March 28, 2024

Ms. Ashley Howard
Remedial Project Manager, Superfund Emergency Management Division
United States Environmental Protection Agency, Region 6
1201 Elm Street, Suite 500
Dallas, Texas 75270

RE: **San Jacinto Waste Pits Superfund Site, Channelview, Texas (Site)**
        Updated Hindcast Model Supplement to Plan in Response (Plan) to the United States Environmental
        Protection Agency (EPA) January 5, 2024 Notification of Serious Deficiency (Notice) Pursuant to
        Paragraph 59 of Administrative Settlement Agreement and Order on Consent for Remedial Design
        (AOC), CERCLA Docket No. 06-02-18

Dear Ms. Howard:

International Paper Company (IPC) and McGinnes Industrial Maintenance Corporation (MIMC), collectively referred to as the Respondents, hereby submit the enclosed Updated Hindcast Model Memorandum as a supplement to Respondents' Plan submitted on January 25, 2024 in response to the above referenced Notice received from EPA on January 5, 2024. GHD prepared the memorandum on behalf of the Respondents as part of our ongoing efforts to anticipate the river water elevations at the Northern Impoundment. This memorandum supercedes Section 5.3.1 of the Pre-Final 90% Remedial Design – Northern Impoundment submitted on June 27, 2022, and Section 5.1.2.3.3 of the Pre-Final 90% Remedial Design – Northern Impoundment (Northwest Corner Component) submitted on November 8, 2022.
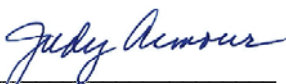
As noted in Respondents' Plan and as expressed in both the meeting held on February 9, 2024, between Respondents and EPA, as well as in the February 19, 2024 email to John Meyer, Respondents are committed to addressing EPA's concerns and continuing work on remedial design items as outlined in the Plan.

Regards,

International Paper Company

By: _____
    Brent Sasser
    Sr. Environmental/Remediation Manager

McGinnes Industrial Maintenance Corporation

By: _____
    Judy Armour
    Senior District Manager
    Environmental Legacy Management Group

cc: Anne Foster, EPA
     Lauren Poulos, EPA
     Robert Appelt, EPA
     Katie Delbeq, P.G., TCEQ

Technical Memorandum

March 28, 2024

To	Lee Lavergne	**Contact No.**	
Copy to	Jonathan Eller	**Email**	
From	Kandasamy Vignesh Sivasubramanian	**Project No.**	11215702
Project Name	San Jacinto River Waste Pits SF – Northern Impoundment		
Subject	Updated Hindcast Model		

1.   Introduction

GHD has prepared this memorandum to document the continued efforts to evaluate historic river levels in the San Jacinto River at the Northern Impoundment of the San Jacinto River Waste Pits Superfund Site (Site). River levels at the Northern Impoundment are subject to both tidal fluctuations, as well as increases in river level from rainfall and tropical storm events.

A hindcast model of river levels at the Northern Impoundment was evaluated in connection with the Remedial Investigation/Feasibility Study for the Site. To better understand the river level locally, and as part of the remedial design (RD) process for the Northern Impoundment, a transducer was installed on-site in July 2019. Prior to the installation of the transducer, historical routine water level readings had not been collected at the Northern Impoundment. The hindcast model had been based on publicly available historical United States Geological Survey (USGS) data from the Sheldon gage upstream of the Northern Impoundment, which is available dating back to 1996. The hindcast model has been updated during the RD process as discussed below.

The current hindcast model utilizes a fixed data set of Sheldon gage inputs compared to site-specific data collected from the transducer at the Northern Impoundment to produce a dataset of calculated site-specific historical river levels dating back to 1996. Northern Impoundment transducer data and Sheldon gage data continue to be collected. As new data become available, the model can then be periodically re-hindcasted to reflect the additional data and provide increased confidence in the outputs.

The original hindcasted data provided in the May 2020 Preliminary 30% RD (30% RD) and the June 2022 Pre-Final 90% (90%) RD was based on approximately 6 months of site-specific transducer data (July 2019 through December 2019) available at the time of the 30% RD. In connection with the November 2022 90% RD (Northwest Corner [NWC]), the hindcast model was updated and rerun with a larger, more recent dataset from both the Sheldon gage and the on-site transducer (July 2019 through December 2021). For purposes of this memorandum, the hindcast model has been updated and rerun using available data from February 2023 through February 2024.

The Power of Commitment

1.1   Updated Hindcast Model

To hindcast the Sheldon gage data to the Northern Impoundment, synchronous observations from the Sheldon gage and the Northern Impoundment were subjected to a machine learning model, Multivariate Adaptive Regression Splines (MARS). MARS is an advanced form of linear regression that allows varying relationships between dependent and independent variables across the range of the independent variable. For example, in this case the model has the flexibility to predict different correlations between the Northern Impoundment and Sheldon gage depending on the water surface elevation at the Sheldon gage.

The model selects relationship terms using a generalized cross validation (GCV) method which takes the form of:

$$GCV = RSS/(N \times (1 \ Ne)/N2)$$

Where RSS is the residual sum of squares of the model, N is the number of observations, and Ne is the effective number of parameters. Thus, the GCV algorithm balances minimization of RSS (which may result in an overfitted model) with parameter number (which allows more flexibility in the model).

The form of the hindcasting model for the Northern Impoundment is:

$$WSESJ,t = WSESH,t \times LSH,t$$

Where, $WSESJ,t$ is the water surface elevation at the Northern Impoundment at time t, $WSESH,t$ is the water surface elevation at the Sheldon gage at time t, and LSH,t is the either rising or falling limb of the hydrograph at the Sheldon gage at time t.

The hindcast model utilizes a fixed data set of Sheldon gage inputs compared to site specific data collected from the transducer at the Northern Impoundment to produce the hindcasted outputs. When new data becomes available, the model can then be re-hindcasted to reflect the additional data available and allow increased confidence in the hindcasted outputs.

In preparing this technical memo, the hindcast model was updated and rerun with a larger, more recent dataset from both the Sheldon gage and the on-site transducer (July 2019 through December 2021 and February 2023 through February 2024) [1].

Exploration of the time series alignments has revealed how better pre-processing of the time series results in a dataset that more accurately enables comparison between them. Further analysis has also been conducted on how to present extreme events based on the predicted San Jacinto water levels during different months of the year. One way of visualizing these events is by projecting values as boxplots with overlays of different heights, and conducting a flood frequency analysis. In evaluating the hindcasted predictions back to 1996, a maximum level of +8.72 feet (ft) North American Vertical Datum of 1988 (NAVD88) was predicted in November 1998 for the planned excavation season (November through April).

The updated river level hindcasted predictions for the full year and the planned excavation season, November through April, are shown on the attached Figures 1 and 2, respectively. The boxplot in the attached Figure 3 also highlights the predicted month-wise river levels at the Northern Impoundment. Figure 3 demonstrates that all of the predicted outliers or rare events where water levels exceeded +9 ft NAVD88 occurred outside the planned excavation season.

As stated above, the hindcast model was updated and rerun with additional river stage data collected since the last modeling run in connection with the modeling report submitted in November 2022. This rerun of the model is based on a dataset that is nearly double the size of the dataset available for purposes of the previous hindcast modeling report submitted in November 2022. Because of this larger dataset, the hindcast model has

---

[1] On-site data was also collected between December 2021 and February 2023; however, issues with the transducer and data cable ultimately corrupted the entire dataset recorded during this period. The corrupted data was not discovered until after the data was manually downloaded and evaluated.

more information to draw on when building and predicting the correlation and relationship between the river stages for the Sheldon gage and on-site.

1.2   Design River Level

Using the outputs from the updated hindcast model, the number of times that a specific river level was reached or exceeded during the planned excavation season was quantified, as shown in the table below.

Hindcasted River Levels On-Site During Excavation Season

Hindcasted River Level (feet NAVD88)	Number of Occurrences[1] (Since 1996)
+3	7
+4	5
+5	5
+8	1
+9	0

Note:
[1] An occurrence is defined as an event that occurred a minimum of three days from another event

Based on the hindcast model, the +9 ft NAVD88 river stage has not been exceeded between the months of November and April (the excavation season) since the beginning of the dataset in 1996. The +8 ft NAVD88 river stage was only exceeded once during this same period further supporting the appropriateness of using +9 ft NAVD88 river stage for the Extreme Case applicable to the excavation season. The +5 ft NAVD88 river stage was exceeded five times between the months of November and April since 1996, or approximately on average once every 6 years. This estimated frequency suggests that it would be possible to experience a river stage of +5 ft NAVD88 during the 7+ year RA activities making it an appropriate elevation for the Reasonable Maximum Case during the excavation season.

Regards,

[signature: Kanda]

Kandasamy Vignesh Sivasubramanian

Encl: Figure 1 - Updated Hindcasted Water Surface Elevations - Year Around
           Figure 2 - Updated Hindcasted Water Surface Elevations - November to April
           Figure 3 - Month-Wise Boxplots for Daily Maximum Elevation

Elevation (ft - NAVD88)

Month

Station
- SanJac
- Sheldon

Legend

— Northern Impoundment Water Surface (Hindcasted)

— Sheldon Gage Water Surface (Measured)

Notes:
San Jacinto River water surface elevations measured at the Sheldon Gage (USGS #08072050)

NAVD88 = North American Vertical Datum of 1988

San Jacinto River water surface data at the Northern Impoundment based upon data obtained from a transducer installed in the river on the west side of the Northern Impoundment in July, 2019

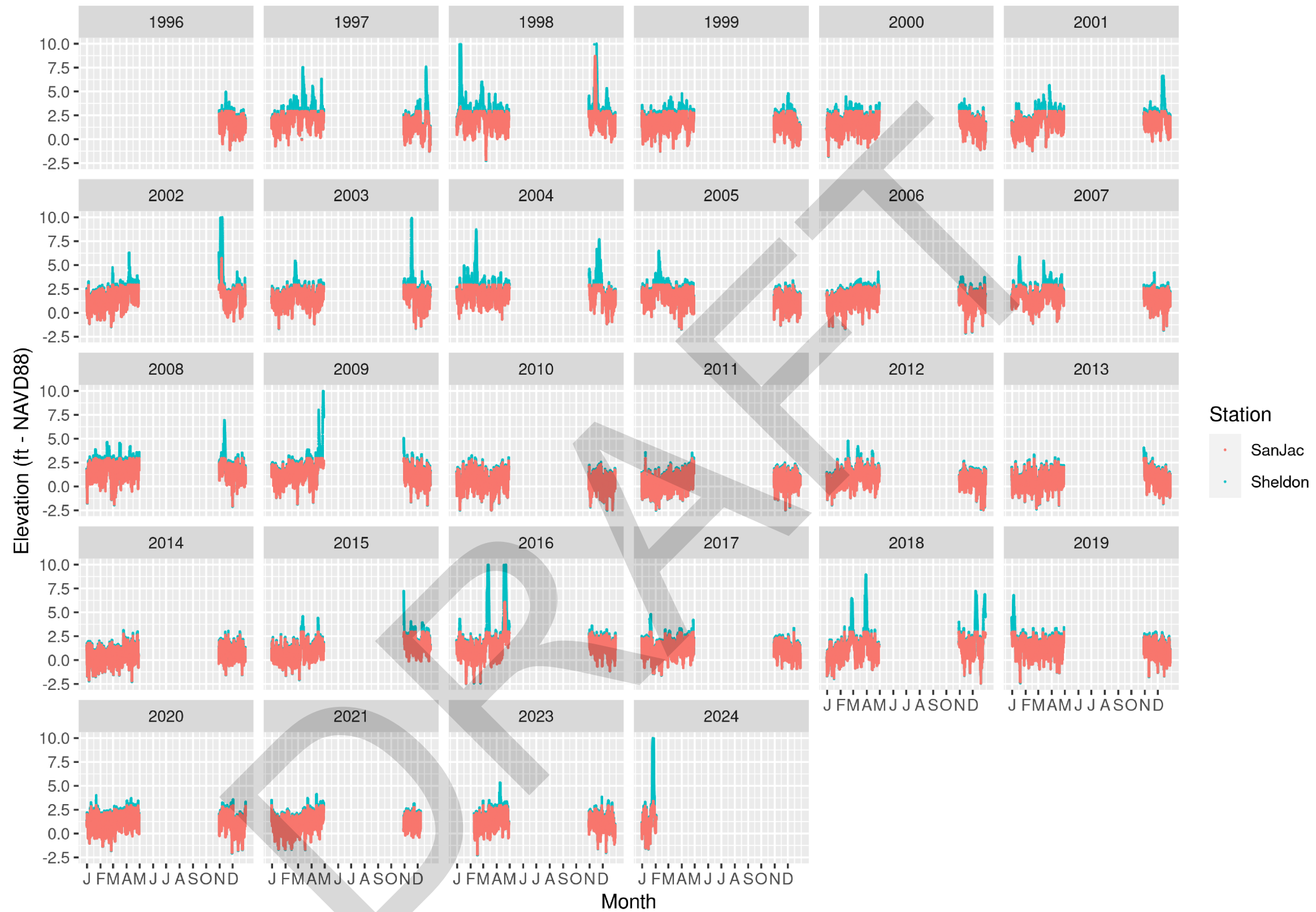BMP = Best Management Practice (ie: cofferdam or sheetpile wall)"

Paper Size ANSI B

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

UPDATED HINDCASTED WATER SURFACE ELEVATIONS - YEAR ROUND

Project No. **11215702**
Revision No. **-**
Date **Mar 22, 2024**

FIGURE 1

Q:\GIS\PROJECTS\11215000s\11215702\MEMO001\11215702_202403_MEMO001_GIS001.mxd

UPDATED HINDCASTED WATER SURFACE ELEVATIONS - NOVEMBER TO APRIL

Legend

— Northern Impoundment Water Surface (Hindcasted)
— Sheldon Gage Water Surface (Measured)

Notes:
San Jacinto River water surface elevations measured at the Sheldon Gage (USGS #08072050)

NAVD88 = North American Vertical Datum of 1988

San Jacinto River water surface data at the Northern Impoundment based upon data obtained from a transducer installed in the river on the west side of the Northern Impoundment in July, 2019

BMP = Best Management Practice (ie: cofferdam or sheetpile wall)"

Paper Size ANSI B

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

UPDATED HINDCASTED WATER SURFACE ELEVATIONS - NOVEMBER TO APRIL

GHD

Project No. **11215702**
Revision No. **-**
Date **Mar 22, 2024**

FIGURE 2

Q:\GIS\PROJECTS\11215000s\11215702\MEMO001\11215702_202403_MEMO001_GIS002.mxd
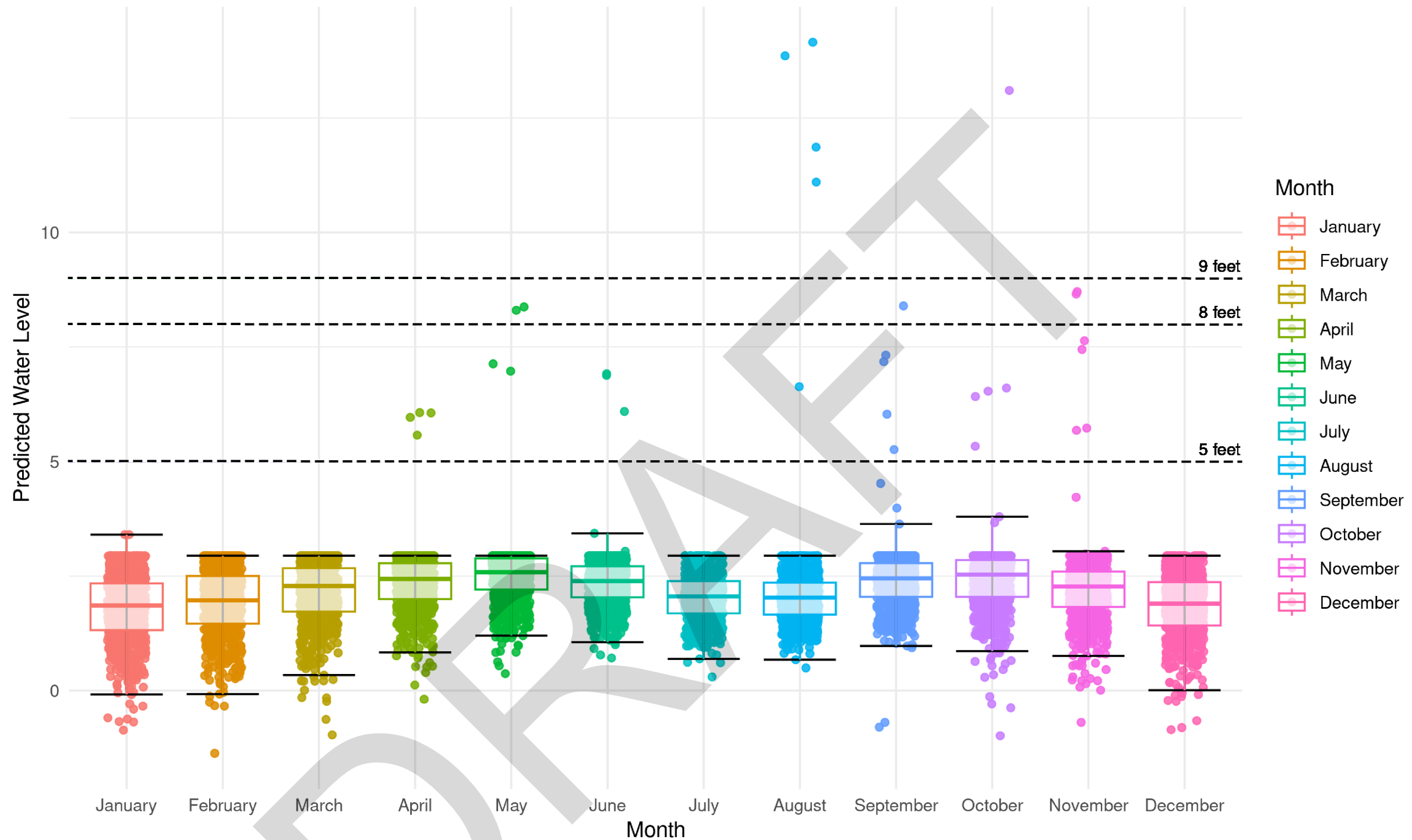
Boxplot interpretation:
The bold horizontal line inside the box represents the median.
The height of the box is the interquartile range (IQR), showing the middle 50% of the data.
*The whiskers extend to 1.5 * IQR or the maximum/minimum values within this range (black lines).*
Points lying outside the whiskers are typically considered as outliers

Note:
Points shown are based on the highest 1-day value

Paper Size ANSI B

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

Project No. **11215702**
Revision No. **-**
Date **Mar 27, 2024**

MONTH-WISE BOXPLOTS
FOR DAILY MAXIMUM ELEVATIONS

FIGURE 3

Q:\GIS\PROJECTS\11215000s\11215702\MEMO001\11215702_202403_MEMO001_GIS003.mxd