

A collage of various images related to a pump station, including buildings, pipes, and machinery. The central text is overlaid on a white background with a black border.

Consequences

Pump Station Performance

IPET NRC Meeting
New Orleans, La.
March 20-21, 2006

Pump Station Performance

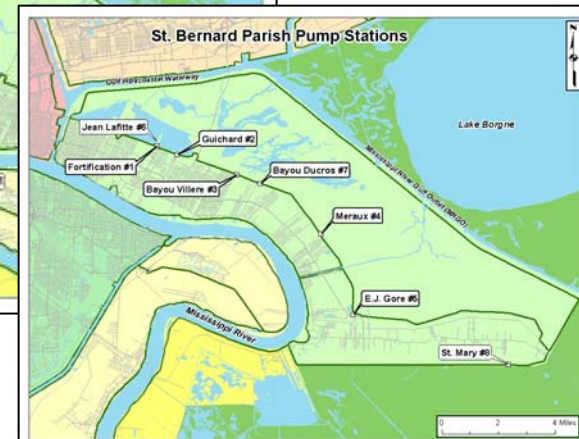
System constructed to provide flood protection for greater New Orleans area consists of levees, floodwalls, flood gates and pump stations. Pump stations are designed to remove runoff from rainfall events.



Pump Stations

Total of 67 Pump Stations:

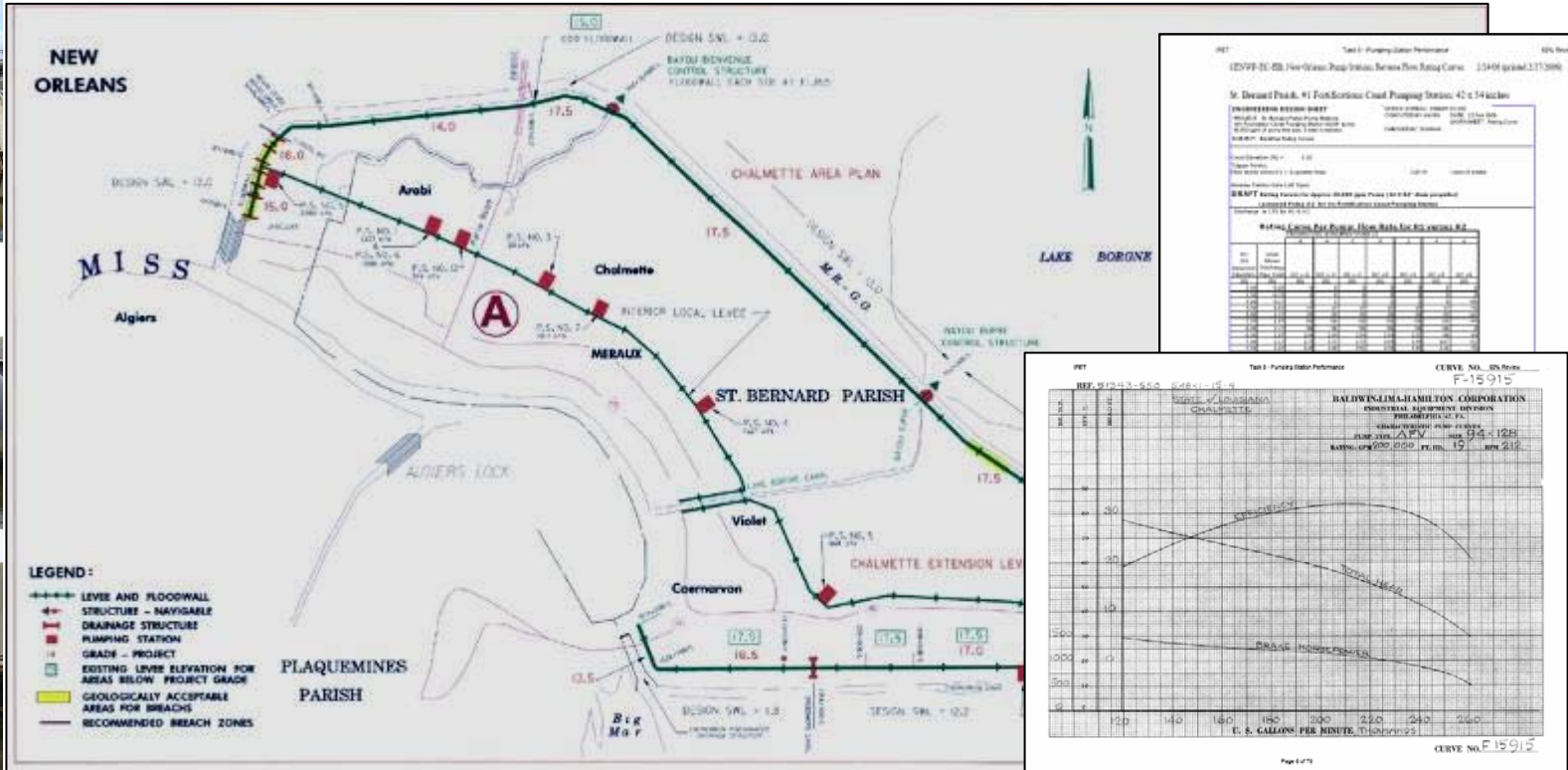
Jefferson Parish	6 pump stations East bank 10 pump stations West bank
Plaquemines Parish	19 pump stations
Orleans Parish	22 pump stations East bank 2 pump stations West bank
St. Bernard Parish	8 pump stations



Pump Station Performance

Evaluation to include location and description of each pump station and pumps within the station, elevations of critical components, reverse flow prevention capability, operation times during Katrina event, operation rules/criteria, pump system curves, reverse flow system curves.

Information provided to Interior Modeling Team for model development and calibration.



Pump Station Performance

Information to be provided to Risk and Reliability team to include damage history during Katrina, critical elevations that affect pump performance, fuel burn and storage, station condition and construction, dependencies of systems (25 hz power, water for bearings), operator requirements.



St. Bernard Parish

PS 1 - Fortification

Fuel Endurance Calculation

Assumptions:

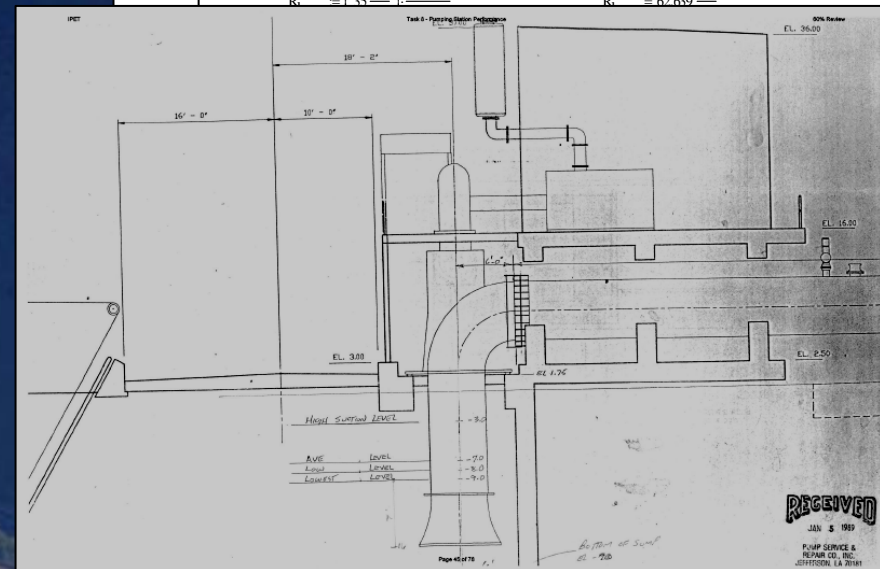
- 1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal
- 2) Burn rate of 35 gph @ 500 KW with above HHV rating
- 3) Diesel engines are running at rated capacity

PS 1 Fortification

3 pump drivers - 2 diesel and 1 electric. The diesels are rated at 1200 horsepower

The approximate burn rate for each diesel is then calculated:

$$R_1 = \left(\frac{35 \text{ gal}}{1} \right) \cdot \frac{1200 \text{ hp}}{140,000 \text{ btu/gal}} \quad R_2 = 62,630 \frac{\text{gal}}{\text{hr}}$$



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JAN 5 1999

PUMP SERVICE &
REPAIR CO., INC.
JEFFERSON, LA 70087



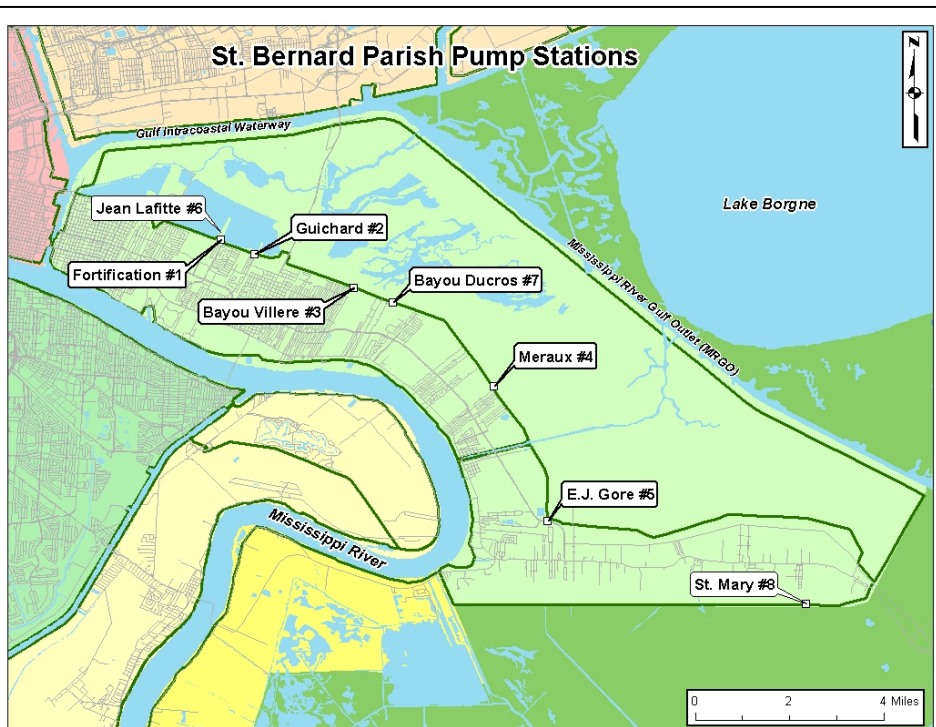
Pump Stations

Summary of Accomplished Work

- Obtained available documents through the contracted Architecture-Engineering firm (CH2M Hill), Task Force Guardian, Task Force Hope, and the USACE New Orleans District.
- Completed approximately 90% of the work for St Bernard Parish and have submitted the information for St. Bernard Parish as the Technical Appendix I for Report 2.
- The remaining Parishes will be brought to the 90% level similarly to the work accomplished for St Bernard Parish.

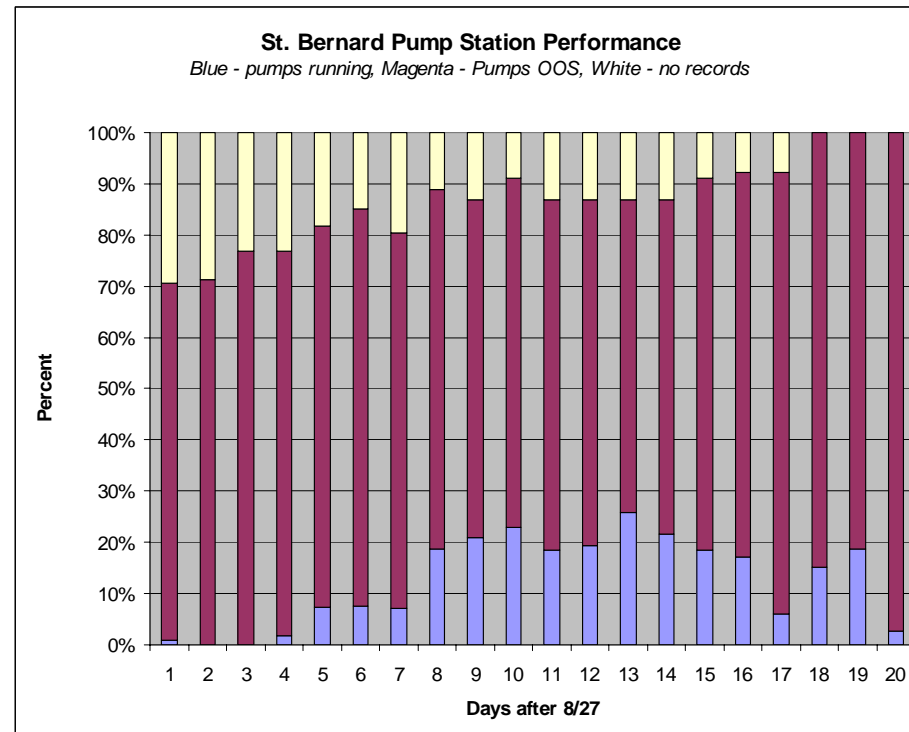
St. Bernard Pump Stations Interim Results

- Information in Report 2, Appendix I
- Eight pump stations in St. Bernard Parish.
- Total discharge capacity of 6,960 cfs (cubic feet per second) to evacuate accumulated runoff from precipitation in a drainage area of 17,620 acres.



St. Bernard Pump Stations Interim Results

- Five stations (representing 80% of total capacity) have operating floors approximately 12 feet above the natural ground surface which substantially reduced storm-induced damage.
- Stations #2, #3 and #5 were flooded to a depth of six to eight feet above the operating floor which destroyed the diesel engines, vacuum pumps, and many accessories.



St. Bernard Pump Stations Interim Results

Recommendations and Improvements

- Repairs and refurbishments (Katrina and general)
- Backflow prevention
- SCADA, Remote Start Capability (2,3,5)
- Trash Racks
- Safe house/shelter near pump stations
- Additional pump capacity at Station 5
- Fuel supply and replenishment
- Communications system upgrade







Pre-Hurricane Katrina – View from Inlet Canal

**4200 Jean Lafitte Pkwy.
Chalmette, LA 70043
504.512.6331**

Position: Latitude 29.966557° Longitude -89.975821°



Pre-Hurricane Katrina – Aerial view of pump station

Pump Station Description

Fortification is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains three vertical pumps that were installed in 1972 with a total pumping capacity of 980 cubic feet per second (cfs)¹. Two of the pumps are driven by diesel engines and one by an electric motor. The drainage water is supplied to the pumps from the Florida Walk Forty Arpent canal and discharges through the interior back levee to the marsh known as Bayou Bienvenue. The individual pump discharges have a tainter gate installed to cut off water flow in either direction. The station has (4) 5,000 gallon and (2) 110 gallon diesel fuel tanks.

Pump Station Operation

Pump station operators will turn the pumps on as they are required to reduce the water elevation in the canal. The pumps are normally turned on when the water in the canal reaches approximately -6 feet (NGVD) and turned off when the water level reaches -6.5 feet (NGVD). When heavy rainfall events are expected the station operators will pump the canal down to an elevation of -8.5 feet (NGVD). If the water elevation on the discharge side of the pump station is predicted to exceed 3.5 feet (NGVD) the station operator closes the discharge tainter gates.

Pump Curves

Pump curves, where available, are attached to this section.

Fuel Endurance Calculation

Assumptions :

- 1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal
- 2) Burn rate of 35 gph @ 500 kW with above HHV rating
- 3) Diesel engines are running at rated capacity

PS 1 Fortification

3 pump drivers - 2 diesel and 1 electric. The diesels are rated at 1200 horsepower

The approximate burn rate for each diesel is then calculated:

$$R_{\text{burn}} := \left(35 \frac{\text{gal}}{\text{hr}} \right) \cdot \frac{1200\text{hp}}{500\text{kW}} \qquad R_{\text{burn}} = 62.639 \frac{\text{gal}}{\text{hr}}$$

Fuel Capacity

- 4 - 5000 gallon tanks
- 2 - 110 gallon day tanks

Fuel Endurance

The time the 5000 gallon tanks will last is calculated:

$$t_1 := \frac{4 \cdot 5000\text{gal}}{2R_{\text{burn}}} \qquad t_1 = 159.645 \text{ hr}$$

The time the 110 gallon tanks will last is calculated:

$$t_2 := \frac{2 \cdot 110\text{gal}}{2R_{\text{burn}}} \qquad t_2 = 1.756 \text{ hr}$$

The approximate total continuous run time for the pump station is:

$$T_t := t_1 + t_2 \qquad T_t = 161.402 \text{ hr}$$

$$T_t = 6.725 \text{ day}$$

Reverse Flow

This station contains tainter gates that prevent reverse flow when used. Reverse flow curves have been prepared for cases where tainter gates may not be closed.

Katrina Event

- 8/28/05 - Operators pumped water in canal down to approximately 8.5 ft.
- 8/29/05 - Operators evacuated pump station at approximately 1:15 am.
- 8/30/05 - Operators returned to the station at 10:00 am. Water was the same elevation on both sides of pump station.
- 9/01/05 - Both pumps running.
- 9/05/05 - **Pump station back to normal operation.**

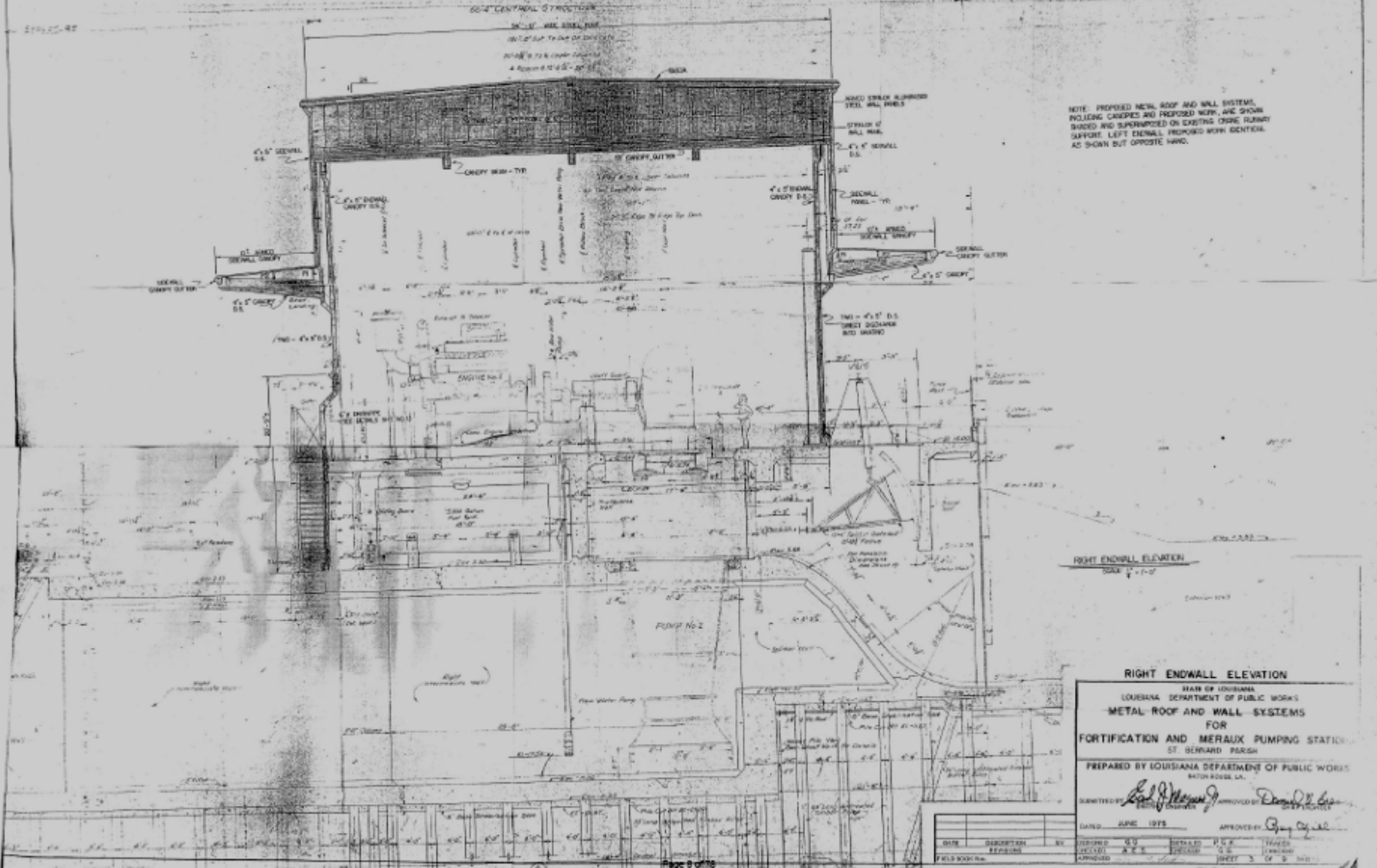
Damage Report



Post-Hurricane Katrina – View from the Inlet Canal

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 1 sustained relatively minor damage because its operating floor elevation is 16 feet N.G.V.D. Flooding from the storm flooded the lower level of the station but the flood waters were approximately three feet below the concrete operating floor level. Pump station equipment that was damaged includes an electric pump motor, generator, trash rack bearing and gear box, and lighting. The building sustained damage to the metal siding and roof. Additionally, the diesel engine cooling system developed a leak. Auxiliary equipment damage included flooding of a bobcat used to remove debris from the trash racks.



F-15915

REF. 51343-550 548x1-15-4

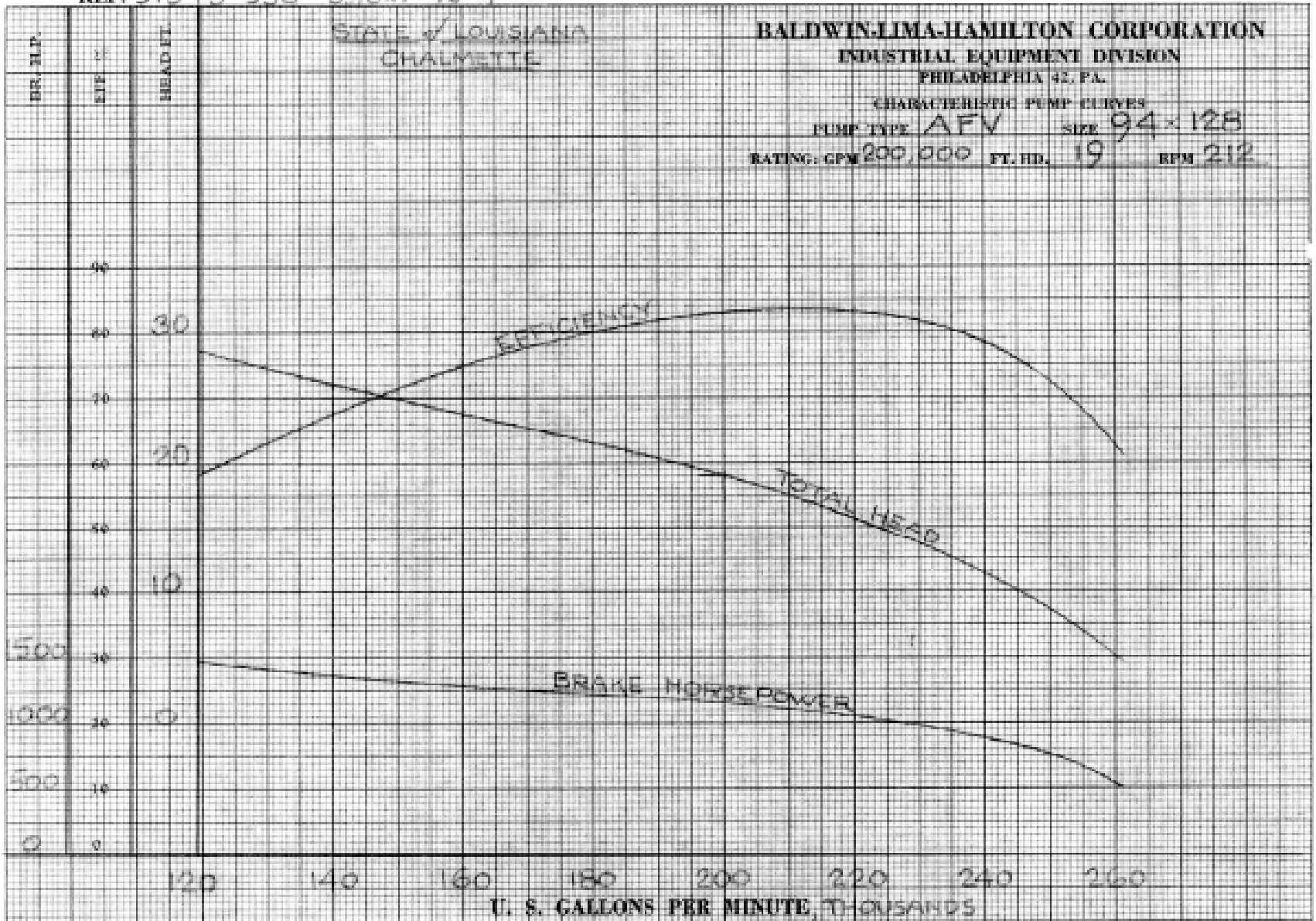
STATE OF LOUISIANA
CHALMETTE

BALDWIN-LIMA-HAMILTON CORPORATION
INDUSTRIAL EQUIPMENT DIVISION
PHILADELPHIA 42, PA.

CHARACTERISTIC PUMP CURVES

PUMP TYPE AFV SIZE 94 x 128

RATING: GPM 200,000 FT. HD. 19 RPM 212



CURVE NO. F-15915

St. Bernard Parish, #1 Fortifications Canal Pumping Station: 42 x 54 inches

ENGINEERING DESIGN SHEET OFFICE SYMBOL: CENWP-EC-HD
 PROJECT: St. Bernard Parish Pump Stations COMPUTED BY: KK/SS DATE: 22 Feb 2006
 #1/ Foundation Canal Pumping Station-42x54" pump WORKSHEET: Rating Curve
 40,000 gpm (1 pump this size, 3 total in station) CHECKED BY: SJS/KAK
 SUBJECT: Backflow Rating Curves

Crest Elevation (ft) = 3.83
 Trigger Points:
 Flow starts when H1 > is greater than 3.83 ft crest of intake

Assume Tainter Gate Left Open
DRAFT Rating Curves for Approx 40,000 gpm Pump (42 X 54" diam propeller)
 (assumed Pump #1 for #1 Fortification Canal Pumping Station)

Discharge in CFS for H1 & H2

Rating Curve Per Pump: Flow Rate for H1 versus H2

		Elevation (H2) at Backflow Outlet C3						
		-6	-4	-2	0	2	4	6
H1 U/s Reservoir Elevation (ft)	Level Above Discharge Pipe Crest (ft)	H2 = -6 (ft)	H2 = -4 (ft)	H2 = -2 (ft)	H2 = 0 (ft)	H2 = 2 (ft)	H2 = 4 (ft)	H2 = 6 (ft)
3.00	-0.83	0	0	0	0	0	0	0
3.50	-0.33	0	0	0	0	0	0	0
4.00	0.17	2	2	2	2	2	0	-88
4.50	0.67	17	17	17	17	17	17	-76
5.00	1.17	39	39	39	39	39	39	-62
5.50	1.67	66	66	66	66	66	66	-44
6.00	2.17	98	98	98	98	98	98	88
6.50	2.67	134	134	134	134	132	98	44
7.00	3.17	173	173	173	164	139	107	62
7.50	3.67	215	210	191	170	145	116	76
8.00	4.17	232	215	196	175	152	124	88
8.50	4.67	236	219	201	181	158	132	98
9.00	5.17	240	224	206	186	164	139	107
9.50	5.67	244	228	210	191	170	145	116
10.00	6.17	248	232	215	196	175	152	124
10.50	6.67	252	236	219	201	181	158	132
11.00	7.17	256	240	224	206	186	164	139
11.50	7.67	259	244	228	210	191	170	145
12.00	8.17	263	248	232	215	196	175	152
12.50	8.67	267	252	236	219	201	181	158
13.00	9.17	270	256	240	224	206	186	164

NOTES:

- Rating curve is accurate within $\pm 30\%$ due uncertainty of pump curve loss coefficient and unknown width of discharge channel
- Loss and Trigger Point Assumptions:
 Pump loss coefficient = 3.00
 Siphon flow does not start till H1 > soffit of pipe at crest(Zt)
 Intake loss = 0.5
 Exit Loss = 1.2 (grating effect)
 Bend and expansion losses also incorporated
- Data Assumptions:
 Tainter Gate Left open
 Discharge Channel width = 10 feet
- Data Needs:
 Discharge Channel width
- Backflow prevention:
 Available: Tainter Gate for closure