Date:   February 4, 2013

Re:    Fill and Culverted Road Repair, Plaquemines Parish, LA, Sundown Energy –
       CUP Number P20111629, WQC # 121217-01 and Permit # MVN-2011-2607d

To:     Chris Seifert, OCM Reviewer
         State of Louisiana
         Department of Natural Resources, Office of Coastal Management
         P.O. Box 44487
         Baton Rouge, Louisiana 70804-4487

         Jamie Phillippe, Project Manager
         State of Louisiana Department of Environmental Quality
         Attn: Water Quality Certification
         Post Office Box 4313
         Baton Rouge, Louisiana 70821-4313

Dear Mr. Seifert:

Please accept these comments and supporting comment documents for the Sundown Energy LP
permit application at Mardi Gras Pass.

**LPBF Recommendation:**

It is recommended that the permit be denied or held until:
1. A thorough analysis of the direct and indirect ecologic impacts are determined
2. Rigorous alternatives are evaluated, including those suggested in these comments
3. Accurate hydrologic analysis is provided of the actual existing conditions
4. Mardi Gras Pass is determined to be navigable by Federal or State statute
5. Mitigation is required for any permitted work with either direct or indirect impacts

Sincerely,

[Signature]

John A. Lopez, Ph.D.
Executive Director
Lake Pontchartrain Basin Foundation
johnlopez@pobox.com  504 421 -7348
Comments Submitted to the Corps of Engineers Regarding Permitting of Fill and Culverts across Mardi Gras Pass – CUP Number P20111629, WQC # 121217-01 and Permit # MVN-2011-2607

By Lake Pontchartrain Basin Foundation Dr. John A. Lopez
February 4, 2013

Background

In 2012, Mardi Gras Pass (MGP) became the most recent distributary of the Lower Mississippi River (Figures 1 and 2). It was created by natural erosion processes initiated by the high-water event of 2011, and observed while LPBF was conducting a spillway-wide hydrologic survey. A proposed private project under permit review by the Corps would severely limit flow through Mardi Gras Pass, and severely limit the ecologic benefits.

Our studies of the Bohemia Spillway demonstrate strong evidence that the river flow through the spillway has enhanced the resources of the area as evidenced by very low rates of wetland loss and even the extremely rare natural re-establishment of marsh in canals. The development of Mardi Gras Pass further enhances the spillway function to sustain this area of the coast. Furthermore, the establishment of a new river distributary is a precious coastal habitat that
should be protected for its own ecologic, aesthetic, and public values. The proposed project would severely reduce the natural supply of sediment and nutrients to the coastal area here by altering the freshwater flow.

MGP has great significance to coastal restoration. First, it is a remarkable scientific opportunity to study a significant deltaic process. Secondly, MGP itself could evolve into a managed diversion with large cost savings to the state and the country by replacing the Lower Breton Diversion (Figure 3). Mardi Gras Pass has continued to evolve since breaching to the river in late February of 2012. LPBF has been documenting deltaic processes in the Bohemia Spillway where MGP is located since 2007 (see SaveOurLake.org for more information). We expect Mardi Gras Pass to continue to expand over time during future high water events, increasing its importance as a restoration feature in the region. LPBF will continue to monitor the changes to Mardi Gras Pass.

![Figure 2: Location of Mardi Gras Pass at the top of the Bohemia Spillway showing Reaches 1 through 4.](image)

Reaches 1 and 3 were newly formed in 2011 and 2012 and Reaches 2 and 4 are the conveyance canals for the defunct diversion structure built in 1979.
Since the early 1990’s, with intense coastal planning in response to the coastal collapse due to wetland loss, there has been a succession comprehensive planning efforts with a consistent theme: to re-establish connections of the Mississippi River to the deltaic plain. The goals of such proposals were to resurrect deltaic processes that would help sustain or re-build precious wetlands. The Louisiana Coastal Area Study authorized in 2003, and the Louisiana Coastal Protection and Restoration studies in 2009, proposed major outlets along the Mississippi River. Foremost now is the recently approved Louisiana State Master Plan which calls for multiple land-building type diversions, including a 50,000 cfs diversion just a mile from the location of Mardi Gras Pass. The estimated cost of the Lower Breton Diversion approved within the State Master Plan is $216,000,000 which would not be necessary to spend if Mardi Gras Pass were allowed to continue to develop into a managed diversion.
Technical Conclusions

1. Mardi Gras Pass is a free-flowing distributary of the Mississippi River within the Bohemia Spillway, an area of river flow since 1926.
2. Mardi Gras Pass has already developed a riverine ecology including at least otter, beaver and fish.
3. Fish species of Mardi Gras Pass are both fresh and salt water species and demonstrate that the MGP is an important migratory path between the Mississippi River and the Gulf of Mexico.
4. Turbidity measured in Mardi Gras Pass at the Mississippi River inflow is relatively high (~2 times greater than turbidity of discharge through the Caernarvon Diversion).
5. Sediment transport through Mardi Gras Pass is indicated by newly created, vegetated shoals, and by aggrading and degrading channel bathymetry.
6. Recreational fishers are successfully utilizing Mardi Gras Pass.
7. Mardi Gras Pass is physically navigable and complete passage through the pass was made from the marsh to the Mississippi on September 14, 2012 by LPBF staff.
8. Mardi Gras Pass dimensions are very similar to oil and gas navigation canals, and exceed criteria normally assumed to legally determine navigability.
9. Mardi Gras Pass is an exceptionally rare, and highly valuable opportunity to scientifically document the deltaic process utilizing the river’s capacity to reconnect itself to the marsh and the related ecologic benefits.
10. Mardi Gras Pass is 1.3 miles from the proposed 50,000 cfs Lower Breton Diversion within the State Master Plan. The State modeled a diversion comparable to the current discharge of Mardi Gras Pass (peak 5000 cfs), and the model suggests that over 50 years 7,400 to 9,800 acres of new wetlands would be created under the current flow regime.
11. Mardi Gras Pass is 1.3 miles from the proposed 50,000 cfs diversion within the State Master Plan, and could eventually provide comparable benefits of 13,000 acres of wetland creation as predicted in the State Master Plan.
12. Mardi Gras Pass has modestly enlarged (degradation) from February to May 2012, and afterward, May 2012 to September 2012, the channel modestly became shallower (aggradation) due to deposition during low water.
13. MGP will continue to see net enlargement through annual river flood cycles if allowed to continue to develop.
14. The highest discharge documented in Mardi Gras Pass is 2,300 cfs, but could be as great as 5,300 cfs with Mississippi River rising to 2011 flood level (7.5 feet) and with existing MGP channel dimensions.
15. The applicant’s hydrodynamic analysis is misleading since it defines “existing conditions” which are not existing or even hypothetically accurate.
16. If the proposed culverts were constructed, the peak discharge through Mardi Gras Pass would be reduced by at least 85%, i.e. to approximately 800 cfs rather than 5,300 cfs.
17. The proposed culverts would prevent vessel navigation by boats to the Mississippi River and to Reaches 1, 2 and 3, and would immediately limit access by recreational fishers.
18. The proposed culverts would limit fish migrations, and diminish the riverine ecology of Mardi Gras Pass.
19. Existing river breaches near Ostrica indicates that Mardi Gras Pass could be adaptively managed by use of rock dikes with appropriate gapping to maintain a connection to the Mississippi River.
**Recommendations**

It is recommended that the permit be denied or held until:

- A thorough analysis of the direct and indirect ecologic impacts are determined
- Rigorous alternatives are evaluated, including those suggested in these comments
- Accurate hydrologic analysis is provided of the actual existing conditions
- Mardi Gras Pass is determined to be navigable by Federal or State statute
- Mitigation is required for any permitted work with either direct or indirect impacts

**Mardi Gras Pass Bank Delineation and Bathymetric Surveys**

The LPBF has conducted five bank and three bathymetric surveys to monitor the evolution of the entire length of Mardi Gras Pass (Figure 4). The MGP is divided into 4 Reaches. Reach 1 is closest to the river and was newly created by headward erosion during the 2011 flood. Reach 2 is the former intake canal for the now inoperable diversion structure. Reach 3 is the portion of the pass that breached through the road, around the diversion structure and Reach 4 is the former receiving canal for the diversion structure (see Figure). All survey data points were obtained using a Trimble Geo Explorer 6000 GeoXR GPS unit with Zephyr Model 2 GNSS receiver attached. Capable of Real Time Kinematic (RTK) data collection, this survey-grade GPS system provides latitude, longitude, and elevation (XYZ) of land locations to a high degree of precision.

By May 2012, the approximate end of the high water event of 2012, Mardi Gras Pass (Reach 1-4) had an average width of 77.5 feet, an average depth of 10.1 feet, and an average thalweg depth of 12.0 feet (see Table 1 & 2) for reach by reach measurements).

By August 2012, Mardi Gras Pass (Reach 1-4) had an average width of 77.9 feet, and, an average depth of 9.6 feet.

By September 2012, just after Hurricane Isaac, Mardi Gras Pass (Reach 1-4) had an average width of 77.9 feet, and an average depth of 8.8 feet. The shallower average depth indicates that deposition was occurring in the MGP during the low water period of the river.

By January 2013, at the end of the low water season, Mardi Gras Pass (Reach 1-4) had an average width of 78.8 feet, an average depth of 9.6 feet, and an average thalweg depth of 12.4 feet. The deeper average depth and thalweg depth is likely due to increase in flow scouring sediment in the channel that was deposited during the summer. From May to January there is a net increase in thalweg depth.
Figure 4: Most recent bathymetric survey of Mardi Gras Pass

Table 1: Width and depth ranges in Mardi Gras Pass by reach over time.

<table>
<thead>
<tr>
<th>LPBF Trimble Surveys Mardi Gras Pass</th>
<th>Average Width (ft)</th>
<th>Average Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reaches 1-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reach 1</td>
<td>77.5</td>
<td>77.9</td>
</tr>
<tr>
<td>Reach 2</td>
<td>56.2</td>
<td>66.6</td>
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<td>Reach 3</td>
<td>98.7</td>
<td>98</td>
</tr>
<tr>
<td>Reach 4</td>
<td>90.3</td>
<td>89.1</td>
</tr>
<tr>
<td>Reach 4</td>
<td>74.5</td>
<td>73.9</td>
</tr>
</tbody>
</table>

Table 2: Thalweg depths and net change of Mardi Gras Pass by reach over time.

<table>
<thead>
<tr>
<th>Reach</th>
<th>May 2012 Thalweg (ft)</th>
<th>Jan 2013 Thalweg (ft)</th>
<th>Thalweg Change (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 4</td>
<td>12</td>
<td>12.4</td>
<td>-0.4</td>
</tr>
<tr>
<td>1</td>
<td>6.8</td>
<td>8.3</td>
<td>-1.5</td>
</tr>
<tr>
<td>2</td>
<td>14.2</td>
<td>15.3</td>
<td>-1.1</td>
</tr>
<tr>
<td>3</td>
<td>12.1</td>
<td>12.8</td>
<td>-0.7</td>
</tr>
<tr>
<td>4</td>
<td>11.8</td>
<td>11.9</td>
<td>-0.1</td>
</tr>
</tbody>
</table>
The process of channel enlargement is bank erosion which undercuts the rooted banks. In Reach 1, the dominant species is black willow with an average height of 35 feet. These willow collapse into the river as the undercutting triggers slumping into the river (Figure 6). In Reach 1, there are 5 logjams due to the willow trees. We estimate there are 80 downed trees within Reach 1. These trees slow navigation of Mardi Gras Pass, but in the Fall of 2012, LPBF successfully navigated through the entire length of Mardi Gras Pass including Reach 1 that allows final passage to the Mississippi River (Figure 5). Navigating Reach 1 could be more convenient by simply removing some of the willow trees. The modest water level in the river now (February 2013), appears to be clearing some of the log jams that had otherwise persisted.
Figure 6: Bank slump with black willow tree in Reach 1 - photograph June 29, 2012
Mardi Gras Pass Discharge

Reach 1 of Mardi Gras Pass began to form in July 2011. Headward erosion continued in Reach 1 until MGP breached to the river in early March 2012 (Figure 7 green line), eventually eroding through a 200 foot-wide bar that formed on the Mississippi River bank. While the Bohemia Spillway experiences overtopping at stages greater than five to seven feet, the newly formed Mardi Gras Pass discharges continuously at any river stage, into the adjacent marsh and estuary, providing freshwater, nutrients and sediment to the receiving basin. This is due to the elevation of the channel being below sea level (purple line). Flow through Mardi Gras Pass is determined by the head between the river and marsh at any time. During the summer and low river water, reverse flow was occasionally observed, i.e. marsh water flowing into the river.

The Lake Pontchartrain Basin Foundation has contracted with UNO to make flow (ADCP) measurements at different river stages to assess the flow coming through Mardi Gras Pass (see attached documents). In addition, Dr. Alex McCorquodale with UNO determined the maximum flow that the proposed culvert structure would allow (see attached documents).

Figure 7: Graph showing the evolution of Mardi Gras Pass showing river stage at Carrollton (blue) and Pointe a la Hache (red), the overtopping elevation (purple), headward erosion in Mardi Gras Pass and the discharge (in black font) obtained from the ADCP surveys.
The initial discharge through Mardi Gras Pass was estimated on March 10, 2012 by use of a mechanical velocity meter (river stage = 3.1 ft, discharge = 100-200 cfs). Subsequent ADCP surveys were:

March 28, 2012 \hspace{1em} \text{river stage} = 5.5 \text{ ft}, \text{ discharge} = 2,300 \text{ cfs}
April 18, 2012 \hspace{1em} \text{river stage} = 3.5 \text{ ft}, \text{ discharge} = 626 \text{ cfs}
May 3, 2012 \hspace{1em} \text{river stage} = 2.5 \text{ ft}, \text{ discharge} = 475 \text{ cfs}
July 3, 2012 \hspace{1em} \text{river stage} = 1.8 \text{ ft}, \text{ discharge} = 436 \text{ cfs}
January 6, 2013 \hspace{1em} \text{river stage} = 2.5 \text{ ft}, \text{ discharge} = 971 \text{ cfs}
February 1, 2013 \hspace{1em} \text{river stage} = 4.6 \text{ ft}, \text{ discharge} = 2095 \text{ cfs}

(stage as reported for Pointe a la Hache)

The January 6, 2013 discharge is double the discharge measured in May 2012 when the river was at the same stage. This indicates increased flow capacity due to the channel enlargement. It is suspected that if the river rises to a level comparable to last April (5.5 feet), discharge would be at least 3,000 cfs. Based on these surveys and a review of other reported discharges, a rating curve was developed. Dr. Alex McCorquodale, who has been modeling the river at Bohemia for several years, estimated the stage-discharge relationship with the proposed culverts (see attached document). \textbf{Figure 8} below is a stage-discharge rating curve under the existing conditions and with the proposed culverts. Based on the rating curve below, at 5 foot stage, the difference in discharge is 1,600 cfs, and at 7.5 feet stage the difference in discharge is 4,200 cfs, corresponding to a 80% decrease and an 85% decrease in discharge, respectively, with the proposed culverts vs. existing conditions.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure8.png}
\caption{Estimated discharge through Mardi Gras Pass (at its current dimensions) and through the proposed culvert structure by river stage (at Pointe a la Hache).}
\end{figure}
Biological Surveys of Mardi Gras Pass

Mardi Gras Pass (MGP) has great significance for aquatic biology as it serves as a migratory route for both fresh and saltwater organisms. This unobstructed, free-flowing connection between the marsh estuary and the Mississippi River is rare for this reach of river. There is no similar connection for hundreds of miles upriver. The closest free-flowing channel downriver of Mardi Gras Pass is near Ostrica which is 16 miles downriver. Prior to MR&T levees, there were many small, seasonal outlets from the river. This biologic context of MGP is the rare opportunity to study the ecology of this distributary and consider its value to the broader estuary and even the Gulf of Mexico.

Fresh, sediment-rich water from the Mississippi River, at high stages, will flow into the wetlands/marsh, while at low stages, dependent on tides, the flow may be occasionally reversed. In some cases, over the period of one tidal cycle, both fresh- and salt-water species may move in and out of MGP, making this a very dynamic ecosystem.

In order to better capture this activity, LPBF has conducted three biological surveys over the past three months (November and December 2012, and January 2013) in order to better understand the biological assemblage of MGP. A wide variety of gear has been used in order to fully capture the aquatic species utilizing MGP including: cast nets, gill nets, minnow traps, crab traps, crawfish traps, trout lines, jug lines, hoop nets, and rod and reel.

A number of species have been captured using these methods. The list of captured species includes:

Salt Species:
speckled seatrout (*Cynoscion nebulosus*)
red drum (*Sciaenops ocellatus*)
blue crab (*Callinectes sapidus*)
striped mullet (*Mugil cephalus*)

Fresh Species
largemouth bass (*Micropterus salmoides*)
channel catfish (*Ictalurus punctatus*)
gizzard shad (*Dorosoma cepedianum*)
a variety of turtles
silver perch (*Bairdiella chrysoura*)

A number of other species have been spotted in the field over the course of all of LPBF visits to MGP including:

river otter (*Lutra canadensis*)
beaver (*Castor canadensis*)
American alligator (*Alligator mississippiensis*)
deer
rattle snake
water moccasin (*Agkistrodon piscivorus*)
fiddler crab
Gulf menhaden (*Brevoortia tyrannus*)
blue catfish (*Ictalurus furcatus*)
grass shrimp
river shrimp
spotted gar (*Lepisosteus oculatus*)
needle fish
crawfish

There are also a number of bird species that have been spotted in and around MGP including (Figure 9 and 10)

various egrets
great blue heron (*Ardea herodias*)
cormorants (*Phalacrocoracidae*)
king fisher
brown pelican (*Pelecanus occidentalis*)
white pelican (*Pelecanus erythrorhynchos*)
various seagulls
roseate spoonbills (*Ajaia ajaja*)

Sidescan sonar imaging of Mardi Gras Pass shows there are numerous tree snags and variations in bottom bathymetry, which enhance the ecologic value of the riverine ecology (Figure 12). A number of recreational fishers have been spotted fishing Reaches 2, 3, and 4, on numerous occasions (Figure 11). We have witnessed recreational fishers catching several largemouth bass on artificial soft plastics. MGP is an important waterway for both aquatic and terrestrial species. It also serves as a recreational body of water for recreational fishers.
Figure 9: Some Species captured in Reach 1 on April 21, 2012, crawfish, river shrimp, and grass shrimp

Figure 10: Spotted Gar June 20, 2012 in Reach 1
Figure 11: Recreational fishers in Mardi Gras Pass January 15, 2013

Figure 12: Sidescan sonar image of Reach 4 showing the presence of submerged tree snags and slumps which are known beneficial habitat for aquatics in river ecology
Ecologic Benefits of Mardi Gras Pass

LPBF has a draft comprehensive report on the Bohemia Spillway that includes an analysis of historical land change. The map below depicts the land change from 1932 to 2010 (Figure 13). Note that land loss is dominated by the direct impact of oil and gas canals, and by shoreline erosion near the sound. Arguably, both types of loss are inevitable even in the healthiest wetlands in Louisiana. There is a near complete absence of internal wetland loss prevalent though most of coastal Louisiana. We suggest that the preponderance of data suggests that this lack of internal loss is an incidental consequence of operation of the areas as a spillway allowing river water and sediment to be introduced to the system.

The table below shows that land loss is low, in general, but has declined to a near zero rate of loss (Figure 14). In addition, there are small areas of wetland growth that we have documented, including infilling of oil and gas canals (Figure 15). One area that is expected to create new land is Uhlan Bay which receives river flow from Bayou John. The Bay has become very shallow and impassible. LPBF has documented that in 2008 and 2001, river waters flowed into Bayou John toward this bay. We also know that this occurs with flow from Mardi Gras Pass. It is very likely that with the increased flow through Mardi Gras Pass these areas will more quickly convert to emergent wetlands and in addition new areas will begin to shallow.

![Figure 13: Land change map of the Bohemia Spillway](image-url)
**Figure 14:** Percent land loss of the Bohemia Spillway

**Figure 15:** An extraordinarily rare sight in Louisiana is the natural infilling and reclaiming by marsh of an oil and gas canal seen in this canal near Cox Bay Field. This reclaiming is believed to be the result of river water being introduced through the Bohemia Spillway. Photograph July 10, 2010
Figure 16: The graph above illustrates the estimated discharge through Mardi Gras Pass along with measured turbidity. The data is limited, but so far Mardi Gras Pass has seen similar timing of turbidity spikes as at the Caernarvon Diversions but with substantially higher sediment concentration. MGP may be located at a more optimum position to capture river sediment.

Other data supporting sediment introduction via Mardi Gras Pas is field measured turbidity of water flowing directly from the river into Mardi Gras Pass. This data suggest Mardi Gras Pass is in a favorable position to capture unusually high sediment concentration (Figure 16). The sediment concentration is significantly higher than the Caernarvon Diversion inflow. Also, a couple small islands have formed within Mardi Gras Pass channel. In one case, the islands have already become covered in emergent vegetation (Figure 17).
Perhaps, the best prediction of the benefit of Mardi Gras Pass is the ecologic modeling done for the 2012 State Master Plan (summarized below). Two discharge models were run for the Lower Breton Diversion. The lower discharge model is 5,000 cfs, which is the maximum flow of Mardi Gars Pass now. This model suggests that over 50 years 7,400 to 9,800 acres of new wetlands would be created. Since this is close to the existing conditions at Mardi Gras Pass, the difference in benefits with the existing conditions to the proposed culverts should be a basis for mitigation. This would suggest a minimum of 6,300 acres of wetlands would need to be mitigated assuming benefits are proportional to discharge. If Mardi Gras Pass were allowed to continue to enlarge, it could reach 50,000 cfs within 10 years. The 13,000 acres of wetlands predicted at this flow would be expected in the following 50 years, but are beginning to accrue now.
Summarized from 2012 State Master Plan

**Lower Breton Diversion (5,000CFS) SMP Modeling (Appendix A2, Page 74)**
Model = 5,000 CFS at River discharge over 200,000, no flow at River discharge below 200,000.

**Land Gain**

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<th>Moderate Scenario</th>
<th>Less Optimistic Scenario</th>
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<tr>
<td>20 years</td>
<td>-6192 acres</td>
<td>-6974 acres</td>
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<td>50 Years</td>
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**Cost**

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**Lower Breton Diversion (5,000CFS) SMP Modeling (Appendix A2, Page 21)**
Model = 50,000 CFS at River discharge over 600,000, 8% of river discharge at river discharge 200,000-600,000 and no flow when the river discharge is below 200,000.

**Land Gain**

<table>
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<tr>
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<th>Moderate Scenario</th>
<th>Less Optimistic Scenario</th>
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<td>20 years</td>
<td>382 acres</td>
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<td>50 Years</td>
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<td>11,976 acres</td>
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**Cost**

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<td>$169,040,000</td>
<td>$33,810,000</td>
<td>$216,370,000</td>
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Navigability

Reaches 2, 3 and 4 have been physically navigable since Reach 3 was breached in July 2011. LPBF and others have routinely navigated these three reaches since then, typically in a 19-foot Cape Horn (outboard), but also vessels as large as 27 feet (Figure 18). Also, LPBF has witnessed recreational fisherman, recreational boaters and agency boats traveling on Reaches 2, 3 and 4, indicating that these three reaches are indeed navigable by water craft.

Reach 1 is the reach closest to the river, and it was physically navigated by LPBF staff on September 14, 2012 in a 14-foot flat boat with an outboard engine. The major challenge was navigating around willow trees which had fallen into Mardi Gras Pass during its formation. Reach 1 had five log jams, two smaller ones with four to six trees and three larger ones with more than 15 trees. The log jams were created when trees on the bank fell into the MGP as the bank eroded during its expansion. The log jams consist of black willow (Salix nigra) trees with an average diameter of six inches (trees are small because they only established within the last 40 years as the sand bar developed on the river). However, despite the presence of the log jams, LPBF was able to navigate a flat boat around the trees and successfully travel all the way into the Mississippi River through Mardi Gras Pass (see pictures). It would a minor task to remove the willow trees, and make Reach 1 even more accessible. The ongoing high water and increased discharge appears to be clearing some of the logjams making MGP even more readily navigable.

The State of Louisiana has a history of using the dimensions of 66 feet wide and 6 feet deep as being the minimum threshold to define legally navigable waters in Louisiana. By January 2013, with an average width of 78.8 feet, virtually all of Mardi Gras Pass is greater than the 66 feet wide threshold. There are only a few small sections of Reaches 1 and 4 that are as narrow as 55 feet. The average width is very close to the typical width of oil and gas canals utilized for navigation across the coast. Even there the narrowest width (55 feet) is easily navigable for most coastal vessels.

Figure 18: Research vessel Blue Moon (length 27-feet) in Reach 1 April 21, 2012
Permit Application Flaws

The hydraulic analysis provided by the applicant defines the existing condition as simply the hypothetical flow through an obsolete and inoperable culvert structure, and does not incorporate the actual flow through the culvert structure or the actual flow of Mardi Gras Pass in their “existing conditions”. The maximum flow estimated by the applicant for “existing conditions” is 771 cfs, when it known that in 2012 flow was as great as 2,300 cfs (See attached report). Furthermore, the applicant’s culvert analysis only estimates flow through the actual box culverts when it is common for the structure to also have significant flow across the overtopping weir, as seen in the pictures below (Figures 20 and 21). The elevation of this weir crest is 3.9 feet NAD 88 (Figure 19). The river would normally exceed 3.9 feet for approximately 100 days per year. This overtopping flow and the actual flow through Mardi Gras Pass are not included in the “existing conditions” of their analysis.

The applicant’s analysis would lead to the erroneous conclusion that placement of the culverts will maintain flow. Even with the current proposal of 4 culverts rather than 2 (as analyzed), the discharge with culverts will be reduced by more than 85% when the river rises to a stage of 7.5 feet as occurred in 2011.

It is also of note that the applicant was cited by the state for a “major unpermitted violation” in 2012 for filling and placing culverts on the Bohemia Road approximately ¾ mile south of Mardi Gras Pass (See state record below). In 2012, partial fill was also placed in the Bohemia Road at Mardi Gras Pass, but it is unknown to us who placed this illegal fill. It should also be noted that the applicant does not own the land upon which the project is located.
Figure 19: Culverts adjacent to Mardi Gras Pass- note the weir crest is 3.9 feet NAD 88

Figure 20: September 14, 2012 culverts adjacent to Mardi Gras Pass- note the weir crest in low water
Figure 21: Note the water is overtopping the weir in high water. This additional flow is not considered as the existing conditions in the applicant’s hydrodynamic analysis.

Applicant’s hydrologic analysis results:

<table>
<thead>
<tr>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>The existing Bohemia Spillway control structure has an estimated flow of 129 cfs at the 50% exceedance condition. The maximum estimated flow of the existing structure is 771 cfs at the 1% exceedance condition. In order to maintain these same approximate flow conditions, it would be necessary to install either four 48&quot;, three 60&quot;, or two 72&quot; corrugated metal pipes culverts in the blowout prior to rebuilding the roadway. At 50% exceedance condition, two 72&quot; culverts have an approximate flow of 264 cfs. Flow rates for other sizes and configurations of culverts can be seen in Figure 2.</td>
</tr>
<tr>
<td>ENFORCEMENT INFO</td>
</tr>
<tr>
<td>------------------</td>
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Alternatives to the Proposed Action

Use existing water dockage to service the Sundown Facility - No action to repair Bohemia Spillway road and avoids impacts to Mardi Gras Pass

Potash Field was discovered more than 40 years ago and, until around 2004, it was serviced by water using their dock located on the marsh side of the facility and accessed through the Back Levee Canal, and oil & gas canals (Figure 22) and not the Bohemia Spillway road. Twenty-four miles of oil and gas canals are present in the Bohemia Spillway specifically to service the oil and gas fields by water. There are a total of 45 miles of canals present throughout the Spillway that are used for oil and gas activities. It is only in the last few years that Sundown (Eland) has used the road to service the Potash Field. Cox Bay field facility which is also in the Bohemia Spillway does not use road access at all, and services their facility entirely by water. In the past few years when the Bohemia Road was not usable (such as now), the Sundown facility used their dock. One obvious alternative to evaluate is to continue to service the Sundown facility by water as has been the tradition within the Bohemia Spillway for almost all of its history. This requires no action by the applicant for the Bohemia Road breach of Mardi Gras Pass.

Figure 22: Existing Serviceable dock at the Sundown facility

Build a single lane bridge over the breach at a cost of ~ $1,000,000 to $2,084,000, with negligible effects on Mardi Gras Pass

A single lane causeway type bridge could be constructed across the problematic area of the Bohemia Road which is prone to being washed out. This would need to have a capacity of 80,000 to 150,000 pounds according to Sundown officials. LPBF obtained a “rough order of magnitude” cost estimate of $2,084,000 for a 2,000 foot long bridge (see attached document). However, it is possible a shorter and less expensive bridge may be adequate.
Build a dock on the river at the Sundown facility at an unknown cost—No action to repair Bohemia Spillway road and avoids impacts to Mardi Gras Pass

In discussions with Sundown, they mentioned the option of servicing their facility by water but from the Mississippi River rather than from the Back Levee Canal. This seems viable, since the Sundown facility is located directly on the bank of the Mississippi River. This should be evaluated as an alternative. This would require no action to the Bohemia Spillway road. The Cox Bay field within the Bohemia Spillway has a river front dock (see Figure 23) as well as a dock to access the Back Levee Canal. Recent activity at the Sundown facility indicates that a Mississippi River dock is already under construction (Figure 24).

Figure 23: River front dock at Cox bay Field which has no road access

Figure 24: Ongoing construction at the Sundown Facility of an apparent dock on the Mississippi River
Future Management of Mardi Gras Pass

The development of Mardi Gras Pass has been monitored very closely by LPBF, and all data is available to the public. LPBF will continue to monitor MGP, as long as it is a free flowing distributary for both the scientific documentation and for future management.

So far, the changes to Mardi Gras Pass are dominantly during high water events. During low water, the pass is very manageable and subject to ease of future modifications. Since every year there is low water, no matter how large MGP becomes there will be extended periods to modify the channel. It is not certain that MGP will enlarge indefinitely. In fact, other cuts or breaches elsewhere on the river seem to stabilize over time, although that maybe due to some engineering in some cases. However, if MGP in the future became sufficiently large as to be a concern, there are numerous precedents for intervention or adaptive management.

Below Ostrica there are approximately eight cuts or breaches through the river’s east bank. These have been established for decades, e.g. the breach at Ft St. Phillip was cut over 40 years ago. All of the cuts appear to be relatively stable enough, and are not perceived as major threats to navigation or others. These breaches have been managed simply by use of the rock dike along the river bank (See Figure 25, 26 and 27). The dikes are actually placed to manage the bank and flow in the Mississippi River, but the rock dikes have been modified with dips dike which allow boat passage and free flowing connection to the Mississippi River. The expense of a rock dike is a fraction of the cost of a new diversion and the cost could be considered under the existing Corps authority for their river management of the deep draft channel. The dips in the rock dike are minor adjustments to a project commonly used by the Corps on the river. Rock embankment is present in the Bohemia Spillway, and located just a few miles downriver of MGP.

Figure 25: Location of the two breaches shown in the following imagery which are controlled by use of the Mississippi River rock dike.
Figure 26: A breach into a canal which is controlled by use of the Mississippi River rock dike.

Figure 27: A breach into a canal which is controlled by use of the Mississippi River rock dike.