REGIONAL FLOODING FREQUENCY ANALYSIS

VERMILLION RIVER/BAYOU TECHE

1940-2018

Presented by: Dave Dixon

AGENDA

- Welcome and Introductions – Harold Schoeffler
- Presentation "A Regional Flooding Frequency Analysis" – Dave Dixon
- Contributing Speakers
  - Guy Cormier, St. Martin Parish President
  - Bill Fontenot, St. Landry Parish President
  - Monique Boulet, Chief Executive Officer, Acadiana Planning Commission
  - Don Segrera, manager of the Teche Vermilion District
  - Dr. David Cheramie, manager of the Bayou Vermilion District
  - Dr. J. Paul Kemp LSU Hydrologist
  - Mark R. Wingate, P.E. Deputy District Engineer for Programs and Project Management for the U.S. Army Corps of Engineers New Orleans District

TOPICS

- VIDEO OVERVIEW OF REGIONAL WATERSHED
- UNDERSTANDING WHAT HAPPENED DURING THE AUGUST 2016 FLOOD
- ANALYSIS OF THE AUGUST 2016 FLOOD
- REGIONAL RECOMMENDATIONS FOR PREVENTION OF FUTURE FLOOD EVENTS

FIXING A PROBLEM

- THE FIRST STEP TO FIXING A PROBLEM IS **UNDERSTANDING WHAT HAPPENED**
- THE FOLLOWING SLIDES ARE AN ANALYSIS OF THE MAJOR FLOOD EVENT IN AUGUST 2016 IN AN EFFORT HELP TO **PROVIDE THAT UNDERSTANDING**
- WE WILL ALSO PRESENT OUR **REGIONAL PROJECT RECOMMENDATIONS** THAT WILL HOPEFULLY HELP PREVENT ANOTHER AUGUST 2016 LIKE FLOOD EVENT IN OUR COMMUNITY
- THIS ANALYSIS **DOES NOT ADDRESS** INDIVIDUAL PARISH AND LOCAL FLOOD MITIGATION PROJECTS SUCH AS CLEANING THE COULEES OR CONSTRUCTION OF LEVEES

OVERVIEW- DATA USED - OBSERVATIONS - ANALYSIS

ALL DATA USED IN OUR ANALYSIS WERE FROM GOVERNMENTAL SOURCES INCLUDING NOAA, USGS, AND THE ARMY CORPS OF ENGINEERS

- THE OBSERVATIONS AND ANALYSIS OF THE DATA COLLECTED ARE NOT TO BE CONSIDERED A DETAILED ENGINEERING STUDY
- OBSERVATIONS
  - LIVING RIGHT ACROSS THE STREET FROM THE VERMILION RIVER FOR > 20 YEARS ALLOWS ME TO SEE THE RIVER LEVEL FROM MY DRIVEWAY AND I NOTICED FREQUENCY OF HIGH WATER SEEMED TO BE INCREASING
- ANALYSIS PROCESS
  - AFTER THE 2016 FLOOD STARTED INVESTIGATING MORE IN-DEPTH WHAT WAS HAPPENING THAT LED TO THE DATA I WILL SHORTLY PRESENT
  - MET HAROLD SHUFFLER AFTER HE AUTHORED GUEST EDITORIAL IN LOCAL PAPER REGARDING THE FLOODING IN AUGUST 2016.
  - TOGETHER WE STARTED INVESTIGATING THE POSSIBLE CAUSES OF THE INCREASE OF FLOOD EVENTS THAT INCLUDED MANY FIELD TRIPS IN ADDITION TO 100'S OF HOURS OF RESEARCH AND WORK ON THE DATA PRESENTED

VERMILION RIVER HISTORICAL EVENTS AND DATES

- 8/9/1940 – GREATEST RECORDED FLOOD ON VERMILION RIVER WITH A CREST AT 24.87 FT AT SURREY STREET BRIDGE -

  NOTE:THIS CREST WAS > **7FT HIGHER** THAN THE AUGUST 2016 FLOOD!

- SOON THERE AFTER 2 OTHER MAJOR FLOODS HAPPENED –

  1942 (**1.25 FT LESS** THAN 2016 FLOOD)

  1947 (**0.82 FT LESS** THAN 2016 FLOOD)

VERMILION RIVER HISTORICAL EVENTS AND DATES

FLOOD REMEDIATION/NAVIGATION PROJECTS AFTER THE MAJOR FLOODS DURING THE 1940'S INCLUDED -

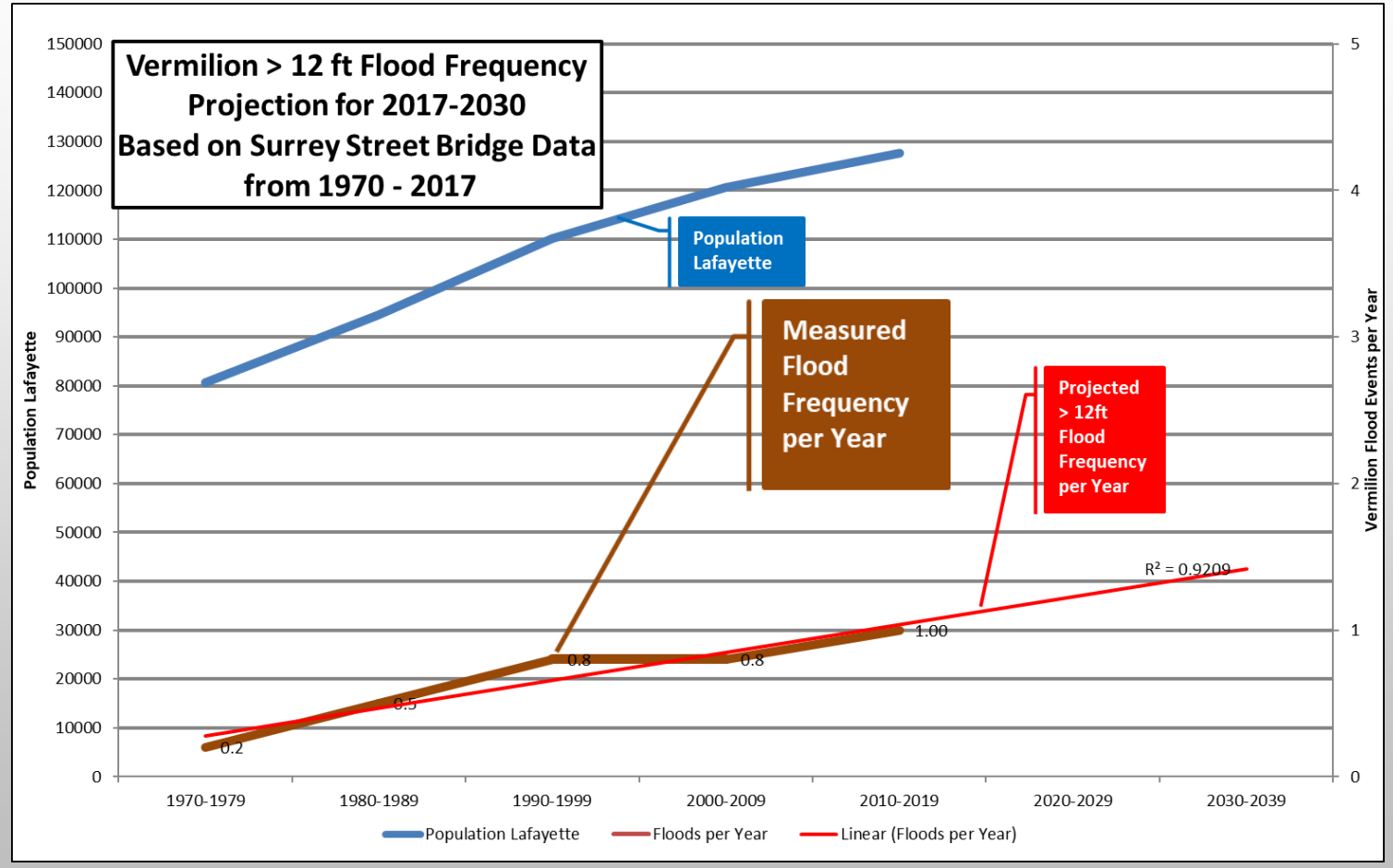
- ✓ 1957 - DREDGING OF VERMILION RIVER TO CHANNEL DEPTH OF 10 FEET AND 100 FEET WIDE BETWEEN LAFAYETTE AND THE INTRACOASTAL WATERWAY
- ✓ 1957 – CONSTRUCTION OF DRAINAGE CONTROL STRUCTURE FOR BAYOU COURTABLEU INTO THE HENDERSON SWAMP

- **NO** ADDITIONAL MAJOR FLOODS HAPPENED ON THE VERMILION FOR THE NEXT 59 YEARS UNTIL THE AUGUST 2016 FLOOD

OTHER PROJECTS AND NOTES

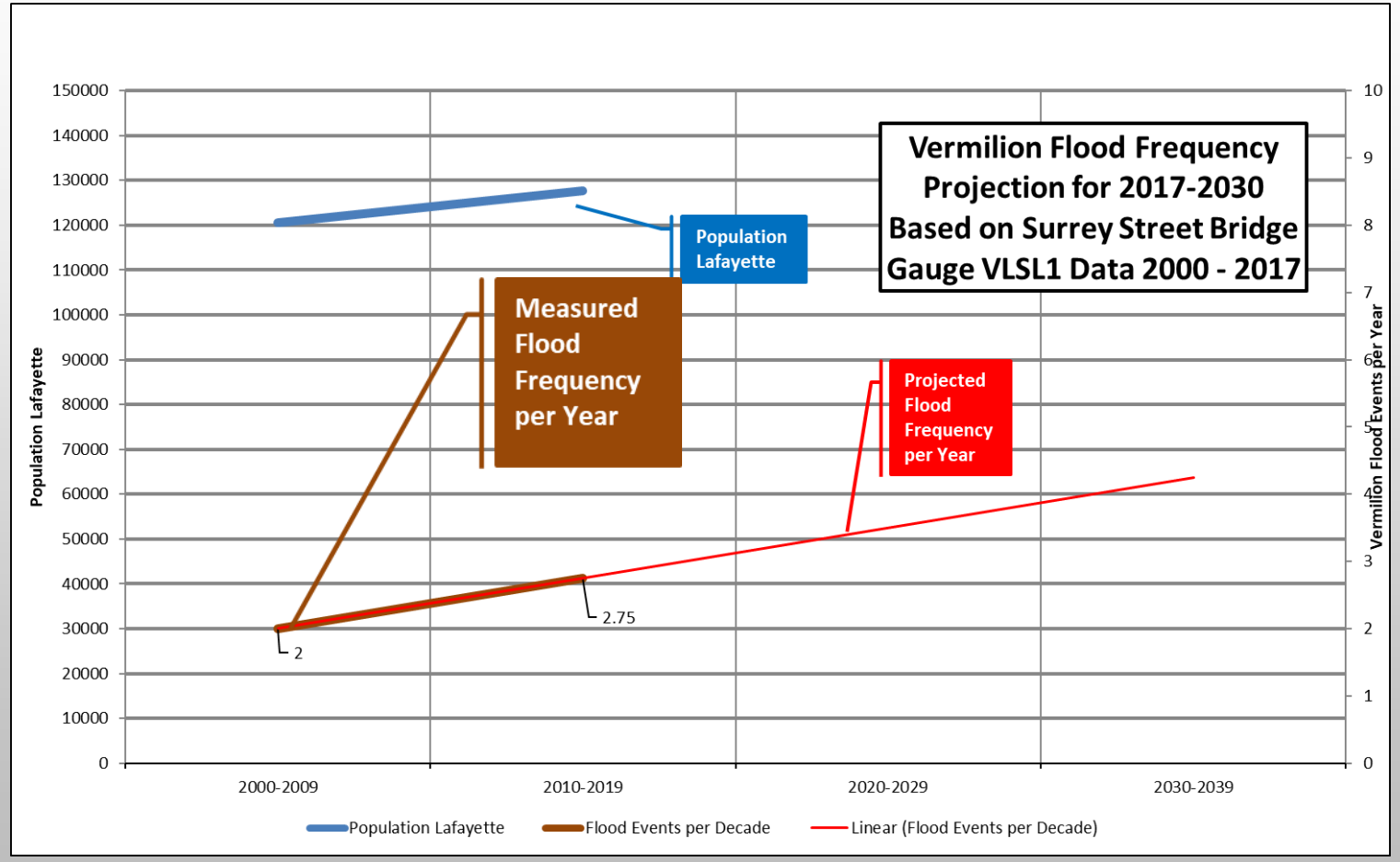
- 1982
  - ✓ COMMISSIONED TECHE-VERMILION FRESHWATER PROJECT
- LATE 90'S
  - ✓ NOAA LOWERED THE FLOOD STAGE FOR THE VERMILION FROM 12FT TO 10FT

VERMILION RIVER >12 FT FLOOD FREQUENCY MEASURED AND FORECAST 1970-2040



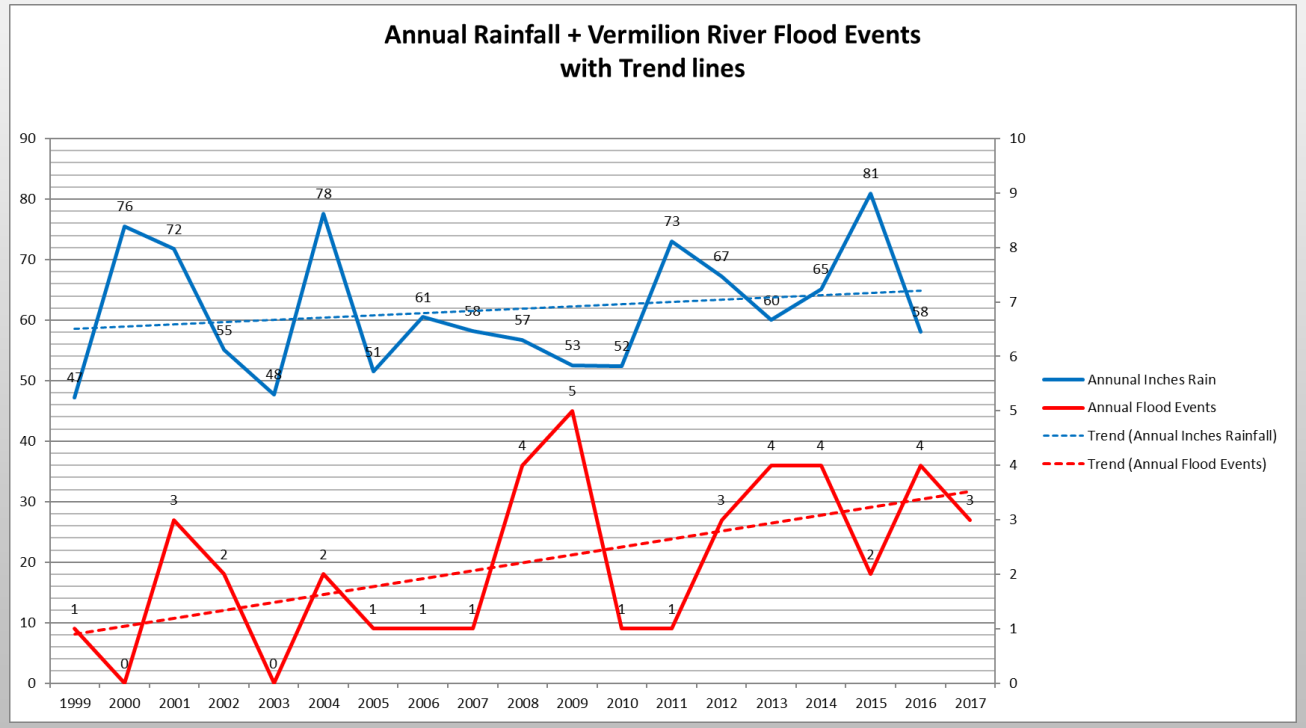
Analysis: We note that annual > 12 ft flood events are increasing with the current decade experiencing 1 event per year

VERMILION RIVER >10 FT FLOOD FREQUENCY MEASURED AND FORECAST 2000-2040

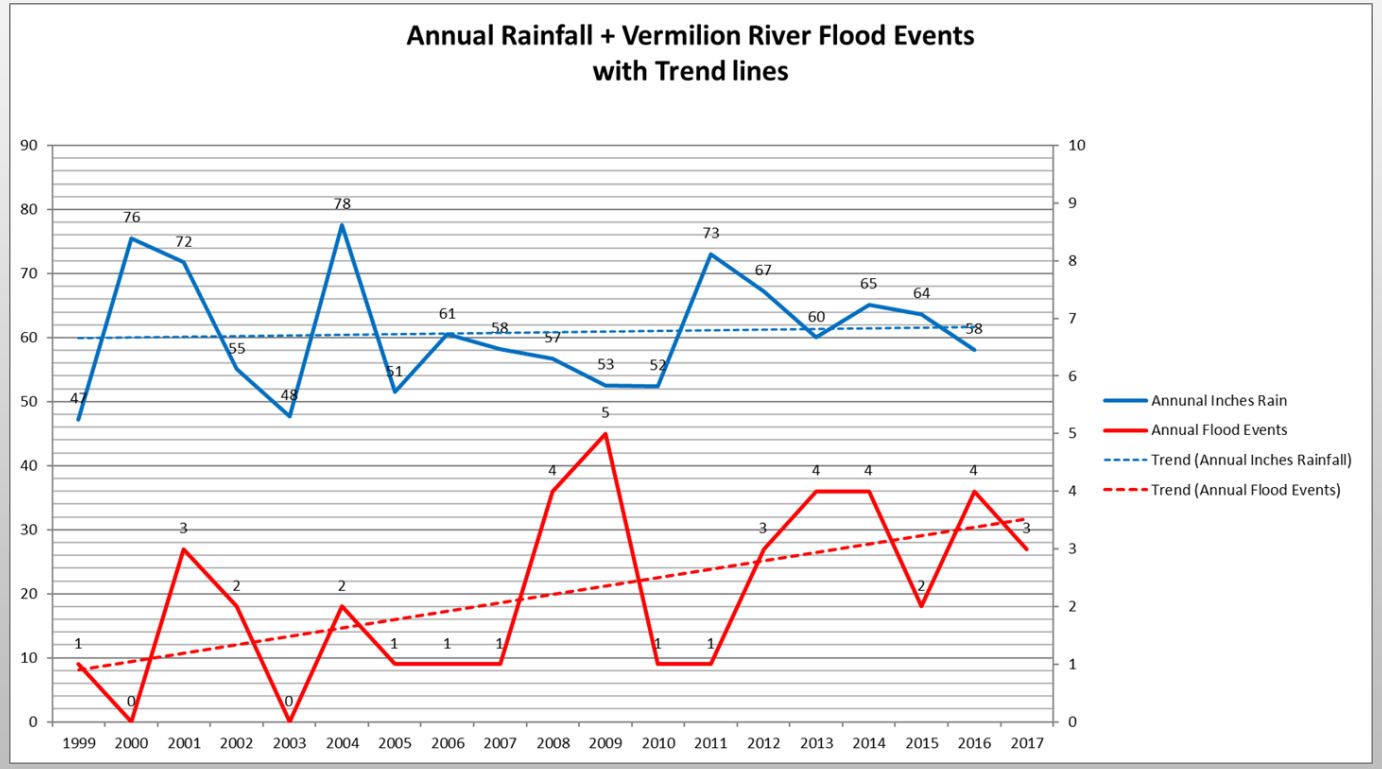


Analysis: We note that annual > 10 ft flood events are increasing with current decade experiencing almost 3 events per year

ANNUAL RAINFALL VS. VERMILION RIVER ANNUAL FLOOD EVENTS 1999-2017



ANNUAL RAINFALL & VERMILION RIVER ANNUAL FLOOD EVENTS 1999-2017 (2016 NORMALIZED TO DECADE AVERAGE)

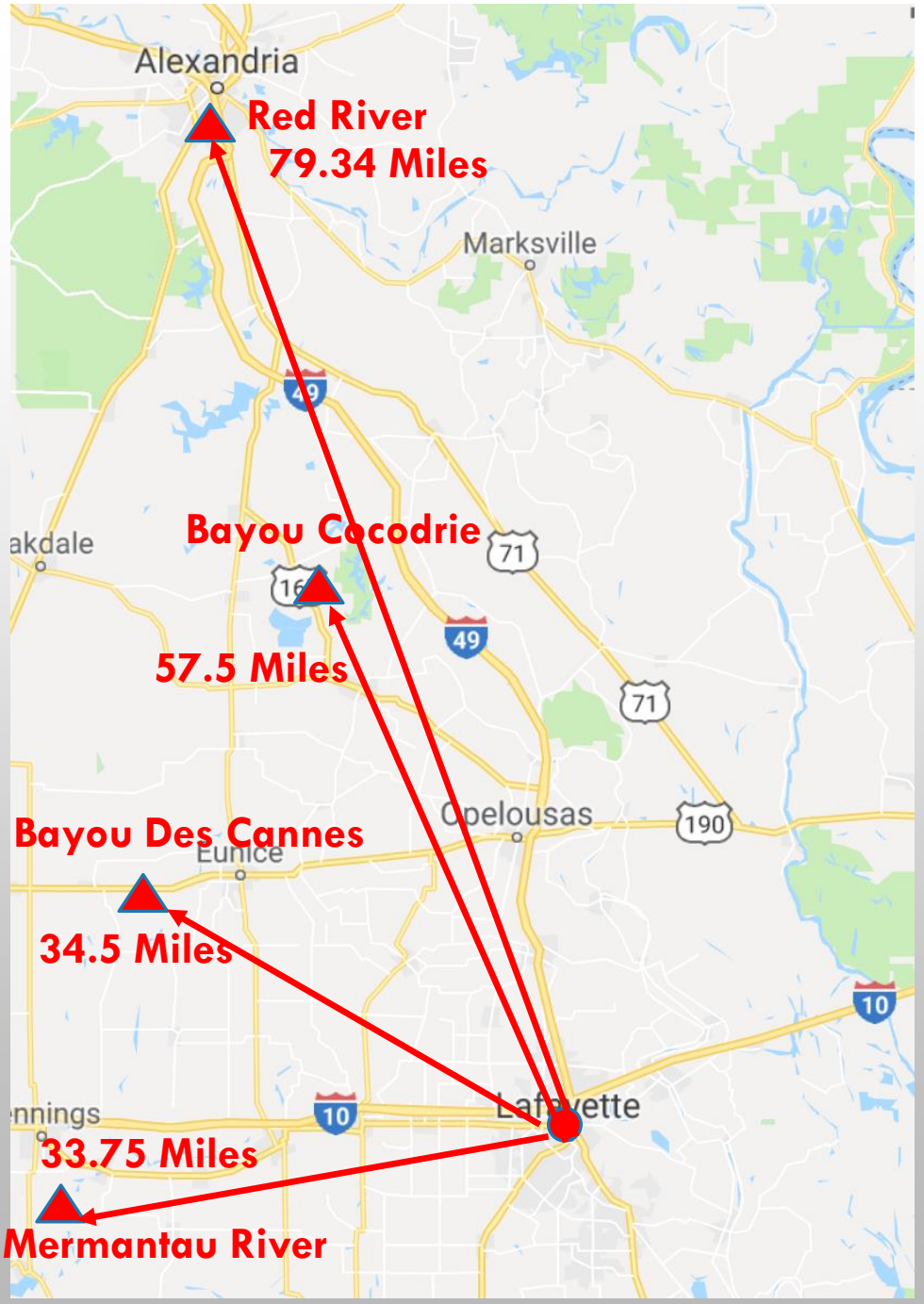


Analysis: We note that annual rainfall totals are not significantly increasing BUT the frequency of flood events are increasing

ARE OTHER AREAS AROUND US EXPERIENCING MORE FREQUENT FLOODS?

FLOOD GAUGES NEARBY WITH FLOOD CREST DATA

RED RIVER
BAYOU COCODRIE
BAYOU DES CANNES
MERMANTAU RIVER



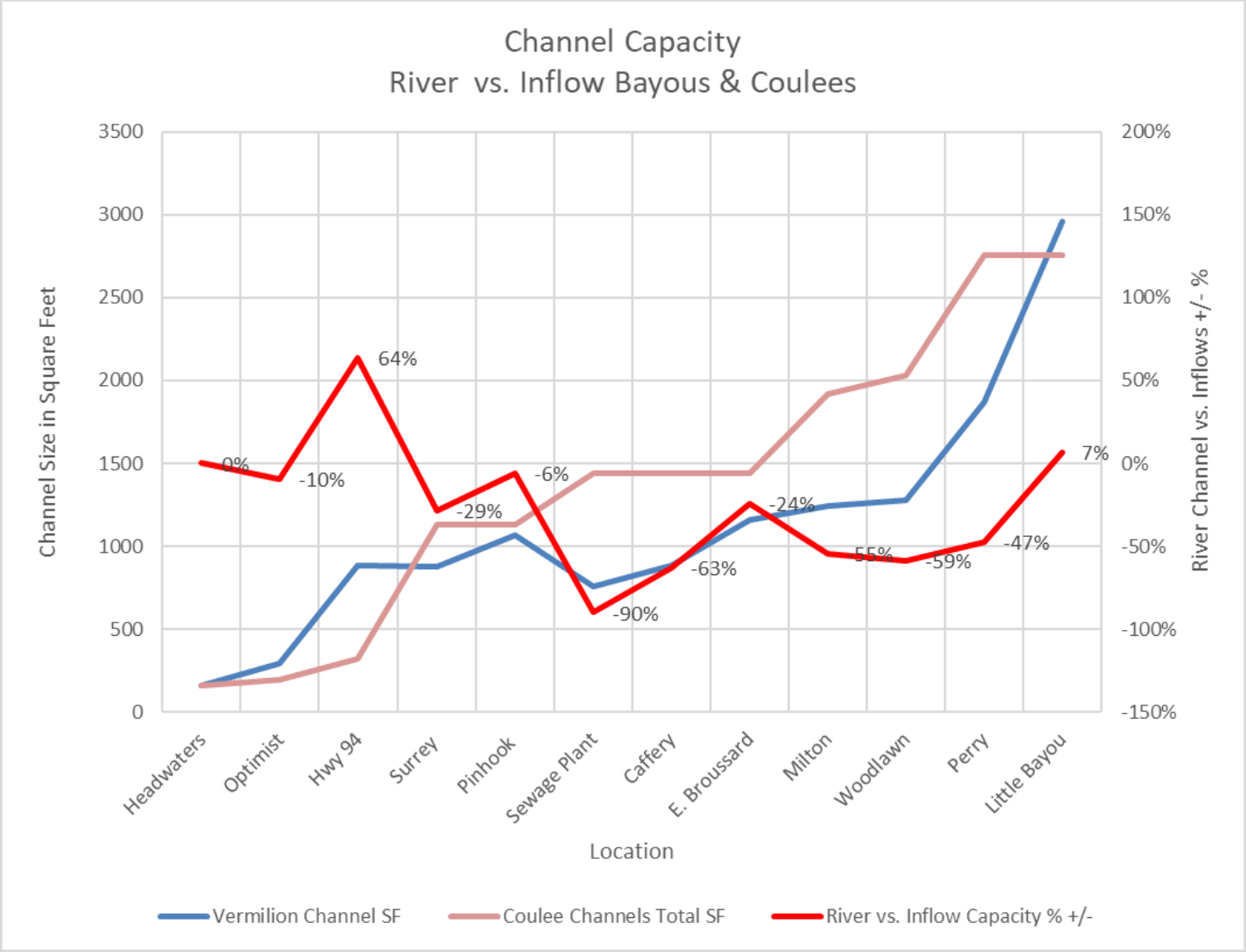
FLOOD GAUGES NEARBY WITH FLOOD DATA

- RED RIVER AT ALEXANDRIA LA (79 MILES NORTH)
  - FLOOD FREQUENCY DECLINING SINCE 1970
- BAYOU COCODRIE AT CLEARWATER LA (58 MILES NORTH)
  - FLOOD FREQUENCY DECLINING SINCE 1970
- BAYOU DES CANNES NEAR EUNICE LA (35 MILES NORTHWEST)
  - FLOOD FREQUENCY DECLINING BETWEEN 1970 UNTIL 2010 THEN TRENDED UPWARDS
- MERMANTAU RIVER AT MERMANTAU LA (34 MILES WEST)
  - FLOOD FREQUENCY DECLINING BETWEEN 1970 UNTIL 2000 THEN TRENDED UPWARDS
- VERMILION RIVER AT LAFAYETTE LA
  - > 12FT FLOOD FREQUENCY STEADILY INCREASED SINCE 1970 UNTIL NOW BY A FACTOR OF 5X

VERMILION RIVER AND RELATED BAYOU + COULEE CHANNEL CAPACITY DATA ANALYSIS

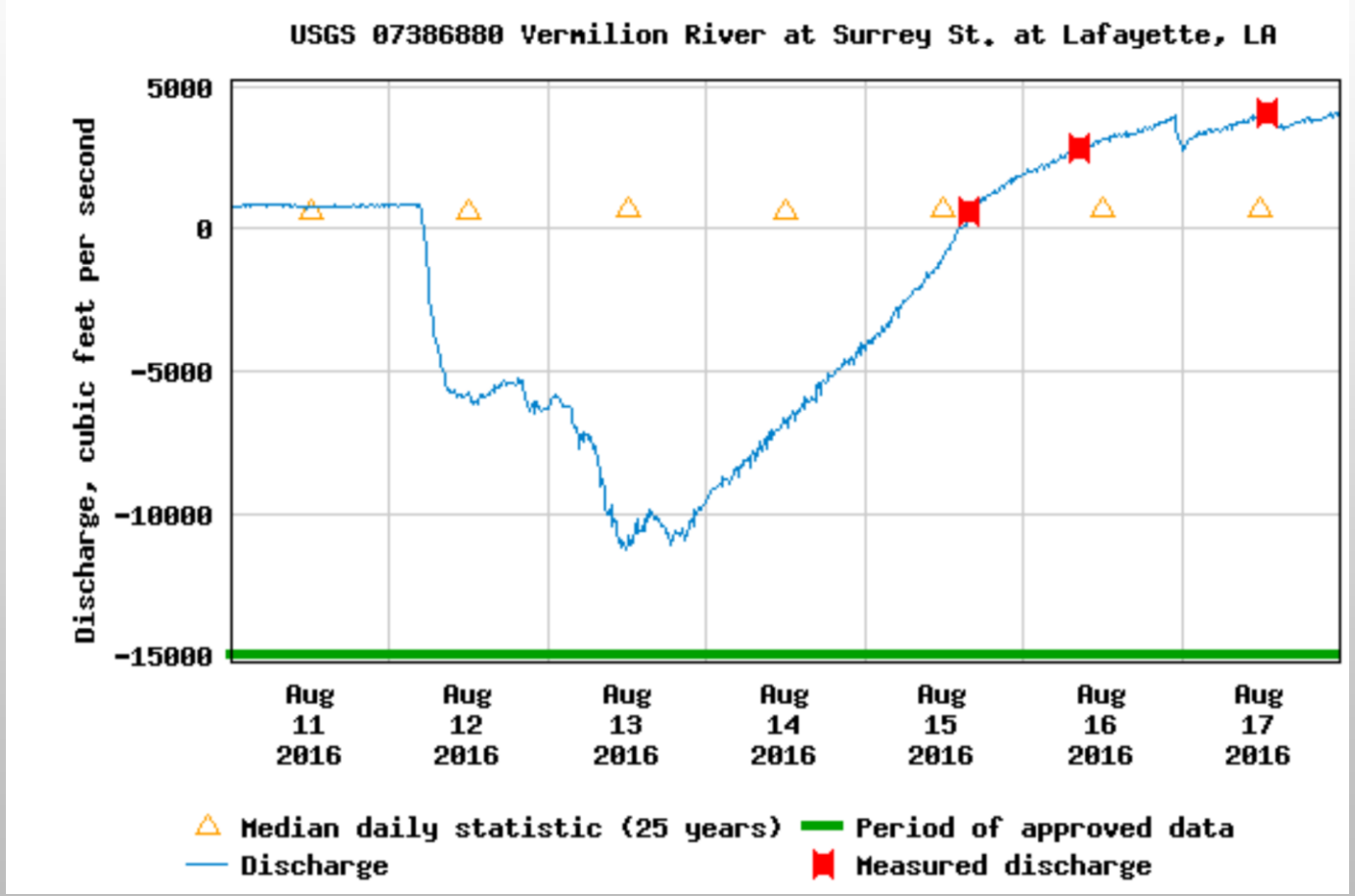
- 1988- USGS CONDUCTED AND PUBLISHED "HYDROLOGIC FEATURES AND PROCESSES OF THE VERMILION RIVER, LOUISIANA" STUDY
  - ALL VERMILION INFLOW TRIBUTARY BAYOUS AND COULEES IDENTIFIED AND MEASURED IN STUDY WERE USED IN CALCULATIONS ON NEXT SLIDE
  - MINOR AND ADDITIONAL COULEES INSTALLED SINCE THE DATE OF THE STUDY WERE NOT INCLUDED AS WE HAVE NO CHANNEL DATA ON THESE INFLOWS. HOWEVER, WE NOTE THESE UNDOCUMENTED INFLOWS MAY CONTRIBUTE A SUBSTANTIAL INFLOW TO THE RIVER AS SOME OF THESE DRAINAGE SYSTEMS ARE LARGE SUCH AS THE DRAINS FOR THE RETAIL DEVELOPMENTS AT THE CORNER OF KALISSE SALOOM AND AMBASSADOR.

ANALYSIS OF THE VERMILION RIVER CHANNEL CAPACITY DATA



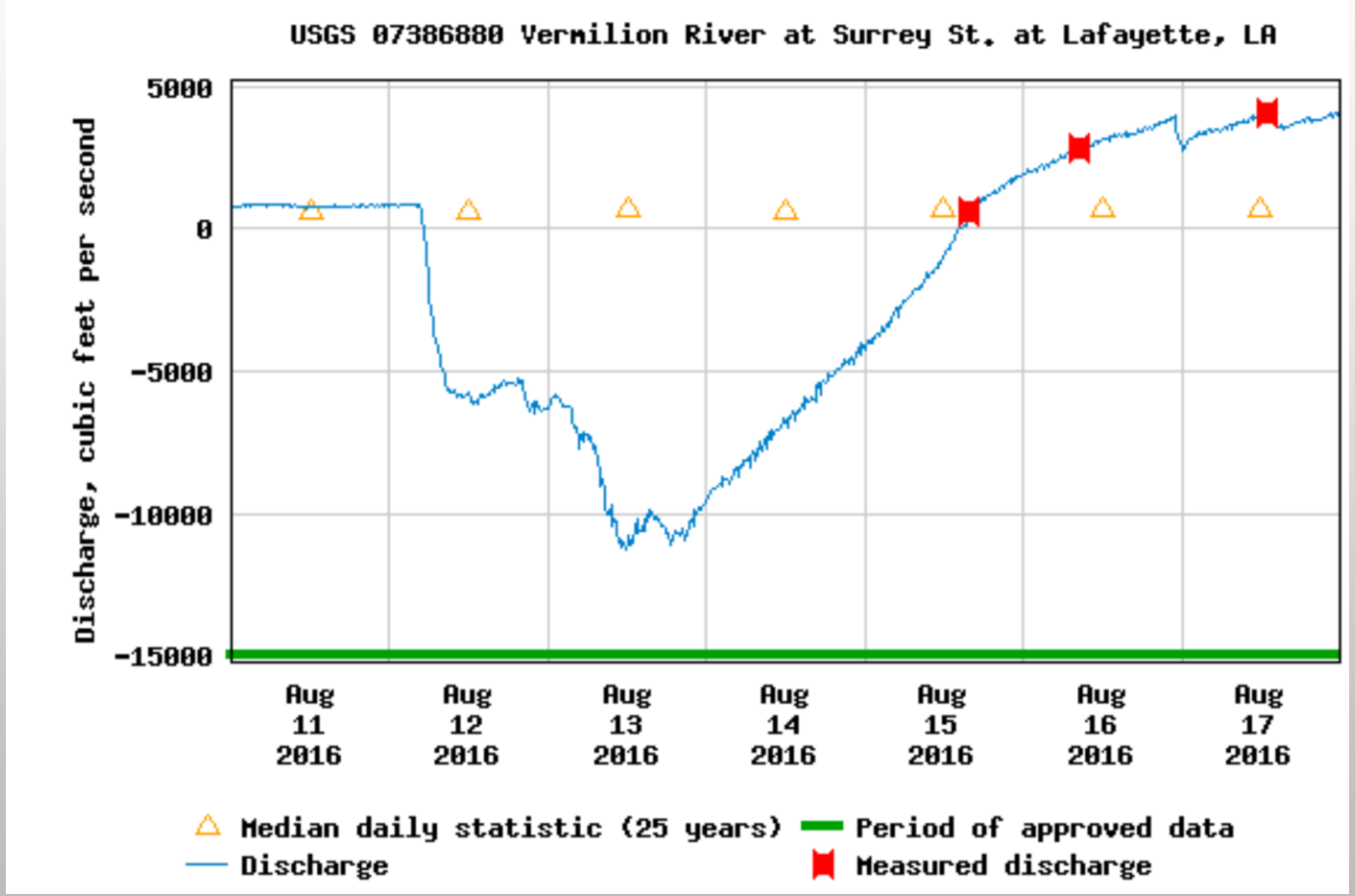
- **BLUE TREND LINE-** River Capacity at points along the river
- **BROWN TREND LINE-** Sum of UPSTREAM inflow Coulees and Bayous Capacity at points along the river
- **RED TREND LINE-** Difference +/- as a % of River capacity versus sum of UPSTREAM Coulees Capacity at points along the river
- **Analysis:** Note the river at the sewerage treatment point off of West Bayou Parkway is <u>90% smaller than the sum of the upstream coulees and bayous that flow into the river!</u>
- As this data was collected in 1988 the channel capacities used in the calculations for the river are probably somewhat smaller in 2016 than was measured in 1988 due to shoaling

TIMELINE OF THE VERMILION RIVER STREAM FLOW DATA DURING FLOOD EVENT



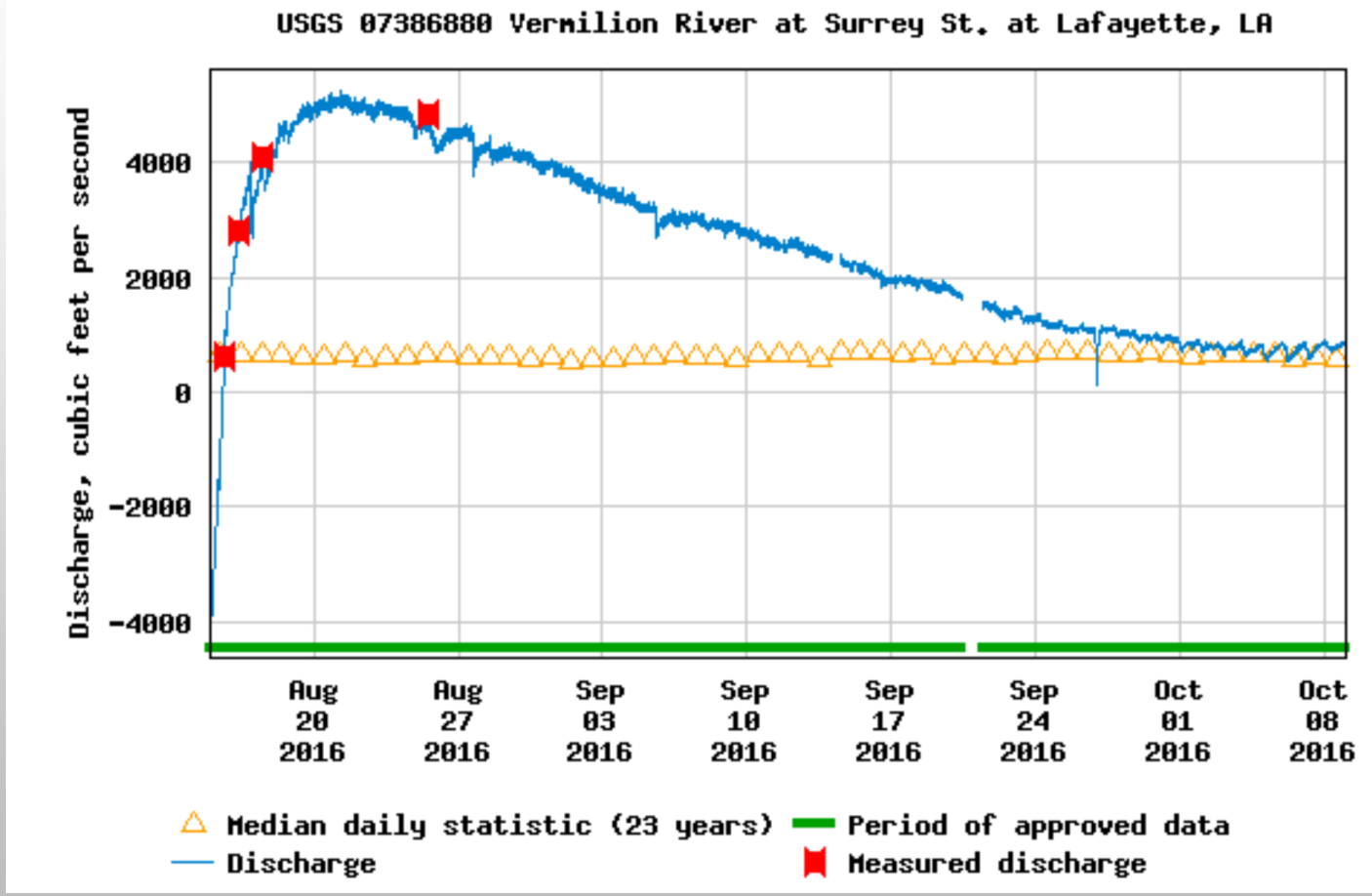
- **AUGUST 12th about 5am-** River flow started to change direction from South to Vermilion Bay to North towards Cypress Island Swamp
- **AUGUST 13th about 10am-** River flow North into Cypress Island peaked at about 11,300 Cubic Feet per second
- **August 15th about 3pm-** River Crests. Flow North into Cypress Island ceases and flow South towards Vermilion Bay resumed
- **Approximately 42,590 Acre/Feet of water flowed into Cypress Island before flow South to Vermilion Bay resumed**
- **Note- 42,590 Acres = 66.54 Square Miles**

ANALYSIS OF THE VERMILION RIVER STREAM FLOW DATA DURING FLOOD EVENT



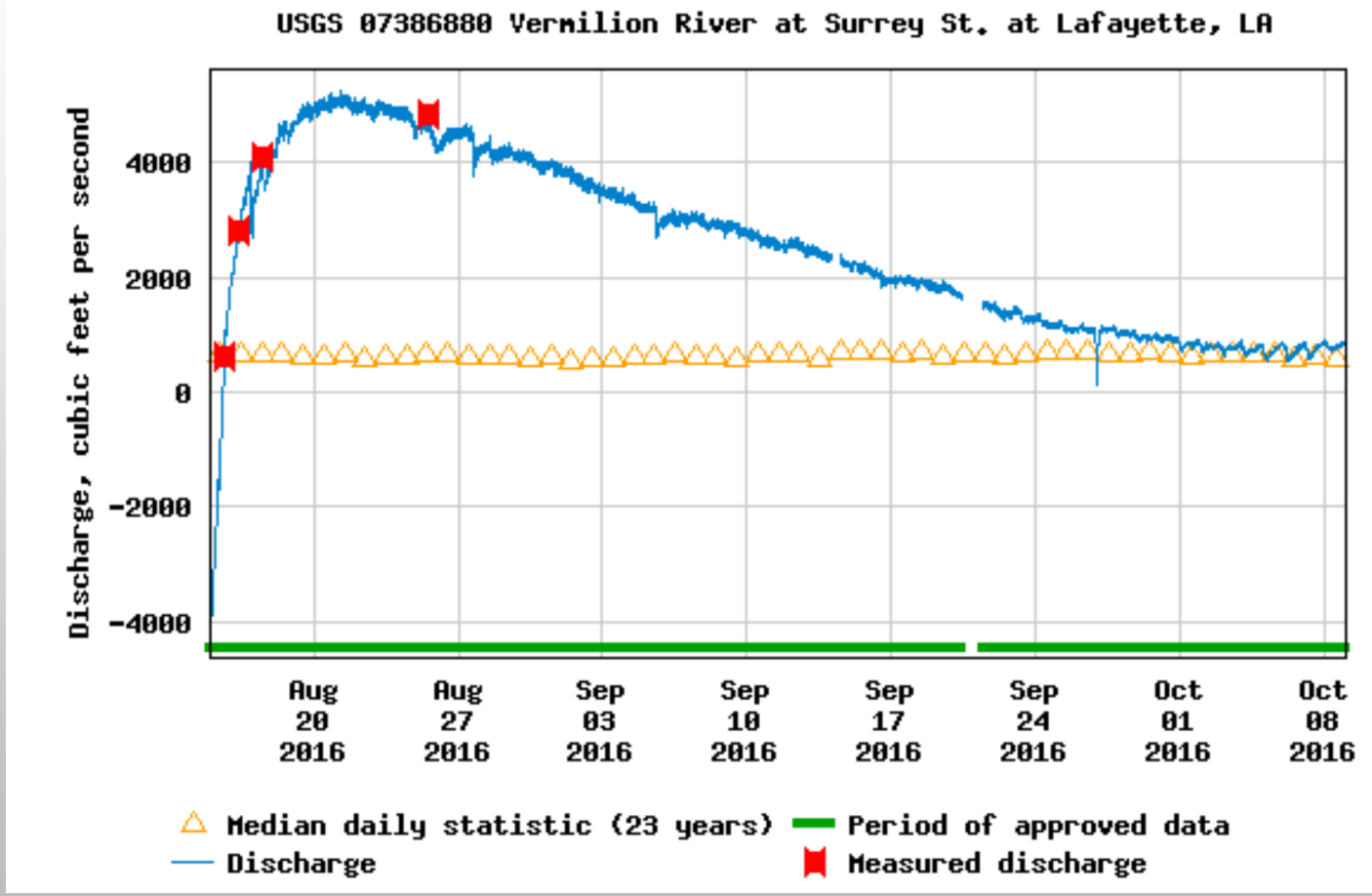
- **Analysis :** The river flowed North for a total of 58 hours. From a study done by the USGS after the 2016 flood of high water marks indicates that a “water dam” is happening at the river at the Ils De Cannes coulee inflow at the Lafayette-Vermilion parish line . We believe this is happening because the water is entering the river so fast here that the water is stacking up due to shoals in the river south of this point. It flows North due to the elevation of this “water dam” is higher than the elevation of Cypress Island swamp which is where the water is flowing to.

TIMELINE OF THE VERMILION RIVER STREAM FLOW DATA AFTER FLOOD EVENT



- **August 15th about 3pm-** River Crests. Flow North into Cypress Island ceases and flow South towards Vermilion Bay resumed
- **Oct 8th about 8:15pm or 55 days after crest-** River stage falls to level before flood event
- **Approximately 274,253 Acre/Feet of water flowed South at SURREY to Vermilion Bay before river quit falling and returned to stage before the flood event**
- **274,253 Acres = 428.52 Square Miles.**
- **This is <u>644% > than the flow into Cypress Island!!</u>**

ANALYSIS OF THE VERMILION RIVER STREAM FLOW DATA AFTER FLOOD EVENT



- **Analysis:** This flow out of Cypress Island is 644% > than the flow into Cypress Island at Surrey. The total water in Cypress Island is comprised of the water that flowed North in to the swamp from the river south of Surrey, water from the North including water from as far North as Alexandria via Bayou Courtableu plus the water that fell in the Cypress Island watershed including water from Youngsville.
- All water that flows OUT of Cypress Island MUST flow down the river as there is no other outlet.

2016 FLOOD- MORE VERMILION RIVER DATA AND FINDINGS

VERMILION FLOOD STAGE BENCH MARKS

- 12 DAYS RIVER WAS AT > MAJOR FLOOD STAGE
- 21 DAYS RIVER WAS AT > MODERATE FLOOD STAGE
- 28 DAYS RIVER WAS AT > OLD 12FT FLOOD STAGE
- 34 DAYS RIVER WAS AT > 10FT FLOOD STAGE
- 55 DAYS FOR RIVER TO RETURN TO PRE-FLOOD STAGE

2016 FLOOD- VERMILION RIVER -STILL MORE DATA AND FINDINGS

VERMILION RIVER AVERAGE FALLS PER DAY AFTER THE CREST ON AUGUST 15:

- WITH RIVER LEVELS AT > MAJOR FLOOD STAGE HAD AN AVERAGE FALL OF -0.16 FT/DAY FOR 12 DAYS
- WITH RIVER LEVELS AT BETWEEN MAJOR FLOOD STAGE AND THE NORMAL STAGE HAD AN AVERAGE FALL OF -0.25 FT/DAY OVER THE NEXT 44 DAYS

WEATHER DATA AFTER THE CREST ON AUGUST 15:

- FOR THE PERIOD AFTER 2016 FLOOD EVENT CREST ON AUGUST 15 UNTIL OCT 8 RAIN TOTALED 6.61 INCHES
- FOR THE PERIOD AFTER 2016 FLOOD EVENT CREST ON AUGUST 15 UNTIL OCT 8 WE HAD 37 DAYS WITH N-NE-NW WINDS AND 18 DAYS WITH S-SE-SW WINDS
- NO ABNORMALLY HIGH TIDES HAPPENED AT FRESHWATER BAYOU AFTER RIVER CRESTED
- **ANALYSIS:** THE RIVER IS DRAINING VERY SLOWLY. DURING THE 55 DAYS IT TOOK THE RIVER TO RETURN TO THE PRE-FLOOD STAGE THE WINDS WERE PREDOMINANTLY FAVORABLE 66% OF THE TIME AND NO ABNORMALLY HIGH TIDES WERE EXPERIENCED. ADDITIONALLY, THE AMOUNT OF RAINFALL DURING THIS 55 DAYS WAS SLIGHTLY BELOW AVERAGE. WE BELIEVE (AND HAVE ACTUALLY MEASURED DURING FIELD TRIPS) THAT SHOALS IN THE RIVER ARE HINDERING THE RIVER FROM DRAINING.

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2016 FLOOD- BAYOU TECHE DATA AND FINDINGS

KEYSTONE DAM SOUTH OF ST. MARTINVILLE STAGE BENCH MARKS

- 2 DAYS BAYOU WAS AT > 16FT STAGE
- 7 DAYS BAYOU WAS AT > 14FT STAGE
- 14 DAYS BAYOU WAS AT > 12FT STAGE
- 19 DAYS BAYOU WAS AT > 11FT STAGE
- 40 DAYS FOR BAYOU TO RETURN TO PRE-FLOOD STAGE

ANALYSIS: : THE TECHE IS ON A HIGH RIDGE WITH ESSENTIALLY NO DRAINS INTO THE BAYOU EXCEPT BAYOU COURTABLEAU. AS BAYOU COURTABLEAU CONNECTS TO A LARGE WATERSHED AREA SOUTH OF ALEXANDRIA WE ARE CONFIDENT THAT MOST OF THE WATER FLOWING DOWN THE TECHE CAME FROM CENTRAL LOUISIANA VIA BAYOU COURTABLEAU.

RECOGNIZING THAT THERE IS A WEIR AT ELEVATION 10’ IN THE KEYSTONE DAM WHICH GREATLY REDUCES THE CHANNEL CAPACITY OF THE BAYOU WE NOTE THAT BAYOU TECHE TOOK 6 DAYS AFTER CREST TO FALL 2 FEET FROM 16 TO 14 FEET INDICATES THAT THE BAYOU DRAINING INTO LAKE FAUSSE POINTE IS FAIRLY EFFICIENTLY.

2016 FLOOD- VERMILION RIVER VS. BAYOU TECHE KEY COMPARISONS AND TOTALS

STAGES

- 12 DAYS RIVER WAS AT > 16FT STAGE
- 2 DAYS BAYOU WAS AT > 16FT STAGE
- 55 DAYS FOR RIVER TO RETURN TO PRE-FLOOD STAGE
- 40 DAYS FOR BAYOU TO RETURN TO PRE-FLOOD STAGE

VOLUMES -WATER FROM NORTH OF LAFAYETTE INTO THE RIVER OR TECHE

- APPROXIMATELY 274,253 ACRE/FEET OF WATER FLOWED SOUTH AT SURREY
- APPROXIMATELY 212,2285 ACRE/FEET OF WATER FLOWED SOUTH AT KEYSTONE
- TOTAL OF 486,538 ACRE/FEET OF WATER
- **486,538 ACRE/FEET OF WATER = 760 SQUARE MILES! !**
- **NOTE THIS DOES NOT INCLUDE FLOWS INTO THE RIVER SOUTH OF SURREY WHICH COULD BE EQUAL TO OR GREATER THAN THE FLOWS INTO THE RIVER FROM THE NORTH OF SURREY OR WATER THAT FLOWED OVER THE BAYOU COURTABLEU WEIRS OR THROUGH THE FLOOD GATES**

ANALYSIS: WE ARE CONFIDENT THAT THE WATER THAT FLOWED SOUTH AT SURREY ON THE RIVER CAME FROM:

1. CYPRESS ISLAND AREA IN ST. MARTIN PARISH
2. NORTHEAST LAFAYETTE PARISH AND SOUTHEAST ST. LANDRY PARISH
3. THE BAYOU COURTABLEAU WATERSHED

THE WATER THAT FLOWED DOWN THE TECHE CAME MOSTLY FROM THE BAYOU COURTABLEU WATERSHED

SUMMARY AND CONCLUSIONS

- GREATER THAN 12 FT FLOOD FREQUENCIES ON VERMILION RIVER INCREASED BY A FACTOR OF 5X SINCE 1970!
- LOCAL PARISH COULEE MAINTENANCE IS NOT THE ONLY PROBLEM
- THE VERMILION RIVER IS DRAINING VERY SLOWLY AFTER A FLOOD EVENT
- THE VERMILION RIVER WATERSHED HAS CHANGED

SUMMARY AND CONCLUSIONS

PROBABLE CAUSATIONS

1. SHOALING IN THE RIVER BOTTOM-LAST DREDGING WAS IN 1950'S (EXACT DATE IS IN QUESTION)
2. FLOOD WATER BACKFLOW INTO CYPRESS ISLAND SWAMP FILLS THAT AREA AND SHOALS CAUSE RIVER TO DRAIN THIS AREA SLOWLY AFTER A FLOOD HOLDING RIVER LEVELS UP
3. INADEQUATE FLOOD GATE DRAINAGE CAPACITY AT BAYOU CORTABLEU-WEST ATCHAFALAYA LEVEE FILLS AREA SOUTH OF ALEXANDRIA AND NORTH OF US, AND AGAIN SHOALS CAUSE RIVER TO DRAIN SLOWLY AFTER A FLOOD HOLDING RIVER LEVELS UP?

   BOTH OF THE ABOVE ITEMS 2 & 3 INCREASES RISK OF ANOTHER HEAVY RAIN SOON AFTER WILL CAUSE YET ANOTHER FLOOD EVENT
4. INADEQUATE CHANNEL CAPACITY IN BAYOU TECHE (AT THE KEYSTONE DAM)

SUMMARY AND CONCLUSIONS

OTHER POTENTIAL ISSUES

- TECHE-VERMILION FRESHWATER PROJECT RAISED WATER LEVEL IN BAYOU COURTABLEU NORTH OF US ELIMINATED MOST RETENTION CAPACITY IN COURTABLEU- AN UNINTENDED CONSEQUENCE?
- RED RIVER NAVIGATION PROJECT RAISED POOL STAGES IN RED FORCED SOME ALEXANDRIA WATER SOUTH TO US?
- INCREASE IN DEVELOPMENT IN LAFAYETTE METRO AREA INCREASES RUNOFF AND SPEED OF RUNOFF?
- TOO MANY DRAINS INTO THE RIVER?
- BRIDGES ON RIVER DESIGNED IN THE 50'S CAUSING A DAM EFFECT?

REMEDIES AND RECOMMENDATIONS

1. ADD ADDITIONAL FLOOD GATES TO THE BAYOU CORTABLEU –WEST ATCHAFALAYA SPILLWAY LEVEE TO DRAIN WATER COMING FROM THE NORTH INTO THE BASIN AND HENDERSON SWAMP QUICKER
   - WE NOTED THAT THE CORPS HAD IDENTIFIED A NEED TO INCREASE THESE FLOOD GATES IN A 2007 REPORT BUT PROJECT WAS PUT ON HOLD DUE TO NO ECONOMIC JUSTIFICATION
2. PROVIDE AN ALTERNATIVE DRAIN FOR THE CYPRESS ISLAND SWAMP THAT COULD TAKE SOME OF THE RIVER WATER OUT A DIFFERENT PATH. NOTE: ST MARTIN PARISH IS CURRENTLY WORKING ON A PROJECT TO DO SO
3. ADD FLOOD CONTROL GATES IN THE KEYSTONE DAM
4. DREDGE THE RIVER IN CONJUNCTION WITH THE PARISHES COULEE CLEANING EFFORTS
   - WE HAVE BEEN ABLE TO DETERMINE DEFINITIVELY THAT THE CORPS OF ENGINEERS IS NOT CURRENTLY WORKING ON A STUDY OR A PROJECT TO ADDRESS THE RIVER

VISUAL OVERVIEW OF RECOMMENDATIONS

BENEFITS OF EXECUTING THE RECOMMENDATIONS

- FUTURE FLOOD PREVENTION
- BETTER WATER QUALITY IN THE BASIN, CYPRESS ISLAND SWAMP, AND LAKE FAUSSE POINTE
- POSSIBLY LOWER FLOOD INSURANCE RATES
- IMPROVED COMMUNITY CREDIT RATING FOR BOND ISSUES - SOME RATING ENTITIES HAVE THREATENED TO DOWNGRADE RATINGS IF COMMUNITIES DO NOT ADDRESS FLOODING RISKS

TAKEAWAYS FROM THIS MEETING

THIS PROBLEM CAN BE FIXED!

- NOTHING CONCRETE HAS BEEN DONE TO SOLVE THE MAIN REGIONAL FLOODING PROBLEM OTHER THAN THE PROJECT BY ST. MARTIN PARISH TO PROVIDE AN ALTERNATIVE DRAIN OUT OF CYPRESS ISLAND SWAMP AND RELATED CONTROL STRUCTURE
- IN CLOSING WE ARE ASKING THE CORPS FOR 3 IMMEDIATE PROCEDURAL CHANGES

1. WHEN THERE IS A FORECAST FOR LARGE RAIN EVENT OPEN THE BAYOU COURTABLEU GATES AND LOWER LEVELS IN COURTABLEU
2. EXECUTE A TEST OF USING THE LOCK GATES ON KEYSTONE TO ASSIST IN LOWERING STAGES
3. IF THE TEST PROVE SUCCESSFUL PUT IN PLACE A PROCEDURAL OPERATION TO UTILIZE THE LOCK GATES AS A FLOOD CONTROL METHOD UNTIL THE REMAINING REMEDIATION EFFORTS ARE COMPLETED

SO WHAT CAN YOU DO?

EXPRESS YOUR CONCERN REGARDING THE LACK OF ACTION RESOLVING THE REGIONAL PROBLEMS

1. YOUR US REP(CLAY HIGGINS)
2. YOUR LOCAL PARISH PRESIDENTS, MAYORS, POLICE JURORS, AND COUNCIL MEMBERS

THERE SHOULD BE A SENSE OF URGENCY TO FIX THE PROBLEM BEFORE WE HAVE ANOTHER MAJOR FLOOD EVENT

WE DO NOT HAVE YEARS TO STUDY THIS PROBLEM AS MUCH TIME HAS BEEN WASTED ALREADY

REMEMBER WE HAD 3 MAJOR FLOODS IN THE 40’S BEFORE ANY PROJECTS WERE EXECUTED!