

**Louisiana International Terminal
Saint Bernard Parish, Louisiana**

Hydrologic Modification Impact Analysis Report

Prepared for:

Port of New Orleans



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1. Purpose of Project

The proposed Louisiana International Terminal (LIT) project in Violet, Louisiana, aims to significantly increase the Port of New Orleans' capacity to handle container volume by developing a modern container terminal. This terminal will accommodate an annual capacity of up to 2 million TEU at full buildout. The 400-acre site, located in the vicinity of Violet, Louisiana (Figure 1), will feature a three-berth modern container terminal with waterfront to accommodate up to 3,600 linear feet of berth space. The project's location is strategically situated to optimize the port's operational efficiency and future expansion opportunities.

The project area is generally bounded by the Violet Canal to the north, the Mississippi River to the west, the Forty Arpent Canal to the east, and the ditch between East St Bernard Highway (ESB) and East Judge Perez Drive (EJP) at Theresa Drive to the south. Port NOLA has purchased a 1,200-acre site, with approximately 400 acres designated for the container terminal (Phases 1, 2, and 3), buffer areas, and related infrastructure. The only portion of the property east of EJP being developed as part of the terminal is an electrical substation, drainage pump station, and drainage canals.

The hydrologic and hydraulic aspect of the project focuses on designing efficient drainage channels, pump station requirements, and other infrastructure to minimize environmental impact, protect the surrounding communities from flooding risks, and ensure safe and efficient operations. The main goal of the drainage design is to collect and route any increased runoff from the LIT development offsite without requiring modifications to the EJ Gore Pump Station or adversely impacting the surrounding communities (Violet and Riverbend) or other areas of the EJ Gore Pump Station basin.

2. Purpose of Hydrologic Modification Impact Analysis

The purpose of conducting the Hydrologic Modification Impact Analysis (HMIA) for the Louisiana International Terminal (LIT) project is to thoroughly evaluate the potential impacts of the proposed coastal use on the existing hydrologic conditions, ensuring that the project adheres to the regulatory standards of the Louisiana Department of Natural Resources (LDNR). This analysis is a critical component of the coastal permit application process and aims to minimize adverse effects on the local environment, neighboring properties, and waterways.

This HMIA for the LIT project focuses on assessing the modifications to the existing drainage networks and water flow patterns, providing a comprehensive understanding of the project's impact on runoff conditions. By evaluating the potential consequences of these modifications, the HMIA informs the design team on the need for measures to mitigate potential negative impacts, such as increased flooding risks. Ultimately, the HMIA will help ensure that the LIT project is designed and implemented in a manner that aligns with the state's coastal management goals and preserves the integrity of the coastal environment.

The Office of Coastal Management (OCM) identifies the HMIA for the LIT project as a level 3, which requires the following information:

1. A map showing existing and proposed water flow patterns.
2. Identification of the design storm event and the drainage network to be impacted.
3. Information relative to the pre-and post-project volume/rate of runoff expected for the design storm event.
4. Information on the existing and post-project hydrologic conditions, including at a minimum, local topography, slope, surface condition, drainage pattern, response to storm event, etc.
5. A discussion of how the runoff identified in #4 above will affect adjacent properties and the existing drainage network.
6. Monitoring data which establishes background hydrologic conditions over a one-year period (i.e. rainfall data, tide data etc.).
7. An evaluation of the short- and long-term changes anticipated to the hydrologic system resulting from construction, operation, and maintenance of the proposed activity.
8. A site-specific study predicting the response of the existing drainage network to the alteration under normal conditions and from the design storm, the 100-year storm and a Category 1 tropical storm event with associated storm surge. (Please note that a detailed regional study or model can be used in place of a site-specific study.)
9. Elevation details, capacity, and operational schedule for all proposed water control structures (WCS) or pumps (if proposed).

3. Hydrology

The LIT project site is mostly a wooded area located between the Forty Arpent Canal and the Mississippi River Levee. The area is protected from normal water stages as well as high water stages produced by major storms and hurricanes by levees along the Mississippi River and Forty Arpent Canal. The elevation in the area ranges from about +6' NAVD88 near Mississippi River levee to about +0' NAVD at low lying former marshes and swamps. Because of this topography, the stormwater runoff collected within the system must be pumped out to prevent flooding in the area.

The average annual normal precipitation for the project area, based on National Centers for Environmental Information (NCEI) at New Orleans International Airport (MSY) and New Orleans Lake Front Airport (NEW) for the period 1990-2020, is 61.74 inches. Monthly and annual means for the same period are presented in Table 1. The heaviest rainfall typically occurs during the summer (June-August) averaging more than 6 inches, while October is the driest month, averaging less than 4.00 inches.

Table 1 Mean Monthly and Annual Rainfall in Inches (1990-2020)

Month	NO International Airport (MSY)	Lake Front Airport (NEW)	Average
January	5.18	5.26	5.22
February	4.13	4.08	4.11
March	4.36	4.63	4.50
April	5.22	5.87	5.55
May	5.64	4.94	5.29
June	7.62	6.04	6.83
July	6.79	6.29	6.54
August	6.91	6.46	6.69
September	5.11	4.64	4.88
October	3.7	3.64	3.67
November	3.87	3.64	3.76
December	4.82	4.63	4.73
Annual	63.35	60.12	61.74

(Data: NCEI)

3.1. Drainage Network to be Impacted

The general existing drainage pattern of the LIT site is from west to east from the Mississippi River Levee, through culverts under the ESB and EJP Highways, and then to the Forty Arpent Canal (Figure 2). The existing site runoff collected in the Forty Arpent Canal is routed south to the EJ Gore Pump Station. The LIT site is part of a larger watershed that includes two drainage pump stations, EJ Gore and St. Mary's. The EJ Gore P.S. discharges into the wetlands between the Forty Arpent Levee and the St. Bernard Hurricane and Storm Damage Risk Reduction System (HSDRRS) levee/floodwall (Figure 3). This wetland area drains by gravity into Lake Borgne through two flood control gates. The St. Mary Pump Station discharges into the Lake Lery basin located south of the study area.

3.2. Existing vs Proposed Waterflow Patterns within LIT

The waterflow pattern in the LIT area under the existing condition is from west to east, as shown in Figure 4. The runoff generally flows from the west towards the east via natural ditches and crosses the ESB and EJB highways through culverts, finally reaching the Forty Arpent Canal located on the east. Except for the westernmost part of the LIT area closest to the Mississippi River Levee, most of the area is very flat, contributing to flooding during extreme events. Most of the area east of the EJP Highway is below -0.5' NAVD, which is the EJ Gore Pump Station's start level. Therefore, this area acts as a floodplain during storm events.

The waterflow patterns within the LIT site under the proposed development plan are shown in Figure 5. The master plan (Phase 3,3, Appendix A-6) illustrates the planned development and major channel network in the proposed plan. In the proposed plan, the runoff from the west of

the EJP Highway would be collected onsite and routed to the Forty Arpent Canal via three open channels, with a major channel in the middle carrying the most runoff from the developed area. There is a 25-acre detention basin that would primarily receive runoff from the container yard area and mitigate peak flow while helping to improve water quality of the runoff before it reaches the Forty Arpent Canal. Most of the runoff from the southern area would cross under the EJP Highway through culverts to join an open channel running parallel to the EJP Highway, whereas the runoff from the Violet community would be routed directly to the Forty Arpent Canal. A new pump station with a 400 cfs capacity would be built to draw water from the Forty Arpent Canal into the central wetlands to the east.

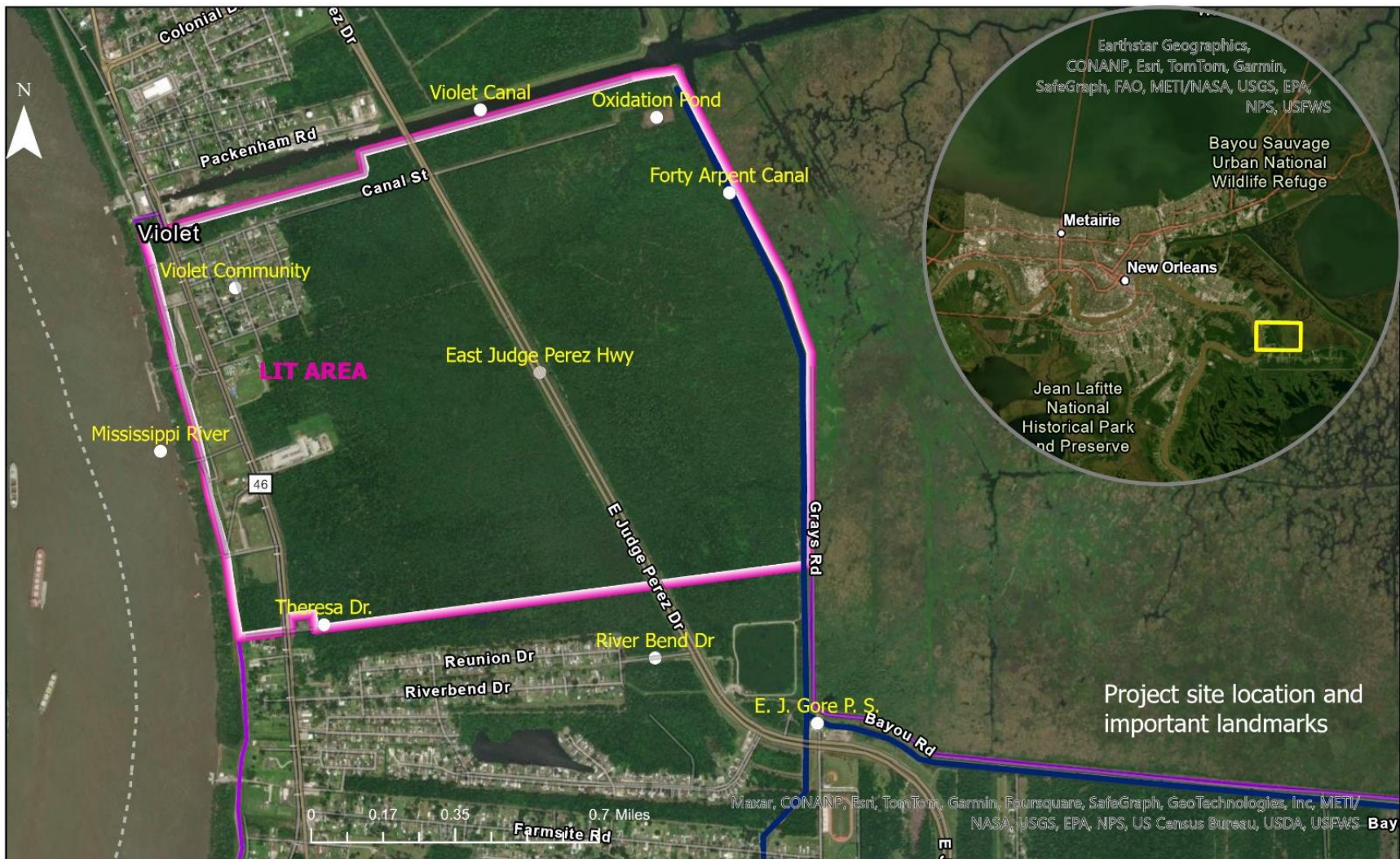


Figure 2 Project Site Location and Important Landmarks

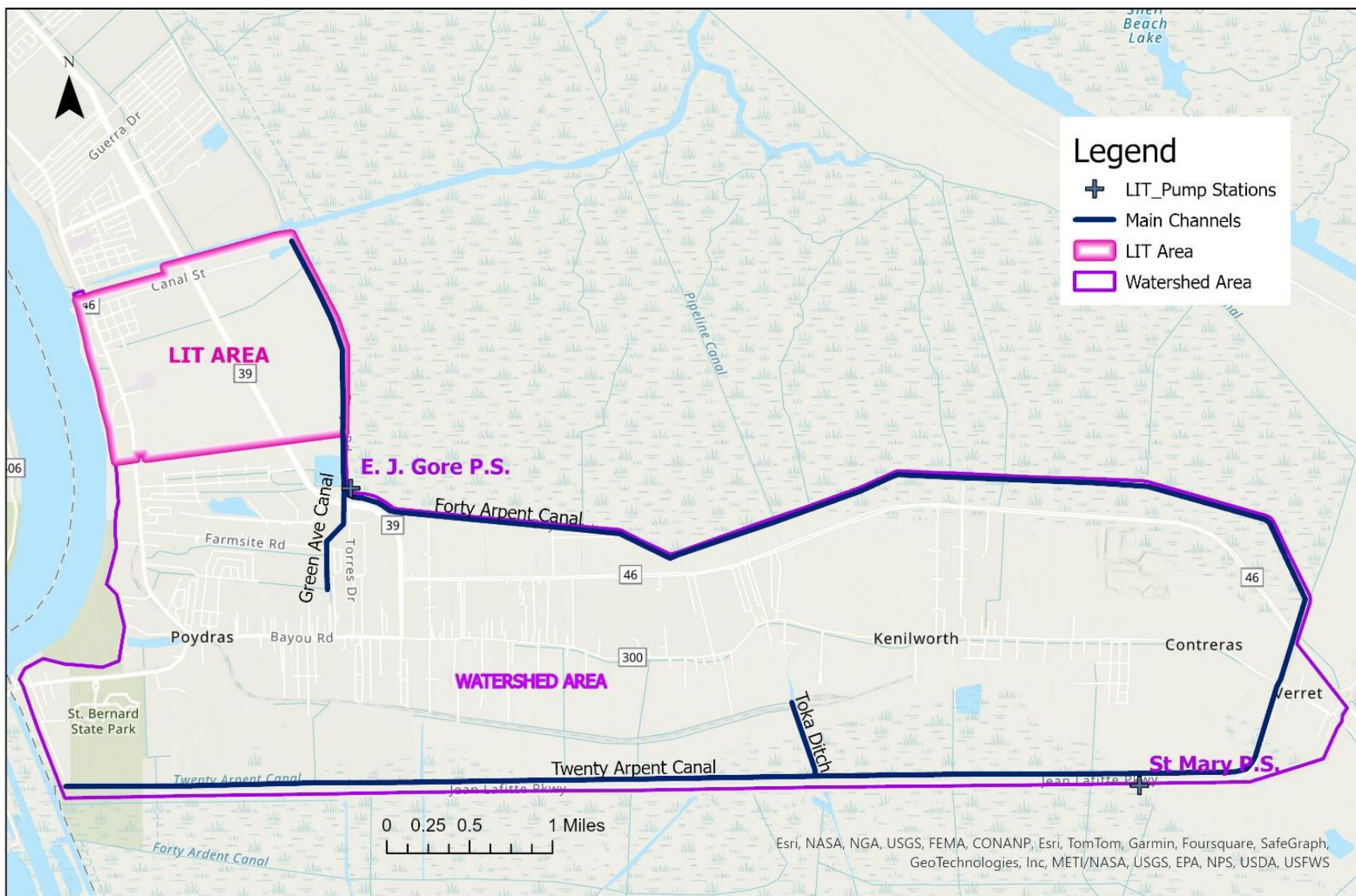


Figure 3 LIT Area and Major Drainage Network in the Watershed

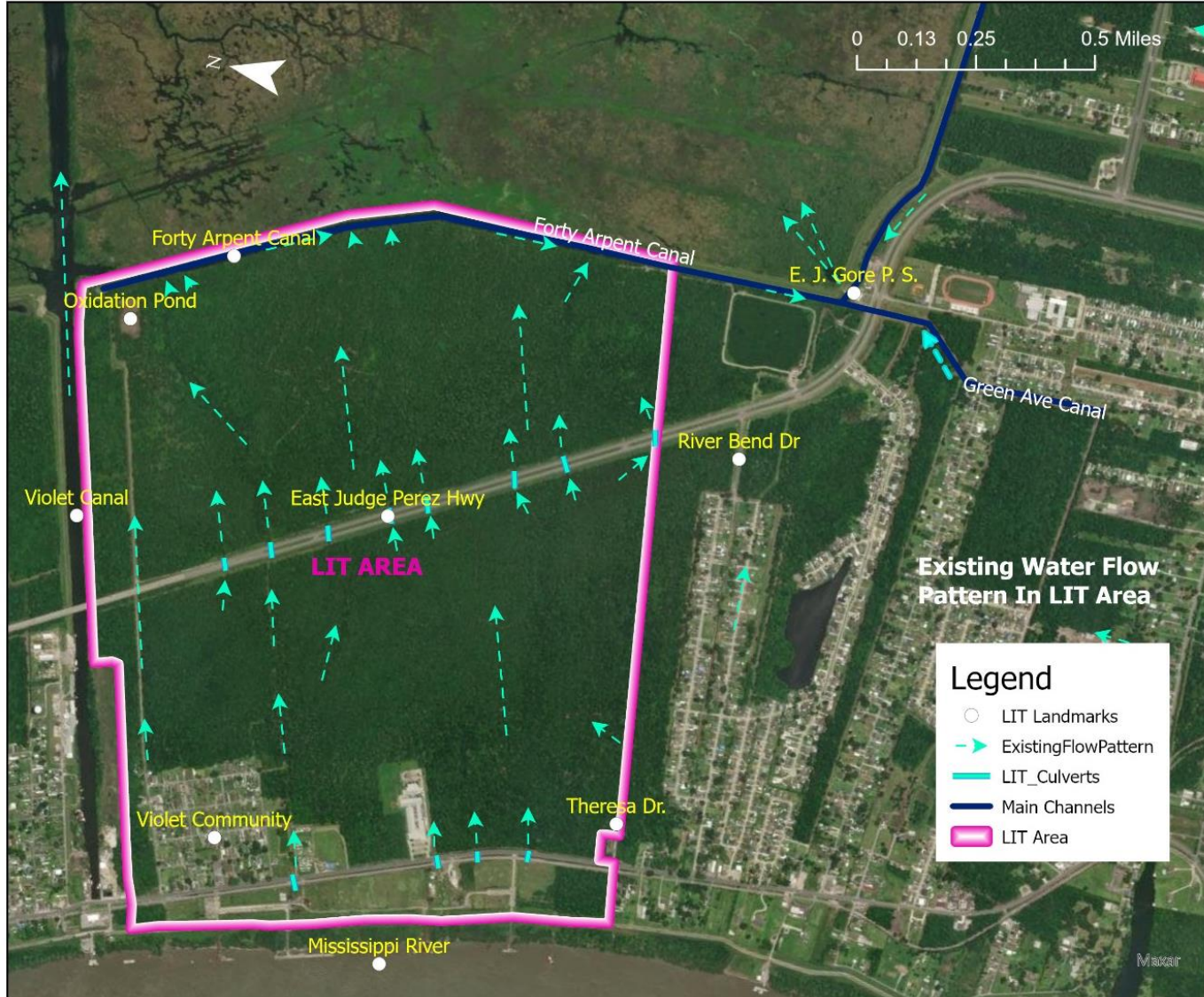


Figure 4 Existing Water Flow Pattern in LIT AREA

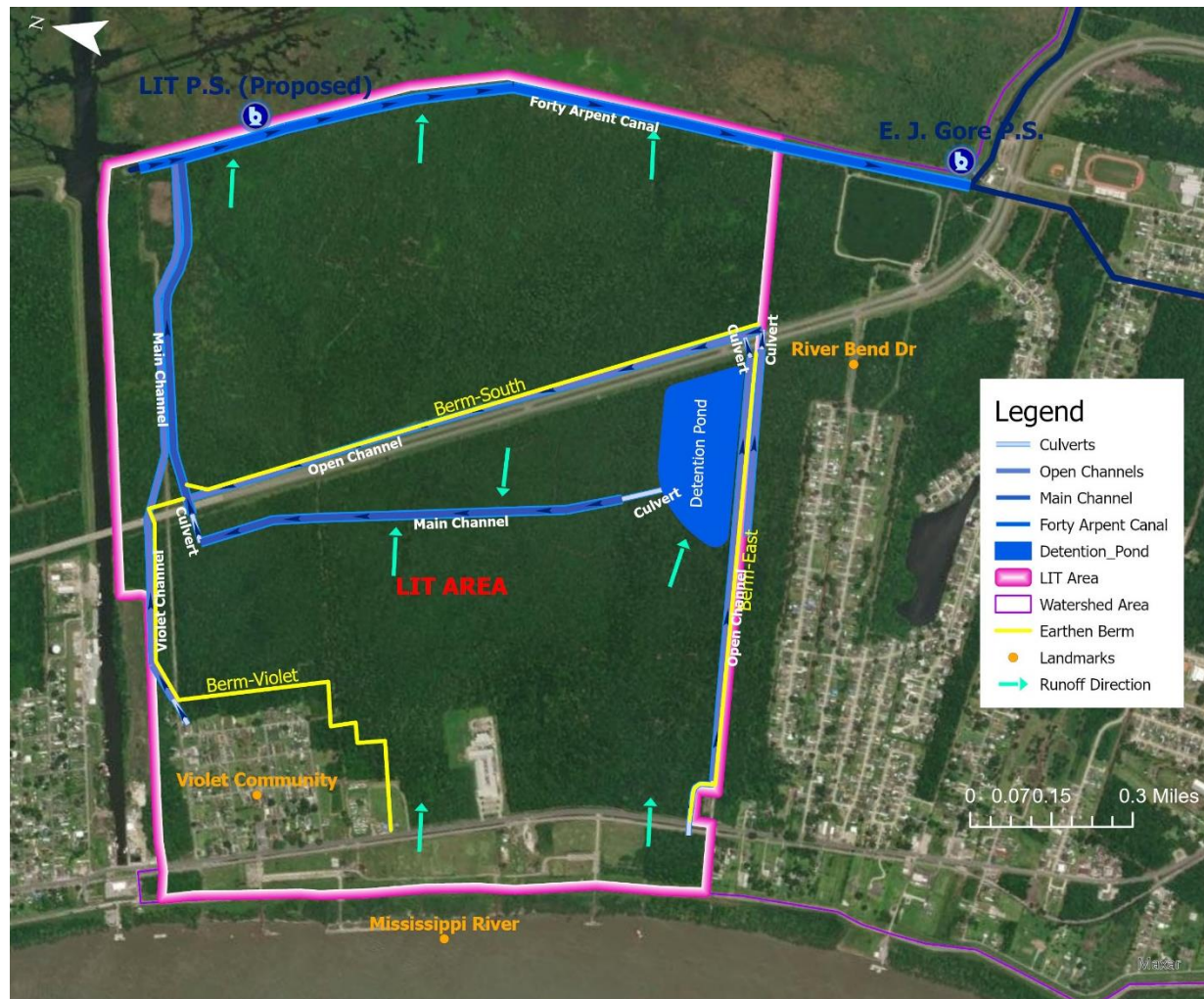


Figure 5 Proposed Water Flow Pattern in LIT Area

3.3. Monitoring Data for the Baseline Hydrologic Conditions

This assessment utilizes existing historic information and data, such as rainfall data, tide records, and gauge data, to establish baseline hydrologic conditions.

The NOAA Atlas 14 rainfall intensity-duration-frequency (IDF) standards were employed instead of the Technical Paper 40 (TP 40) IDF standards in cases where the NOAA Atlas 14 IDF is greater than the TP 40 IDF. This adjustment is especially relevant for the 50-year and 100-year return periods, as it ensures that the most accurate and up-to-date data is used for these critical long-term planning scenarios. For instances where TP 40 IDFs are higher, they would be considered for the design of smaller drainage elements, such as the subsurface drainage system and smaller side drain ditches that connect to the main drainage outfall channel. These higher TP 40 IDFs tend to be associated with smaller return period (more frequent) storms. Rainfall data for use in stormwater design computations is summarized in Table 2 below.

Table 2 Rainfall Depth, Duration and Frequency Standards

Rainfall Depth/Duration/Frequency (Rainfall in inches)							
Return	5 min	15 min	30 min	60 min	6 hours	12 hours	24 hours
2 year	0.632	1.13	1.99	2.50	4.20	5.10	6.00
5 year	0.765	1.37	2.40	3.05	5.3	6.65	7.75
10 year	0.88	1.57	2.7	3.40	6.35	7.7	9.2
25 year	1.04	1.86	3.05	4.13	7.63	9.04	10.70
50 year	1.17	2.09	3.29	4.76	9.14	10.80	12.40
100 year	1.31	2.34	3.67	5.45	10.80	12.70	14.4
<i>Source: NOAA Atlas 14 at New Orleans Audubon (white) and Technical Paper 40 (tan)</i>							

A plot of the NOAA predicted tidal cycles near the Dupre Flood Control Structure that may affect the performance of the E J Gore Pump Station near Violet, LA is shown in Figure 6 below. This tidal data is used as a boundary condition for that station in the model.

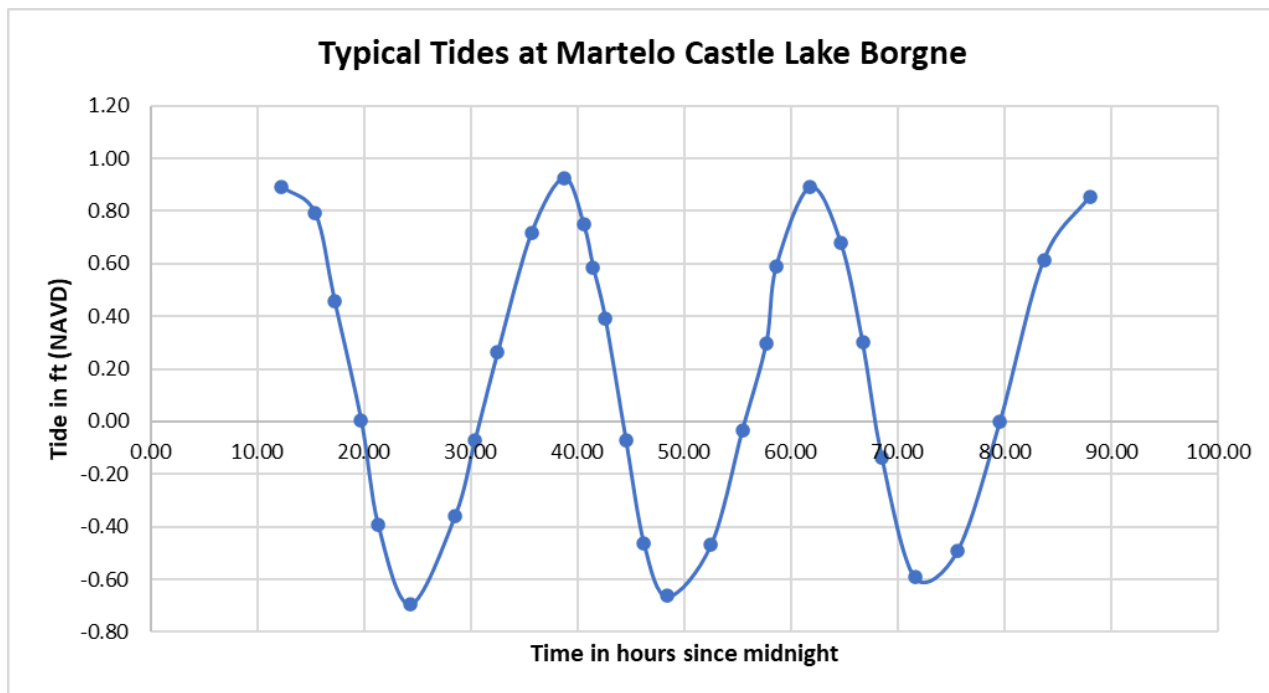


Figure 6 NOAA Predicted Tidal Cycles Near the Dupre Flood Control Structure

3.4. Hydrologic and Hydraulic Modeling

The EPA Storm Water Management Model (SWMM), a dynamic rainfall-runoff simulation model, is a powerful tool for understanding existing and future stormwater conditions. In preparing for a Hydrologic and Hydraulic (H&H) Impact Analysis (HMIA), a detailed model of the watershed was created using the SWMM program. SWMM 5 model was used as a basis for the generation of most hydraulic data for HMIA analysis. The existing conditions SWMM model was designed to closely align with the Flood Insurance Study (FIS) results, establishing a reliable baseline for the proposed conditions model at the new terminal site. Notably, the basin was initially modeled by the USACE for the FIS using HEC-HMS 3.5 to determine base flood elevations. Rainfall events were directly input as hydrographs and a temporal distribution was applied. Frequency-based synthetic rainfall was used for subbasins, and annual chance storm events were derived from NOAA and SRCC reports. The schematic of the existing conditions SWMM model is shown in Figure 8.

With the existing conditions model in place, a proposed conditions model was then constructed to facilitate preliminary assessments on critical aspects such as culvert sizing, pump station requirements, detention ponds, and other improvements. The overarching goal of this modeling approach is to minimize the potential for new stormwater-related issues in the surrounding communities, thus ensuring a sustainable and resilient infrastructure design. Based on the modeling results, the terminal stormwater design was meticulously modified to prevent adverse impacts on the EJ Gore Pump Station and Violet community. This involved modifications to

stormwater routing, detention basin sizing, and addition of a new pumping facility to promote a sustainable and resilient stormwater infrastructure design.

4. Design Storm

4.1. Identification of Design Storm

The design storm refers to a rainfall event with a specific duration, intensity, and frequency that the drainage system must be able to handle effectively. The design storm should account for the extreme storm conditions that the area experiences. Typically, a design storm with a higher return period (50-year or 100-year storm) is selected for critical infrastructures to ensure that the drainage system can withstand extreme rainfall events and prevent flooding that could disrupt port operations and cause significant economic losses. Additionally, the design storm should account for the potential impacts of climate change, as changing precipitation patterns and sea level rise may affect the drainage requirements in the future. The selection of an appropriate design storm must also be considered to address the physical, environmental, and regulatory elements associated with storm runoff from the proposed project.

The design storm for this flood analysis was selected based on project-specific requirements, while considering guidelines from the Federal Emergency Management Agency (FEMA), Louisiana Department of Transportation and Development (LADOTD), Federal Highway Administration (FHWA), and St. Bernard Parish 2019 Master Drainage Assessment and the St. Bernard Parish MS4 Storm Water Management Program. After careful considerations of various factors, including the project's criticality, potential impacts on operations, historical rainfall data analysis, and climate change projections, Port NOLA has selected a 100-year storm event as the design storm. The 100-year design storm represents a rainfall event with a 1% annual exceedance probability. It ensures that the drainage system can withstand extreme precipitation events and prevent flooding.

The proposed site development routes surface runoff through drainage components of a major drainage system designed to manage the 100-year storm frequency. This includes the drainage of the rail spur, railyards, and container yard, which are designed to handle the runoff from such a storm to prevent ponding and potential damage to containers. The roughly 25-acre detention basin is a component of the major drainage system, which will be a peak flow managed feature that will have least 12 inches of freeboard during the design event.

Subsurface drainage systems for the ESB and EJP roadway drainage systems will adhere to the DOTD drainage criteria. The roadway elements are not part of the facility proper, however the project drainage network and system are designed to capture and convey this flow through the project drainage system. The SWMM model is utilized to evaluate the performance of the roadway drainage system upon integration into the major drainage system.

4.2. Rainfall Depths, Durations, and Frequencies

For the rainfall depth-duration-frequency analysis, this study employed the more recent and precise NOAA Atlas 14 depth-duration-frequency (DDF) standards as the primary data source. However, to ensure a conservative design approach, as recommended by the Port NOLA, the higher rainfall frequency values from Technical Paper 40 (TP 40) were incorporated when they exceeded the corresponding Atlas 14 values. The use of Atlas 14 data was particularly critical for the 100-year return period, which is the design criteria for the major drainage features of the LIT project. For smaller drainage elements like subsurface systems and side ditches, TP 40 values would be used where they are higher than Atlas 14, as this approach ensures a more conservative design for frequent, smaller storm events.

This project has a projected lifespan of fifty years. To accommodate potential increases in rainfall intensity, the Port NOLA has chosen to utilize the rainfall intensity data from the Atlas 14 reference, supplemented with an additional 1 inch of rainfall depth. This adjustment generally accounts for the anticipated effects of future greater storm severity.

Rainfall Intensity/Duration/Frequency (Rainfall in inches)							
Return	5 min	15 min	30 min	60 min	6 hours	12 hours	24 hours
2-year	0.63	1.13	1.99	2.5	4.2	5.1	6
5-year	0.761	1.36	2.4	3.05	5.3	6.65	7.75
10-year	0.875	1.56	2.7	3.4	6.35	7.7	9.2
25-year	1.04	1.86	3.05	4.11	7.61	9.13	10.7
50-year	1.17	2.09	3.29	4.75	9.11	10.8	12.5
100-year	1.31	2.34	3.68	5.44	10.8	12.7	14.5*
Source: NOAA Atlas 14 at New Orleans Audubon (white) and Technical Paper 40 (Gold)							
*Add 1" rainfall for a total of 15.5" for future conditions							

Figure 7 Table of Rainfall Depth/Duration Relationships

5. Existing Conditions

5.1. Existing Hydrologic Conditions for the Model Development

The LiDAR & Photogrammetry Survey of the area west of EJP highway was conducted in March 2022 for the LIT project. The LiDAR data collection achieved an absolute horizontal accuracy of 15 cm and a vertical accuracy of 10 cm. The Bare Earth LiDAR points were used to create the Digital Elevation Model (DEM). For the rest of the watershed, including east of EJP Hwy, the LiDAR included with the FIS model was used. A composite mosaic of these two LiDAR sets was created and used for the SWMM modeling.

The LiDAR map of the watershed provides a clear visualization of the general topography of the area, as illustrated in Figure 9. This map also shows the existing general drainage pattern within

the watershed. Two main canals, the Forty Arpent and Twenty Arpent canals, drain into the two pump stations EJ Gore Pump Station and St. Mary Pump Station, respectively. Bayou Road (Figure 10) acts as a semi-permeable barrier, affecting the division of the watershed between the two pump stations. The wetland areas adjacent to these two canals are notably flat, making them highly susceptible to flooding even during frequent storm events. These wetland areas, like the one north of the EJ Gore Pump Station and west of Forty Arpent Canal, essentially act as storage areas during storm events. The canals exhibit extremely low velocities, even during large storms, resulting in a prolonged drainage process that can take several days to clear this wetland-type area.

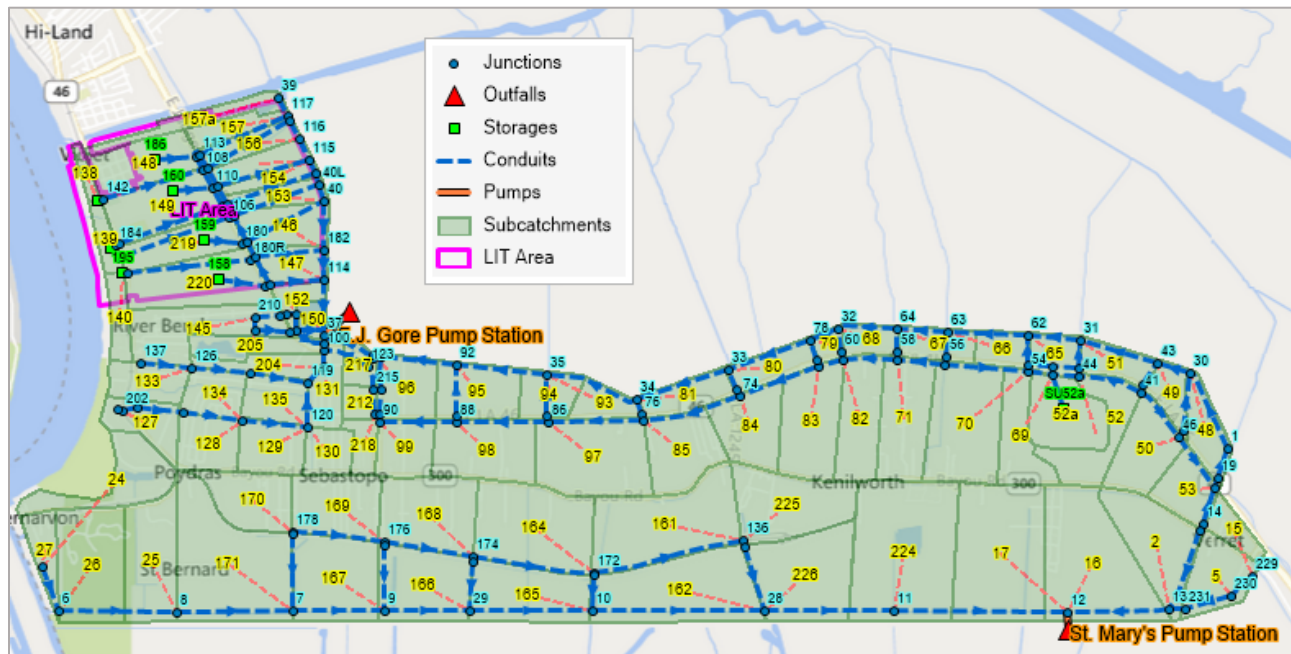


Figure 8 Existing Condition SWMM Model of the Total Watershed

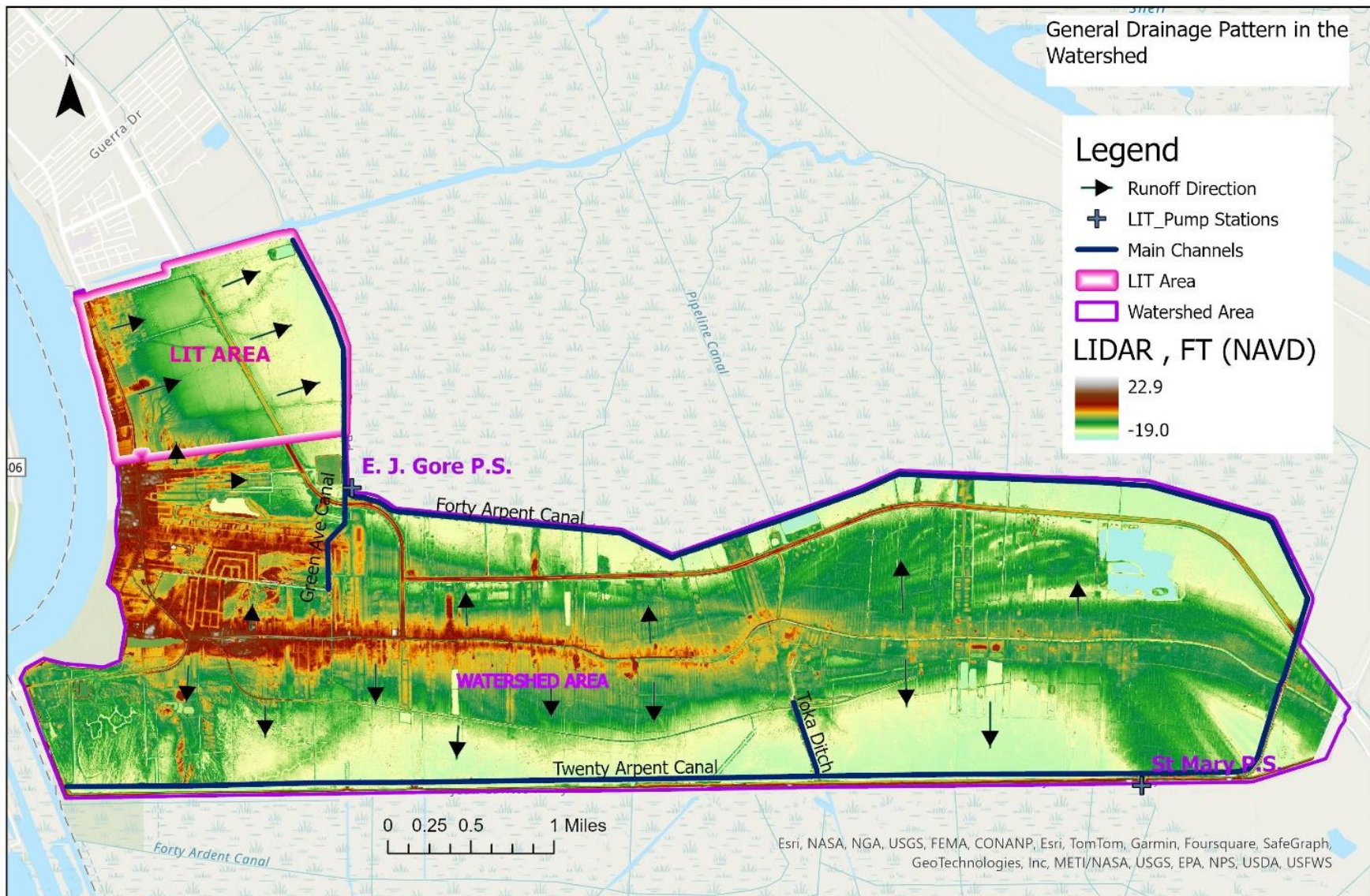


Figure 9 Major Drainage Features and Runoff Pattern in the Watershed

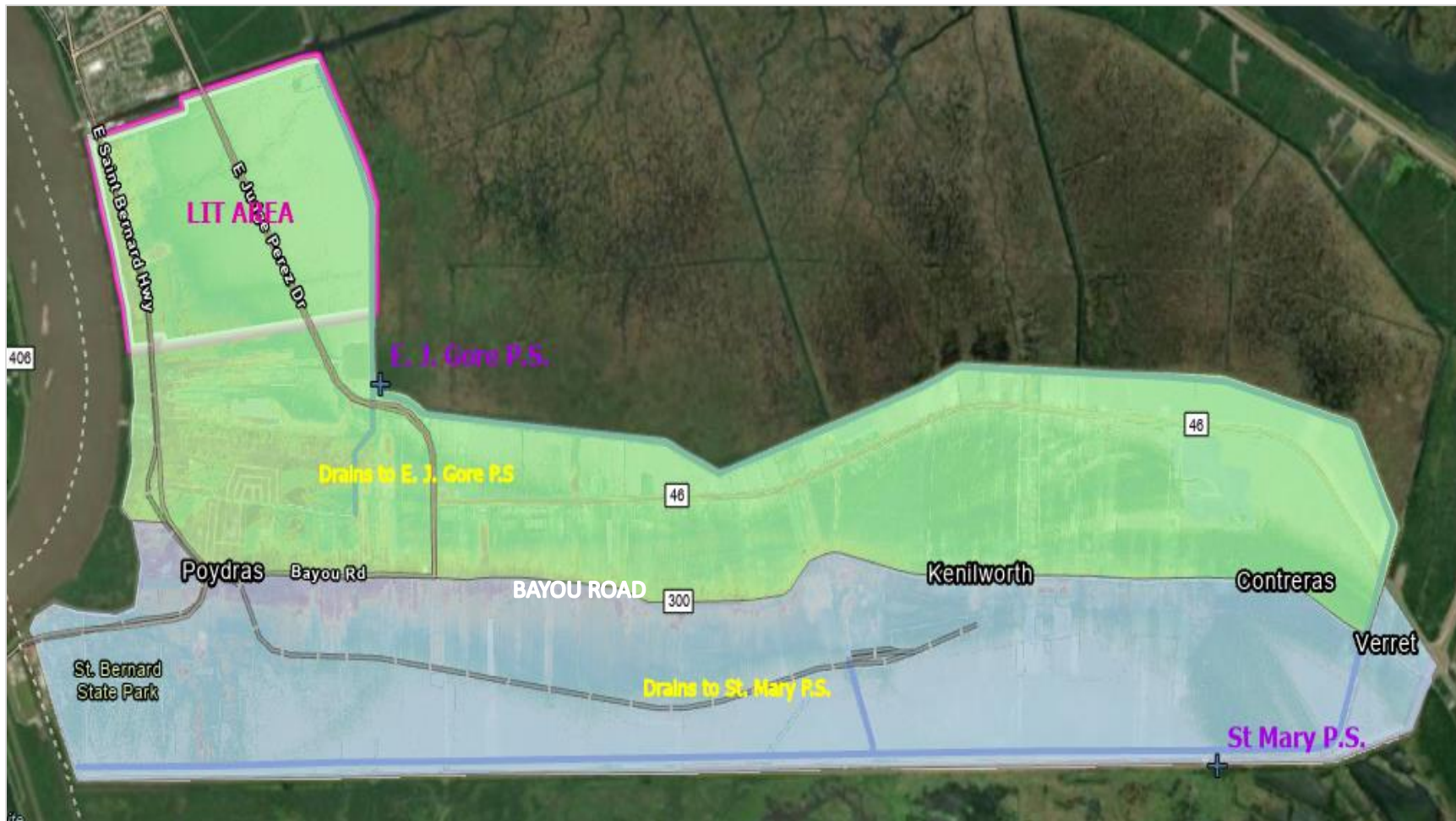


Figure 10 Bayou Road: A Watershed Divide for Two Pump Stations

The National Land Cover Database (NLCD) 2021 provides comprehensive and up-to-date information on land cover across the United States, which is essential for accurately representing the diverse land types in our study area. However, the NLCD imperviousness data does not adequately capture the unique characteristics of wetlands, a significant portion of our study area. Therefore, NLCD 2021 for both impervious (Figure 11) and land cover (Figure 12) data was utilized to get final imperviousness data for the SWMM model. Field surveys were also conducted to understand specific characteristics of the wetlands.

The infiltration rates utilized in this model are derived from Hydrologic Soil Groups as outlined in Part 630, Hydrology, of the National Engineering Handbook and a Soil Classification Map, provided by the National Resources Conservation Service. The soil categories predominantly encountered within the model domain are Groups C and D. Group C soils exhibit a moderately high runoff potential when thoroughly saturated. For such soils, the SWMM 5 User's Manual suggests a K value of 0.26 inches per hour. Group D soils, on the other hand, possess a high runoff potential under similar conditions, with K values ranging from 0.01 to 0.06 inches per hour, contingent upon the depth of the impermeable layer. The surface of a bog is consistently wet and thus presents an impermeable characteristic. By employing the Soils Classification Map and the LiDAR map, areas with low infiltration rates, characteristic of wet environments, were identified and applied to the model using GIS tools.

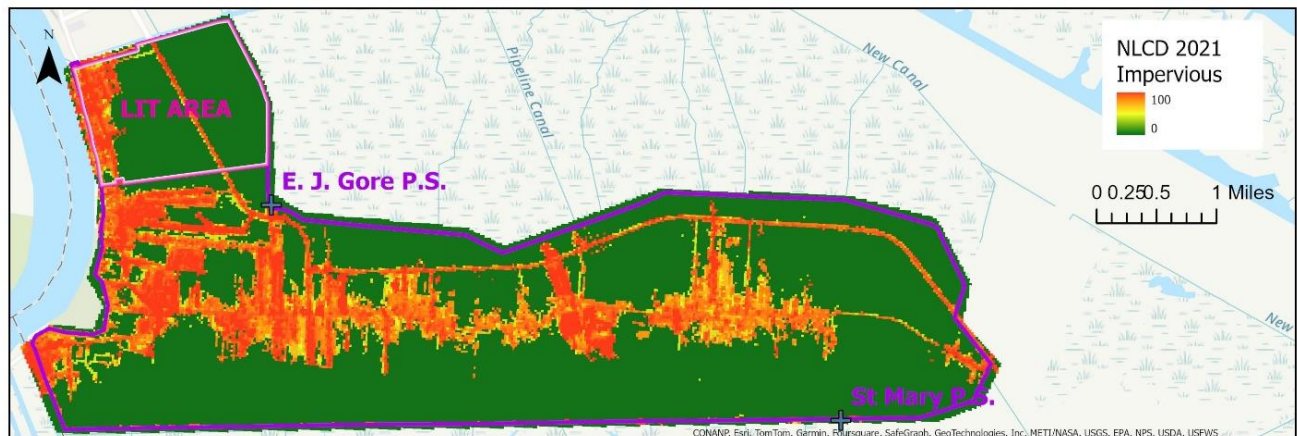


Figure 11 NLCD 2021 Impervious

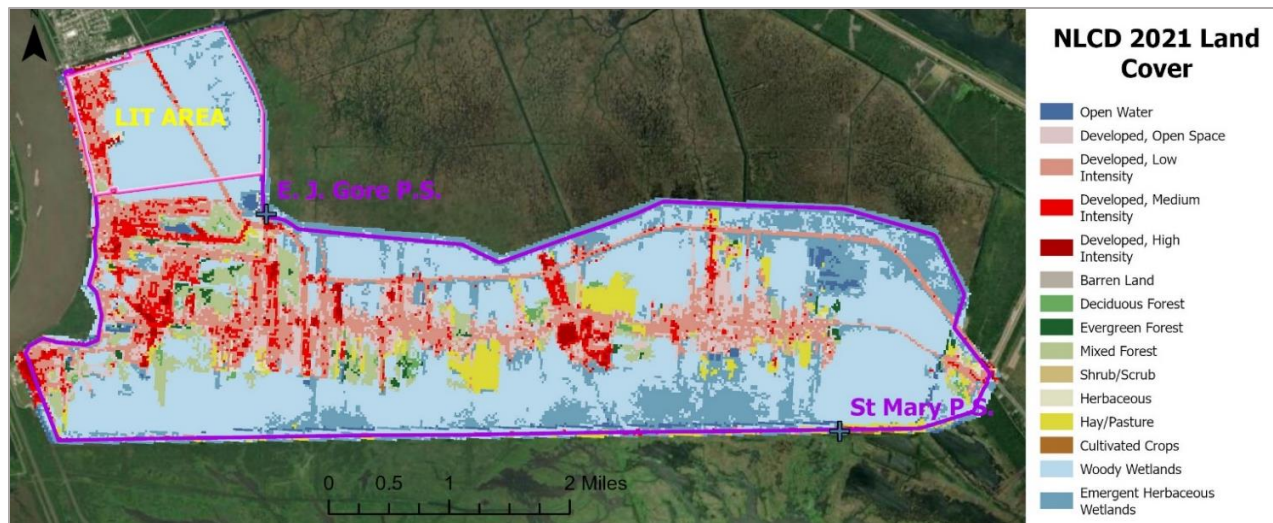


Figure 12 NLCD 2021 Land Cover

The watershed is divided into 81 subbasins for this modeling. Hydrologic parameters of the models were either calculated using GIS or were estimated based on the literature reviews. Parameters such as subbasin width were determined based on model performance relative to FIS model for a similar storm and also using best engineering judgement.

Table 3 Soil Type and Distribution in the Watershed

Soil Name	Soil Description	Area, Acres	Percent Area
AD	Aquents, dredged, frequently flooded	284.93	3.00%
BB	Barbary clay	813.78	8.56%
CE	Clovelly muck, 0 to 0.2 percent slopes, very frequently flooded	621.87	6.54%
Cm	Cancienne silt loam, 0 to 1 percent slopes	1587.46	16.71%
Co	Cancienne silty clay loam, 0 to 1 percent slopes	996.37	10.49%
Ha	Harahan clay, 0 to 1 percent slopes	538.68	5.67%
Hf	Harahan clay, frequently flooded	300.69	3.16%
Sh	Schriever silty clay loam, 0 to 1 percent slopes	1066.41	11.22%
Sk	Schriever clay, 0 to 1 percent slopes, rarely flooded	1705.00	17.94%
Ub	Urban land	119.56	1.26%
Va	Vacherie silt loam, 0 to 3 percent slopes	1151.38	12.12%
W	Water	316.61	3.33%
		9,502.74	100.00%

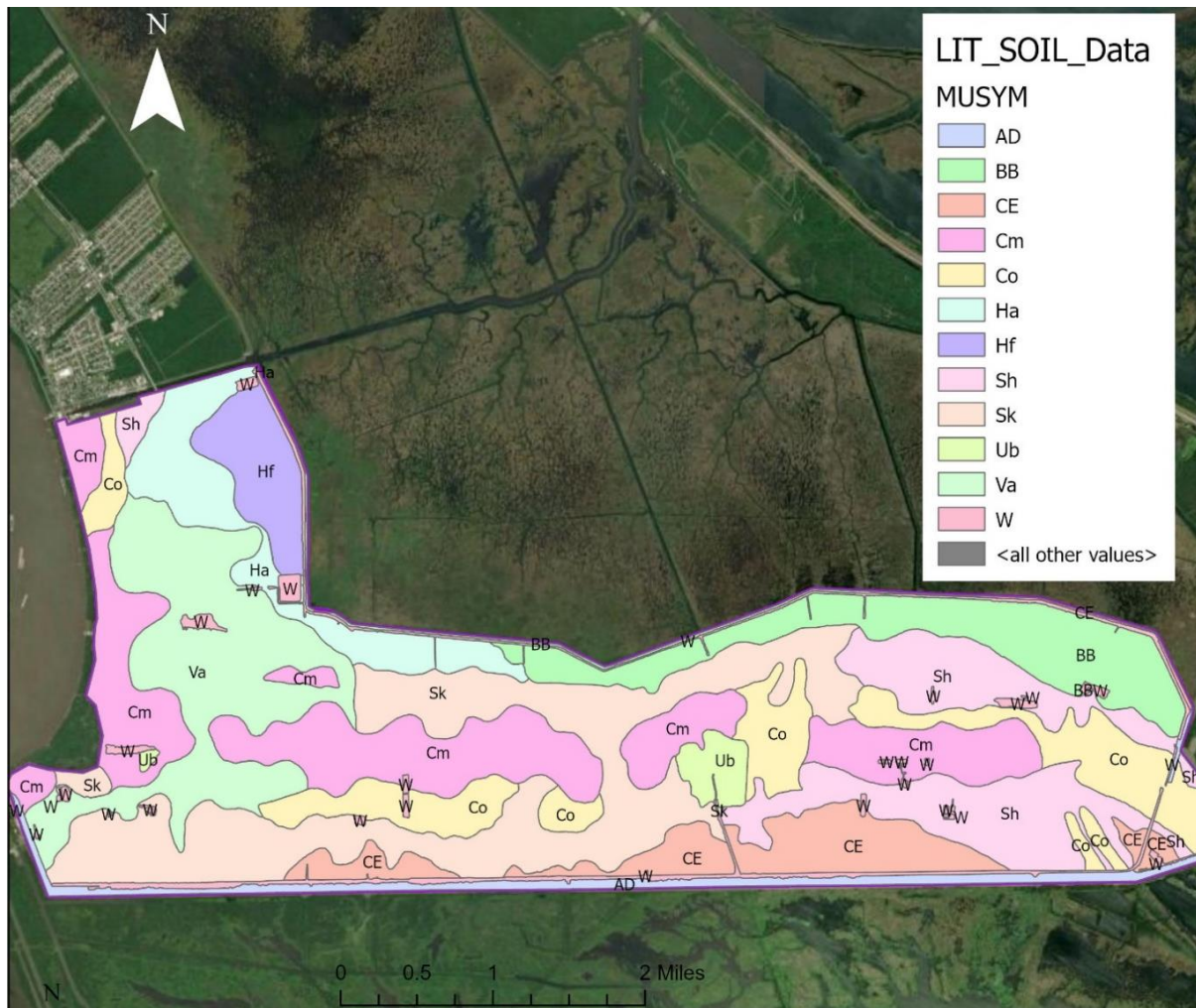


Figure 13 Soil Classification Map (SSURGO online Database, 2024)

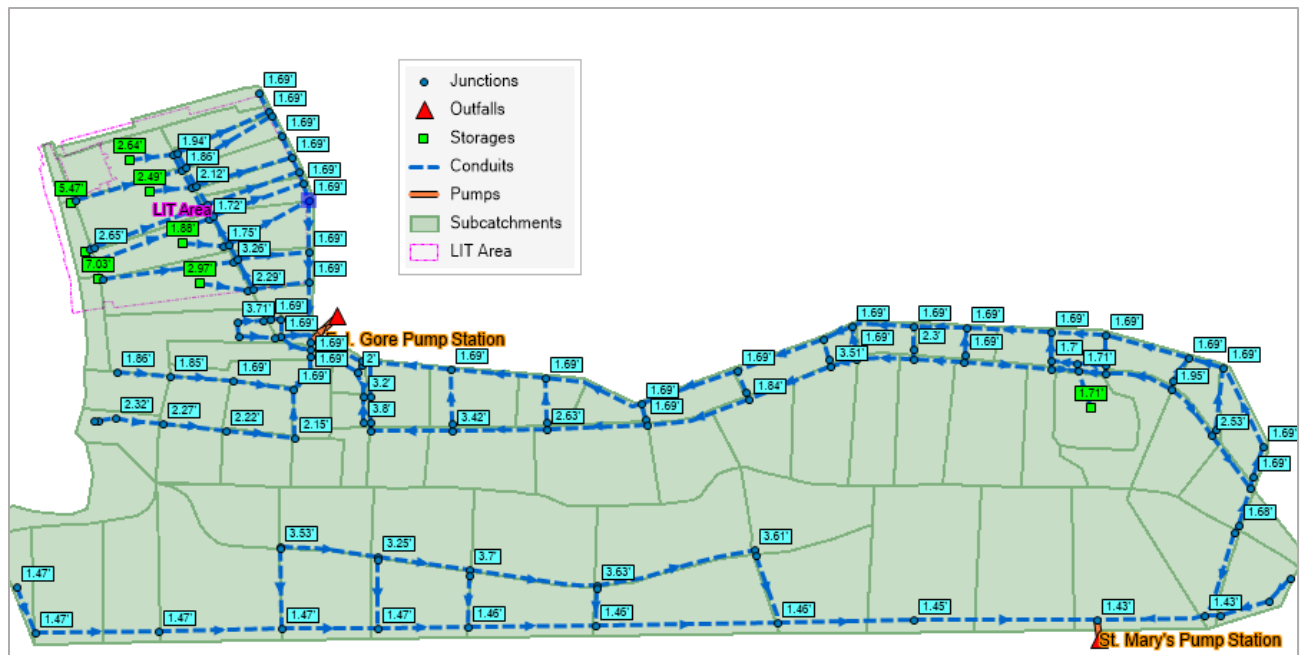


Figure 14 Maximum Water Surface Elevations under Design Storm (Existing Conditions SWMM Model)

5.2. Pre-project Volume/Rate of Runoff Expected for the Design Storm Event.

The EPA SWMM model (Figure 8) is used to calculate pre-project runoff volumes for the design storm of 15.5" rainfall. The design maximum flood is based on the 100-year storm stage-frequency water surface (Atlas 14) plus 1" to account for future greater storm severity as explained in Port NOLA's Flooding and Sea Level Rise Vulnerability Assessment report. This design rainfall is significantly higher than the 13.6 inches used in the original Flood Insurance Study (FIS).

To accurately capture the hydrologic response of the watershed, the existing conditions SWMM model is run for an extended period of five days, simulating a 24-hour design storm event. This extended simulation duration accounts for the gradual drainage of stormwater runoff through the slow-moving wetlands and channels before ultimately reaching the pump stations. The results of this simulation indicate that the total surface runoff volume generated across the watershed is 9,435 acre-feet, with an infiltration loss of 2,838 acre-feet (see Appendix, A-1). It is important to note that the total surface runoff volume and infiltration loss values obtained from this simulation are representative of the entire watershed under existing conditions and serve as a baseline for comparison with future development scenarios.

Since the project development area is much smaller than the entire watershed, it is preferable to focus on the runoff volumes generated specifically in the LIT area subject to development (west of EJP Hwy and some areas near the pump station access road). The subbasins selected in the existing SWMM model for this purpose and relevant runoff matrices are shown in Figure 15 and Table 4 below. The pre-project runoff volume from this development area for a 15.5-inch design

storm given by SWMM model is 260.41 million gallons (MG). The weighted average runoff coefficient for this selected area is 12.44 inch.

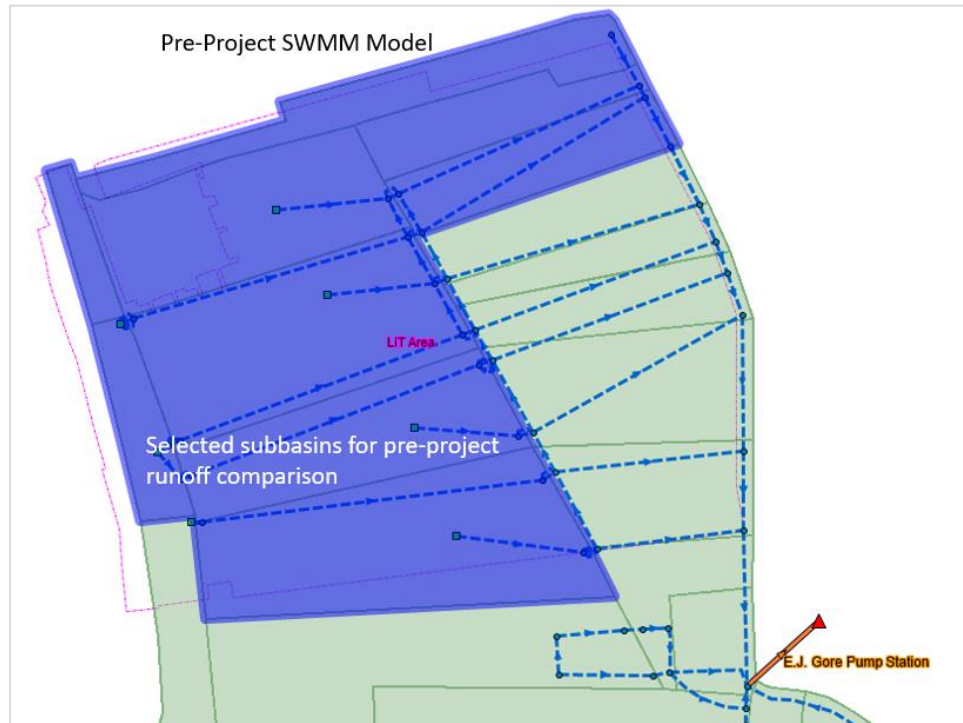


Figure 15 Selected Subbasins Covering Development Area in a Pre-Project SWMM Model

Table 4 Pre-Project Runoff Matrix for Selected SWMM Subbasins

Name	Area (ac)	Infiltration (in)	Imperv Runoff (in)	Perv Runoff (in)	Runoff Depth (in)	Runoff Volume (MG)	Peak Runoff (cfs)	Runoff Coefficient
138	16.73	4.44	5.72	5.33	11.05	5.02	49.20	0.71
139	32.85	4.90	5.10	5.49	10.59	9.45	82.74	0.68
148	119.10	2.74	4.48	8.26	12.75	41.22	291.94	0.82
149	148.47	3.48	2.32	9.70	12.01	48.44	294.96	0.78
156	58.92	1.32	1.70	12.47	14.17	22.68	157.28	0.91
157	48.62	1.16	1.86	12.49	14.34	18.93	156.47	0.93
157a	71.30	1.84	2.32	11.34	13.66	26.44	197.78	0.88
219	106.86	3.62	1.55	10.33	11.88	34.48	212.65	0.77
220	167.97	3.71	1.55	10.24	11.78	53.75	313.72	0.76
Weighted Avg:		3.05	2.50	9.95	12.44	38.08	244.54	0.80
Total	770.82					260.41		

Another approach in evaluating the impact of the development on the flooding potential on adjacent properties would be to examine the flow in the Forty Arpent canal towards the EJ Gore Pump Station. The runoff hydrograph from the design storm at Forty Arpent Canal north of EJ

Gore Pump Station is shown in Figure 16. As depicted in the figure, the flow away from EJ Gore Pump Station experiences a sharp increase during and immediately after the peak storm event. Subsequently, the flow is reduced and reversed for more than two days before eventually diminishing to zero.

This reversal of flow in the Forty Arpent Canal is a significant observation, as it indicates that the excess stormwater runoff generated during the peak storm event is temporarily stored within the canal system and surrounding floodplain or low-lying wetland areas. The prolonged duration of the reversed flow suggests that there is a need to pump more for the increased runoff volumes resulting from any development.

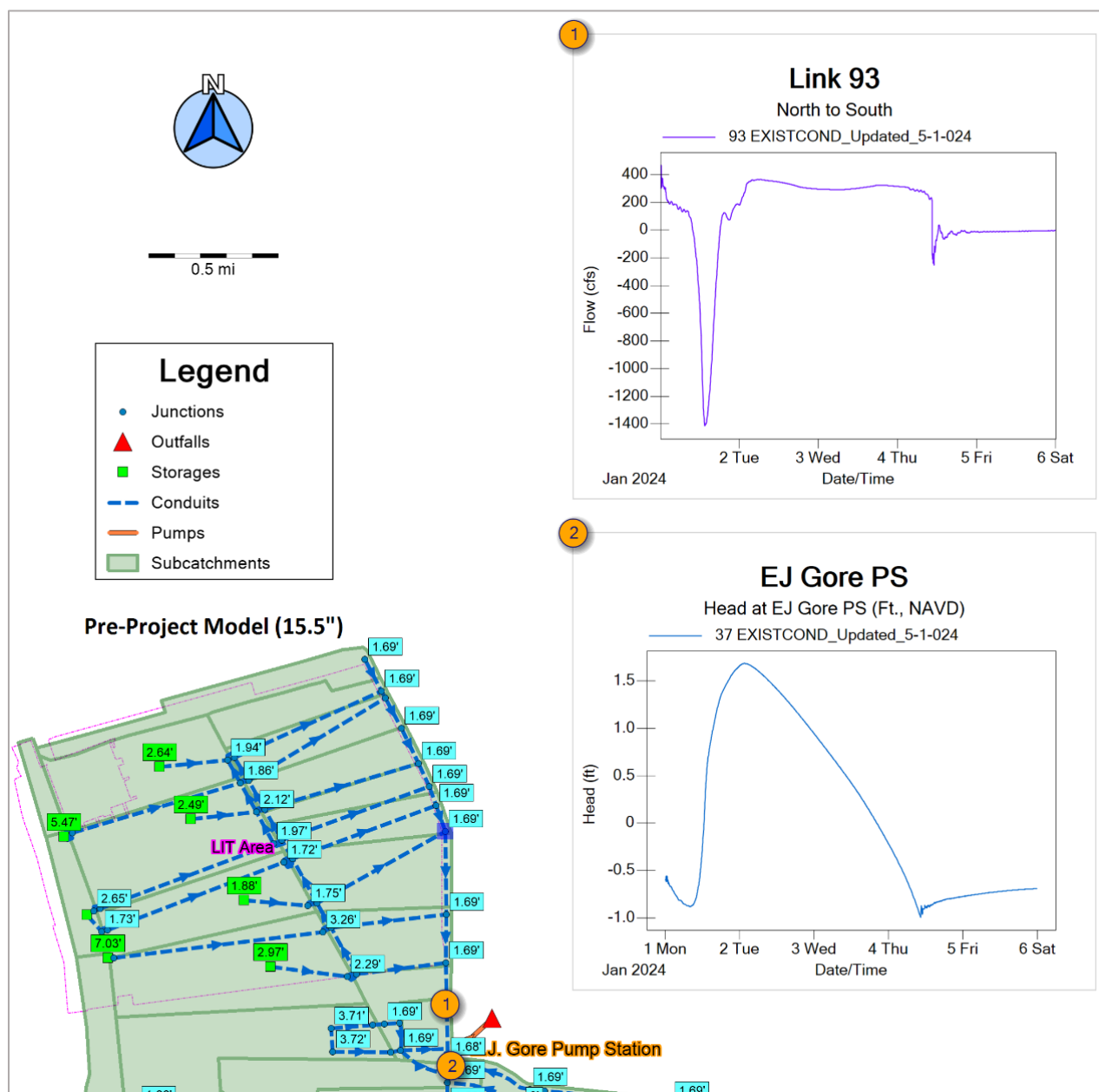


Figure 16 Pre-Project Design Storm (15.5") HGLs and Flow/Head at EJ Gore PS

6. Proposed Conditions

6.1. Post-project Hydrologic Conditions

The proposed development plan for the LIT site involves significant modifications to the existing topography and drainage patterns. As illustrated in the master plan (Phases 1a, 1b, 2, 3, see

Appendix), the site will be graded to accommodate the built-out area, facilitating the overall flow of stormwater runoff towards the Forty Arpent Canal.

While the general direction of flow remains consistent with the existing conditions, the post-project drainage system will feature a more structured network of channels and conveyance systems. Three primary open channels will be constructed to the west of the EJP Highway, with the central channel serving as the main conveyance for runoff from the developed areas. These channels will direct the runoff directly into the Forty Arpent Canal, improving the overall drainage efficiency.

Main drainage features in the proposed plan are shown as numbered items in the overall site plan phase 3 (Figure 17)



Figure 17 Major Drainage Features in the Overall Site Plan Phase 3

According to this plan, a 25-acre detention pond (Item 1, Figure 17) (also Figure 18) will be constructed to reduce the risk of increases in water surface elevations, particularly in the Violet community, by lowering peak water levels in the developed area. The runoff from west of ESB Highway will join an open channel (Item 2) that will flow via roadside ditches along EJP Highway (Item 3) to the new major discharge canal (Item 4). The flow from the main channel will enter

the Forty Arpent Canal (Item 5) and ultimately reach the new project pump station (Item 6) located on the tidal protection levee of the Forty Arpent Canal.

This new pump station is proposed to be synchronized to start pumping at the same elevation as the EJ Gore station (Item 7). Additionally, to accommodate the Violet community, Violet Community Drainage canal (Item 8) will be improved and routed to the north side of the project site and join the Forty Arpent Canal on the east side of EJP Highway. A berm (Item 9) will need to be constructed to separate the site drainage from the Violet Community drainage. Item 10 in the figure indicates the location of an earthen berm to be constructed towards the south property line between the LIT site and the Riverbend Community to the south of the LIT site. The construction of the berm will also require an interceptor ditch (Item 11) to be included on the south side of the berm. This ditch is necessary to ensure that the surface flows from the Riverbend Community have an access route to the Forty Arpent Canal.

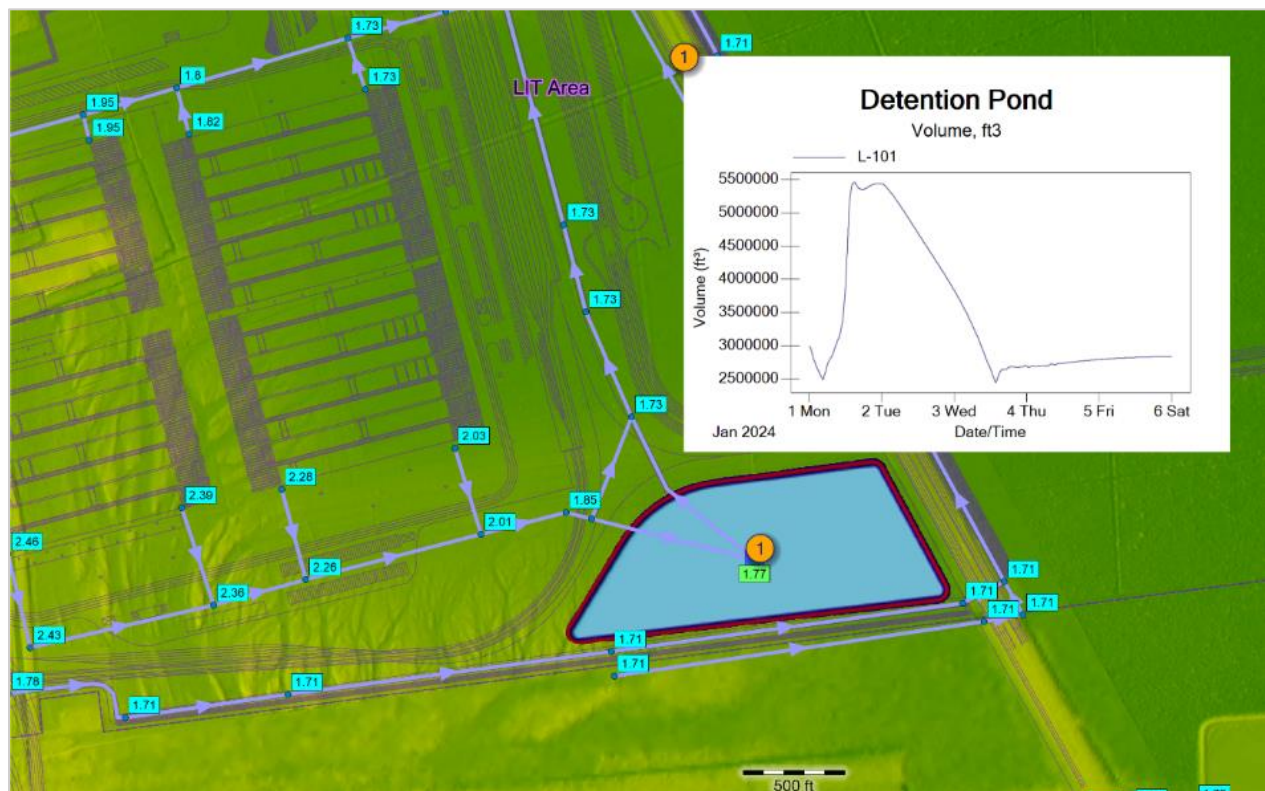


Figure 18 Detention Pond

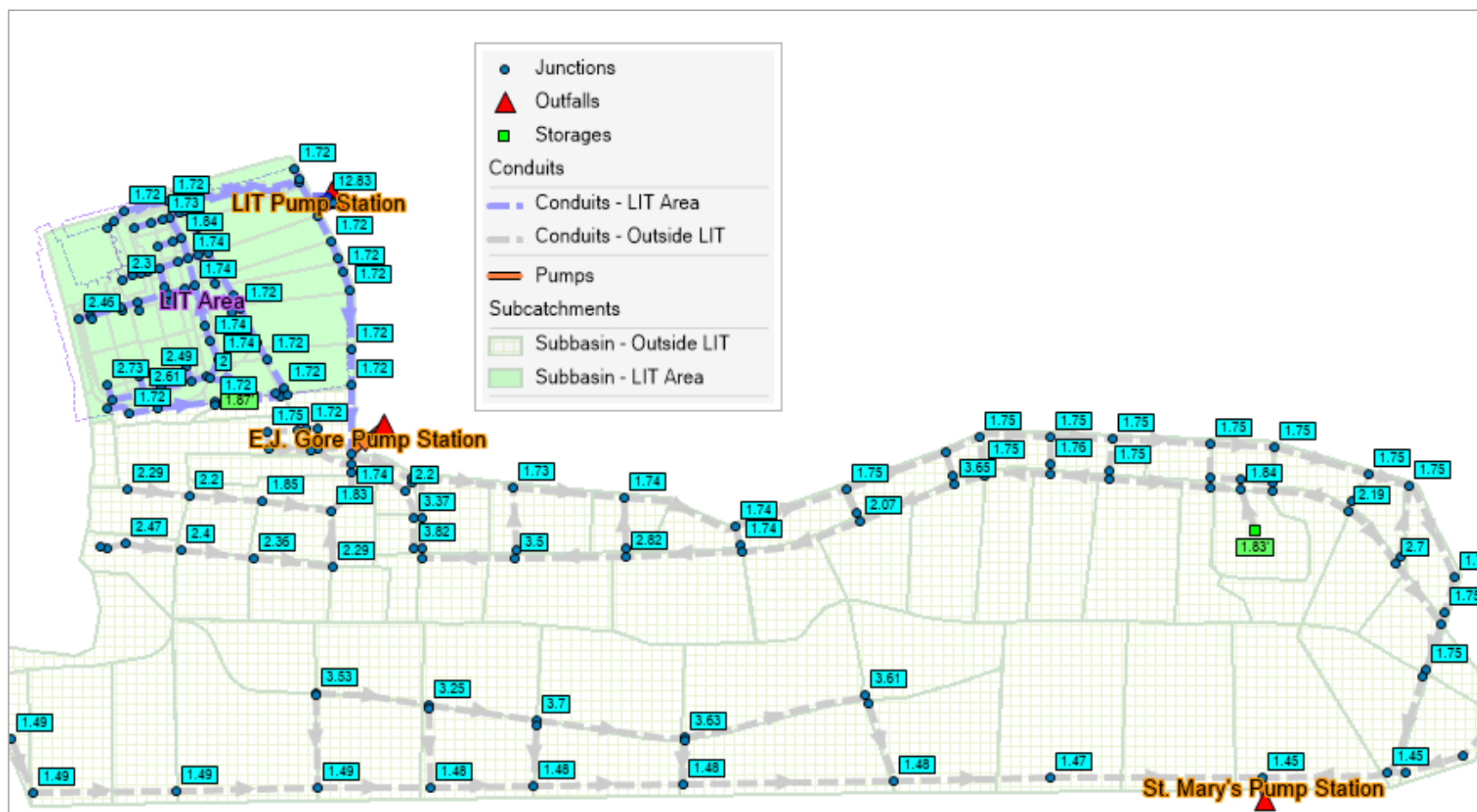


Figure 19 Future Condition Model of the LIT Watershed

Similar to the pre-project analysis described earlier, the future condition SWMM model was run for five days, simulating a 24-hour design storm event with a rainfall depth of 15.5 inches. The results of the post-project simulation indicate that the total surface runoff volume generated across the watershed is 9493.4 acre-feet, with an infiltration loss of 2778.5 acre-feet (Appendix A-2).

Selected subbasins for post-project runoff comparison

LIT Area

LIT Pump Station

LIT Area

LIT Pump Station

29
June 21, 2024

Table 5 Post-Project Runoff Matrix for Selected SWMM Subbasins

Name	Area (ac)	Infiltration (in)	Imperv. Runoff (in)	Perv Runoff (in)	Runoff Depth (in)	Runoff Volume (MG)	Peak Runoff (cfs)	Runoff Coefficient
L-1_1	14.64	0.00	15.45	0.00	15.45	6.14	40.63	1.00
L-1_2	15.51	0.00	15.45	0.00	15.45	6.51	42.46	1.00
L-12	4.66	5.26	3.87	6.36	10.23	1.30	14.65	0.66
L-13_1	5.88	1.27	9.27	4.94	14.21	2.27	19.91	0.92
L-14	25.27	3.17	2.32	10.01	12.33	8.46	61.88	0.80
L-15	39.22	2.72	3.87	8.91	12.78	13.61	106.37	0.82
L-156	73.30	1.37	1.70	12.43	14.13	28.12	184.85	0.91
L-17	13.91	2.58	3.87	9.05	12.91	4.88	41.61	0.83
L-18_2	27.79	1.72	7.73	6.03	13.76	10.38	86.91	0.89
L-18_3	18.43	2.81	3.87	8.81	12.68	6.34	46.69	0.82
L-18_4	7.94	2.62	3.87	9.01	12.88	2.78	23.14	0.83
L-19	11.60	1.67	7.73	6.08	13.81	4.35	37.53	0.89
L-19_1	7.43	2.44	3.87	9.18	13.05	2.63	24.17	0.84
L-2_1	15.94	0.00	15.45	0.00	15.45	6.69	43.37	1.00
L-2_2	16.66	0.00	15.45	0.00	15.45	6.99	44.83	1.00
L-3	79.96	1.23	10.05	4.20	14.25	30.94	253.56	0.92
L-34	13.99	3.39	1.81	10.30	12.11	4.60	31.50	0.78
L-35_1	5.32	1.61	7.73	6.14	13.88	2.00	17.79	0.90
L-35_2	4.76	1.60	7.73	6.15	13.88	1.79	15.96	0.90
L-48_1	15.83	0.00	15.45	0.00	15.45	6.64	43.13	1.00
L-48_2	16.66	0.00	15.45	0.00	15.45	6.99	44.84	1.00
L-5_1	14.31	0.00	15.45	0.00	15.45	6.00	39.92	1.00
L-5_2	15.21	0.00	15.45	0.00	15.45	6.38	41.85	1.00
L-50_1	2.56	2.45	3.87	9.18	13.05	0.91	8.31	0.84
L-50_3	6.43	5.25	3.87	6.37	10.24	1.79	20.36	0.66
L-50_4	1.98	2.43	3.87	9.19	13.06	0.70	6.48	0.84
L-50_5	2.77	2.42	3.87	9.21	13.08	0.99	9.15	0.84
L-51	7.51	1.66	7.73	6.09	13.83	2.82	24.55	0.89
L-51_1	8.43	2.52	3.87	9.11	12.98	2.97	26.29	0.84
L-51_2	2.66	2.36	3.87	9.26	13.13	0.95	8.92	0.85
L-52_1	3.46	2.38	3.87	9.24	13.11	1.23	11.54	0.85
L-52_3	10.22	2.49	3.87	9.14	13.00	3.61	32.41	0.84
L-52_4	6.68	2.44	3.87	9.19	13.06	2.37	21.82	0.84
L-53	8.98	2.52	3.87	9.11	12.98	3.16	28.01	0.84
L-62_1	6.80	2.47	3.87	9.16	13.03	2.41	21.86	0.84
L-62_3	8.85	0.00	15.46	0.00	15.46	3.71	30.24	1.00
L-62_4	3.03	0.78	11.60	3.10	14.70	1.21	10.34	0.95
L-63_1	4.66	2.39	3.87	9.23	13.10	1.66	15.48	0.85
L-63_2	6.41	0.00	15.47	0.00	15.47	2.69	22.05	1.00
L-63_6	2.28	2.35	3.87	9.28	13.15	0.82	7.67	0.85
L-68	4.88	0.00	15.47	0.00	15.47	2.05	16.79	1.00

Name	Area (ac)	Infiltration (in)	Imperv. Runoff (in)	Perv Runoff (in)	Runoff Depth (in)	Runoff Volume (MG)	Peak Runoff (cfs)	Runoff Coefficient
L-69	8.43	2.56	3.87	9.07	12.93	2.96	25.55	0.83
L-7_1	6.11	2.51	3.87	9.12	12.99	2.15	19.17	0.84
L-7_2	5.27	2.49	3.87	9.14	13.01	1.86	16.75	0.84
L-7_3	3.06	2.37	3.87	9.26	13.13	1.09	10.24	0.85
L-70_2	5.05	0.79	11.60	3.08	14.68	2.01	17.21	0.95
L-70_3	5.57	0.00	15.46	0.00	15.46	2.34	19.11	1.00
L-70_4	7.36	0.80	11.60	3.07	14.67	2.93	24.97	0.95
L-8_2	5.16	2.46	3.87	9.17	13.04	1.83	16.71	0.84
L-8_3	3.40	2.41	3.87	9.21	13.08	1.21	11.23	0.84
L-8_4	3.76	2.42	3.87	9.20	13.07	1.34	12.38	0.84
L-86	25.70	9.17	1.86	4.48	6.33	4.42	57.16	0.41
L-87	28.13	8.94	2.32	4.23	6.56	5.01	58.83	0.42
L-89	10.55	2.81	3.87	8.82	12.69	3.64	26.89	0.82
L-9_3	3.74	0.78	11.60	3.10	14.70	1.49	12.75	0.95
L-9_4	4.93	0.78	11.60	3.09	14.70	1.97	16.84	0.95
L-91	57.55	2.17	2.63	10.69	13.32	20.82	116.51	0.86
L-99	32.30	1.10	3.87	10.53	14.39	12.63	91.90	0.93
Weighted Avg:		2.13	6.80	6.56	<u>13.36</u>	11.61	85.64	0.86
Total	<u>778.87</u>					<u>282.54</u>		

6.3. Proposed Water Control Structures

The Port NOLA has proposed a new pump station along the Forty Arpent canal (see Figure 21) that has a capacity of 400 cfs, with a potential for additional operational redundant pumps. The pumps will be vertical pumps and they will start pumping at -0.5' NAVD and stop pumping at -1.0' NAVD, which is the same operational scenario as the existing E. J. Gore Pump Station.

The proposed 25-acre detention basin will have an invert elevation of -3.5' and the top of the embankment will be at +4' which is well above maximum expected hydraulic grade line (HGL).

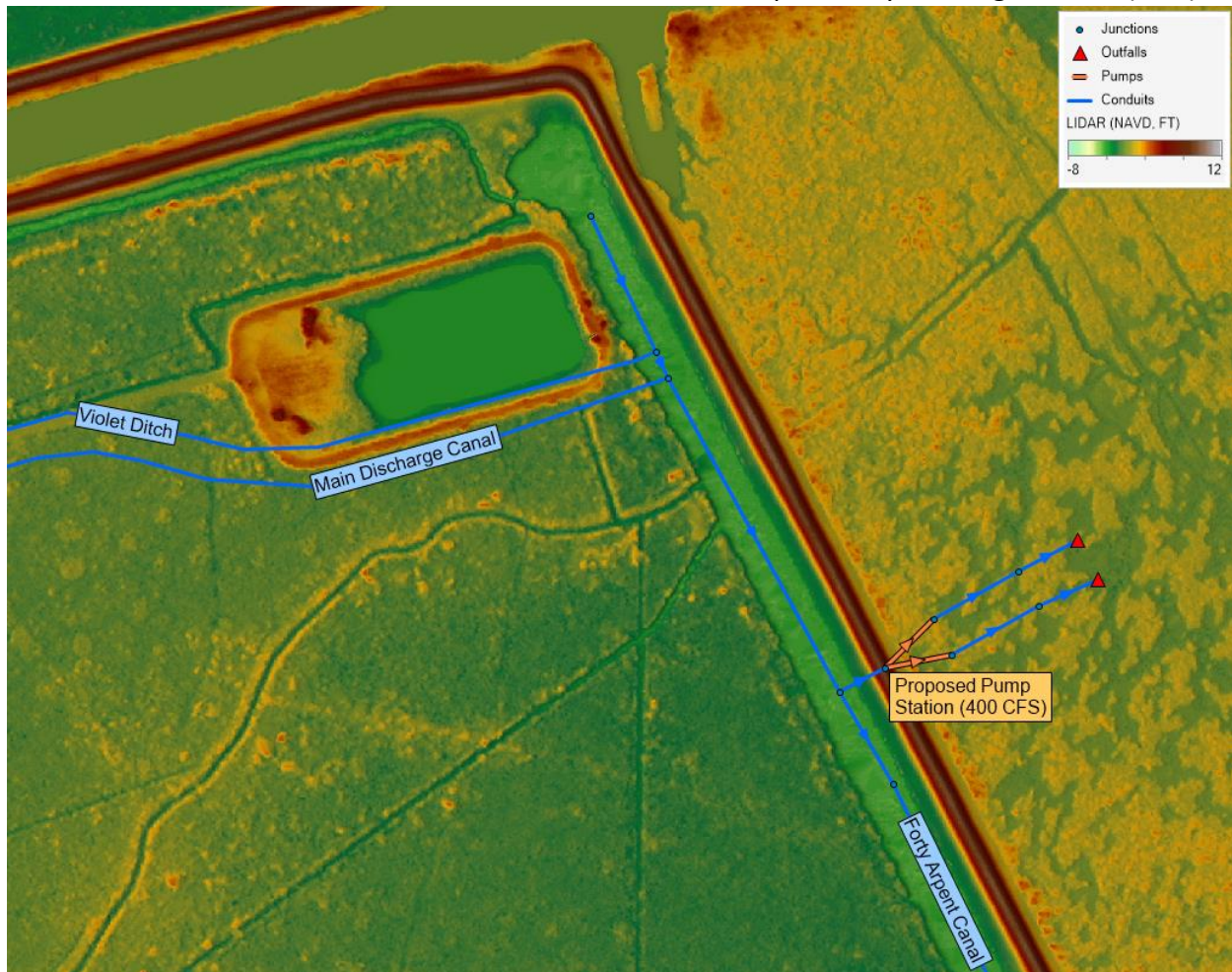


Figure 21 New LIT Pump Station Location

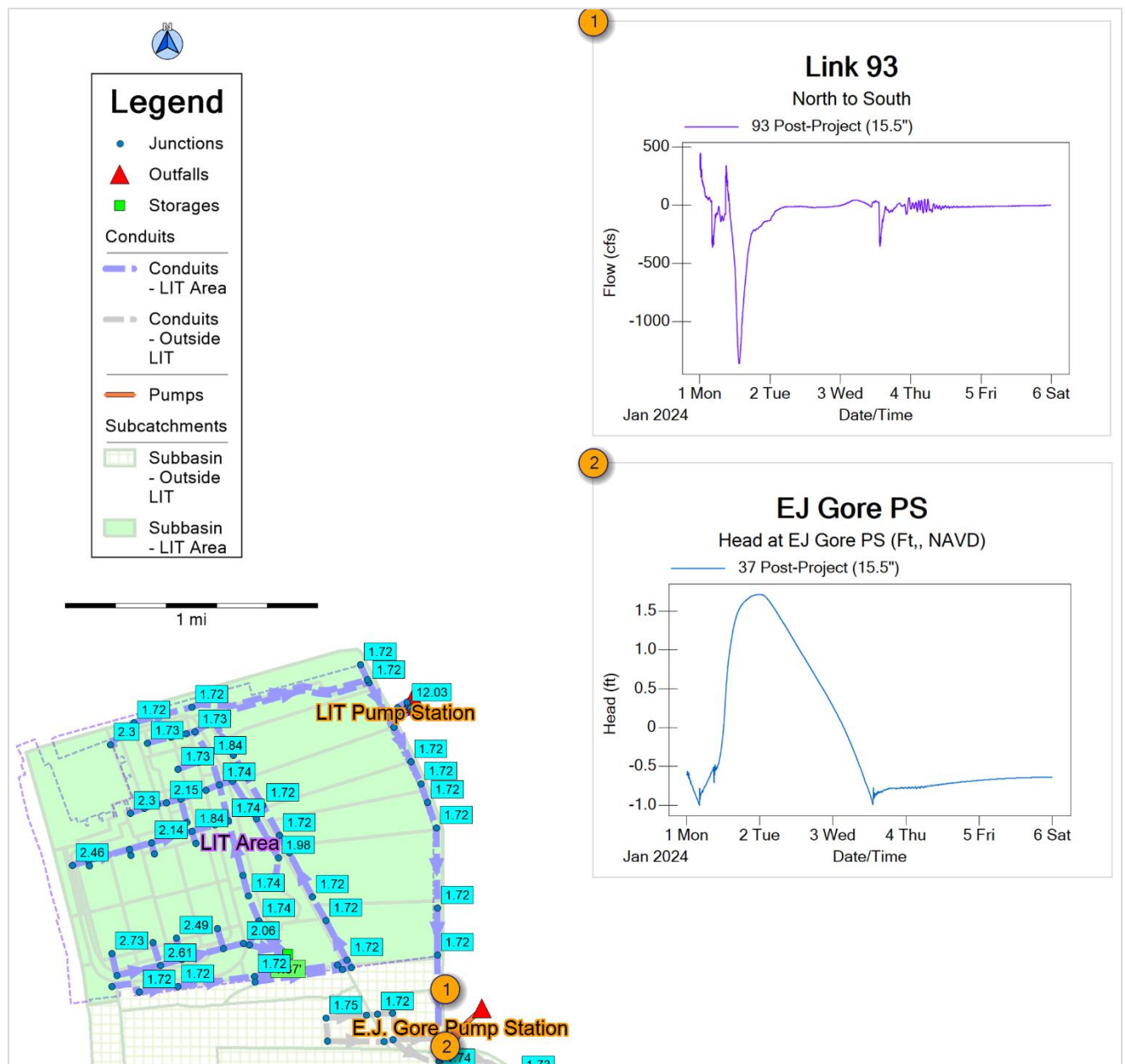


Figure 22 Post-Project Design Storm (15.5") HGLs and Flow/Head at EJ Gore PS

7. Impact of Design Storm Runoff Change on the Adjacent Properties and Existing Drainage Network

Upon comparing the post-project runoff volumes and coefficients with the pre-project values for a 100-Yr design storm, it is evident that the proposed development would result in a small increase in stormwater runoff. The pre-project runoff volume from the area selected for

development is 260.4 million gallons (MG), with a weighted average runoff coefficient of 12.4 inches. In contrast, the post-project runoff volume from the same developed area is 282.5 MG, representing an increase of 8.5 MG. Similarly, the weighted average runoff coefficient has increased from 12.4 inches to 13.36 inches, indicating a higher proportion of impervious surfaces and reduced infiltration in the developed area. This increase in runoff volume and coefficients is mainly attributed to the introduction of impervious surfaces, such as container yards buildings, roads, and other infrastructure, within the developed area. The conversion of previously undeveloped land to impervious surfaces reduces the ability of the soil to absorb and infiltrate rainfall, leading to a higher volume of surface runoff. It is to be noted that the detention basin offsets some of the increase in runoff volume/rate, which is not counted in these calculations.

With the new pump station pumping 400 cfs from the Forty Arpent Canal into the central wetlands, the detention basin reducing the peak flow from the developed area, and other stormwater management strategies aimed at protecting the Violet community from flooding, there is no net increase in flooding on the adjacent properties. As evidenced by the flow hydrographs at the Forty Arpent canal next to the existing EJ Gore Pump Station (Figure 23), the volume of water reaching the pump station is reduced substantially while the water level at EJ Gore remained practically constant during the flow and reduced afterward (see Figure 24). The new LIT pump station helps to reduce the flooding in the watershed for an extended period and does not negatively affect areas south of EJ Gore Pump Station. The effectiveness of the pump station in reducing the peak stage is insignificant because of the vast area of remaining wetland on the east of East Judge Perez acts as a floodplain storage during large events. Most of that area is already underwater as the pumps start operating at -0.5' NAVD.

The new 400 cfs pump station, discharging directly into the central wetlands on the east side of the Forty-Arpent levee, is expected to have a minimal impact on water levels, given the vast expanse of the wetlands relative to the pump discharge. The station will be located on the levee behind the Forty Arpent Canal with the storm water discharge pipes located on the east side of the tidal levee. A stilling basin will be built for the discharge pipes to prevent erosion in the outfall area of the discharge pipes.

To reduce the chance of flooding in the Violet community south of Violet Canal, the community's drainage will be routed to the north side of the project site to discharge directly to the Forty Arpent canal. A berm (Item 26 in Master Plan Layout, Appendix A-6) will be built to separate the LIT site drainage from the Violet Community drainage.

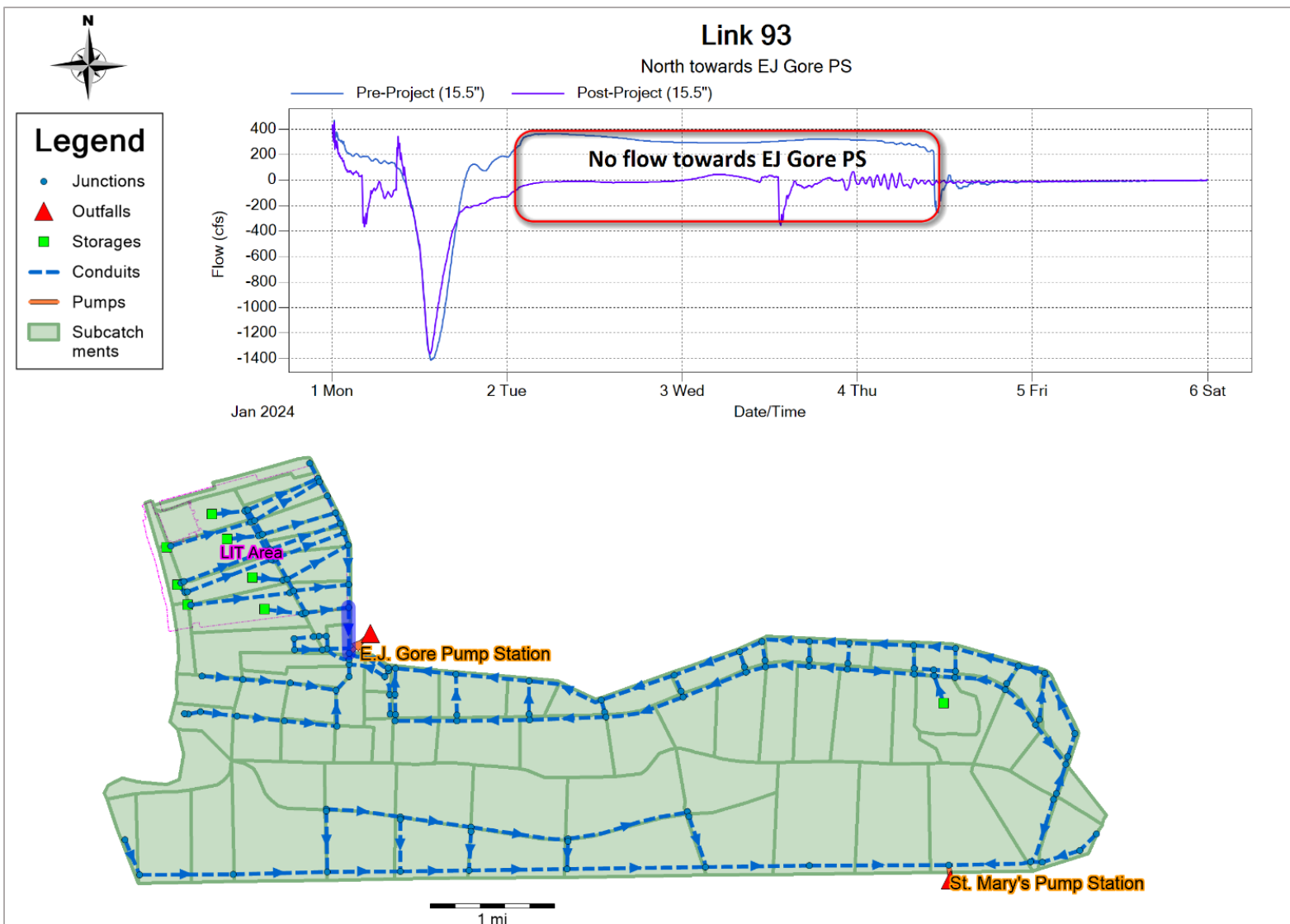


Figure 23 Flow Towards EJ Gore PS

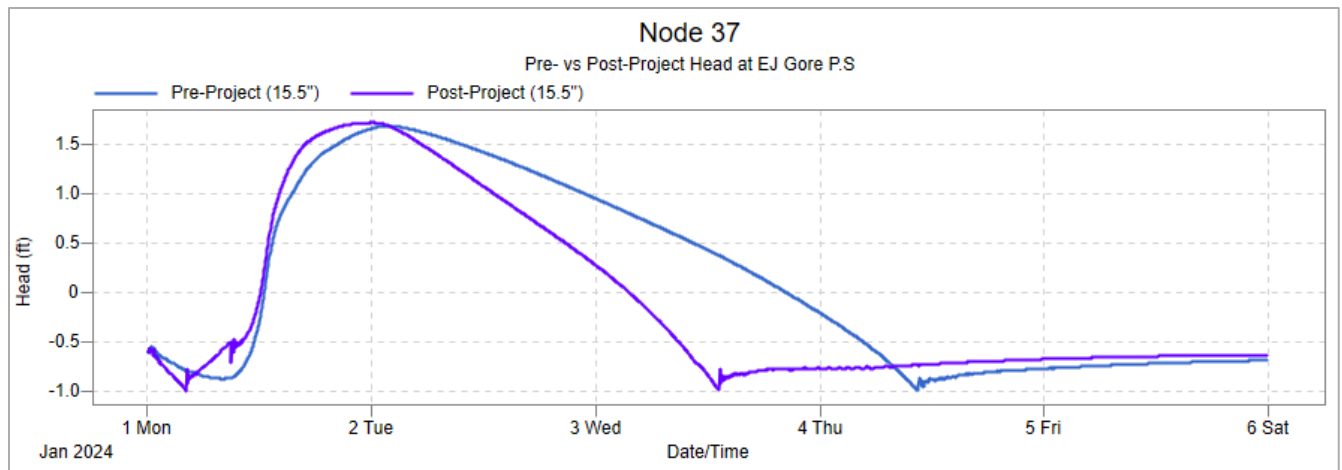


Figure 24 Pre- Vs Post-Project Head at EJ Gore PS

8. Response of Existing Drainage Network to the Proposed Modification under Normal and Category 1 Tropical Storm Event with Associated Storm Surge

Under normal rainfall conditions, the proposed stormwater management system, including the detention basin, new pump station, and improved drainage channels, is designed to effectively handle the increased runoff volumes from the LIT development. The detention basin will help attenuate peak flows, while the new 400 cfs pump station will provide additional discharge capacity into the adjacent marshes, reducing the burden on the existing E. J. Gore Pump Station.

During a Category 1 tropical storm event with associated storm surge, the perimeter levee system constructed as part of the Hurricane and Storm Damage Risk Reduction System (HSDRRS) will play a crucial role in protecting the project area from coastal flooding. The HSDRRS, designed to protect the Greater New Orleans area from the 1-percent annual chance flood, will safeguard the LIT site from storm surge inundation. However, it is essential to consider the potential impacts of heavy rainfall and increased runoff volumes during such an event. The stormwater management system, including the detention basin and new pump station, will be critical in mitigating the risk of localized flooding within the developed areas and preventing adverse impacts on adjacent properties and the existing drainage network.

The detention basin's capacity and the new pump station's discharge rate have been designed to accommodate the anticipated runoff volumes from a Category 1 tropical storm event, ensuring that excess stormwater is effectively conveyed and discharged into the adjacent marshes without overwhelming the existing drainage infrastructure. Furthermore, the proposed drainage improvements, such as the dedicated open channels and the separation of the Violet community's drainage system, will help minimize the risk of backflow and flooding in the surrounding areas.

9. Evaluation of Short- and Long-term Changes Anticipated to the Hydrologic System.

The proposed development of the LIT site will inevitably bring about changes to the existing hydrologic system, both in the short and long term.

In the short term, during the construction phase, the following changes can be expected:

- Increased erosion and sedimentation due to land disturbance and vegetation removal; however, the Port's construction contractor will adhere to a Stormwater Pollution Prevention Plan (SWPPP) that includes adequate erosion/siltation control measures around land-based earthwork to ensure that no project related sediments, debris, or other pollutants enter adjacent wetlands or Lake Borgne Canal. Control techniques will be installed prior to the commencement of earthwork activities and maintained until the project is complete and/or subject areas are stabilized.
- Temporary alterations in drainage patterns and flow paths as the site is graded and the new drainage network is constructed.

In the long term, after the completion of the development, the following changes are anticipated:

- Increased impervious surfaces (container yard, buildings, roads, parking areas) will lead to higher runoff volumes and peak flows, potentially exacerbating flooding risks if not properly managed.
- The new drainage network, including the open channels, detention basin, and pump station, will alter the timing and patterns of stormwater discharge into the Forty Arpent Canal and adjacent marshes.
- Changes in water quality due to potential pollutants from the developed areas.

To address these long-term changes, the proposed stormwater management system has been designed to accommodate the increased runoff volumes and mitigate potential flooding risks. The detention basin will attenuate peak flows, while the new pump station will provide additional discharge capacity into the adjacent marshes, reducing the burden on the existing EJ Gore Pump Station. Any runoff falling on maintenance areas with the potential for petroleum contamination will be routed to the sanitary sewer system. The entire terminal will be designed with the capability of isolating any spills for cleanup.

By proactively addressing both short- and long-term changes, the proposed development aims to minimize adverse impacts on the hydrologic system and ensure the long-term sustainability and resilience of the stormwater management infrastructure.

10. Conclusions

Based on the hydrologic and hydraulic modeling and analysis conducted for the proposed LIT development, the following conclusions can be drawn:

- Impact on stormwater runoff: The proposed development will result in an increase in impervious surfaces, leading to slightly higher stormwater runoff volumes and peak flow rates compared to the pre-development conditions. However, the increase in post-project runoff volume from the developed area would be temporarily stored in the detention basin to reduce peak flow rate.
- Stormwater management strategies: To mitigate the potential impacts of increased runoff volumes/peak flows, and minimize adverse impacts to surrounding communities, a comprehensive stormwater management system has been proposed, including:
 - A 25-acre detention basin to attenuate peak flows and promote water quality improvement through sedimentation processes.
 - A new 400 cfs pump station (LIT Pump Station) to draw water from the Forty Arpent Canal into the adjacent central wetland area, providing additional discharge capacity and mitigating adverse impact to EJ Gore Pump Station.
 - Separation of the Violet community's drainage system with a separate open channel draining to the Forty Arpent Canal.
 - A structured network of open channels and conveyance systems to efficiently route runoff from the developed area west of EJP highway to the Forty Arpent Canal.
- Impact on adjacent properties and the existing drainage network is expected to be minimal:
 - The detention basin and new pump station will effectively manage the additional runoff, reducing the burden on the existing EJ Gore Pump Station and preventing any adverse impacts on areas south of EJ Gore Pump Station.
 - The separation of the Violet community's drainage system will protect this area from potential backflow and flooding risks associated with the increased runoff volumes.
 - While the total runoff volume across the entire watershed may have increased slightly, the localized impacts within the developed areas have been addressed through the proposed stormwater management strategies.
 - Ongoing monitoring and adaptive management will be essential to ensure that the stormwater management measures are working effectively and address any unanticipated impacts on the water flow and drainage system.

Appendix

A-1 Pre-Project Runoff Quantity and Flow Routing Continuities Under Design Storm for the Total Watershed

A-2 Post-Project Runoff Quantity and Flow Routing Continuities Under Design Storm for the Total Watershed

A-3 Master Plan Layout Phase 1-A

A-4 Master Plan Layout Phase 1-B

A-5 Master Plan Layout Phase 2

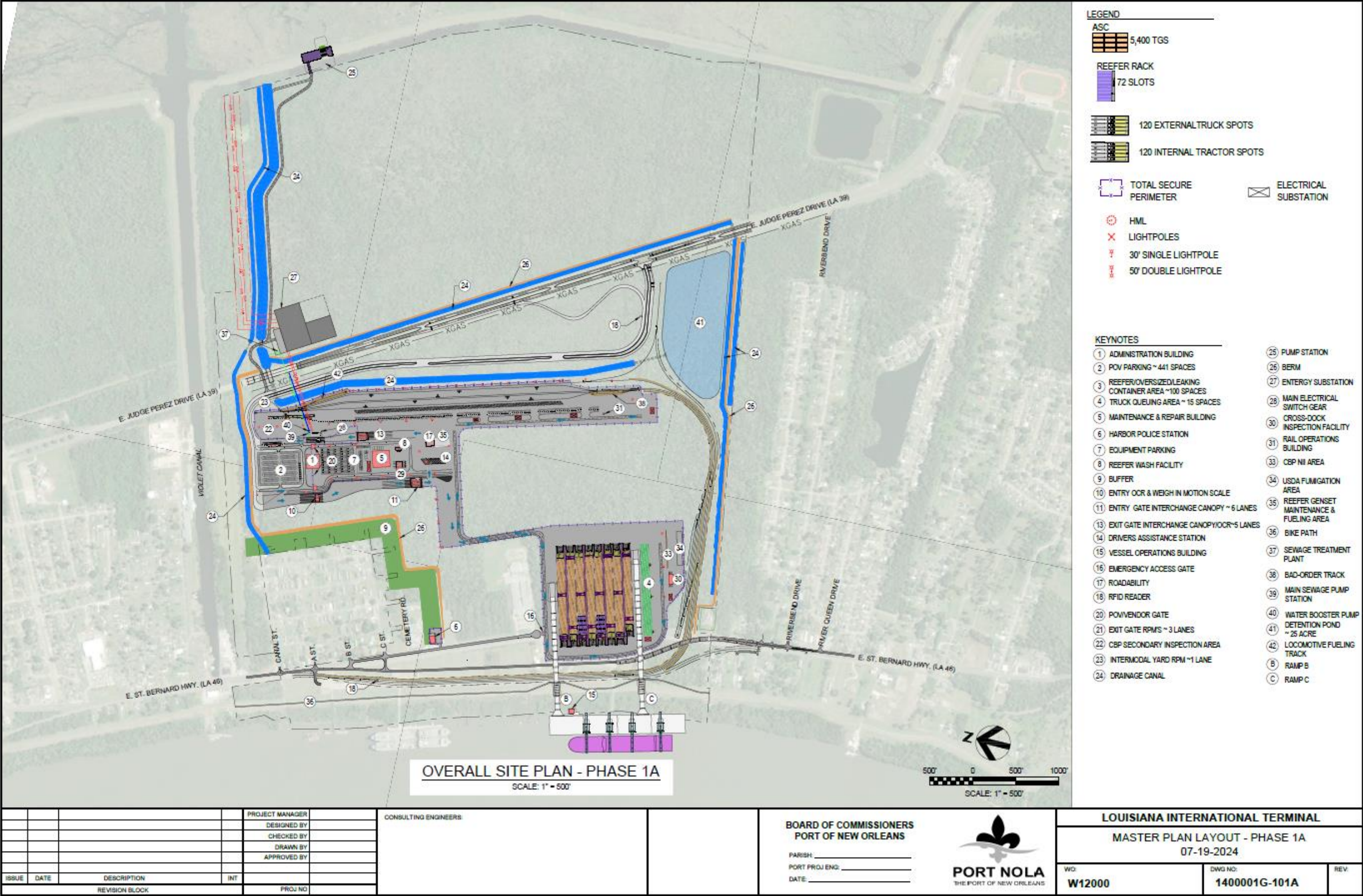
A-6 Master Plan Layout Phase 3

*****	Volume	Depth
Runoff Quantity Continuity	acre-feet	inches
*****	-----	-----
Total Precipitation	12278.827	15.500
Evaporation Loss	0.000	0.000
Infiltration Loss	2838.088	3.583
Surface Runoff	9435.690	11.911
Final Storage	5.784	0.007
Continuity Error (%)	-0.006	
*****	Volume	Volume
Flow Routing Continuity	acre-feet	10^6 gal
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	9435.415	3074.671
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	9668.367	3150.582
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	4213.344	1372.981
Final Stored Volume	4012.451	1307.517
Continuity Error (%)	-0.235	

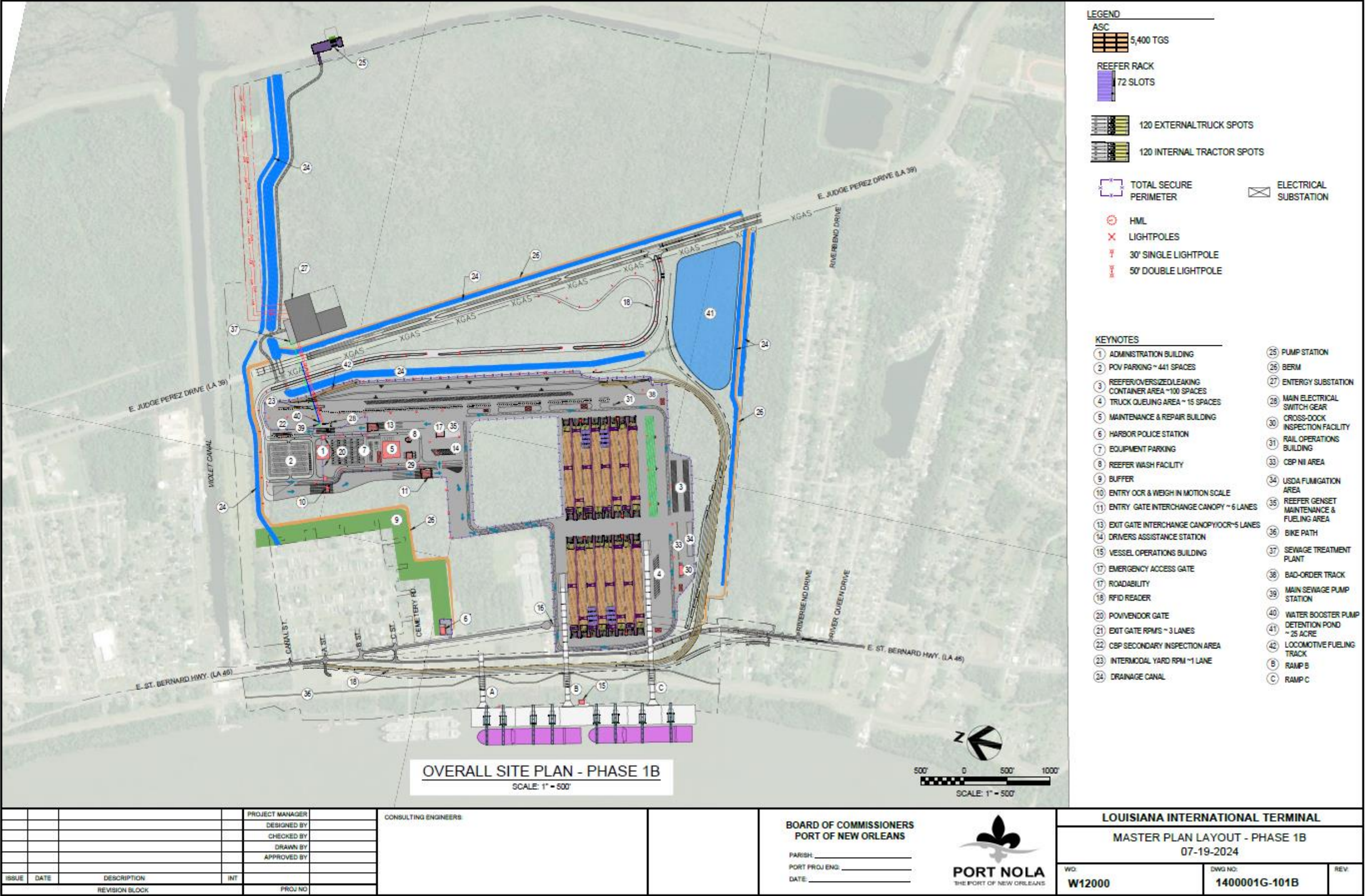
A-1 Pre-Project Runoff Quantity and Flow Routing Continuities Under Design Storm for the Total Watershed

*****	Volume	Depth
Runoff Quantity Continuity	acre-feet	inches
*****	-----	-----
Total Precipitation	12277.932	15.501
Evaporation Loss	0.000	0.000
Infiltration Loss	2778.492	3.508
Surface Runoff	9493.402	11.985
Final Storage	6.811	0.009
Continuity Error (%)	-0.006	
*****	Volume	Volume
Flow Routing Continuity	acre-feet	10^6 gal
*****	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	9493.333	3093.544
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	9730.423	3170.804
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	4314.027	1405.790
Final Stored Volume	4082.645	1330.391
Continuity Error (%)	-0.041	

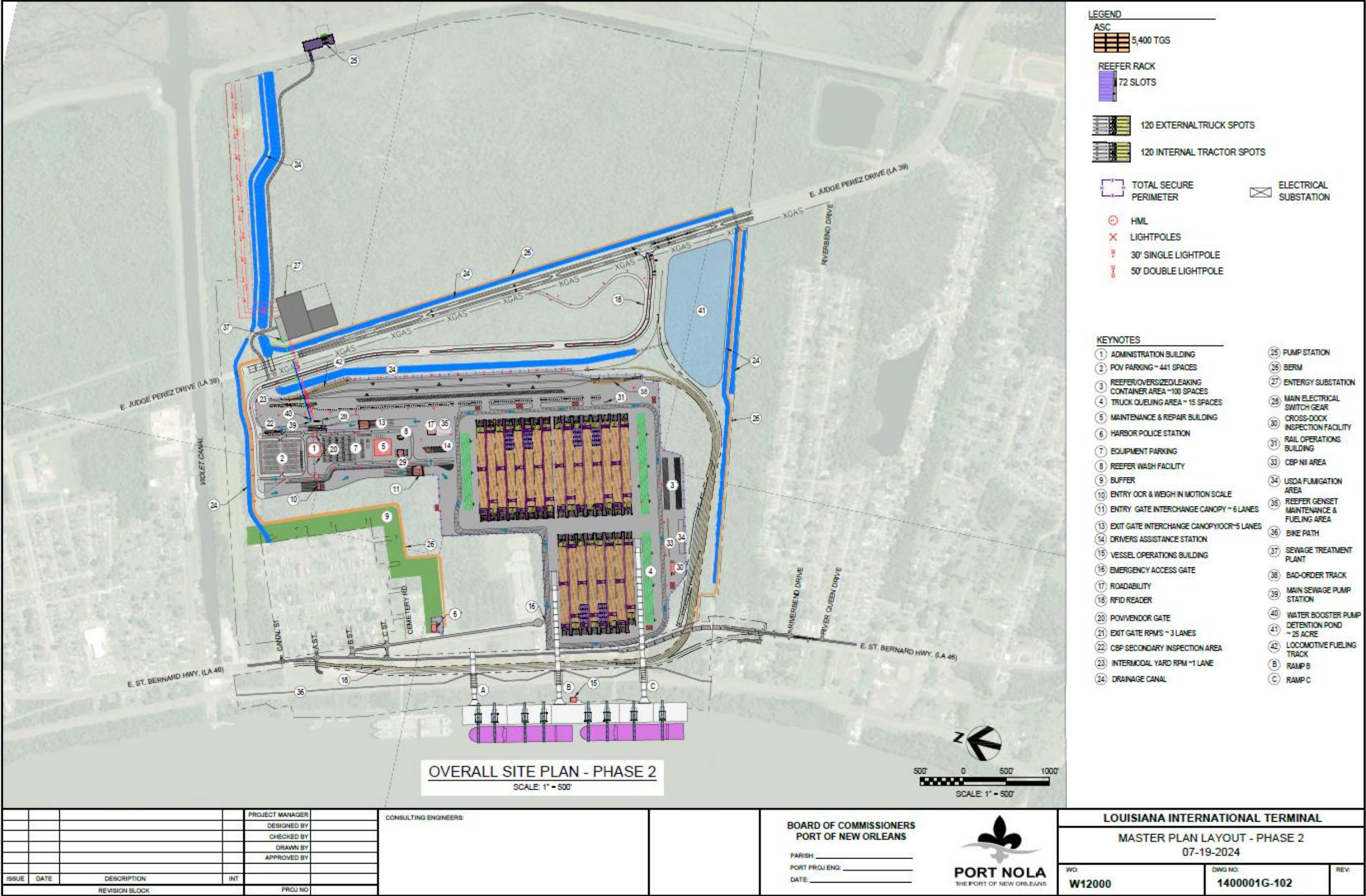
A-2 Post-Project Runoff Quantity and Flow Routing Continuities Under Design Storm for the
Total Watershed



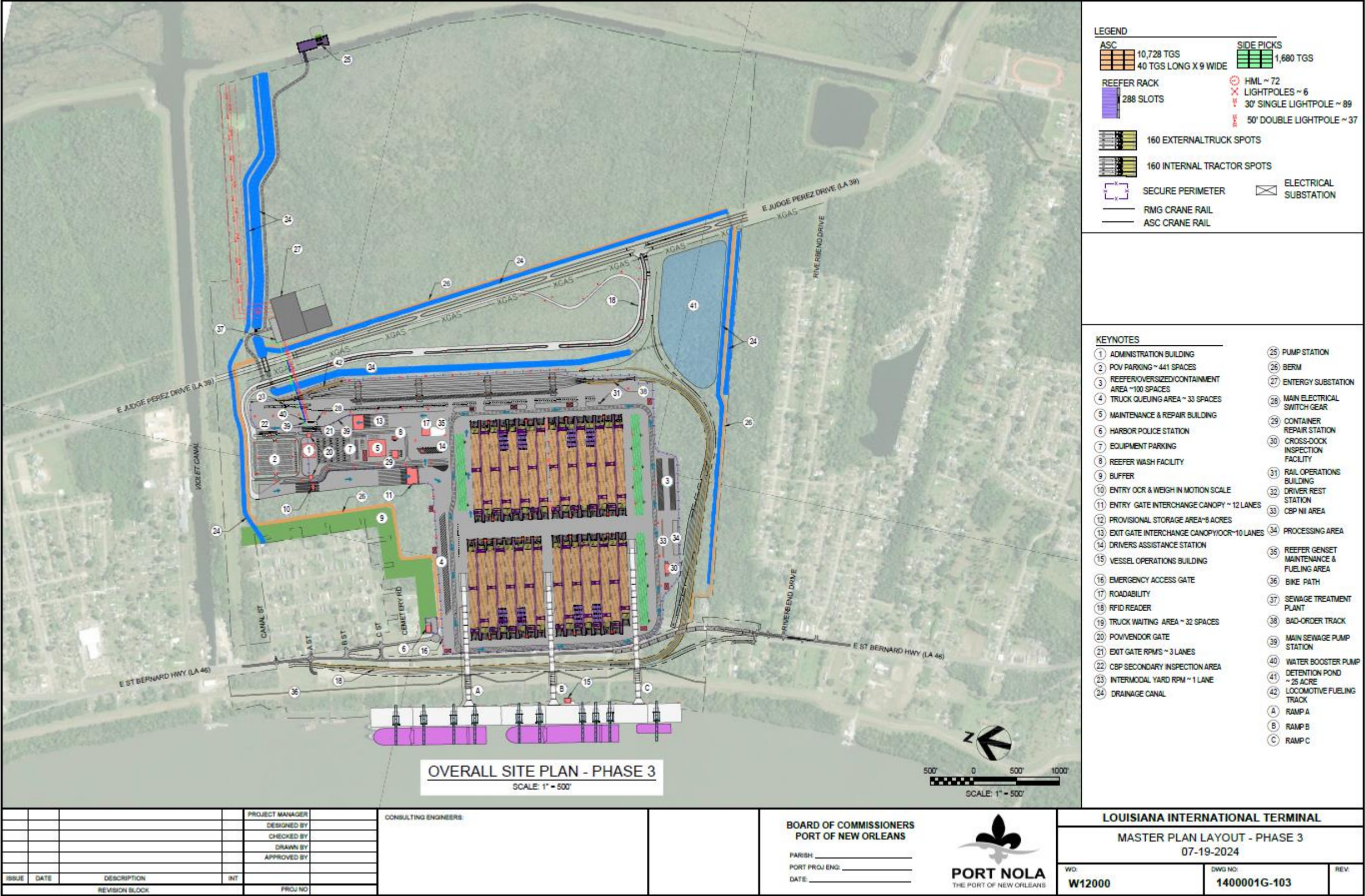
A-3 Master Plan Layout Phase 1-A



A-4 Master Plan Layout Phase 1-B



A-5 Master Plan Layout Phase 2



A-6 Master Plan Layout Phase 3