

**COLORADO/LAVACA  
BBEST/BBASC  
LAVACA PROJECT ANALYSIS**

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CL BBEST

# OVERVIEW

- TCEQ LAVACA RUN3 WAM USED AS BASE MODEL WITH FOLLOWING MODIFICATIONS
  - TEXANA STAGE II REMOVED FROM MODEL
  - CONTROL POINT FOR PROPOSED PROJECT INSERTED
- WAM PERIOD OF RECORD: 1940-1996
- WAM FLOWS FOR PROJECT LOCATION EXTRACTED FROM BASELINE MODEL
- MONTHLY WAM FLOWS DISTRIBUTED TO DAILY FLOWS USING GAGED DAILY FLOW
- RESULTING DAILY FLOWS INPUT INTO DAILY PROCESS (FRAT)
- FIRM YIELD OF PROJECT DETERMINED FOR 6 SCENARIOS
- DAILY RESULTS USED TO PRODUCE PLOTS FOR BBASC AND AFTER PROJECT FLOWS FOR BBEST
- DEPLETIONS FROM DAILY PROCESS PLACED BACK IN WAM TO ASSESS BAY

# SCENARIOS TESTED

- FIRM YIELD OF PROJECT DETERMINED FOR 6 SCENARIOS
  - 1- No Environmental Requirements.
  - 2- TCEQ Modified Lyons Instream Flow Requirements.
  - 3- TWDB Consensus Planning Instream Flow Criteria.
  - 4-CL BBEST Recommendation.
  - 5-CL BBEST without Pulse.
  - 6-CL BBEST with HEFR Results used for Subsistence.

# PRODUCT OF ANALYSIS

- Firm Annual Yield of Project Subject to Various Environmental Flow Concepts.
- Daily Flows for Project Site for all Scenarios.
- Monthly Flows for Lavaca Bay for all Scenarios.
- Charts of Daily Flows for all Scenarios.
- Basis for Assessing Balance between Environmental and Other Needs.

# FIRM YIELD RESULTS

- (1) No EFLOW Req: 15,875 af/y.
- (2) Lyons EFLOW Req: 10,240 af/y.
- (3) Consensus EFLOW Req: 9,900 af/y.
- (4) FULL BBEST EFLOW: 10,300 af/y.
- (5) BBEST EFLOW; no Pulse: 10,675 af/y.
- (6) BBEST EFLOW; HEFR as Sub 10,375 af/y.

# INPUTS FOR STUDY

- CL BBEST Recommendations for Edna Location
- Hydrologic Condition
- Daily Pattern of Flow
- Project Configuration (FNI Study)
  - Area / Capacity Relationship
  - Pump Rate
- WAM Model (TCEQ)
  - Total Flow
  - Flow Required for Downstream Seniors
  - Evaporation Rate

# FRAT (FLOW REGIME ANALYSIS TOOL)

- DEVELOPED BY HDR AND REFINED BY TPWD (DAN OPDYKE)
- COMPLEX EXCEL SPREADSHEET
- INPUTS
  - DAILY FLOWS
  - HYDROLOGIC CONDITION
  - FLOW RECOMMENDATIONS
    - Specifically Designed to Test SB3 Type Recommendations
  - PROJECT CONFIGURATION
- OUTPUTS
  - DAILY REPRESENTATION OF PROJECT
  - DAILY FLOWS AFTER PROJECT
  - NUMEROUS CHARTS
    - TIME SERIES PLOTS
    - FLOW FREQUENCY CURVES
  - FLOW PROTECTED (RESERVED) BY FLOW RECOMENDATIONS

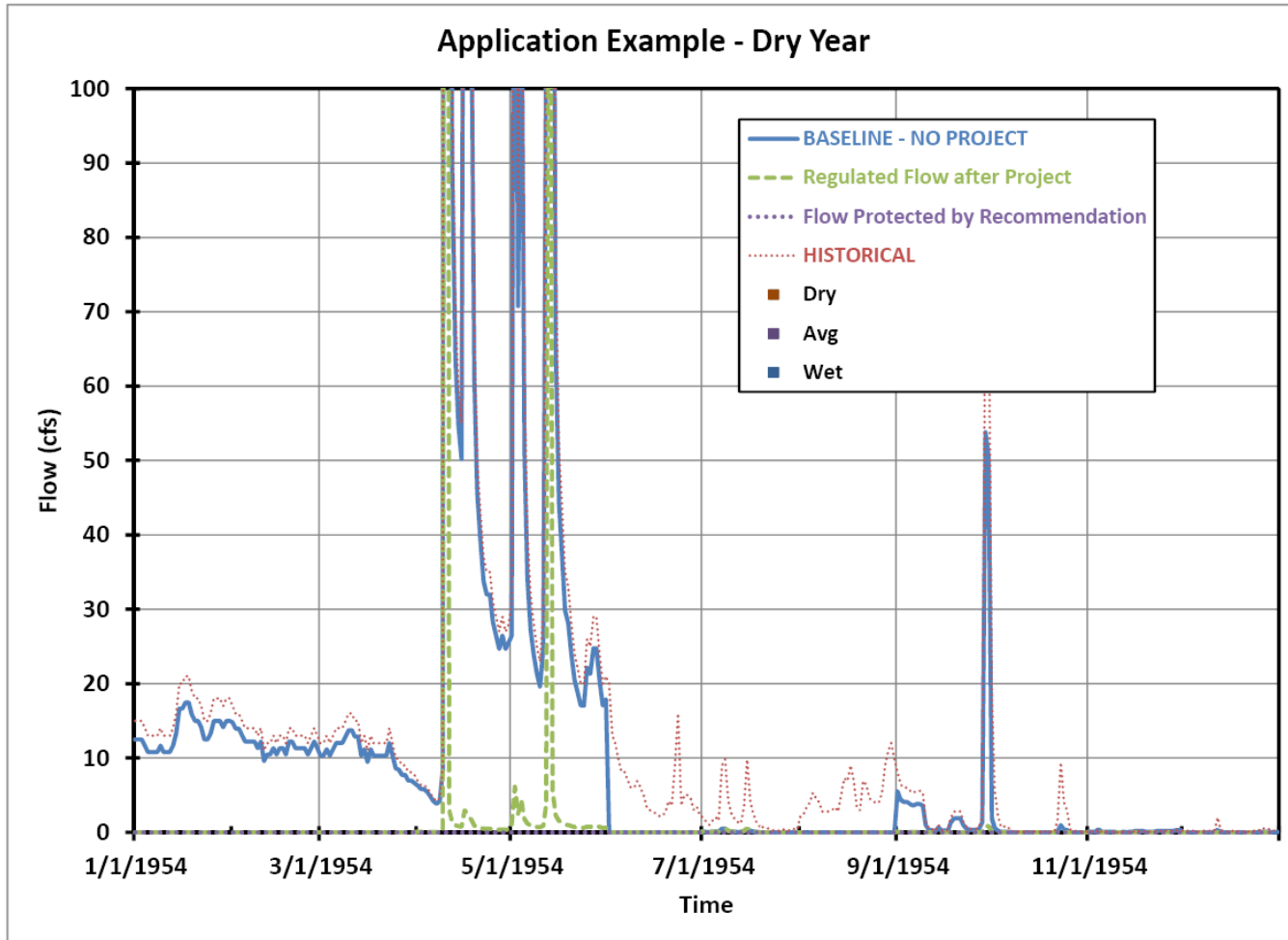
# CHARTS

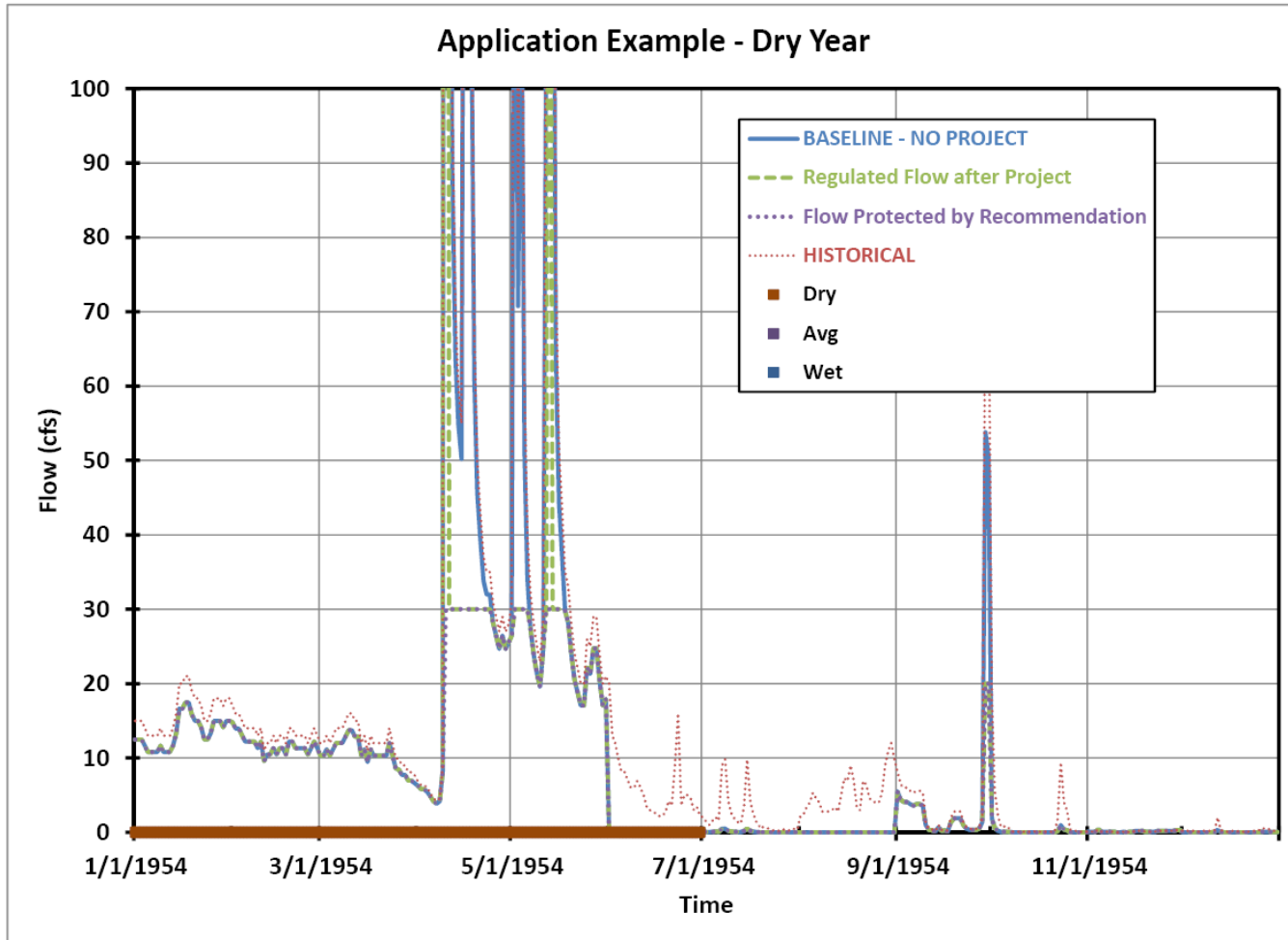
- DAILY TIME SERIES CHART FOR EXAMPLE DRY, AVERAGE AND WET YEAR
- DAILY FLOW FREQUENCY CHARTS FOR PERIOD OF RECORD
- DAILY FLOW FREQUENCY FOR EACH OF THE FOUR SEASONS



# TIME SERIES CHART

- TIME (SINGLE YEAR) IS THE X AXIS
- FLOW (CFS) IS THE Y AXIS
- DIFFERENT FLOWS DEPICTED
  - WAM FLOW WITHOUT PROJECT IN PLACE
  - WAM FLOW WITH PROJECT IN PLACE
  - FLOW PROTECTED BY FLOW REGIME
  - HISTORICAL FLOWS



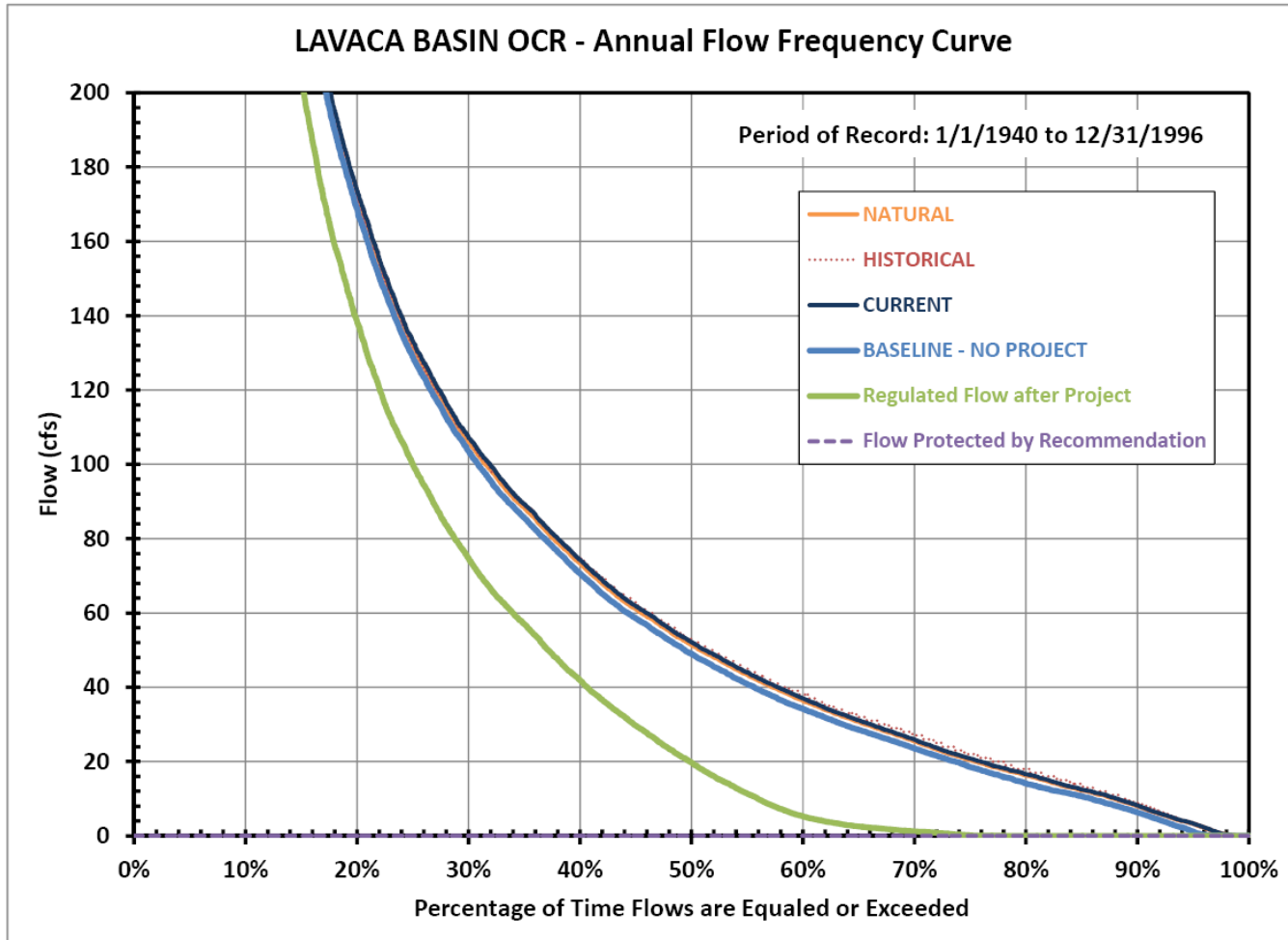


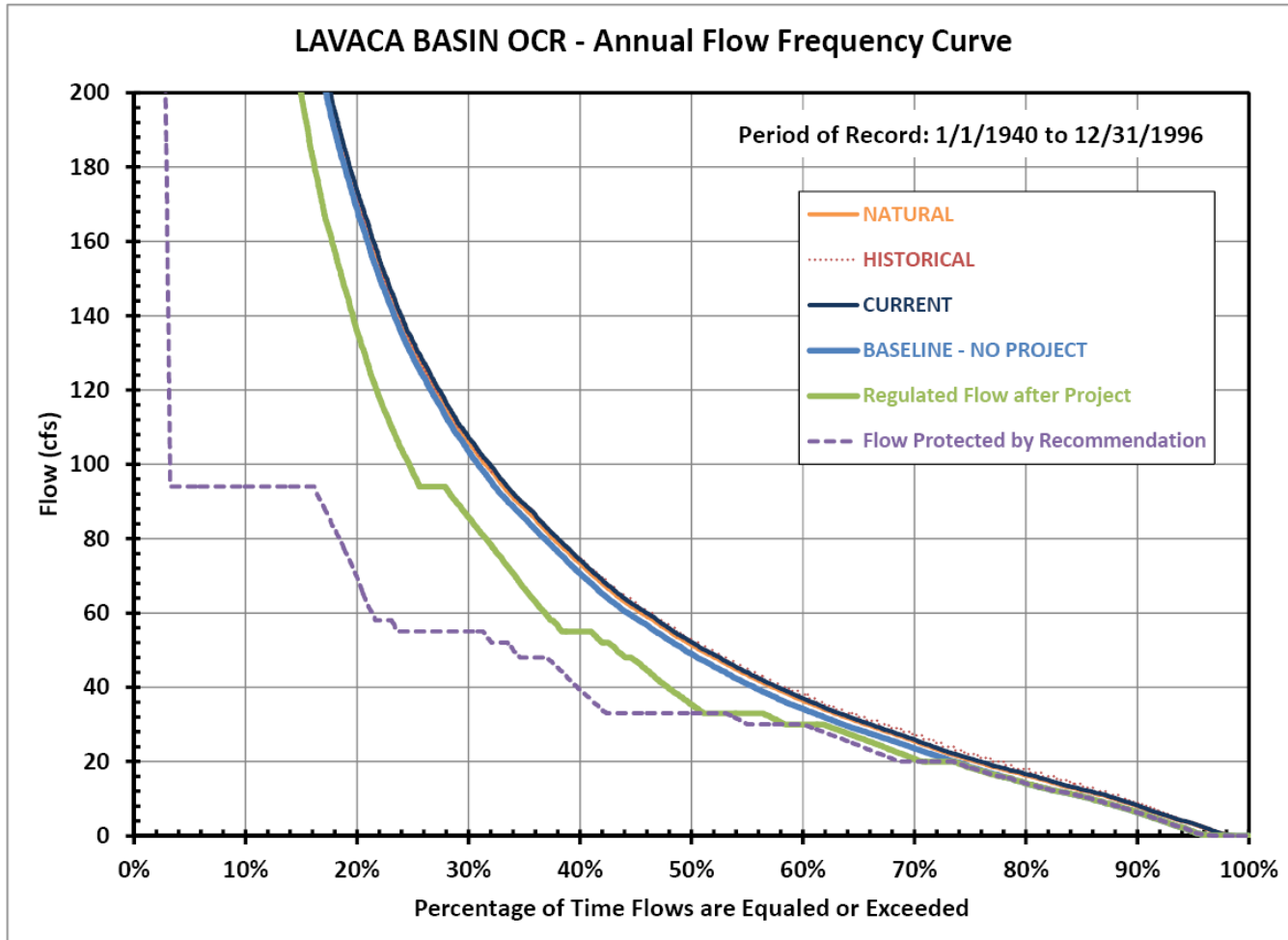
# FLOW FREQUENCY CHART

- PERCENT OF TIME FLOW EXCEEDED ON X AXIS
- FLOW (CFS) ON Y AXIS
- DIFFERENT FLOWS DEPICTED
  - NATURALIZED FLOW (INPUT TO WAM)
  - HISTORICAL FLOWS (BASIS FOR BBEST NUMBERS)
  - CURRENT CONDITION (WAM RUN8)
  - WAM FLOW WITHOUT PROJECT IN PLACE
  - WAM FLOW WITH PROJECT IN PLACE
  - FLOW PROTECTED BY FLOW REGIME

# HOW TO USE FLOW FREQUENCY CHART

- Area Between Without and With Project represents the quantity of water the project depleted.
  - Blue – No Project
  - Green – With Project
- NO EFLOWS; Large Difference Between Without and With Project Curves.
- WITH EFLOWS; Small Difference Between Without and With Project Curves.
- For any Percent of time on X Axis, flows for all curves can be compared.
- For any Flow on Y Axis, Percent of Time Each Curve Equaled or Exceeded can be Compared.





# FLOWS PLOTTED

- NATURAL
- CURRENT
- BASELINE (before project diverts)
  - TCEQ RUN3 with noted changes
- PROJECT (after project diverts)
  - BASELINE with Lavaca Off-Channel Reservoir diverting water subject to no or various instream flow requirements.
- HISTORICAL
- FLOW PROTECTED BY FLOW REGIME



# 1 -NATURAL

Input Flow Associated with all WAM Models

- No Surface Water Rights Exercised
- No Return Flows Entering the Water Courses
- For Comparison Purposes Only

# 2-CURRENT

## TCEQ RUN8

- Approximation of Current Demands for All Water Rights of Record
- Return Flows Reflecting Current Use Levels
- Major Reservoirs Represented with Current Sedimentation Conditions
- For Comparison Purposes Only

# 3-BASELINE

TCEQ RUN3, with noted changes

- Full Authorized Demands for All Water Rights of Record
- No Assumed Return Flows
- Major Reservoirs Represented with Authorized Capacities
- Output of this model used as Input to all Project Scenarios

# 4-PROJECT

BASELINE model used for Hydrology Inputs.

- Off-Channel reservoir project diverting water (by pump) from the Lavaca River
- Represented as most Junior Right in Basin
- General Magnitude of Off-Channel Reservoir Project
  - Capacity = 25,000 acre-feet conservation capacity
  - Area = 1,030 acres
  - Pump Rate from Lavaca = 200 MGD (309.44 cfs)

# 5-HISTORICAL

## USGS Observed Flow

- Lavaca River near Edna
- Same Information Used by BBEST in HEFR Analysis

# 6-FLOW PROTECTED BY FLOW REGIME

Flow Reserved by Flow Recommendation

Considers:

- Applicable Hydrologic Condition.
- All Tiers of Flow Recommendation.
- Has been called “Infinite Infrastructure” line.

# HYDROLOGIC CONDITION

AS SUGGESTED IN BBEST REPORT, BASED ON LAKE TEXANA SIMULATED STORAGE IN BASELINE WAM

## BBEST DIRECTION

Percent of time condition expected to be applied

Subsistence	5
Dry	20
Average	50
Wet	25

## RESULT USING BASELINE WAM

Percent of time conditions actually applied in BBEST scenario

Subsistence	5.3
Dry	20.7
Average	45.5
Wet	30.5

ONLY APPLIES TO BBEST SCENARIO

# CORRESPONDING TRIGGERS

## SUBSISTENCE

- BELOW 93,298 af (54% CAPACITY)

## DRY

- BETWEEN 93,298 af (54%) AND 132,460 af (77%)

## AVERAGE

- BETWEEN 132,460 af (77%) AND 170,300 af (FULL)

## WET

- TEXANA FULL (170,300)



# ADDITIONAL NEEDS

- FLOW TO BAY FOR EACH PROJECT SCENARIO.
- FREQUENCY OF EACH PROJECT SCENARIO.  
MEETING CL BBEST RECOMMENDATIONS.
- BBEST REVIEW OF AFTER PROJECT FLOWS FOR  
SELECTED SCENARIOS.
- DISCUSSION OF HYDROLOGIC CONDITION  
USED AND IMPLEMENTATION ISSUES.

# FUTURE TOPICS

- ADDITIONAL IDEAS FROM BBASC ON SCENARIOS TO BE TESTED.
- OTHER IDEAS OF MEANINGFUL OUTPUT.
- OTHER BASELINE CONSIDERATIONS.
- OTHER?