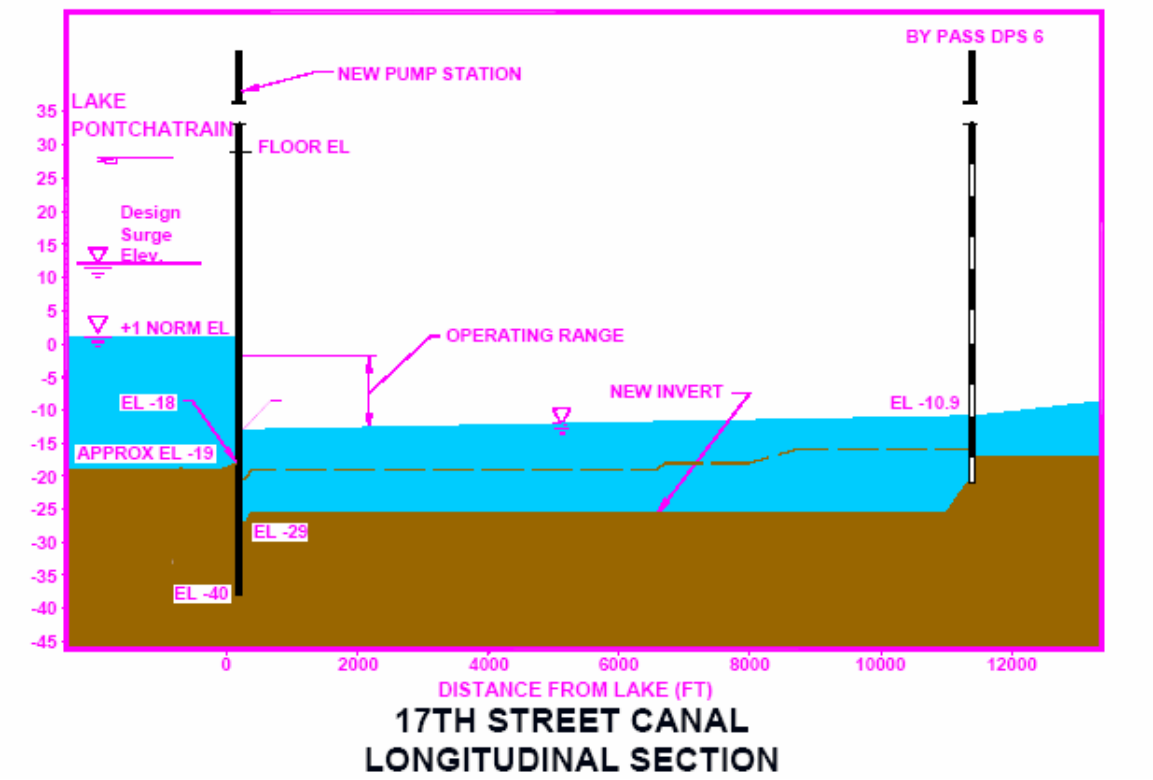


Figure 3-3 Option 2, 17th Street Canal Profile

The primary difference in the pump station for Option 2 is the depth of the foundation. Because of the uplift loads, the foundation would have to be substantially thicker than for the Option 1 pump station.

The significance of the below-grade canal can be seen by comparing Figure 3-2 Option 1 – Typical Canal Cross Section and Figure 3-4 Option 2 – Typical Canal Cross Section. Comparison shows that Option 2 results in a water surface elevation lower than

the adjacent developed areas, where in Option 1, the water surface elevation is still above the adjacent ground elevation.

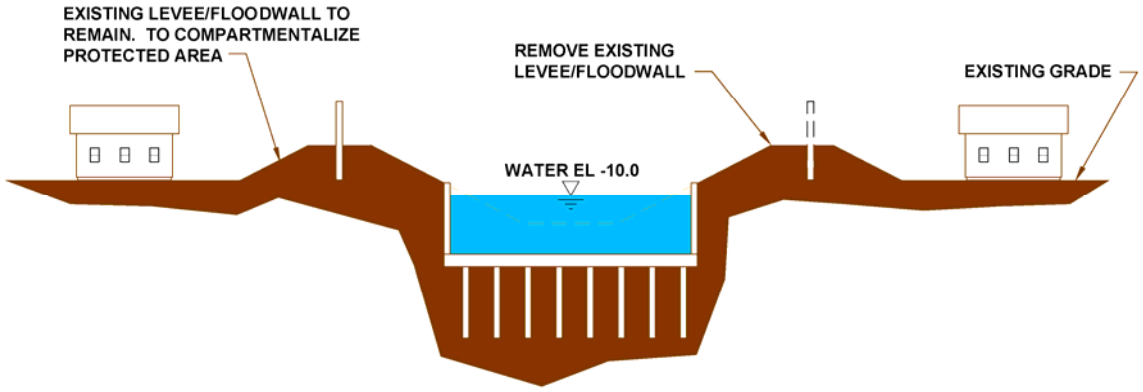


Figure 3-4 Option 2 – Typical Canal Cross Section

The potential locations of the new pump stations may be at or near the lakefront and are the same as the locations considered for Option 1. Since the motors for the pumps are larger, the standby power requirements are also greater. The greater standby power requirements would require a larger power plant and tank farm for fuel. The actual pump station may be somewhat smaller due to the elimination of the gate bays from this Option. Overall, however, more real estate is required for the Option 2 solution because of the larger power plant and tank farm requirements.

3.2.1 Option 2: Technical Operational Effectiveness

The operation of this pumping station would be much the same as the operation of the existing pumping station and is substantially simplified from Option 1. The primary difference would be the size of the motors required to achieve the design conditions for the new plant. It is likely that various sizes of pumps would be required for the new pump station. Since the Option 2 pump station would be a constant duty station, it would need to have the flexibility to more closely match the actual flow in the canal.

3.2.2 Option 2: Advantages and Disadvantages

Advantages and disadvantages are grouped based on the five evaluation criteria discussed previously in Section 3.0. The advantages and disadvantages of Option 2 are provided in Table 3-2.

Table 3-2 Option 2, Advantages and Disadvantages

Evaluation Criteria	
1. Risk Reduction and flood damage reduction capability	***Advantages***
	Relocates the primary line of protection for the Area to or near the lakefront. This protects the drainage canals from lake storm surge. Older pumping equipment will be taken out of service and replaced with new, more operationally effective equipment improving the reliability of the flood damage reduction system. Risk is further reduced by the elimination of the gates and associated closure operations. Risk of flooding is reduced by eliminating the above-grade canal and replacing it with a below-grade canal.
	Disadvantages
	None.
2. Engineering challenges.	***Advantages***
	Depending on the canal modifications, most of right-of-way for improvements to the canal is available minimizing delays from land acquisition.
	Disadvantages

	There are additional design complexities from a deeper pump station, deepening of the canals and the requirements for additional real estate because of the larger power plant and tank farm requirements. This option requires significant deepening of the existing canals. The deepening may require a concrete lined channel to reduce groundwater problems and subsidence. Deepening of the canal will require bridge foundation modifications for all the bridges that transit the canal. Working within the existing canal right-of-way limits the alternative canal modification methods that can be utilized. Will require work zones, impacting numerous residential communities (noise, dust, rights-of-way), along entire length of canal.
3. Technical Operational flexibility and effectiveness	***Advantages***
	Older pumping equipment will be taken out of service and replaced with new, more operationally effective and reliable equipment. The number of pump stations required to be operated and maintained by the local operating entity is reduced.
	Disadvantages
	None.
4. Adaptability to higher levels of protection as comprehensive, integrated system.	***Advantages***
	Increasing future storm surge protection at the lake is limited to improvement at the lakefront only, not the interior. Multiple improvements in the flood damage reduction system can be more easily realized with a below-grade canal replacing the existing above grade canal. Facilitates multiple future flood damage reduction improvements.
	Disadvantages
	None.
5. Construction Complexity	Advantages
	None.
	Disadvantages

	There are additional construction complexities from the deeper pump station and deepening of the canals. This option requires significant deepening of the canal. This will require significant work along the entire length of the canal including the bypassing of the existing pump station. The deepening of the canal will have to utilize a construction method which will allow the existing canal flood damage reduction system to remain in operation during construction. Bridge modifications will have to be planned to reduce traffic disruptions on major highway systems and local collectors. The required canal and bridge modifications increase the construction time.

Refer to Appendix A for a consolidated list of Advantages and Disadvantages.

3.2.3 Option 2: Drainage System Analysis

A drainage system analysis, as directly related to the three outfall canals, is needed to determine the effectiveness of Option 2 for London Avenue, Orleans Avenue, and 17th Street Canals. The primary goal of the analysis would be to reduce the maximum hurricane flow to each of the outfall canals. Flow reduction could offset many of the technical disadvantages cited in Table 3-2, in particular those disadvantages associated with construction complexity and canal deepening. Subdividing the drainage basin and considering effective ways to handle drainage from each sub-basin may also reveal opportunities to reduce risk and improve reliability.

Opportunities for reducing the maximum flow to the canals can be grouped into two main categories: flow retention and flow diversion. Flow retention seeks to hold water back from immediate release to the canals such that the peak hurricane flow in the outfall canals is reduced. One example of a possible flow retention plan for Orleans Avenue Canal may be to temporarily retain storm runoff from the higher elevation lands in the City Park Area. Flow diversion consists of diverting flow to locations other than the outfall canals. This analysis would determine whether to divert flow either directly or indirectly via the drainage system to Lake Pontchartrain, the Mississippi River, or the

Inner Harbor Navigation Canal. For example, there may be effective means of reducing the flow in London Avenue Canal by diverting a portion of that flow to the Inner Harbor Navigation Canal. The Jefferson Parish pump to the Mississippi River option (Option 2a) would be a feature of the analysis and is briefly described in the following paragraphs.

3.2.4 Option 2a: Option 2 in Combination with Discharges Directly to the Mississippi River in Jefferson Parish

Approximately 2500 acres of Jefferson Parish, consisting primarily of an area known as Hoey's Basin, currently utilizes gravity drainage into the system served by existing DPS 6, which is discharged into the 17th Street Canal. Option 2a would consider collecting the storm runoff from this area and making provisions to pump it to the Mississippi River instead of routing it through DPS 6. Option 2a has been considered in several previous reports listed in Section 5.0 REFERENCES. The various "pump to the river" reports suggest a range of possible alternatives utilizing both pumping and storage. The primary difference in the alternatives previously considered was whether the proposed "pump to the river" system accommodates a portion or all of the flow from Hoey's Basin. Those alternatives that propose to remove all of the flow from 17th Street canal appear to have the greater merit. Complete capture of the flow from Hoey's basin would reduce the size of the new pump station required at the lake and would reduce the magnitude of the canal modifications required to accommodate gravity flow in the 17th Street system. Even if the system is designed for full capture, a cross tie between the proposed Jefferson Parish System and the current 17th Street Canal drainage system would allow flexibility where a portion of the drainage flow from the 17th Street system could be diverted through the Jefferson Parish system in the event of malfunction of the 17th Street system. Drainage from Jefferson Parish could also be directed through the 17th Street system in the event of malfunction of the pump-to-the-river system. This will provide operational flexibility as well as potential for regional flood protection.

3.2.4.1 Option 2a: Technical Operational Effectiveness

The previously considered options related to additional drainage capacity from Hoey's basin all include pump stations. The operation of the new pump station could essentially be independent of the operation of the 17th Street Canal. If the Option 2a

system captured all of the flow from Hoey's basin, it could simplify the operation of the 17th Street canal and pumping system. Further study would be required to estimate the impact of these potential benefits.

3.2.4.2 Option 2a: Advantages and Disadvantages

The advantages and disadvantages of Option 2a are in addition to those reported above for Option 2 and are grouped based on the five evaluation criteria discussed previously in Section 3.0. The additional advantages and disadvantages of this sub-Option 2a (capturing full flow is assumed) are provided in Table 3-3:

Table 3-3 Option 2a, Advantages and Disadvantages

Evaluation Criteria	
1. Risk Reduction and flood damage reduction capability	***Advantages***
	Removes that portion of Jefferson Parish served by the diversion from any dependence upon conditions in the 17th Street Canal. Interconnection link between the 17th Street system and the new Jefferson Parish system would provide operational flexibility for both systems. Increases regional drainage capacity and reduces local flooding. Provides better floodplain management by subdividing the basin and providing operational flexibility between sub-basins.
	Disadvantages
	None
2. Engineering challenges	***Advantages***
	Reduces the required flow in 17th Street Canal which reduces the required canal size and the size of the pump station at the Lake. Provides a mechanism for by-passing 17th Street Canal flow during construction of the deeper canal sections associated with Option 2.
	Disadvantages
	Requires additional commercial and residential real estate. This will lengthen the time for property acquisition.
3. Technical	***Advantages***

Operational flexibility and effectiveness	Allows for cross-parish pumping during emergencies in either Jefferson or Orleans Parish; thereby, increasing operational reliability and flexibility.
	Disadvantages
	None
4. Adaptability to higher levels of protection as comprehensive, integrated system.	***Advantages***
	None
	Disadvantages
	None
5. Construction Complexity	***Advantages***
	Can be constructed using reasonable and routine construction methods. Provides flexibility to redirect flows during construction.
	Disadvantages
	None

3.2.5 Option 2 and Option 2a: Additional Considerations

Since three of the existing pump stations are on the National Register of Historic Places, the pump stations could be taken out of service, but could not simply be demolished. There would be a need to consider subsequent uses for at least the original part of the buildings. Any work of this type would have to be closely coordinated with the State Historic Preservation Office.

Canal modification for Option 2 would require canal dredging unless deemed unnecessary through the proposed drainage system analysis. The environmental impacts of the canal dredging would have to be analyzed.

3.3 Option 3: Replacing or Improving the Floodwalls and Levees Adjacent to the Three Outfall Canals

Replacement of the parallel protection system was evaluated as an alternative. The parallel protection system would need to be replaced or rehabilitated to allow the system to provide flood damage reduction against the design storm event. Generally, this would require the replacement of the existing “I-walls” and might require the provision

of erosion protection along the banks and canal bottom. Design and analysis of transitions between floodwalls, bridges and pump stations would be required. A cross-section showing a potential option for replacing or improving the floodwalls and levees along the canal is shown in Figure 3-5.

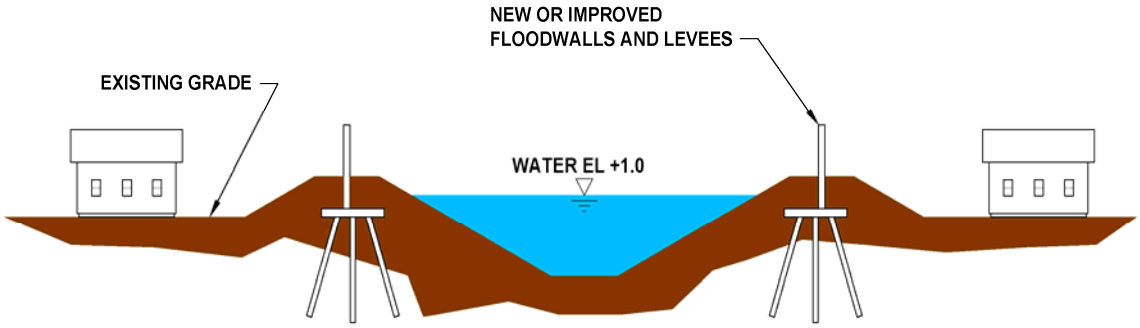


Figure 3-5 Option 3- Restore Parallel Protection System

3.3.1 Option 3: Technical Operational Effectiveness

The passive nature of Option 3 would eliminate the need for the storm surge portion of the system (gates) to "operate." The flood damage reduction system would operate as it did prior to Hurricane Katrina. In Option 1, using the new pump stations to reduce the canal water elevations effectively increases the actual discharge capacity of the existing S&WBNO pumping stations. This secondary benefit from the Option 1 scenario would not be available in Option 3 since the existing pump stations would have to pump against a higher Lake Pontchartrain elevation during a storm surge event. Option 1 would make the existing pump stations more efficient whereas Option 3 would not.

3.3.2 Option 3: Advantages and Disadvantages

Advantages and disadvantages of Option 3 are grouped based on the five evaluation criteria discussed previously in Section 3.0. The advantages and disadvantages of Option 3 are as provided in Table 3-4:

Table 3-4 Option 3, Advantages and Disadvantages

Evaluation Criteria	
1. Risk Reduction and flood damage reduction capability	***Advantages***
	None
	Disadvantages
	Relies on existing pump stations with older equipment and technology resulting in a less reliable flood damage reduction system. Higher risk of interior flooding due to increased length of hurricane protection system. Higher risk of interior flooding from an above-grade canal.
2. Engineering challenges	***Advantages***
	Maximizes the use of existing infrastructure (no new pump stations or closure structures required).
	Disadvantages
	May require bridge modifications for flood-proofing existing bridges. Does not improve interior drainage during high lake stage. Working within the existing canal right-of-way limits the alternative canal modification methods that can be utilized.
3. Technical Operational flexibility and effectiveness	Advantages
	Does not require any additional operational constraint on existing system. There is no new equipment to operate.
	Disadvantages
	None.
4. Adaptability to higher levels of protection as comprehensive, integrated system	***Advantages***
	None
	Disadvantages
	Parallel protection is not readily adaptable to future changes in protection levels for both hurricane protection and flood damage reduction.

5. Construction Complexity	***Advantages***
	Maximizes the use of existing infrastructure (no new pump stations or closure structures required).
	Disadvantages
	May require bridge modifications. The bridge modifications will lengthen the construction period. Reconstruction of the levee and floodwall system canal will have to utilize a construction method which will allow the existing canal drainage.

4.0 SUMMARY

This Report provides the information required by Chapter 3, Section 4303 of Public Law 110-28. Previous reports, engineering analyses, and additional efforts employed to determine the technical advantages, disadvantages, and operational effectiveness of identified options have resulted in three primary observations:

(1) Options 1 and 2 appear more technically advantageous over Option 3 because they are more effective in reducing risk of flooding. Option 3 results in a much longer line of protection against hurricane storm surge and therefore has more exposure to hurricane storm surge and a higher risk of overtopping.

(2) Option 1 could be more advantageous considering the engineering challenges and construction complexity of Option 2.

(3) Option 2 is generally more technically advantageous and may be more effective operationally over Option 1 because it would have greater reliability and further reduces risk of flooding.

Discharge of storm water directly to the Mississippi River would reduce the size of the new pump station required at the lake and would reduce the magnitude of the canal modifications required to accommodate gravity flow in the 17th Street system. This

option was considered as part of Option 2 and may have merit as part of Option 1. This option would provide operational flexibility to both Option 1 and Option 2.

A drainage system analysis, directly related to the three outfall canals, should be pursued to determine the inflow amounts to the outfall canals, and if a reduction in required canal discharge capacity during a hurricane event can be achieved. Such a reduction in capacity requirements has the potential to improve the technical operational effectiveness and reduce the technical and construction complexity of the options. Examples of potential benefits of this analysis are described in Section 3.2.3. Further engineering, environmental and cost analyses are continuing.

The primary advantages and disadvantages of the options for all three canals are shown in Tables 3-1, 3-2, 3-3 and 3-4 herein, and a compilation of the advantages and disadvantages is provided in Appendix A.

5.0 REFERENCES

In creating this Report, the United States Army Corps of Engineers (USACE) reviewed the following documents, and referenced them as documents containing information that may have been reviewed. References to these documents by the USACE in this Report, whether the referenced document was created by a contractor of the USACE or by a local stakeholder, should not be interpreted as an endorsement or adoption of any of these documents, or any parts thereof, by the USACE.

1. *Conceptual Design Report for Permanent Flood Gates and Pump Stations,* July 31, 2006, GEC and Black & Veatch
2. *Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Final Report of the Interagency Performance Evaluation Task Force (IPET), Volume I – Executive Summary*, March 26, 2007, US Army Corps of Engineers
3. *Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Final Report of the IPET, Volume II – Geodetic Vertical and Water Level Datums*, March 26, 2007, US Army Corps of Engineers
4. *Performance Evaluation of the New Orleans and Southeast Louisiana Hurricane Protection System, Final Report of IPET, Volume VI – The Performance – Interior Drainage and Pumping,* March 26, 2007, US Army Corps of Engineers
5. *Final Report of Alternatives Analysis of the Interim Drainage Maintenance Opportunities for the East Orleans Drainage Project,* August 18, 2006, DMJM Harris
6. *Project Information Report, Rehabilitation Hurricane or Shore Protection Projects Damaged by Hurricane Katrina, East Orleans Parish, Revision #2,* May 17, 2006, New Orleans District Corps of Engineers
7. *Application for Hurricane Flood Control Protection Program, Hoey's Basin, Pump to Mississippi River Plan*, October 2006, by Brown Cunningham Gannuch
8. *Report on Alternative Drainage Outlet to the Mississippi River for the Hoey's Basin for Jefferson Parish*, July 9, 2007, NY Associates, Inc.

9. *17th Street Outfall Canal Floodwall Inspection Report, New Orleans District, Engineering Division, May 25, 2006.*
10. *Senior Review Panel Best Technical Solution Evaluation Final Report, ECM-GEC Joint Venture, July 25, 2007.*

APPENDIX A - CONSOLIDATED EVALUATION MATRIX

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
1. Risk Reduction and flood damage reduction capability	***Advantages***		
	Relocates the primary line of protection for the Area to or near the lakefront. This protects the drainage canals from lake storm surge. Remaining repaired floodwalls provide partial compartmentalization (sub-division of the protected Area) which could reduce overall flooding risk.	Relocates the primary line of protection for the Area to or near the lakefront. This protects the drainage canals from lake storm surge. Older pumping equipment will be taken out of service and replaced with new, more operationally effective equipment improving the reliability of the flood damage reduction system. Risk is further reduced by the elimination of the gates and associated closure operations. Risk of flooding is reduced by eliminating the above-grade canal and replacing it with a below-grade canal.	No Advantages Identified
	Advantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		
		Removes that portion of Jefferson	

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
1. Risk Reduction and flood damage reduction capability		Parish served by the diversion from any dependence upon conditions in the 17th Street Canal. Interconnection link between the 17th Street system and the new Jefferson Parish system would provide operational flexibility for both systems. Increases regional drainage capacity and reduces local flooding. Provides better floodplain management by subdividing the basin and providing operational flexibility between sub-basins.	
	Disadvantages		
	Relies on existing Sewerage & Water Board of New Orleans (S&WBNO) pump stations with older equipment and technology, resulting in a less reliable flood		Relies on existing pump stations with older equipment and technology resulting in a less reliable flood damage reduction

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
	damage reduction system. Increased risk of exceeding safe water elevations in the canals through equipment malfunction or operator error. Higher risk of interior flooding from an above-grade canal.	No Disadvantages Identified	system. Higher risk of interior flooding due to increased length of hurricane protection system. Higher risk of interior flooding from an above-grade canal.
	Disadvantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		
		No Disadvantages Identified	
2. Engineering challenges	***Advantages***		
	Utilizes existing infrastructure including pump stations, canals and floodwalls. Most of right-of-way is available minimizing delays from land acquisition.	Depending on the canal modifications provided, most of right-of-way for the improvements to the canal is available minimizing delays from land acquisition.	Maximizes the use of existing infrastructure (no new pump stations or closure structures required).

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
2. Engineering challenges	Provides additional drainage capacity by reducing the water surface elevations on the downstream side of the existing pump stations during a storm surge event.		
	Advantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		
		Reduces the required flow in 17th Street Canal which reduces the required canal size and the size of pump station at the Lake. Provides a mechanism for by-passing the 17th Street Canal during construction of the deeper canal sections associated with Option 2.	
	Disadvantages		

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
2. Engineering challenges	Does not address current drainage problems and flow conveyance upstream of existing pump stations. Working within the existing canal right-of-way limits the alternative canal improvement methods that can be utilized to increase the safe water elevation.	There are additional design complexities from a deeper pump station, deepening of the canals, and the requirement for additional real estate because of the larger power plant and tank farm requirements.. This option requires significant deepening of the existing canals. The deepening may require a concrete lined channel to reduce groundwater problems and subsidence. Deepening of the canal will require bridge foundation modifications for all the bridges that transit the canal. Working within the existing canal right-of-way limits the alternative canal modification methods that can be utilized.	May require bridge modifications for flood-proofing existing bridges. Does not improve interior drainage during high lake stage. Working within the existing canal right-of-way limits the alternative canal modification methods that can be utilized.

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
		Will require work zones, impacting numerous residential communities (noise, dust, rights-of-way), along entire length of canal.	
	Disadvantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		
		Requires additional commercial and residential real estate. This will lengthen the time for property acquisition.	
3. Technical Operational flexibility and effectiveness	***Advantages***		
	No Advantages Identified	Older pumping equipment will be taken out of service and replaced with new, more operationally effective and reliable equipment. The number of pump stations required to be operated and maintained by the local operating entity is reduced.	Does not require any additional operational constraint on existing system. There is no new equipment to operate.
	Advantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
3. Technical Operational flexibility and effectiveness		Allows for cross-parish pumping during emergencies in either Jefferson or Orleans Parish; thereby, increasing operational reliability and flexibility.	
	Disadvantages		
	Requires synchronized operation of multiple pump stations in series during a variety of combinations of storm surge and/or high flood flow events which increases operational complexity. Infrequent operation of the lakefront pump stations will result in an operational hardship for the operating entity. Multiple operation staffs will be required, but on infrequent intervals. Requires operations and maintenance of more pump stations than required for the existing	No Disadvantages Identified	No Disadvantages Identified

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
3. Technical Operational flexibility and effectiveness	system. Floodwall modifications are required to increase safe water elevations in order to provide additional operational flexibility.		
	Disadvantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		
		No Disadvantages Identified	
4. Adaptability to higher levels of protection as comprehensive,	***Advantages***		
	Increasing future storm surge protection at the lake is limited to improvement at the lakefront only, which alleviates the need for additional modifications to the interior floodwalls and levees.	Increasing future storm surge protection at the lake is limited to improvement at the lakefront only, not the interior. Multiple improvements in the flood damage reduction system can be	No Advantages Identified

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
integrated system		more easily realized with a below-grade canal replacing the existing above grade canal. Facilitates multiple future flood damage reduction improvements.	
4. Adaptability to higher levels of protection as comprehensive, integrated system	***Advantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish***		
		No Advantages Identified	
	Disadvantages		
	Increasing interior drainage capacity in the future may require significant modifications to the existing and new pump stations and canals.	No Disadvantages Identified	Parallel protection is not readily adaptable to future changes in protection levels for both hurricane protection and improved flood damage reduction.
	Disadvantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		

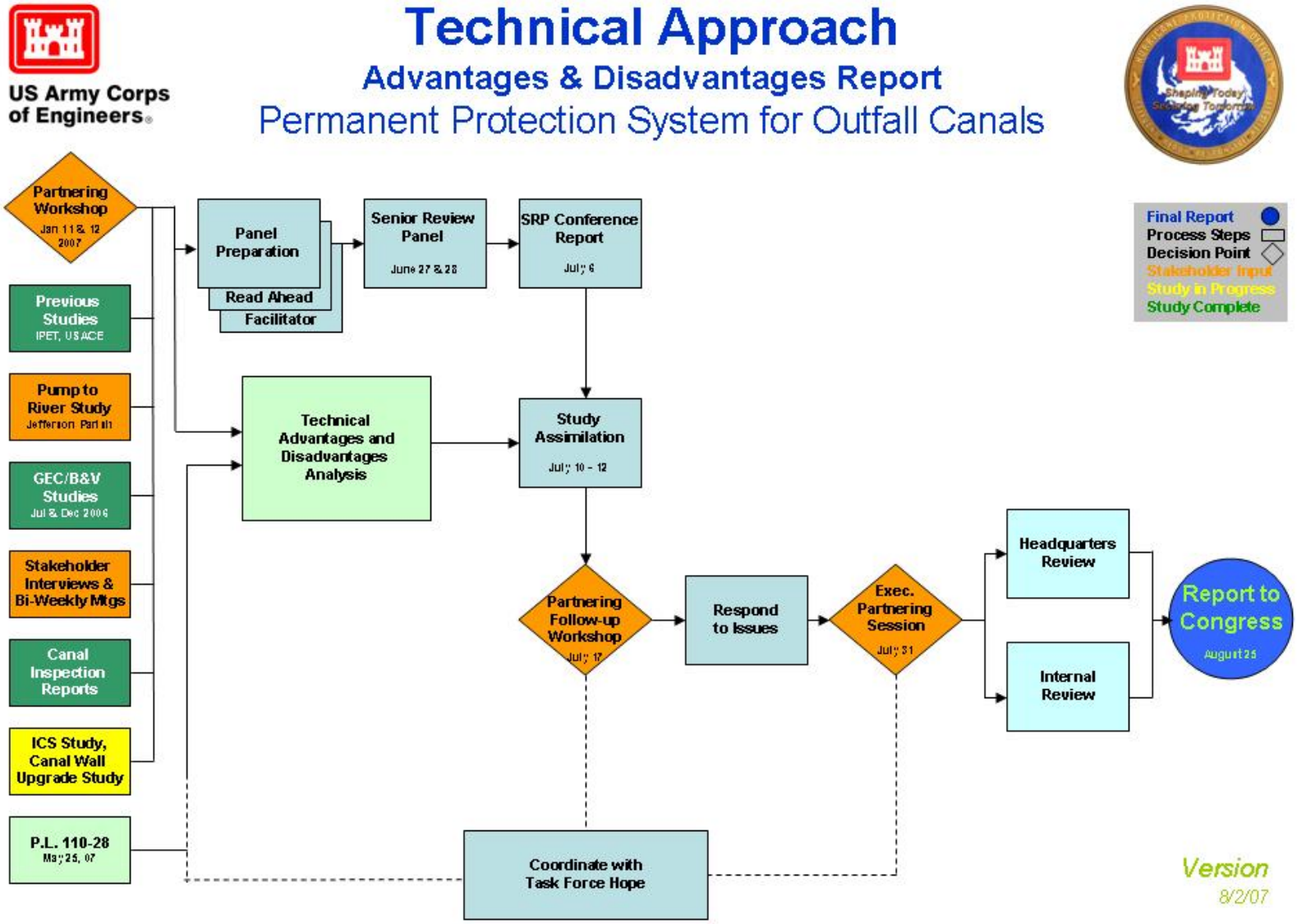
Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
		No Disadvantages Identified	

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
5. Construction Complexity	***Advantages***		
	Utilizes existing infrastructure including pump stations, canals, and floodwalls. The new pump stations can be constructed utilizing conventional construction methods. Excavations required are not expected to produce significant contaminated sediments requiring special handling and disposal. Shorter time to construct.	No Advantages Identified	Maximizes the use of existing infrastructure (no new pump stations or closure structures required).
	Advantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		
		Can be constructed using reasonable and routine construction methods. Provides flexibility to redirect	

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
5. Construction Complexity		flows during construction.	
	Disadvantages		
	Construction required for safe water elevation improvements and/or repairs for the walls will require construction techniques which will maintain the continuity of operations of the existing system during construction.	There are additional construction complexities from the deeper pump station and deepening of the canals. This option requires significant deepening of the canal. This will require significant work along the entire length of the canal including the bypassing of the existing pump station. The deepening of the canal will have to utilize a construction method which will allow the existing canal flood damage reduction system to remain in operation during construction. Bridge modifications will have to be planned to reduce traffic disruptions on major highway	May require bridge modifications. The bridge modifications will lengthen the construction period. Reconstruction of the levee and floodwall system canal will have to utilize a construction method which will allow the existing canal drainage.

Consolidated Evaluation Matrix - Advantages and Disadvantages			
Evaluation Criteria	Option 1 – New pumping stations … concurrently or in series with existing pumping stations	Option 2 – Removing existing pumping stations and configuring the new pumping stations to handle all needed discharge to the Lakefront	Option 3 – Replacing or improving the floodwalls and levees adjacent to the three outfall canals
5. Construction Complexity		systems and local collectors. The required canal and bridge modifications increase the construction time.	
	Disadvantages: Option 2a – Option 2 in combination with discharges directly to the Mississippi River in Jefferson Parish		
		No Disadvantages Identified	

APPENDIX B - PROCESS FLOWCHART


US Army Corps of Engineers
Technical Approach
Advantages & Disadvantages Report
Permanent Protection System for Outfall Canals
Partnering Workshop
Jan 11 & 12 2007
Panel Preparation
Read Ahead
Facilitator
Senior Review Panel
June 27 & 28
SRP Conference Report
July 6
Final Report
Process Steps
Decision Point
Stakeholder Input
Study in Progress
Study Complete
Previous Studies
IPET, USACE
Pump to River Study
Jefferson Parish
GEC/B&V Studies
Jul & Dec 2006
Stakeholder Interviews & Bi-Weekly Mtgs
Canal Inspection Reports
ICS Study, Canal Wall Upgrade Study
P.L. 110-28
May 25, 07
Technical Advantages and Disadvantages Analysis
Study Assimilation
July 10 - 12
Partnering Follow-up Workshop
July 17
Respond to Issues
Exec. Partnering Session
July 31
Headquarters Review
Internal Review
Report to Congress
August 25
Coordinate with Task Force Hope
Version
8/2/07