

Drainage Report

SR-710 (Warfield Blvd/Beeline Highway)

From East of SR 76 to Martin/Palm Beach County Line

FPID No. 432705-1-52-01

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Prepared For:



**Florida Department of Transportation
District IV**

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SR 710
(WARFIELD BLVD. /
BEELINE HIGHWAY)
DRAINAGE REPORT

From E of SR 76 to
Palm Beach/Martin
County Line
(M.P. 0.552 to
M.P. 6.124)

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INTRODUCTION

The Florida Department of Transportation (FDOT) is proposing to widen SR 710 (Warfield Blvd./Beeline Highway) from a two-lane section to a four-lane divided rural roadway. The proposed limits of the project are from east of SR 76 to the Martin/Palm Beach County Line (milepost 0.552 to 6.124), approximately 5.7 miles. In order to accommodate the proposed widening, stormwater treatment and attenuation will be provided by roadside dry detention swales. The dry detention swales will discharge to the adjacent wetlands north of SR 710, known as the John C. and Mariana Jones / Hungryland Wildlife and Environmental Area. Refer to [Figure 1](#) in [Appendix A](#) for the Project Location Map.

Currently, the surrounding lands consist of conservation lands and agricultural farmlands. The SR 710 alignment runs parallel to a CSX railroad that provides both freight and passenger service. The CSX railroad lines parallel SR 710 on the south side of the roadway right-of-way but do not cross SR 710 within the project limits. The railroad tracks are offset from the shared right-of-way line on the south side of SR 710 by 100 feet to the south. There are several perpendicular cross streets which connect to SR 710 and cross the CSX tracks within the project limits. Refer to [Figure 2](#) in [Appendix A](#) for the Land Use Maps.

This project is located in Martin County, Florida, within Sections 9, 15, 16, 22, 23, 24 and 25 of Township 40 South, Range 39 East and Sections 30 and 31 of Township 40 South, Range 40 East.

The project corridor is located within the jurisdictional boundary of the South Florida Water Management District (SFWMD). The regulations of SFWMD will govern the minimum stormwater management design criteria for the project; however, the proposed stormwater management system will also conform to any additional design requirements of the Florida Department of Environmental Protection (FDEP) and United States Army Corps of Engineers (USACE).

For continuity with the previous drainage evaluations performed for the SR 710 corridor, the project limits have been differentiated into four main drainage systems based on existing geographical, topographical and waterbody discharge divides, as well as based on adjacent existing and proposed projects within the corridor.

1.1 PROJECT BACKGROUND

The SR 710 corridor is part of the State of Florida's Strategic Intermodal System (SIS), connecting to major roadways (SR 70, SR 76, Florida's Turnpike, and I-95). In order to meet SIS standards, the segment of SR 710 from SR 76 to the Pratt Whitney Entrance will need to be widened from a two-lane undivided facility to four lanes divided. In addition, SR 710 is designed to enhance the economic growth of Florida by connecting residential and employment centers throughout Central Florida to the West Palm Beach urbanized area. The proposed improvements will also enhance access to, as well as alleviate congestion on, significant north-south and east-west transportation corridors within the region. Based on a Project Development and Environment (PD&E) Study undertaken by the FDOT for the entire SR 710 corridor, the Level of Service (LOS) conditions of this roadway section are anticipated to decline if no capacity improvements are made. This project, from east of SR 76 to the Martin/Palm Beach County Line is one of

several proposed by the Department (FDOT), designed to increase the capacity and Level of Service of SR 710, as well as upgrading the facility to meet current SIS standards.

1.2 SCOPE

This Drainage Report describes the existing drainage conditions and addresses the proposed drainage improvements for the SR 710 corridor from east of SR 76 to the Martin/Palm Beach County Line. It has been prepared as part of the Environmental Resource Permit (ERP) package to be submitted to SFWMD for review and approval.

The scope of this Drainage Report consists of addressing the permitting water quality and water quantity requirements as well as the establishment of a detailed hydrologic and hydraulic model to evaluate the existing and proposed drainage conditions (flood stages and discharges) within the limits of the project. The analysis demonstrates that the proposed improvements will have no negative drainage impacts to the surrounding areas and that the proposed stormwater management facilities will have the capacity to adequately treat and attenuate roadway runoff within the project limits.

The proposed stormwater management facilities have been designed to conform to SFWMD water quality and water quantity criteria, with consideration of several design constraints, including avoidance of right-of-way acquisition, and avoidance and minimization of wetland impacts.

DATA COLLECTION

Field and record data collected for this project includes previously issued plans or permits, as-built plans, field reviews, topographic survey, geotechnical testing, and aerial image observation. Topographic survey was provided by FDOT for the entire project limits, with supplemental topographical information provided in the form of proposed design files for the projects located at the eastern and western limits. In addition to topographic survey, the Department also provided survey information for existing cross drains that traverse the corridor within the project limits. Additionally, FDOT furnished geotechnical data, including piezometer readings to be used in the determination of the seasonal high ground water table (SHGWT) elevation.

The topographic survey was used to develop base maps and assist in establishing the pre-development hydrologic and hydraulic conditions. Existing SFWMD permits, FDOT PD&E Study documents, and FDOT as-built plans were obtained and used to establish existing drainage conditions for the drainage design and modeling, and permit application submittal.

DESIGN CRITERIA AND PARAMETERS

3.1 DATUM CONVERSION

The vertical datum used in this report and calculations is NAVD 88. The datum shift was determined using the US Army Corps of Engineers CORPSCON conversion tool. The datum shift used to convert NGVD 29 to NAVD 88 within the study area is summarized in [Table 1](#) below, refer to [Appendix D](#) for the Orthometric Height Conversion.

Table 1 – Datum Conversion from NGVD 29 to NAVD 88

Location	Latitude	Longitude	Conversion (ft.)
SR 710	26°59' 9.19" N	80°25' 0.69" W	-1.38

3.2 STORMWATER QUALITY CRITERIA

The SFWMD has the lead jurisdiction over the stormwater quality criteria for the project and generally requires that all projects meet state water quality standards, as set forth in Chapter 17-302, Florida Administrative Code (FAC). According to the SFWMD Permit Volume IV, all projects must meet the following volumetric retention/detention requirements:

1. For wet detention systems, the first inch of runoff from the project or the total runoff from 2.5 inches times the percent of imperviousness, whichever is greater, must be detained on site. A wet detention system is a system that maintains the control elevation at the seasonal high groundwater elevation and does not bleed down more than one-half inch of detention volume in 24 hours;
2. Dry detention systems must provide 75 percent (75%) of the required wet detention volume. Dry detention systems must maintain the control elevation at or above one foot above the seasonal high groundwater elevation;
3. Retention systems must provide 50 percent (50%) of the wet detention volume; and
4. For projects with more than 50 percent (50%) of imperviousness, discharge to the receiving water bodies must be made through baffles, skimmers, or other mechanisms suitable from preventing oil and grease from discharging to or from the retention/detention areas.

3.3 STORMWATER QUANTITY CRITERIA

3.3.1 South Florida Water Management District (SFWMD)

SFWMD requires that offsite discharge rates be limited to rates not causing adverse impacts to existing off-site properties, and:

1. Historic discharge rates,
2. Rates determined in previous SFWMD permit action, or
3. Basin allowable discharge rates.

The project primarily lies within the SFWMD C-44 Drainage Basin, with the exception of a short segment of the project which extends into the SFWMD Pal Mar Basin. The closest receiving waterbody within the vicinity of the project is the John C. and Mariana Jones / Hungryland Wildlife and Environmental Area. According to the SFWMD ERP Handbook (Volume 2), the District does not have specific requirements governing allowable peak discharges within the C-44 Drainage Basin or the Pal Mar Drainage Basin. Accordingly, Pre-vs-Post Development peak discharge requirements will govern allowable offsite stormwater discharges for this project. Refer to [Figure 6 in Appendix A](#) for the SFWMD Drainage Basin Map, as well as an excerpt from the SFWMD ERP Applicant's Handbook Volume 2 regarding maximum allowable discharge rates.

SFWMD requires that the post-development peak discharge rate for the 25-year, 72-hour rainfall event does not exceed the pre-development peak discharge rate for the 25-year, 72-hour rainfall event. Since flood routing was not completed for the original SR 710/Beeline Highway project, the pre-development peak discharge rates have been determined by modeling the existing conditions as per the topographical survey and/or permitted plans. The preliminary flood routing results indicate that pre- versus post-development peak discharge criteria is met with the proposed stormwater management facilities.

SFWMD also typically requires that provisions be made to replace or otherwise mitigate the loss of historical basin storage provided by the project. In addition, SFWMD requires flood protection within the project as follows: 1) Building finished floor elevation must be set at or above the 100-year flood elevation, as determined from the Federal Flood Insurance Rate Maps (FIRM) or 100-year – 72-hour rainfall event peak stages; and 2) Centerline of roadways must be set at or above the 5-year – 24-hour rainfall event peak stages or two feet above the seasonal high groundwater elevation, whichever is greater. However, this project lies outside of the floodplain, as such, floodplain compensation is not required for this project.

3.3.2 FEMA Floodplain Impacts

The project corridor lies within Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) Panel Nos. 12085C0275F, 12085C0500F, and 12085C0475F, and located outside of the 100-year floodplain in Zone X. Zone X is defined as areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or drainage areas less than 1 square mile; and areas protected by levees from 100-year flood. Refer to [Figure 5 in Appendix A](#) for the FEMA Map FIRMETTES.

In accordance with Executive Order 11988m "Floodplain Management", USDOT Order 5650.2, "Floodplain Management Protection", and Federal-Aid Policy Guide 23 CFR 650A, floodplains must be protected. The intent of these regulations is to avoid or minimize highway encroachments within the base floodplains, and to avoid supporting land use development incompatible with floodplain values.

Given the absence of floodplains within the project limits and the significant increase in storage within the corridor for stormwater management, there is no change in flood "risk" or adverse floodplain impacts associated with this project. Floodplain encroachment compensation is not required for this project due to the fact that it lies outside of the 100-year floodplain.

3.4 STORMWATER MANAGEMENT SYSTEM DESIGN CRITERIA

The drainage design for SR 710 has been developed based upon the stormwater quality and quantity criteria of the agencies that maintain jurisdiction over the corridor. The following subsections describe the design criteria for the available best management practices (BMP's) to meet the required stormwater quality and quantity criteria:

3.4.1 Conveyance Systems

Conveyance systems collect and carry stormwater runoff to receiving bodies of water, other conveyance systems, detention ponds, retention ponds, and French drains. The two main conveyance systems used in roadway projects are storm sewer systems and roadway and median ditches or swales. The design of both storm sewer systems and conveyance ditches/swales shall be based on FDOT drainage design criteria. The criteria are summarized as follows:

- For major expressways, a 10-year recurrence interval shall be used in the design of storm sewer systems.
- For major expressways within a sag vertical curve with no outlet other than the storm sewer, a 50-year recurrence shall be used in the design of the storm sewer system. Also, for a depressed expressway with drainage provided by a pumping station, a 50-year recurrence shall be used for the design of the storm sewer system.
- Design of storm sewer systems shall maintain hydraulic grade line (HGL) a minimum of one foot below gutter line when minor losses are not computed in the design. When minor losses are considered, HGL may be maintained at the gutter line.
- Design of storm sewer system shall maintain minimum and maximum velocities of 2.5 and 15 feet per second, respectively.
- Roadway and median ditches shall be designed to convey the 10-year frequency storm. Outfall ditches shall be designed to convey the 25-year frequency storm.
- The minimum freeboard for linear dry detention ponds (swales) is 0.5 ft.
- The maximum allowed velocity in grassed ditches shall be 5.5 feet per second. For velocities higher than 5.5 feet per second, linings other than grass shall be used such as paved concrete, flexible, riprap, geo-grid or interlocking concrete blocks.

- Two feet sumps shall be provided at all drainage structures when downstream pipe is relatively flat or when the structure has more than one pipe connection (to/from), to minimize entrance of sediments into drainage pipes.
- The minimum pipe size and design service life are 18 inches and 100 years, respectively.

3.4.2 Total Maximum Daily Load (TMDLs) and Nutrient Impaired Water Bodies

The Florida Department of Environmental Protection developed a Basin Management Action Plan (BMAP) which implements certain measures in order to restore and protect state waters and addresses Total Maximum Daily Load (TMDLs) requirements for impaired waterbodies. TMDLs represent the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards.

Section 303(d) of the federal Clean Water Act requires states to submit to the EPA lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. The Florida Department of Environmental Protection has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the Florida Watershed Restoration Act (FWRA) (Subsection 403.067[4], Florida Statutes [F.S.]); the state's 303(d) list is amended annually to include basin updates.

For assessment purposes, the Florida Department of Environmental Protection has divided the St. Lucie and Loxahatchee Basin into water assessment polygons with a unique waterbody identification (WBID) number for each watershed or stream reach. The proposed project is located within WBID 3218 and will ultimately contribute stormwater runoff to the C-44 Canal, which has an adopted TMDL for nitrogen, phosphorus, and biological oxygen demand, pursuant to FAC 62-340.705(9). Since two of the impairments are nutrients, a site specific pre and post development nutrient loading analysis has been performed demonstrating that the post development annual nutrient loading is less than the predevelopment annual loading. Refer to [Figures 9](#) in [Appendix A](#) and the Nutrient Loading Calculations in Appendix D.

3.4.3 Optional Pipe Material

FDOT's Culvert Service Life Estimator was utilized in the determination of optional pipe materials for the project. Existing soil properties were based on geotechnical corrosion test results included in the geotechnical data provided by FDOT. Refer to [Appendix G](#) for the results of the Optional Pipe Material Analysis and [Appendix H](#) for the Geotechnical Data.

3.4.4 Maintaining Agency

The FDOT will be the maintaining agency for the entire SR-710 corridor and all existing and proposed drainage facilities within the Department's right-of-way. This includes, but is not limited to, all linear dry detention swales, berms, cross-drains, end treatments, pipes, inlets, manholes, and control structures.

3.4.5 Temporary Drainage

During construction, temporary drainage measures will be required to ensure that existing drainage patterns and FDOT drainage requirements, including spread, are maintained. Temporary drainage design is often necessary to minimize travel lane flooding, preventing damage to property adjacent to the project during construction, and facilitating construction activities by temporarily rerouting or altering drainage conveyances. The main emphasis on designing temporary drainage systems is on the following items:

- Draining detours efficiently, whether on existing roadways or temporary lanes.
- Preventing drainage problems caused by construction staging.
- Providing details for culvert extensions and replacements that require a temporary rerouting of water away from work areas.

During Phase 1 of the Traffic Control Plan, the proposed eastbound roadway and drainage facilities will be constructed, in conjunction with the proposed cross drains (CD-1 to CD-6). Runoff from the work zone will be accommodated within the constructed linear dry detention ponds (swales). Runoff from the existing roadway will maintain existing drainage patterns until Phase 2.

During Phase 2 of the Traffic Control Plan, traffic will be shifted to the new roadway (eastbound) and the proposed roadway and drainage facilities will be constructed for westbound SR-710, including the median. Runoff from the work zone will be accommodated within the constructed linear dry detention ponds (swales), interconnected with the eastbound drainage facilities.

3.5 DESIGN STORMS AND RAINFALL DEPTHS

Rainfall contour maps provided in SFWMD's Permit Information Manual Vol. IV were used along with the rainfall volume assumptions from previous I-95 projects to estimate the rainfall volumes associated with various design storm events for this study. The rainfall volumes for the various design storms simulated in the pre-development and post-development ICPR models developed for this study are included in [Table 2](#). Refer to [Figure 7](#) in [Appendix A](#) for SFWMD Rainfall Maps.

Table 2 – Design Storm Events

Design Storm	Criteria	Rainfall (in.)
10-year – 24-hour	Roadway and open swale drainage design	6.50"
25-year – 72-hour	Pre-versus-post discharge and peak flooding stages	10.20"
100-year – 24-hour	Floodplain and minimum finished floor elevation	9.40"

3.6 SEASONAL HIGH GROUNDWATER TABLE AND TAILWATER ELEVATIONS

The Seasonal High Groundwater Table (SHGWT) elevation(s) and static tailwater elevation(s) used for this project were determined based on examination of groundwater elevations measured in 15 different piezometers (monitoring wells) placed within the project limits, and monitored monthly between August 2014 and January 2015. Additionally, existing permits were reviewed for the projects at the eastern and western terminus of the project limits. Per SFWMD Permit No. 43-00802-S, the SHGWT elevation at the western limits of this project is 20.00 ft NAVD. Per SFWMD Permit No. 50-04716-P, the SHGWT elevation at the eastern limits of this project is 24.20 ft NAVD. As such, the portions of the drainage system that interface with the adjacent projects will utilize the same control elevation(s).

Per review of the piezometer results within the remainder of the project limits, the SHGWT elevation varies between 22 ft NAVD and 24 ft NAVD, from west to east. This was obtained by determining an average wet season elevation based on the monitoring well readings available from each of the 15 wells between the rainy season months of May and October. Similarly, an October average elevation for each monitoring well was also determined based on the well's readings throughout the month of October. A seasonal high groundwater table profile was then determined according to the location of each monitoring well and the average wet season elevation for the well obtained from the groundwater study. According to naturally existing divides and further evidenced by piezometer data, four distinct systems were determined throughout the limits of the project.

The wet season water table used for System 1, which encompasses the area previously designated as "Basin 500" under SFWMD Permit No. 43-00802-S (i.e. Big John Monahan Bridge Replacement Design-Build Project, FPID No. 419250-2-52-01), is 20.00 ft NAVD, consistent with the approved permit.

The wet season water table elevation used for Systems 2A-2B is a conservative value that was calculated by rounding up the average groundwater table elevation encountered within the piezometers (i.e. MW-3 to MW-8) during the wet season months (i.e. May thru October). The value used was 22.00 ft NAVD, whereas the actual average wet season elevation was 21.58 ft NAVD and the average October elevation was 21.65 ft NAVD. Based on piezometer readings from MW-8, there appears to be a transitional area between Systems 2 and 3, referred to as System 2C, where a conservative average wet season elevation of 22.25 ft NAVD was used. The adjacent drainage ditches and canals within the 1600+ acre agricultural area directly north of System 2A-2C is controlled and permitted to maintain groundwater elevations between

20.65 - 21.65 ft NAVD (22 - 23 ft NGVD), which is consistent with the soil boring elevations described above.

The wet season water table elevation used for Systems 3A-3C was calculated by rounding up the average groundwater table elevation encountered within the piezometers (i.e. MW-9 to MW-11) during the wet season months. The value used was 23.50 ft NAVD, whereas the actual average wet season elevation was 23.33 ft NAVD and the average October elevation was 23.40 ft NAVD.

The wet season water table elevation used for Systems 3D-3F and 4A-4B was calculated by rounding up the average groundwater table elevation encountered within the piezometers (i.e. MW-12 to MW-15) during the wet season months. The value used was 24.00 ft NAVD, whereas the actual average wet season elevation was 23.78 ft NAVD and the average October elevation was 23.94 ft NAVD. Refer to [Appendix D](#) for the SHGWT, Minimum Swale Bottom, and Minimum Profile Grade Elevation Summary and [Appendix H](#) for the original Geotechnical Data.

3.6.1 Base Clearance

Roadway base clearance is determined by establishing a Design High Water (DHW) elevation based on a determination of the local ground water elevation which occurs for a duration of 24 hours or more. The DHW is typically established by determining the SHGWT elevation and elevations of the adjacent water bodies within the vicinity of the project. In accordance with the FDOT's Plans Preparation Manual (PPM), Table 2.6.3, the required clearance for SR 710 is 3 ft. The roadway within the limits of the project will have sufficient elevation in order to exceed the required base clearance criteria. Refer to [Appendix D](#) for base clearance calculations.

3.7 DRAINAGE ANALYSIS METHODOLOGY

3.7.1 Basin Delineation and Parameters

Basin boundaries were delineated using a combination of topographic survey, field assessments, and historical permit documentation. Refer to [Appendices B and C](#) for pre-development and post-development drainage maps, respectively. Curve Numbers (CN) values for each basin were calculated using methods developed by the United States Department of Agriculture, Soil Conservation Services (SCS) method in conjunction with basin specific S-values as required by SFWMD. All basins were assigned the minimum recommended time of concentration value of 10 minutes. Refer to [Appendix D](#) for pre-development and post-development land use tables.

3.7.2 Drainage System Modeling

The pre-development and post-development models of the drainage systems were developed using the software Advanced Interconnected Channel and Pond Routing (AdICPR) version 3.1. The majority of the input used to model existing features was acquired from topographic survey and existing drainage

information obtained by existing plans and permits. In areas where topographic survey data was insufficient, other sources such as existing plans and permits were used to generate the input.

For the pre-development and post-development models, swales were modeled as separate stage-storage nodes in AdICPR, with assigned sub-basins delineated for each node based on their direct contributing runoff area. Elevation contours were created for the swales in AutoCAD using the ACAD Civil 3D surface analysis features. These areas were measured at one-foot contours and input into AdICPR as stage-storage nodes. Boundary conditions were modeled as constant time-stage nodes with elevations set at the season high groundwater table (SHGWT) and established canal/wetland maintained water surface elevations. In scenarios in which basins are directly connected to these receiving waterbodies without any existing control or attenuation, the basins have been assigned directly to the boundary node.

Nodes are generally interconnected by links to exemplify pipes or culverts, weirs and drop structures. Pipe and culvert links have been input based on topographical survey. Weirs and drop structures have also been modeled based on survey information and existing ground surface elevations, depending on intended type of flow simulation and downstream conveyance and node type.

The calculations, AdICPR flood routing input, and results are found in [Appendix D](#). The following design storm events were simulated in AdICPR for each of the following criteria:

- 10-year – 24-hour: Roadway and open swale drainage design storm event
- 25-year – 72-hour: Pre-versus-post discharge and flooding stages design storm event
- 100-year – 24-hour: Floodplain and minimum finished floor elevation design storm event

PERMITTING REQUIREMENTS

The following is a guideline of the environmental permitting requirements for the project and is not intended to be all-inclusive.

- **South Florida Water Management District (SFWMD):** The following permits will be required from SFWMD:
 - o A major modification to Environmental Resource Permit (ERP) No. 43-00802-S is required for the proposed improvements and stormwater management facilities, and wetlands and other surface water impacts. In addition, a minor modification is required to ERP No. 50-04716-P for overlapping improvements proposed at the eastern project termini.
 - o A Master Dewatering Permit, 43-02487-W, has already been issued by SFWMD for FDOT projects in Martin County and a Master Dewatering Permit, 50-09836-W, has already been issued by SFWMD for FDOT projects in Palm Beach County. In accordance with Special Condition 27 of these permits, at least two weeks prior to commencing dewatering (if required), the Department will provide SFWMD with site-specific dewatering plans for each proposed dewatering activity. The Department will not initiate dewatering prior to receiving written notification from SFWMD staff that the proposed dewatering activity is consistent with the approved master permit.

- **United States Army Corps of Engineers (USACE):** Due to unavoidable wetland, surface water, and/or foraging habitat impacts associated with the proposed roadway widening and required swale excavations, a USACE Section 404 Dredge and Fill Permit will be required. This permit will be applied for under the Joint ERP application submittal.
- **Florida Department of Environmental Protection (FDEP):** A Generic Permit for Stormwater Discharge from Large and Small Construction Activities (National Pollutant Discharge Elimination System (NPDES)) Permit will ultimately be required prior to construction. As part of the permit application, the Permit Plans include a Stormwater Pollution Prevention Plan (SWPPP) and Erosion Control Plan. The Contractor will be responsible for submittal of the Notice of Intent (NOI) and any required modifications to the SWPPP and Erosion Control Plan based on construction sequencing.

A summary of the environmental permits required for the project are shown in [Table 3](#).

Table 3 – Summary of Required Permits

Agency	Type	Permit No.
SFWMD	Environmental Resource Permit – Major Modification	43-00802-S
SFWMD	Environmental Resource Permit – Minor Modification	50-04716-P
SFWMD	Consumptive Water Use Permit (Dewatering)	50-09836-W
USACE	Section 404 Dredge and Fill Permit	TBD
FDEP	Construction Generic Permit (NPDES)	TBD

PRE-DEVELOPMENT CONDITIONS STORMWATER MANAGEMENT SYSTEM

5.1 GENERAL PRE-DEVELOPMENT DRAINAGE CONDITIONS

The existing drainage consists of an open swale system with cross-drains connecting the swales on the north and south sides of the road. Typically, stormwater runoff from the existing roadway pavement flows over grassed shoulders into roadside swales located on either side of SR 710. Within the project limits, the existing swales are connected by approximately 13 cross drain pipes.

The roadside swale on the south side of SR 710 is confined by the CSX railroad tracks and SR 710. Half of the CSX railroad right-of-way and half of the SR 710 right-of-way share the south roadside swale. The CSX railroad tracks are assumed to share similar profile elevations as the centerline of the adjacent roadway and therefore act as a major drainage divide, controlling existing drainage patterns. Several driveway entrances connect private properties and conservation lands to SR 710, thereby functioning as lateral basin divides for the south roadside swales. The roadside swale on the north side of SR 710 is not

confined by any divides within the project limits; therefore stormwater runoff is allowed to directly sheet flow into adjacent lands.

The existing roadway was constructed prior to stormwater management regulations; hence there are few segments of the SR 710 corridor that have permitted stormwater management facilities. However, SFWMD issued an ERP for the Big John Monahan Bridge Replacement Design-Build Project (FPID No. 419250-2-52-01) and an ERP for the SR 710 Design-Build Project from the Palm Beach/Martin County Line to Pratt & Whitney Blvd. (FPID Nos. 432704-1-52-01 and 432706-1-52-01).

Four (4) existing drainage systems were delineated within the project limits for the pre-development condition. At the project's west end, between Station (Sta.) 3005+00 and approximate Sta. 3025+00, this project overlaps with Basin 500 of the Big John Monahan Bridge Replacement project. Runoff from this system, System 1, is collected in roadside swales and conveyed and treated within stormwater facilities constructed under SFWMD Permit No. 43-00802-S.

System 1 functions independent from the other existing drainage systems associated with this project. Runoff from the eastbound lanes is collected in a roadside swale prior to overtopping an existing ditch block and co-mingling with the rest of the drainage from the Big John Monahan Bridge Replacement project's East Basin. Runoff from the westbound lanes is collected in a roadside swale and conveyed to Pond 300. Refer to [Appendix F](#) for existing permit documents.

System 2 consists of roadside swales and cross-drains between approximately Sta. 3025+00 and Sta. 3155+00. This system lies within an unpermitted section of SR 710, where stormwater runoff sheet flows into roadside swales with connectivity to the agricultural lands north of the corridor. The SHGWT elevation within System 2 is lower than the adjacent systems to the east due to the agricultural land use and irrigation systems which include on-site pumps and a reservoir that allows the site to maintain groundwater elevations. The pre-development AdICPR model includes the Indian Sun Groves Agricultural Area as an offsite receiving water body node for System 2. The entire site, including pumps, reservoir, and outfall to the SFWMD C-44 Canal were modeled in accordance with the original permit, SFWMD ERP No. 43-00347 (Application No. 12125-D).

System 3 functions similar to System 2 and represents the segment of SR 710 between approximately Sta. 3155+00 and Sta. 3284+00, within an unpermitted section of SR 710. However, System 3 discharges directly to existing public lands (wetlands) located along the north side of the corridor, rather than agricultural lands, and has higher SHGWT elevations. The portion of System 3 draining to the John C. and Mariana Jones Hungryland Wildlife and Environmental Area (WEA) has been designed as System 3A, whereas the portion draining to the Hungrylands/SFWMD Parcels has been designated as System 3B, however, no physical boundary separates these wetlands areas.

At the project's east end, between approximately Sta. 3284+00 and 3302+00, the project overlaps with Basins 1, 2, and Basin West of the SR 710 Design-Build project. For purposes of this project, this system has been designated as System 4. Based on permit plans for the SR 710 Design-Build project, roadway runoff from Basin 1 and Basin 2 is collected within Swales 1 and 2, respectively, and is ultimately

discharged an offsite receiving water body referred to as "Public Lands." Roadway runoff from Basin West discharges directly to the "Public Lands" boundary node, which also represents the John C. and Mariana Jones Hungryland Wildlife and Environmental Area (WEA) / Hungrylands/SFWMD Parcels that System 3 drains to. Accordingly, the pre-development AdICPR model includes the same "Public Lands" node that was permitted under SFWMD Permit No. 50-04716-P (Application No. 131203-1) as the offsite receiving water body for Systems 3 and 4.

5.2 MODELING RESULTS

The flood routing results for all simulated design storm events are summarized in the Drainage System Summary Tables included in [Appendix D](#). AdICPR model results are also included in [Appendix D](#).

POST DEVELOPMENT CONDITIONS STORMWATER MANAGEMENT SYSTEM

6.1 GENERAL POST-DEVELOPMENT DRAINAGE CONDITIONS

The proposed drainage systems will consist of multiple linear dry retention ponds and dry detention ponds (swales) with independent control structures with discharge to receiving waterbodies north of the corridor. Stormwater runoff from the roadway will sheet flow from the travel lanes over grassed shoulders and into the roadside swales. Cross drains are proposed to interconnect the open swales on both sides of the road. Median swales will collect and convey stormwater runoff via ditch bottom inlets that are connected to the cross drain pipes that traverse the corridor. Berms at the right-of-way lines are required on both sides of SR 710 to contain the stormwater within the corridor. Runoff generated within the CSX railroad right-of-way will continue to utilize the existing swale within the CSX right-of-way, as in the pre-development condition. Existing cross drains which connect the CSX swale to the north side swale will be replaced or extended, as necessary, to continue existing drainage flow patterns for the CSX railroad right-of-way. The cross drains serving the CSX swale will maintain or improve maximum stages in the post-development condition. Ultimately, the project corridor will have four separate drainage systems, as described below.

System 1 will function similarly to its currently permitted design, however, the roadside swale adjacent to the eastbound travel lanes will be slightly re-aligned to provide collection and conveyance for the widened section of SR 710. Runoff from System 1 will continue to discharge via the Big John Monahan Bridge East Basin's drainage system. There is approximately 0.65 acres of additional impervious within System 1 in the proposed condition. The existing drainage system has sufficient capacity and surplus to provide water quality treatment and attenuation for the additional runoff.

System 2 runoff will be treated and attenuated within an interconnected system of linear dry retention ponds (swales). System 2 is split into three separate sub-systems, each with their own interconnected

swales. The proposed swales will provide water quality treatment for their contributing areas and fully retain the post-development runoff from SR-710 for the 25-year - 72-hour design storm event in the post-development condition. The proposed swales within System 2 have bottom elevations set at 1-ft above the SHGWT elevation with berm elevations set at 1.5-ft above the swale bottom elevations. Since the proposed roadside swales within System 2 will function as a retention system, all swales within the system recover their entire retention volume within 12 days of the 25-year – 72-hour design storm.

System 3 runoff will be treated and attenuated within an interconnected system of linear dry detention ponds (swales) with control structures (weirs) which outfall into the adjacent John C. and Mariana Jones / Hungryland Wildlife and Environmental Area, and SFWMD Hungryland Parcels located on the north side of the project. System 3 is split into six separate sub-systems, each with their own interconnected swales and control structures. The proposed swales will provide full water quality treatment for their contributing areas and attenuate the post-development peak discharge rates to the pre-development peak discharge rates. The proposed control structures within System 3 consist of concrete lined broad-crested weirs with v-notches. The proposed swales within System 3 have bottom elevations set at 1-ft above the SHGWT elevation with berm elevations set at 1.5-ft above the respective swale bottom elevations.

System 4 will function similarly to its currently permitted design, via roadside dry detention swales with treated overflow into adjacent wetlands. However, the system will be split into two subsystems, System 4A and System 4B. System 4A will consist of the pre-development Basin West area to the west of a cross-drain approximately at STA. 3290+00.00 identified in the East Project's permit. System 4B will consist of Basins 1 & 2 associated with the East Project, as well as a portion of the median between approximate STA. 3284+00.00 and STA. 3290+00.00. System 4A will provide water quality treatment and attenuation for runoff from the westbound lanes of SR 710, while System 3F will service the eastbound lanes within the same segment. Within System 4B, the swale adjacent to the eastbound travel lanes will be slightly re-aligned to provide collection and conveyance for the widened section of SR 710. Runoff from System 4B will continue to discharge via control structures located within the roadside swales, as permitted by SFWMD. There is approximately 0.90 acres of additional impervious within System 4B in the proposed condition. However, water quality treatment and discharge attenuation will be provided for 3.01 acres from "Basin West" within System 4A and 3F, which was not provided in the existing condition. The existing drainage system has sufficient capacity and surplus to provide water quality treatment and attenuation for the additional runoff from the median area and proposed widening to match the East project's typical section.

6.2 POST-DEVELOPMENT CONDITIONS STORMWATER QUALITY ANALYSIS

SFWMD criteria require the water quality treatment to be provided for 2.5-inches over the total onsite impervious area or 1-inch over the total onsite area, whichever is greater. Water quality treatment is proposed within Systems 2, 3, and 4A for all onsite contributing basins. For Systems 1 and 4B, a review of existing permit documentation indicates that both systems have the capacity to provide full water quality treatment based on the additional impervious area constructed as part of this project, within the subject basins, or elsewhere within the corridor. Control structures for both of these systems are located

downstream of the proposed project area and outside of the project limits. Refer to Water Quality Treatment Calculations included in [Appendix D](#). Refer to [Appendix F](#) for permit documentation associated with the adjacent east and west projects.

6.3 POST-DEVELOPMENT CONDITIONS STORMWATER QUANTITY ANALYSIS

SFWMD requires that the post-development peak discharge rate for the 25-year – 72-hour rainfall event does not exceed the pre-development peak discharge rate for the 25-year – 72-hour rainfall event. All AdICPR flood routing results indicate that pre- versus post-development peak discharge criteria is met with the proposed stormwater management facilities. Refer to AdICPR flood routing reports (included in [Appendix D](#)) for a complete summary of results.

6.4 POST-DEVELOPMENT MODELING RESULTS

The peak discharge rates for the 10-year – 24-hour, 25-year – 72-hour and 100-year – 24-hour storm events are shown in the Drainage System Summary Tables, included in [Appendix D](#). The post-development discharge rates are less than the pre-development discharge rates for all design storm events. Refer to AdICPR Node Maximum Conditions (included in [Appendix D](#)) for a complete summary of maximum stages and discharge rates.

CONCLUSIONS AND RECOMMENDATIONS

The proposed SR 710 stormwater management facilities meet FDOT drainage criteria and SFWMD permit criteria. The main drainage and permitting issues, conclusions, and/or recommendations are summarized as follows, separated by system:

System 1:

- The proposed drainage system will provide 1.59 ac-ft. of water quality treatment volume within the linear dry detention ponds (swales). The required water quality treatment volume for Basin 500 of the West Project is 1.34 ac-ft. Refer to permit documents in [Appendix F](#) for water quality calculations. Since dry retention is being utilized as the water quality treatment method, SFWMD allows a credit 50% of the required treatment volume, reducing the required treatment volume to 0.67 ac-ft. Based on existing permit documents for the previous project in addition to post-development calculations for this project, a surplus of 0.92 ac-ft. of water quality treatment volume is provided within the proposed stormwater management system and will be available for any potential future improvements within the project limits.
- The pre-development peak discharge rate from SR 710 into the downstream “CBC Ditch” for the 25-year – 72-hour design storm event is 34.66 cfs and the post-development peak discharge rate is 33.55 cfs. Therefore, the total overall 25-year – 72-hour predevelopment discharge into the agricultural lands is reduced by 1.11 cfs.

- The proposed stormwater management facilities will contain the 100-year - 24-hour and 25-year - 72-hour design storm event without overtopping the right-of-way berms or edge of pavements. Changes to peak stages are negligible in the post-development condition.

System 2:

- The proposed drainage system will provide 70.20 ac-ft. of water quality treatment volume within the linear dry retention ponds (swales). The required water quality treatment volume for the system is 5.45 ac-ft. Therefore, a surplus of 64.75 ac-ft. of water quality treatment volume is provided within the proposed stormwater management system and available for any potential future improvements within the project limits.
- The pre-development peak discharge rate from SR 710 into the adjacent agricultural lands for the 25-year – 72-hour design storm event is 21.02 cfs and the post-development peak discharge rate is 0.93 cfs. Therefore, the total overall 25-year – 72-hour predevelopment discharge into the agricultural lands is reduced by 20.09 cfs.
- The proposed stormwater management facilities will contain the 100-year - 24-hour and 25-year - 72-hour design storm event without overtopping the right-of-way berms or edge of pavements. All proposed stages for the 10-year – 24-hour design storm meet the minimum FDOT freeboard requirement of 0.5-ft below the top of berm elevations.
- In accordance with SFWMD requirements, the proposed retention system will recover the full retention volume within 12 days, as is depicted in Node Time vs. Stage Graph provided in [Appendix D](#).

Systems 3 & 4:

- Water Quality – System 3:
 - o The proposed drainage system will provide 18.01 ac-ft. of water quality treatment volume within the linear dry detention ponds (swales). The required water quality treatment volume for the project is 5.82 ac-ft. Therefore, a surplus of 12.19 ac-ft. of water quality treatment volume is provided within the proposed stormwater management system and available for any potential future improvements within the project limits.
- Water Quality – System 4:
 - o System 4A: The proposed drainage system will provide approximately 0.34 ac-ft. of water quality treatment volume within the linear dry detention ponds (swales). The required water quality treatment volume for the project is approximately 0.10 ac-ft. Therefore, a surplus of approximately 0.23 ac-ft. of water quality treatment volume is provided within the proposed stormwater management system and available for any potential future improvements within the project limits.
 - o System 4B: Based on the removal of Basin West's 3.01 acres from the project area and the re-aligning and re-grading of Swale 2, the proposed drainage system for the East

Project will provide 9.63 ac-ft. of water quality treatment volume within the linear dry detention ponds (swales). The required water quality treatment volume for the project is 9.30 ac-ft. Therefore, a surplus of 0.33 ac-ft. of water quality treatment volume is provided within the East Project's proposed stormwater management system in the post-development condition, which maintains the currently permitted surplus treatment volume of 0.33 ac-ft in the previously permitted pre-development condition (refer to permit documents in [Appendix F](#) for water quality calculations).

- The pre-development peak discharge rate from Systems 3 & 4 of SR 710 into the adjacent Public Lands (John C. and Mariana Jones / Hungryland Wildlife and Environmental Area and SFWMD Hungryland Parcels) for the 25-year – 72-hour design storm event is 430.53 cfs and the post-development peak discharge rate from System 3 is 426.91 cfs. Therefore, the total overall 25-year – 72-hour predevelopment discharge into the adjacent John C. and Mariana Jones / Hungryland Wildlife and Environmental Area, and SFWMD Hungryland Parcels from Systems 3 & 4 is reduced by 3.62 cfs.
- The proposed stormwater management facilities will contain the 100-year - 24-hour and 25-year - 72-hour design storm event without overtopping the right-of-way berms or edge of pavements. Within Systems 3 and 4A, all proposed stages for the 10-year – 24-hour design storm meet the minimum FDOT freeboard requirement of 0.5-ft below the top of berm elevations. Within System 4B, post-development peak stages are consistent with pre-development peak stages.

APPENDIX A
FIGURES

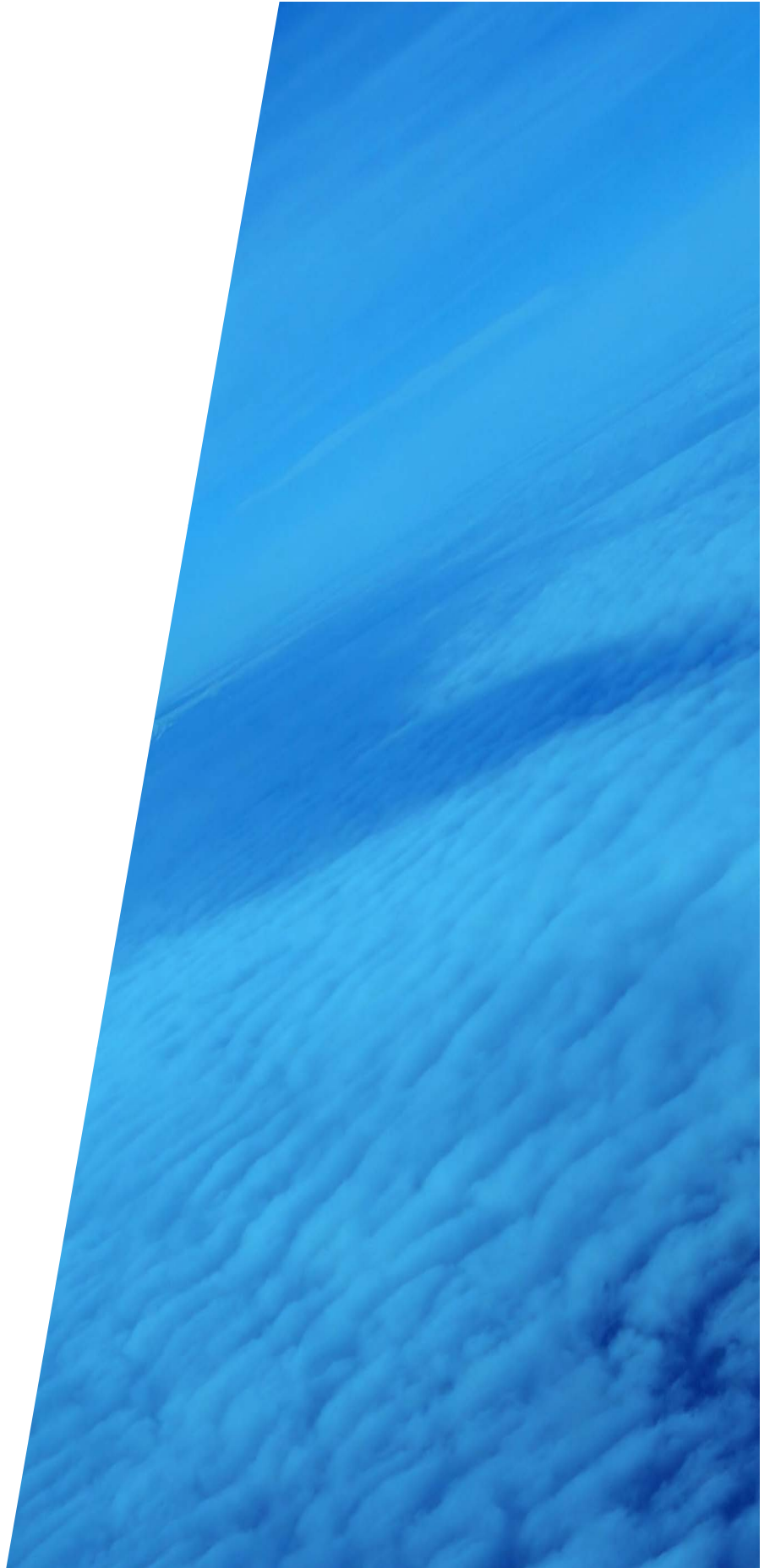
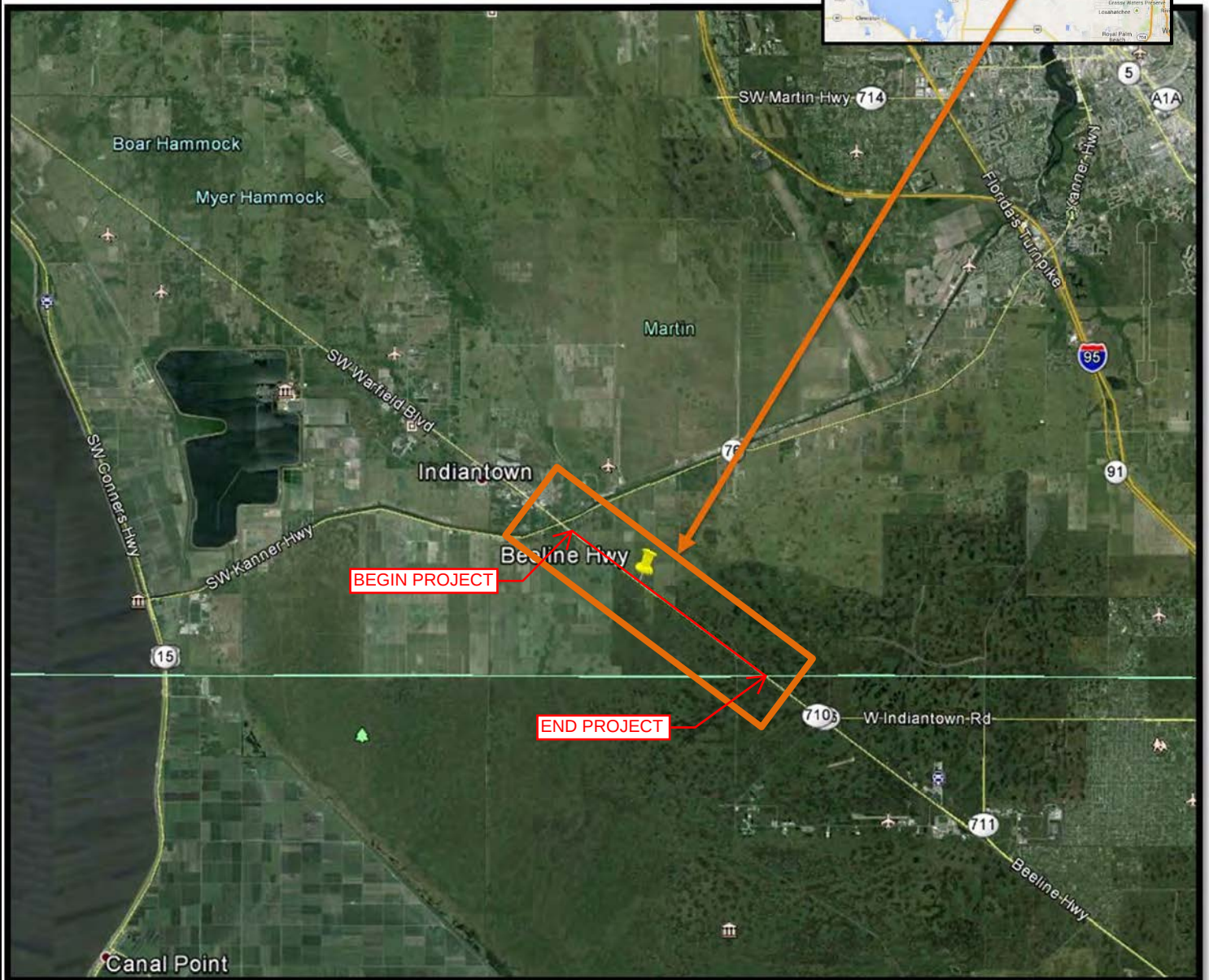
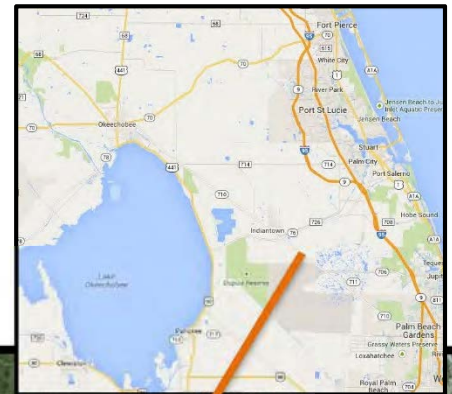


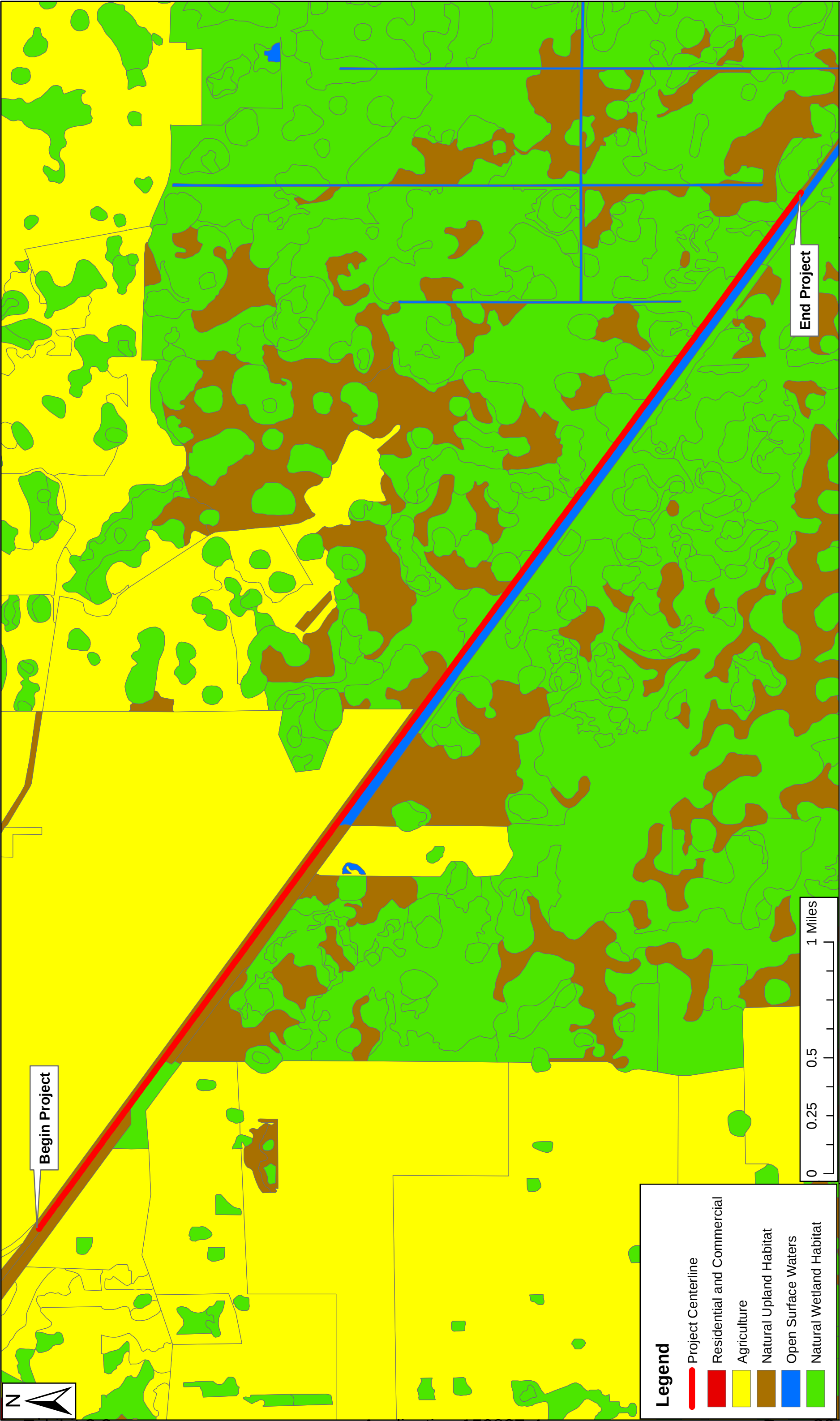
FIGURE 1
PROJECT LOCATION MAP



SR 710 (BEELINE HIGHWAY)
FROM: EAST OF SR 76
TO: MARTIN/PALM BEACH COUNTY LINE

Figure 1
PROJECT LOCATION MAP

FIGURE 2
LAND USE MAP



Legend

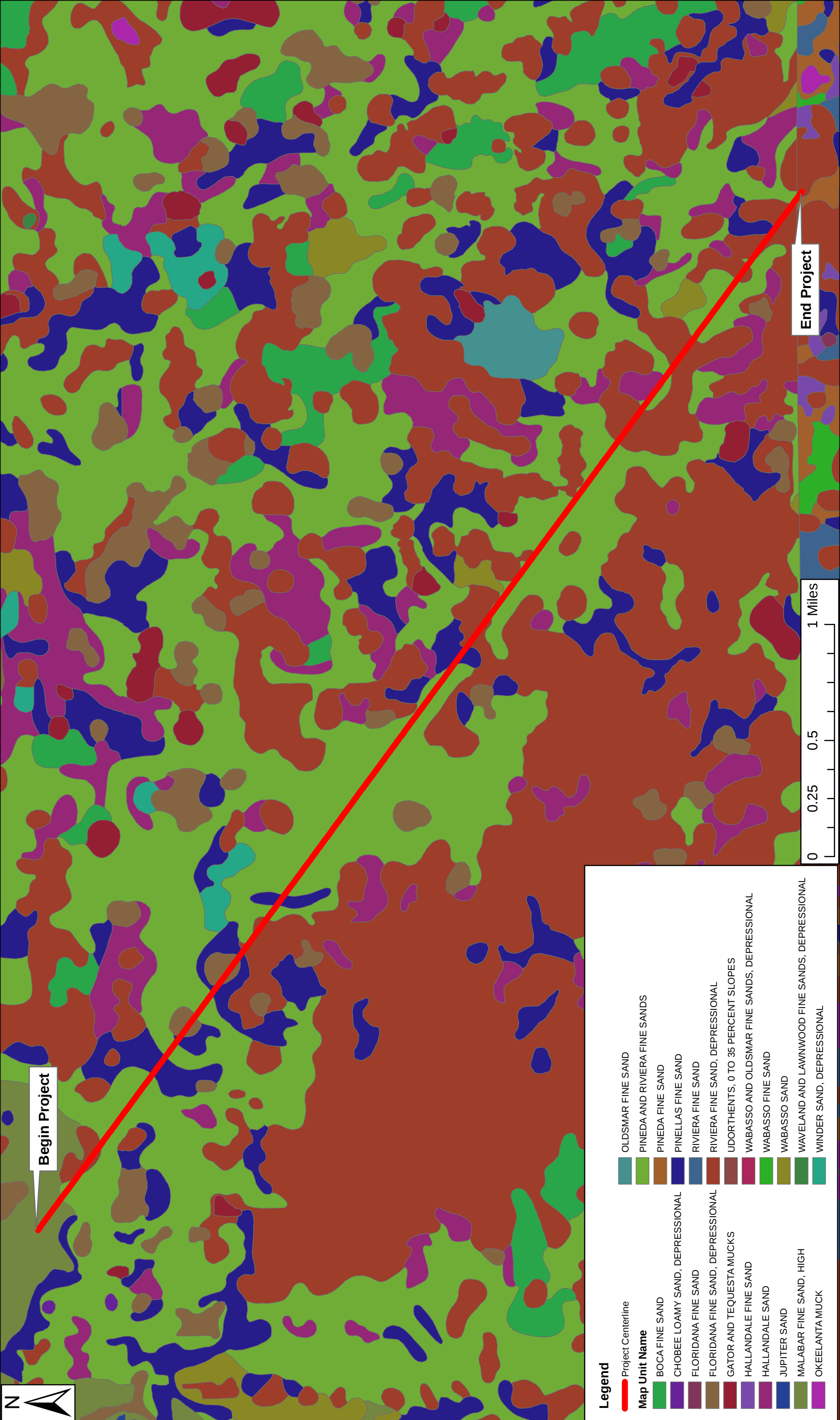
-  Project Centerline
-  Residential and Commercial
-  Agriculture
-  Natural Upland Habitat
-  Open Surface Waters
-  Natural Wetland Habitat



SR-710 (Beeline Highway)
From: East of SR-76
To: Martin/Palm Beach County Line

Figure 2
Land Use Map

FIGURE 3
SOIL MAP



SR-710 (Beeline Highway)
From: East of SR-76
To: Martin/Palm Beach County Line

Figure 3
Soils Map



FIGURE 4
USGS QUADRANGLE MAP

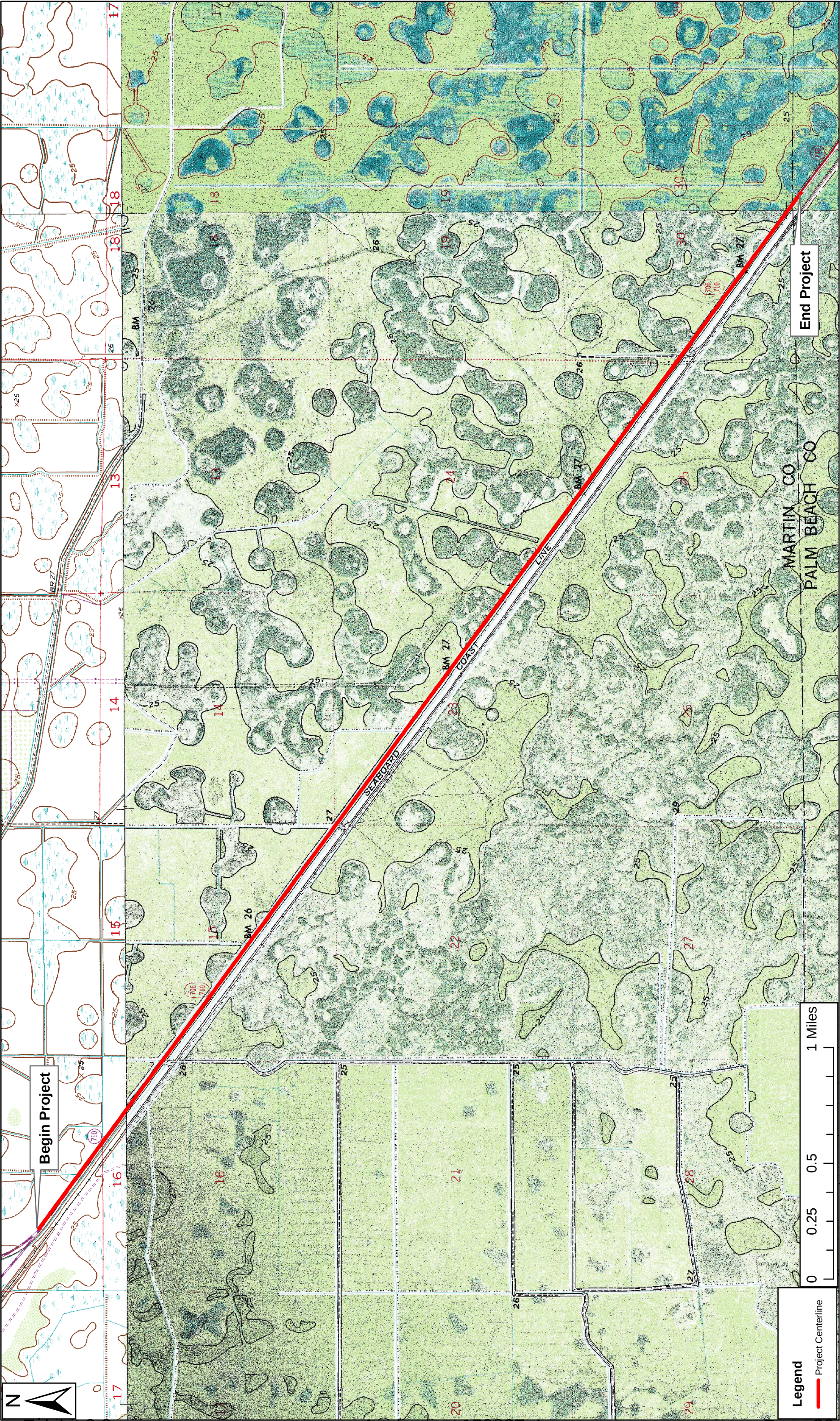
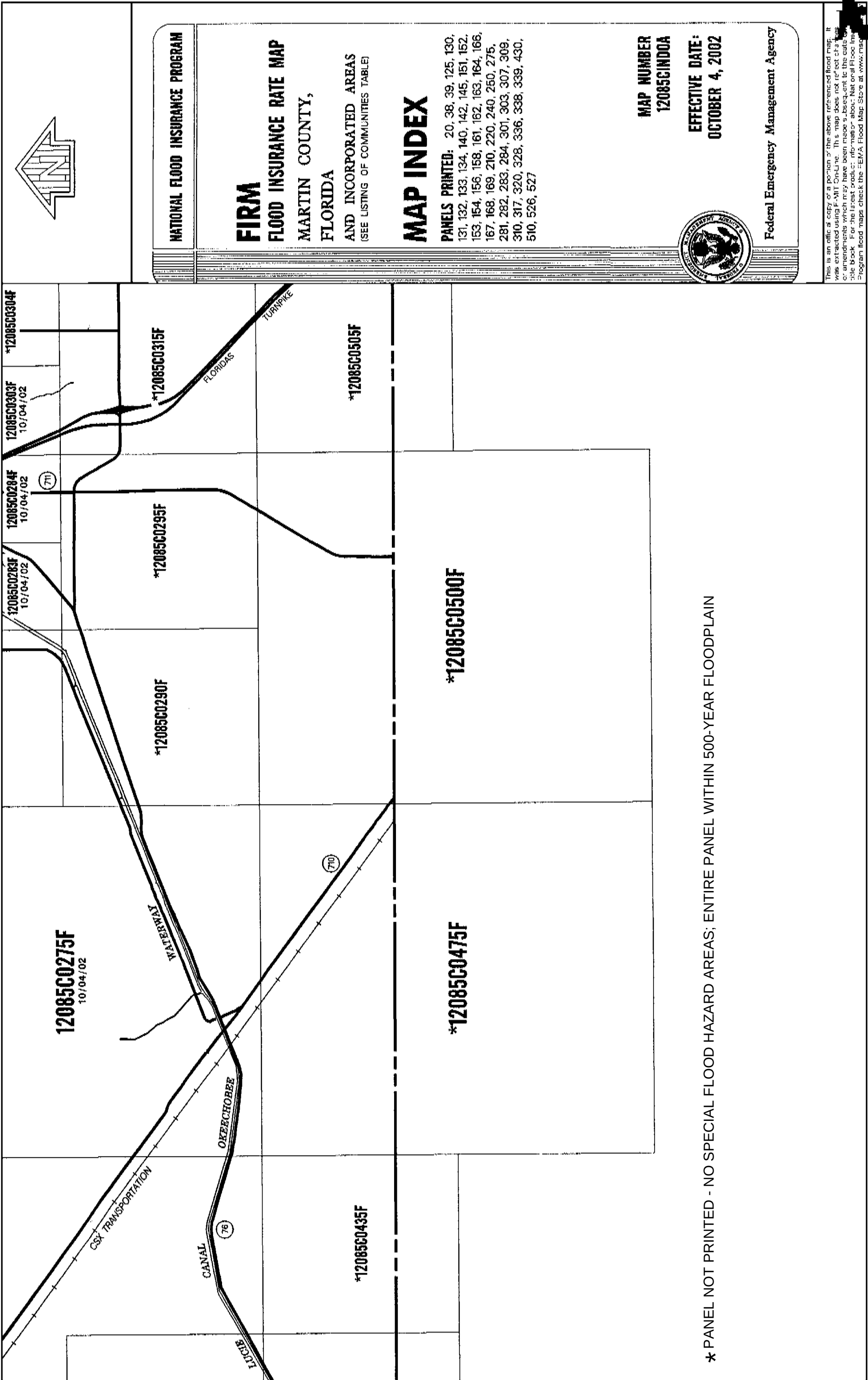


Figure 4
USGS Quadrangle Map

SR-710 (Beeline Highway)
From: East of SR-76
To: Martin/Palm Beach County Line

RS&H

FIGURE 5
FEMA MAPS



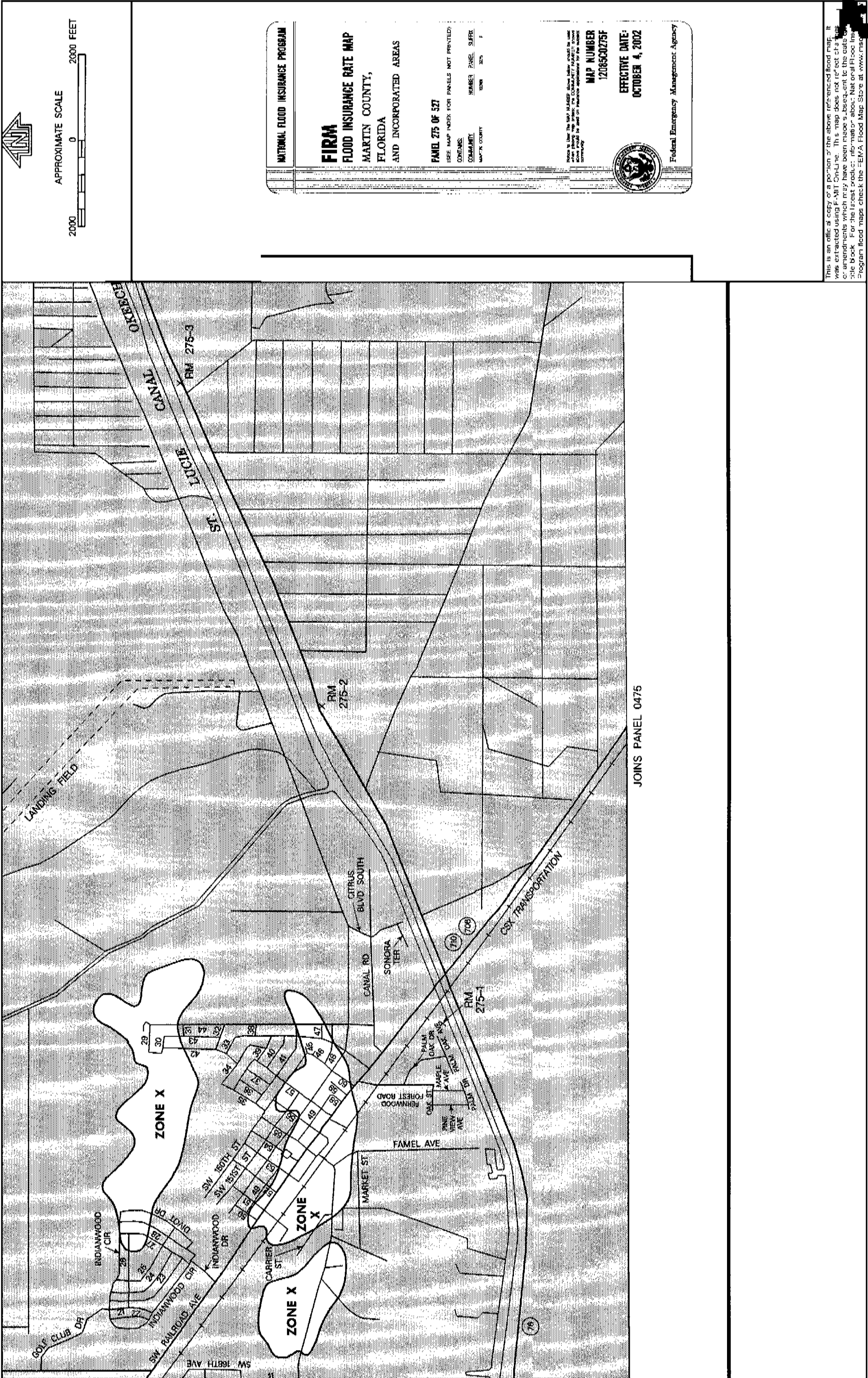


FIGURE 6
SFWMD DRAINAGE BASIN MAP

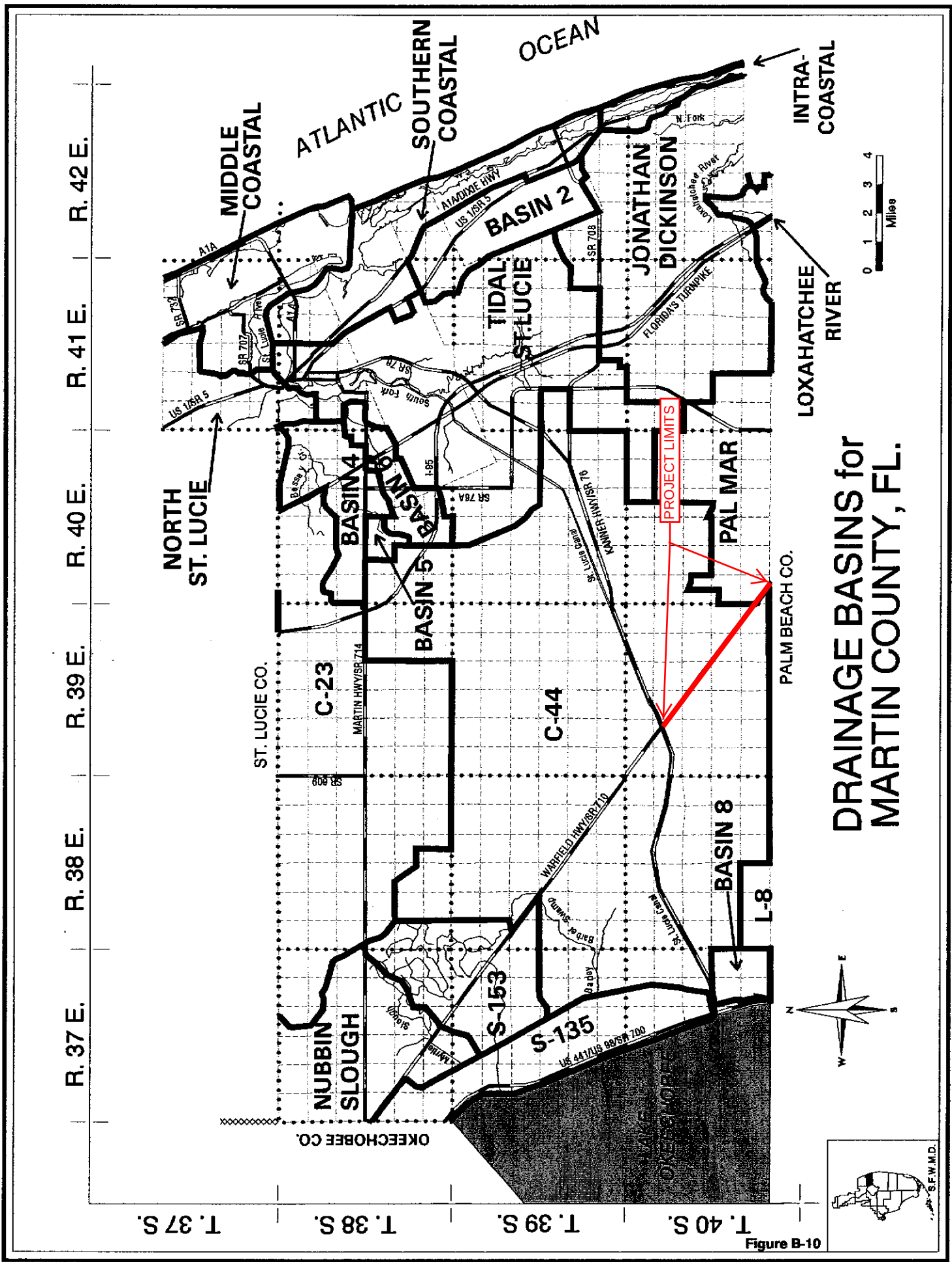


Figure B-10

Appendix A: SFWMD - ALLOWABLE DISCHARGE FORMULAS

<u>Canal</u>	<u>Allowable Runoff</u>	<u>Design Frequency</u>
C-1	$Q = \frac{(112 + 31) A}{\sqrt{A}}$	10 year
C-2	Essentially unlimited inflow by gravity connections southeast of Sunset Drive: 54 CSM northwest of Sunset Drive	200 year +
C-4	Essentially unlimited inflow by gravity connections east of S.W. 87 th Avenue	200 year +
C-6	Essentially unlimited inflow by gravity connections east of FEC Railroad	200 year +
C-7	Essentially unlimited inflow by gravity connection	100 year +
C-8	Essentially unlimited inflow by gravity connection	200 year +
C-9	Essentially unlimited inflow by gravity connection east of Red Road; 20 CSM pumped, unlimited gravity with development limitations west of Red Road or Flamingo Blvd.	100 year +
C-10	-----	200 year +
C-11	20 CSM west of 13A; 40 CSM east of 13A	-----
C-12	90.6 CSM	25 year
C-13	75.9 CSM	25 year
C-14	69.2 CSM	25 year
C-15	70.0 CSM	25 year
C-16	62.6 CSM	25 year
C-17	62.7 CSM	25 year
C-18	41.6 CSM	25 year
C-19	57.8 CSM	-----
C-23	31.5 CSM	10 year
C-24	30.25 CSM	10 year
C-25	$Q = \frac{(47 + 28) A}{\sqrt{A}}$ (Under Review)	10 year
C-38	31.1 CSM (subject to restrictions of Basin Rule)	10 year
C-40, 41, 41A	35.4 CSM	10 year
Hillsboro Canal (east of S-39)	35 CSM	25 year
North New River (east of S-34)	70.8 CSM	25 year
Everglades Ag. Area (all canals)	20 CSM	5 year
L-28	11.8 CSM	-----
C-51	35 CSM east of Turnpike; 27 CSM west of Turnpike (subject to restrictions of Basin Rule)	10 year
C-100, 100A, 100B, 100C, 100D:	$Q = \frac{(104 + 43) A}{\sqrt{A}}$	10 year
C-102	$Q = \frac{(119 + 25) A}{\sqrt{A}}$	10 year
C-103N, C103-S	$Q = \frac{(107 + 39) A}{\sqrt{A}}$	10 year

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C-110	$Q = \frac{(137 + 9)}{\sqrt{A}} A$	10 year
C-111	$Q = \frac{(117 + 29)}{\sqrt{A}} A$	10 year
C-113	$Q = \frac{(104 + 3)}{\sqrt{A}} A$	10 year

Definitions:

Q =	Allowable runoff in cfs (cubic feet per second)	CSM = cfs per square mile
A =	Drainage area in square miles	

FIGURE 7
SFWMD RAINFALL MAPS

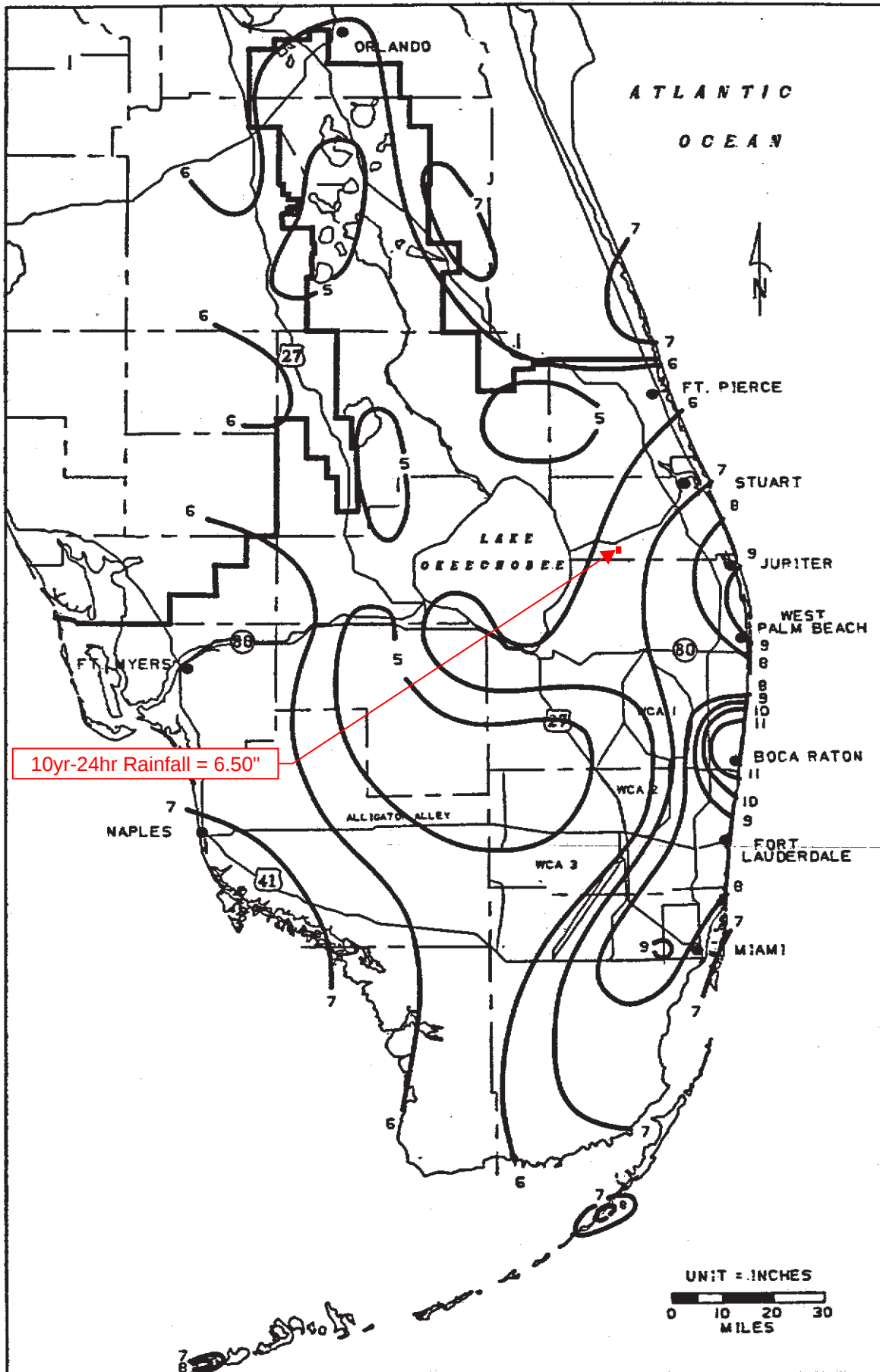


FIGURE C-4. 1-DAY RAINFALL: 10-YEAR RETURN PERIOD

C-6

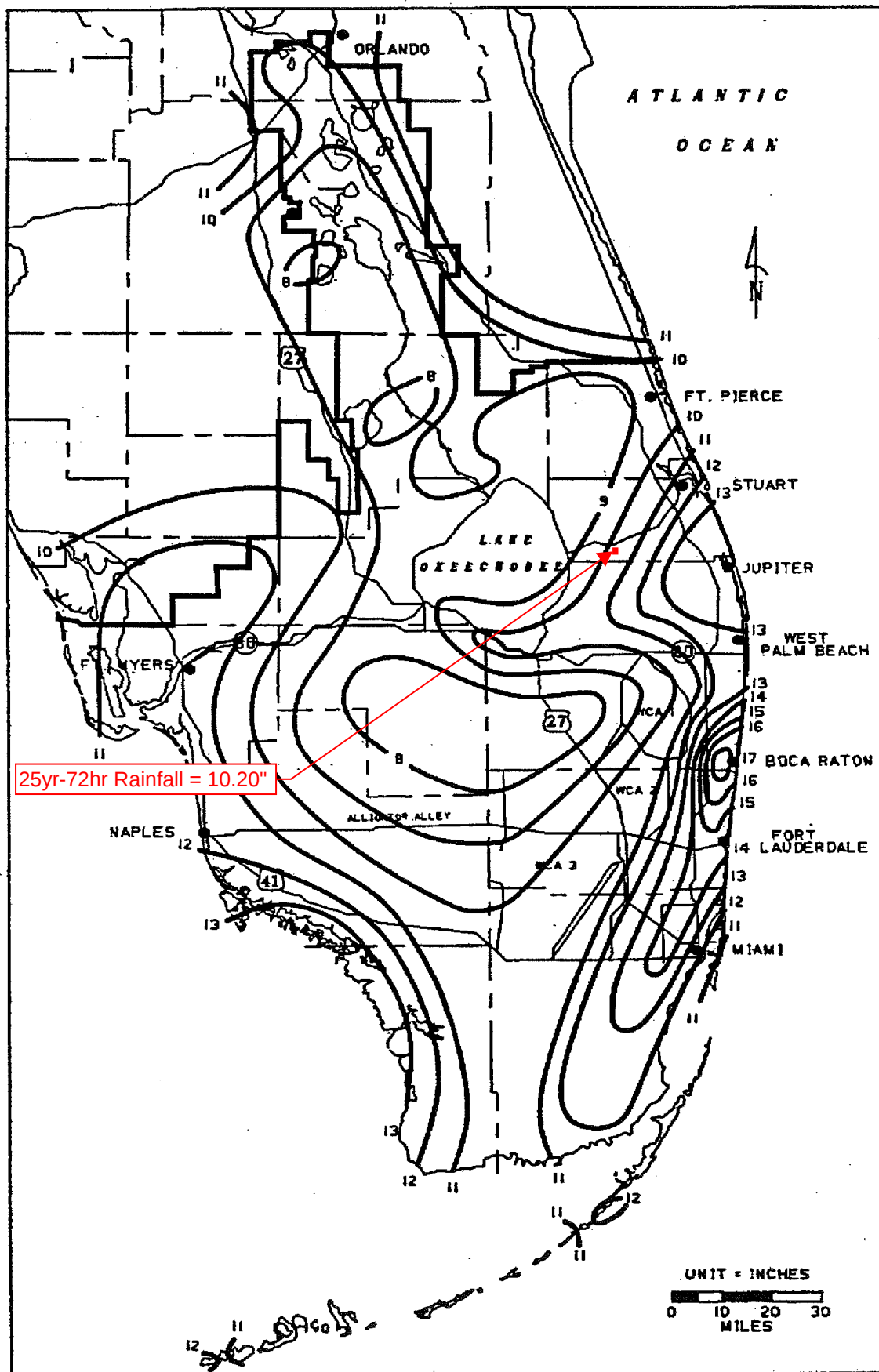


FIGURE C-8. 3-DAY RAINFALL: 25-YEAR RETURN PERIOD

C-10

Figure C-8

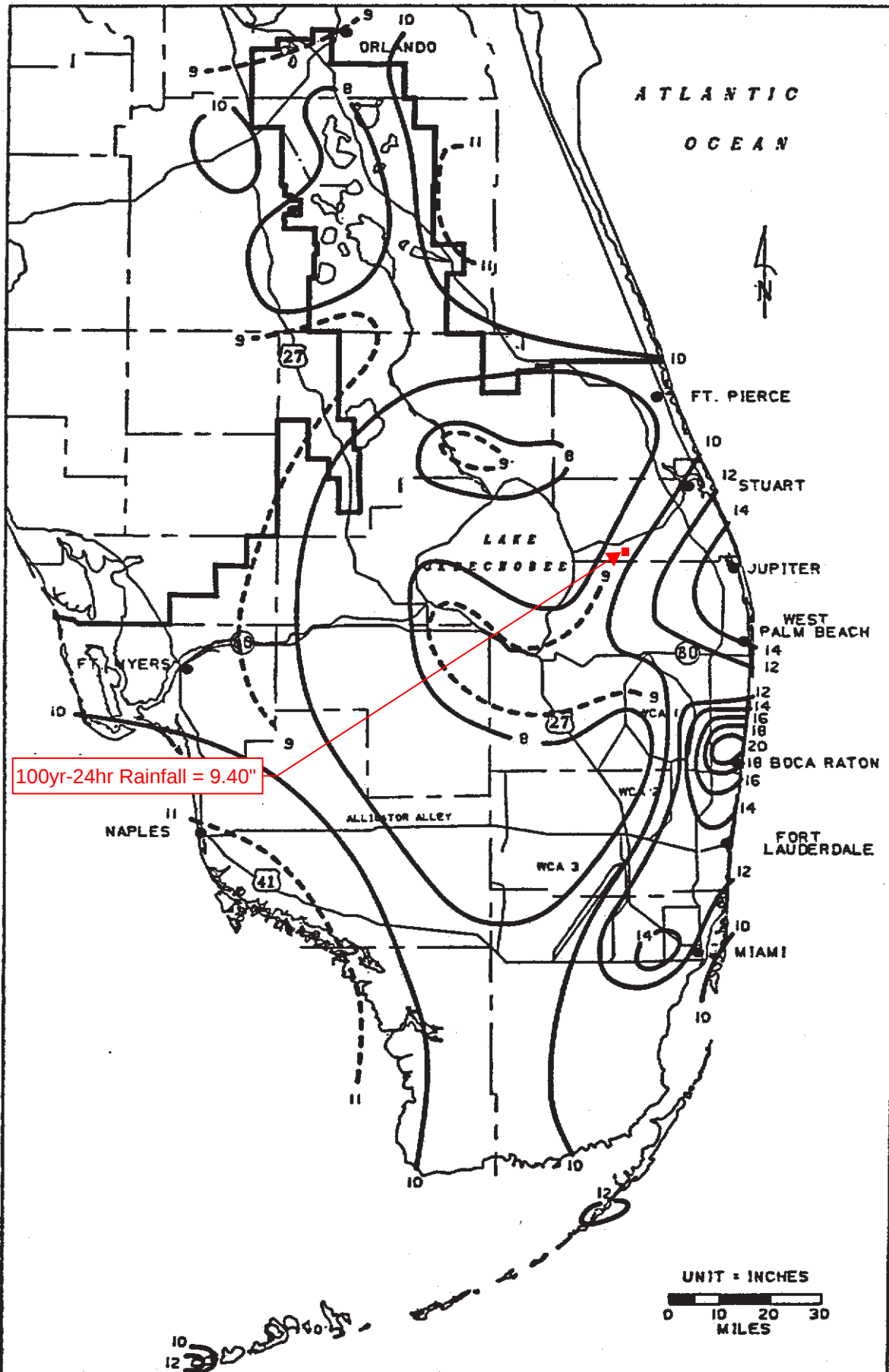
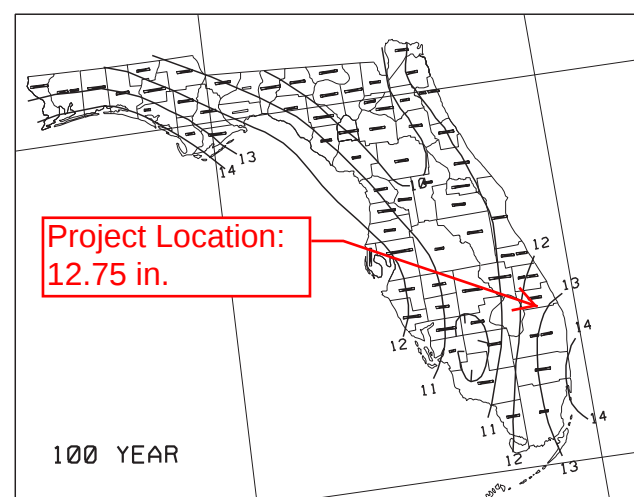
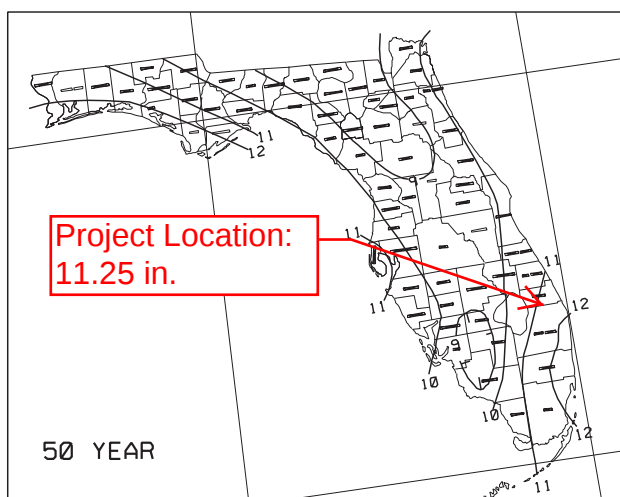
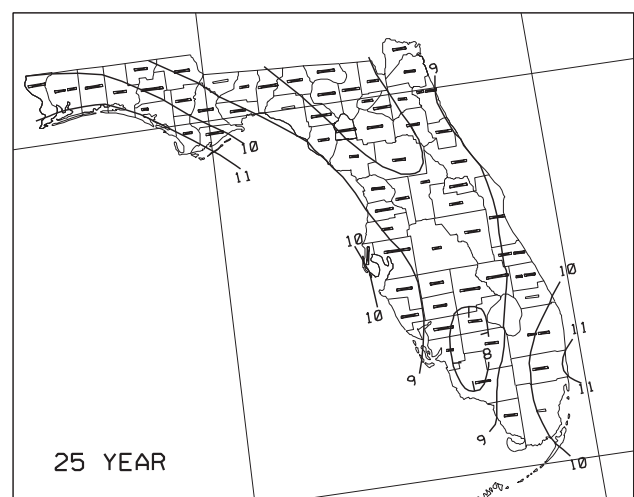
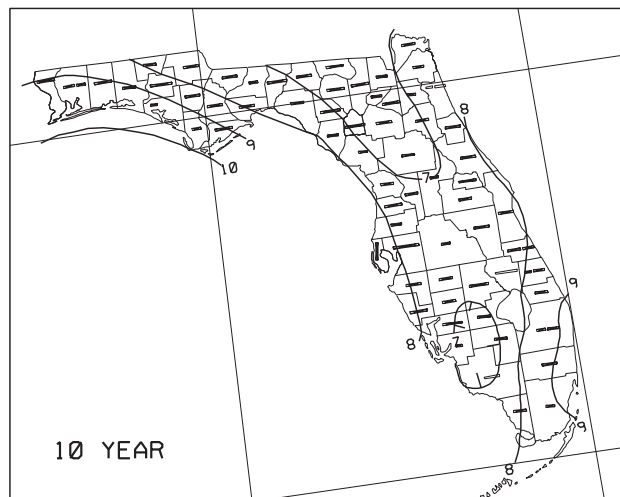
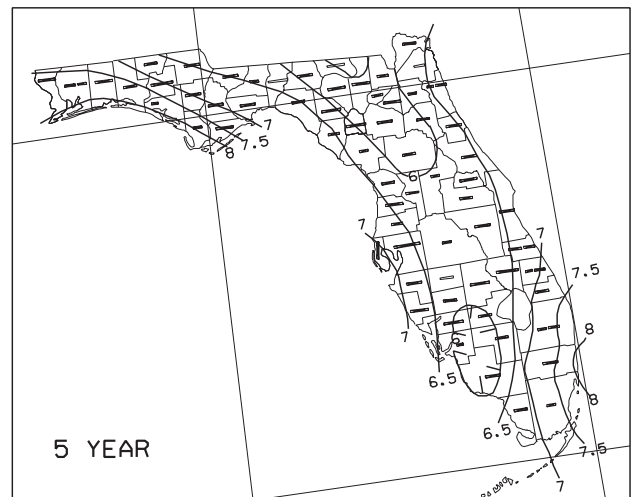
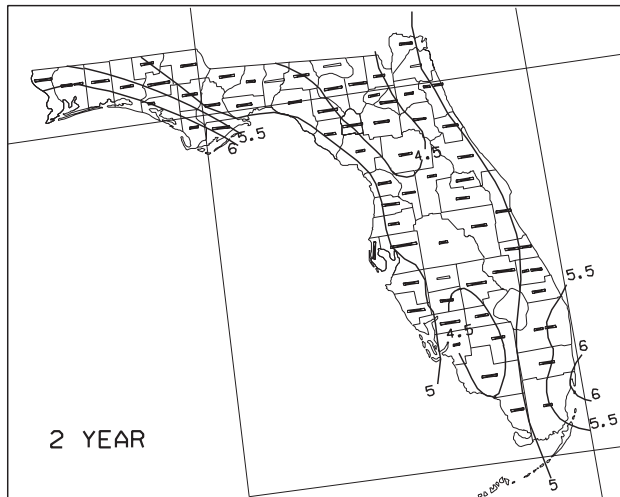


FIGURE C-6. 1-DAY RAINFALL: 100-YEAR RETURN PERIOD

PRECIPITATION DEPTH DATA FOR 2-,5-,10-,25-, 50-, AND 100-YEAR FREQUENCIES

1 DAY



ALL DEPTH CONTOURS IN INCHES

FIGURE 8
GEOPOLITICAL MAP

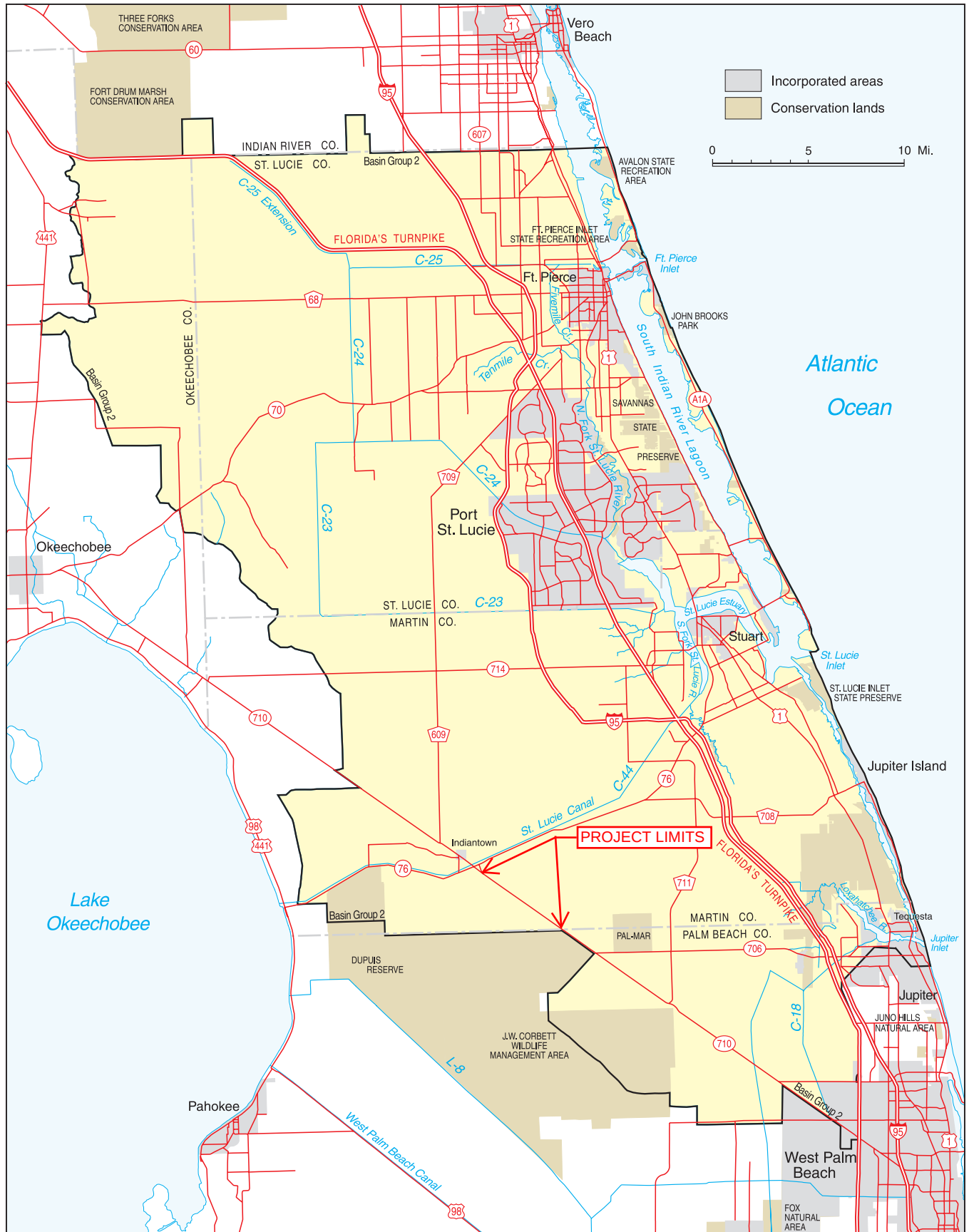


Figure 2.1: Geopolitical Map of the St. Lucie and Loxahatchee Basins

FIGURE 9
IMPAIRED WATERS
(VERIFIED LIST)

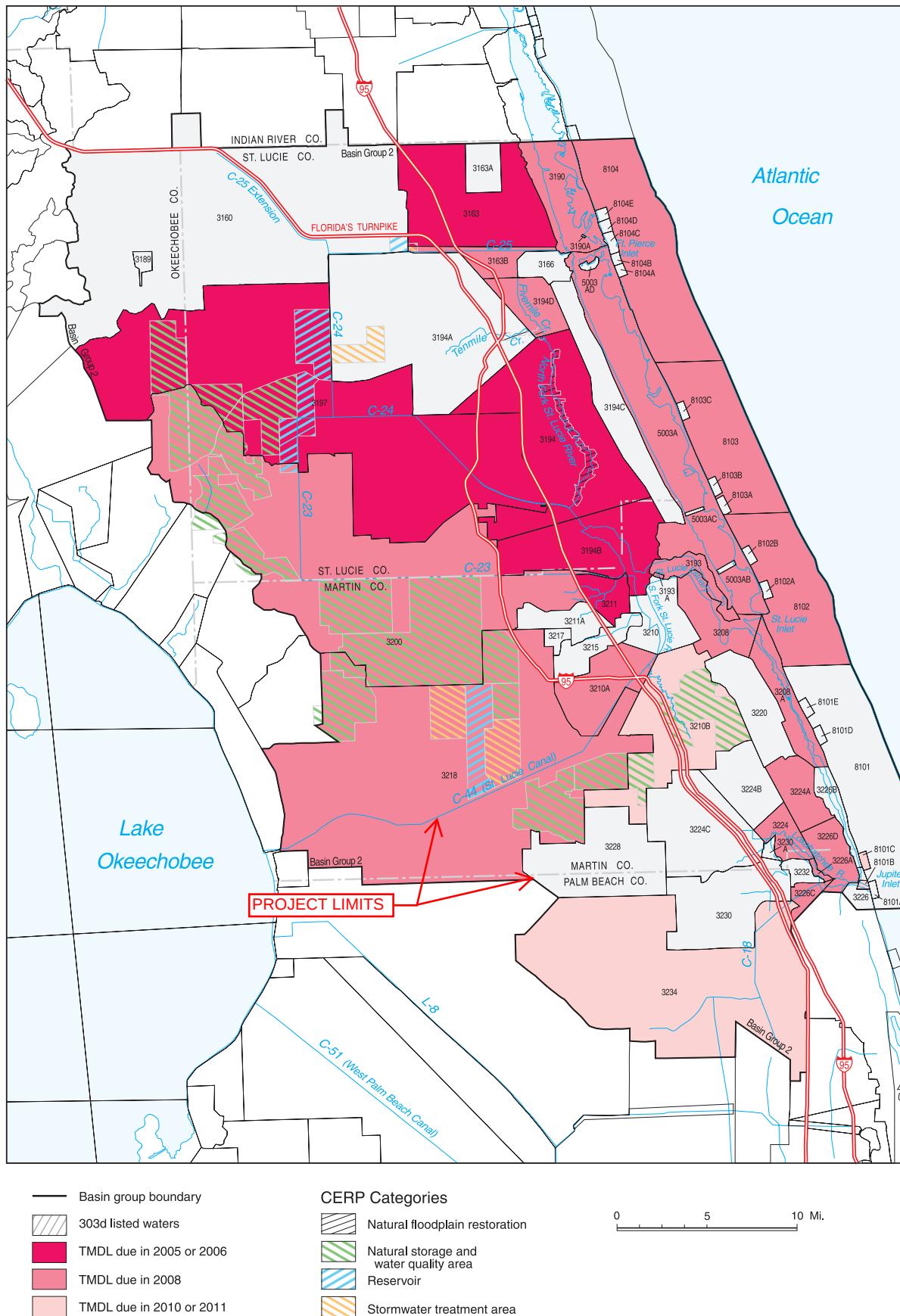


Figure 4.1: Waters on the Verified List, with Projected Year for TMDL Development

FIGURE 10
IMPAIRED WATERS
(WBID 3218 DELISTED)

Cycle Group	OGC#	Group Name	Planning Unit	WBD	Water Segment Name	Water-body Type	Water-body Class ²	1998 308(d) Parameters of Concern	Parameters Assessed Using the Impaired Waters Rule (IWR)	DO / Nutrient / Biology - TN, TP, BOD median Values (mg/L)	Integrated Assessment Status	Verified Period (# of Exceedances / Samples) ³	Comments
2	1	09-1541	Lake Okechobee	3212D	Lake Okechobee	Lake	1	Dissolved Oxygen	Dissolved Oxygen				A TMDL for nutrients was adopted by DEP 8/2001. Delisting from the 1998 308(d) list.
2	1	09-1542	Lake Okechobee	3212D	Lake Okechobee	Lake	1	Nutrients	Nutrients (TS)				A TMDL for nutrients was adopted by DEP 8/2001. Delisting from the 1998 308(d) list.
2	1	09-1543	Lake Okechobee	3212D	Lake Okechobee	Lake	1	Un-ionized Ammonia	Un-ionized Ammonia				A TMDL for nutrients was adopted by DEP 8/2001. Delisting from the 1998 308(d) list.
3	1	13-0711	Lake Okechobee	3212D	Lake Okechobee	Lake	1	Mercury (in fish tissue)	Mercury (in fish tissue)				This parameter is impaired for the waterbody and is being delisted from the Verified List and placed in category A because there is a DEP Adopted TMDL for this parameter.
1	1	09-1544	Lake Okechobee	3212E	Lake Okechobee	Lake	1	Nutrients	Nutrients (TS)				TMDL COMPLETED FOR PHOSPHORUS.
2	1	09-1544	Lake Okechobee	3212E	Lake Okechobee	Lake	1	Nutrients	Nutrients (TS)				A TMDL for nutrients was adopted by DEP 8/2001. Delisting from the 1998 308(d) list.
3	1	13-0712	Lake Okechobee	3212E	Lake Okechobee	Lake	1	Mercury (in fish tissue)	Mercury (in fish tissue)				This parameter is impaired for the waterbody and is being delisted from the Verified List and placed in category A because there is a DEP Adopted TMDL for this parameter.
1	1	09-1545	Lake Okechobee	3212F	Lake Okechobee	Lake	1	Dissolved Oxygen	Dissolved Oxygen				MEETS STANDARDS FOR DO. (6/3/77)
1	1	09-1545	Lake Okechobee	3212F	Lake Okechobee	Lake	1	Dissolved Oxygen	Dissolved Oxygen				PP-5/603. VP=2/659. Not impaired. Overall waterbody 1998 308(d) list. A TMDL has been completed by DEP 8/2001.
3	1	13-0713	Lake Okechobee	3212F	Lake Okechobee	Lake	1	Mercury (in fish tissue)	Mercury (in fish tissue)				This parameter is impaired for the waterbody and is being delisted from the Verified List and placed in category A because there is a DEP Adopted TMDL for this parameter.
1	1	09-1546	Lake Okechobee	3212G	Lake Okechobee	Lake	1	Nutrients	Nutrients (TS)				TMDL COMPLETED FOR PHOSPHORUS.
2	1	09-1546	Lake Okechobee	3212G	Lake Okechobee	Lake	1	Nutrients	Nutrients (TS)				MEETS STANDARDS FOR UNIONIZED AMMONIA. (6/4)
2	1	09-1547	Lake Okechobee	3212G	Lake Okechobee	Lake	1	Nutrients	Nutrients (TS)				A TMDL for nutrients was adopted by DEP 8/2001.
3	1	13-0714	Lake Okechobee	3212G	Lake Okechobee	Lake	1	Un-ionized Ammonia	Un-ionized Ammonia				A TMDL for nutrients was adopted by DEP 8/2001.
1	1	09-1548	Lake Okechobee	3212H	Lake Okechobee	Lake	1	Mercury (in fish tissue)	Mercury (in fish tissue)				This parameter is impaired for the waterbody and is being delisted from the Verified List and placed in category A because there is a DEP Adopted TMDL for this parameter.
3	1	13-0715	Lake Okechobee	3212H	Lake Okechobee	Lake	1	Nutrients	Nutrients (TS)				TMDL COMPLETED FOR PHOSPHORUS.
1	1	09-1549	Lake Okechobee	3212I	Lake Okechobee	Lake	1	Mercury (in fish tissue)	Mercury (in fish tissue)				A TMDL for nutrients was adopted by DEP 8/2001.
3	1	13-0716	Lake Okechobee	3212I	Lake Okechobee	Lake	1	Nutrients	Nutrients (TS)				This parameter is impaired for the waterbody and is being delisted from the Verified List and placed in category A because there is a DEP Adopted TMDL for this parameter.
3	1	13-0717	Lake Okechobee	NHAMS Complex	Myrtle Slough	Stream	3F	Coliforms	Fecal Coliform				This parameter is impaired for the waterbody and is being delisted from the 1998 308(d) list.
2	2	09-1578	St. Lucie - Lovelock	Okechobee Waterway (C-4)	C-4	Stream	3F	Dissolved Oxygen	Dissolved Oxygen	TN = 1.38 (n=318) TP = 0.17 (n=318) BOD = 1.2 (n=15)	Delist	5/417	Part of the SLE TMDL adopted 2/23/09. DO is verified impaired but unable to determine the causative pollutants. TN, TP, and BOD did not exceed the threshold. Data indicate that the WBD is co-impaired by multiple pollutants. The TMDL for TN, TP, and BOD was adopted by DEP 8/2001. Delisting from the 1998 308(d) list.
2	2	09-1579	St. Lucie - Lovelock	Okechobee Waterway (C-4)	C-4	Stream	3F	Iron	Iron		Delist	7/28	Exceeds criterion due to natural groundwater influence. See St. Lucie - Lovelock Basin. Evaluation of Potential Ground Water Influence on the Waterbody. The TMDL for Iron was adopted by DEP 8/2001. Delisting from the 1998 308(d) list.
3	1	13-0718	Lake Okechobee	NHAMS Complex	S-153	Stream	3F	Nutrients (Chlorophyll-a)	Nutrients (Chlorophyll-a)	TN = 2.124 (n=22) TP = 0.38 (n=22) BOD = 2.3 (n=5)	Delist (Analysis Flaw)		This parameter is being delisted from the Verified List based on a flaw in the original analysis. Station 21E-LW99, 26/10/048 for WBD 3219, there is now insufficient data for this waterbody to calculate annual average values for chlorophyll-a. Dissolved oxygen is impaired and historic chlorophyll-a has insufficient data.
2	2	09-1572	St. Lucie - Lovelock	Lovelock	Lovelock River (North Fork)	Stream	3F	Nutrients (Chlorophyll-a)	Nutrients (Chlorophyll-a)	TP = 0.04 (n=77)	Delist		This annual average Chl-a value did not meet the standard of 20.0 µg/L in 2001, 2003, 2004, and 2007. Data indicate the WBD is a TP limited. Biology of the species data is needed to update non-impairment assessment. Historic Chlorophyll-a and DO have been assessed and do not conflict with this delisting assessment. Proposing to delist from the cycle 1 verified list.
1	2	03-2600	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				This segment is being delisted because there were sufficient data for making the planning list assessment. PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2601	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2602	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2603	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2604	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2605	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2606	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2607	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2608	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2609	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2610	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2611	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2612	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2613	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2614	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2615	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2616	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2617	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2618	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2619	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2620	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2621	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2622	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2623	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2624	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2625	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2626	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2627	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2628	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2629	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2630	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2631	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2632	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2633	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2634	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2635	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2636	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2637	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2638	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2639	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2640	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2641	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2642	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2643	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2644	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2645	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2646	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2647	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2648	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2649	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2650	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2651	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2652	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2653	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2654	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2655	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2656	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2657	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2658	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2659	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2660	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2661	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2662	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2663	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2664	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2665	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2666	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.
1	2	03-2667	St. Lucie - Lovelock	Kichings Creek	Kichings Creek	Stream	3F	Coliforms	Fecal Coliform				PP-10/12. Not impaired. VP=10/12. Not impaired.

FIGURE 11
PD&E POND SITING REPORT
EXCERPT

3.0 Site Information

3.1 Existing Drainage Conditions

The project is located within the jurisdiction of the South Florida Water Management District (SFWMD). The existing roadway was constructed prior to stormwater management regulations; hence there are few segments of the SR 710 Study corridor that have permitted stormwater management facilities. The drainage system for SR 710 is an open swale system. Typically, stormwater runoff from the existing roadway pavement flows over grassed shoulders into roadside swales located on either side of SR 710; the swales are connected by approximately 45 cross drain pipes.

The swale on the south side is confined by the CSX railroad tracks and SR 710. The CSX railroad tracks are a major drainage divide. Half of the CSX railroad right-of-way and half of the SR 710 right-of-way share the south roadside swale. The swale on the north side is not confined by any divides except at Caloosa and Steeplechase. Generally, with these few exceptions, the runoff from the roadside swales sheet flows north to adjacent wetlands.

The runoff from SR 710 that is adjacent to Caloosa is captured in the roadside swales and not allowed to flow north due to an earth berm located at the north right-of-way line. There is no visual evidence of a connection to the C-18W Canal; the runoff for this segment of SR 710 simply collects in the roadside swales and either evaporates or infiltrates into the groundwater.

The runoff from SR 710 that is adjacent to Steeplechase is captured in the roadside swales and conveyed east under Haverhill Road and Military Trail to the pond located within the Palm Lake CO-OP; the pond discharges to the C-17 Canal via the Northern Palm Beach County Improvement District EPB-8 Canal.

There are three major structures that cross the CSX railroad tracks and SR 710; these structures provide a hydraulic connection between areas located south of the CSX railroad tracks to areas north of SR 710. These structures serve the C-18W Canal system and the Loxahatchee Slough. These include a bridge structure at the C-18W Canal, a bridge structure at the Loxahatchee Slough, and a double 10-ft x 10-ft box culvert at the C-18 Canal.

In general the existing drainage system works fine. Routine maintenance includes mowing the roadside swales. The pavement condition visually looks in good condition with little signs of deterioration due to the surrounding high ground water table. There are three residential communities adjacent to the project corridor that utilizes an earthen berm which blocks stormwater runoff from SR 710, half the CSX right-of-way, and adjacent canals to provide flood protection. These communities are Caloosa, PGA National, and Steeplechase. Each of these communities has a drainage system which works independently of the SR 710 drainage system.

3.2 Existing Drainage Basins

SR 710 is located adjacent to, or bisects six separate drainage basins as defined by South Florida Water Management District (SFWMD). The drainage basins include the C-44, Pal Mar, L-8, C-18, West Palm Beach Water Catchment Area and C-17 basin. These drainage basins delineate regional drainage divides.

The profile of SR 710 drops constantly from west to east, towards the Atlantic Ocean. For the approximate 25 mile length of the project, the profile of SR 710 drops approximately seven feet in elevation. There are generally no



highpoints along SR 710 that create basin divides. However, basin divides can be identified based on major features that include SFWMD basin divides, canals that intersect SR 710, and major roadways that intersect SR 710. Accordingly, for the purpose of this PD&E Study, the project is split into nine sub-basins. The sub-basin information and control elevations for discharging to the north are included in **Table 3-1**.

Table 3-1 – Sub-Basin Description

Project Sub-Basin Name	SFWMD Basin Name	Sub-Basin Limit Description	Sub-Basin Station to Station	Control Elevation NAVD ¹
W1	C-44	Begin Project to Pal Mar Basin Divide	979+00 to 1173+00	20.5 ft
W2	Pal Mar	Pal Mar Basin Divide to C-18 Basin Divide	1173+00 to 1350+00	20.5 ft
W3	C-18	C-18 Basin Divide to CSX RR spur crossing	1350+00 to 1624+00	21.0 ft
W4	C-18	CSX RR spur crossing to C-18W Canal	1624+00 to 1782+50	16.5 ft
W5	C-18	C-18W Canal to PGA Blvd.	1782+50 to 1973+00	16.0 ft
W6	C-18	PGA Blvd. to Bridge over Loxahatchee Slough	1973+00 to 2086+00	16.0 ft
W7	C-18	Bridge over Loxahatchee Slough to C-18 Canal	2086+00 to 2145+00	16.0 ft
W8	C-17	C-18 Canal to Florida's Turnpike	2145+00 to 2246+00	15.7 ft
W9	C-17	Florida's Turnpike to Blue Heron Blvd.	2246+00 to 2321+48.79	10.5 ft

1. North American Vertical Datum (NAVD) elevation is listed in this table to conform to the preferred FDOT vertical datum (NAVD 1988). Many control elevations were listed in National Geodetic Vertical Datum (NGVD) (assumed 1929) found during the basin research of permits and documents. The conversion used to obtain NAVD elevations assumed NAVD = NGVD – 1.5 ft.

See **Appendix A** for the drainage map that delineates SFWMD basin boundaries and the sub-basin boundaries.

The control elevations listed in **Table 3-1** were determined using several sources of information including geotechnical, approved stormwater permits, North Palm Beach County Improvement District public facilities reports and South Florida Water Management District Comprehensive Everglades Restoration Project plans, as follows:

Unless otherwise noted, the control elevation is based on the Seasonal High Ground Water Table (SHGWT) estimate from the Geotechnical Report dated October 2008, Section 6.1, Table 2.

- For sub basin W1, the control elevation is based on the Geotechnical Report SHGWT estimate of 2.0 ft below existing ground. Based on surveyed cross sections every 1,000 feet and the boring locations, the existing ground at the boring is approximately 22.50 ft NAVD and the control is at 20.50 ft NAVD.



- For sub basin W2, the control elevation is based on permit number 50-07040-P that estimates the SHGWT to be 22.0 ft NGVD (the permit is for a roadway project at intersection of Pratt Whitney Road and Indiantown Road). No other information for the Pal Mar Basin was found.
- For sub basin W3, the control elevation is based on NPBCID control elevation of 22.50 ft NGVD on north side of SR710 near railroad spur for Northern Palm Beach County Improvement District (NPBCID) Unit 16.
- For sub basin W4, the control elevation is based on NPBCID (Unit 16) control for the Caloosa development which is 18.0 ft NGVD.
- For sub basins W5, W6 and W7, the control elevation for each sub basin is the same and based on the SFWMD Comprehensive Everglades Restoration Plan (CERP) project which proposes to change the hydro period within the Loxahatchee Slough to a control elevation of 17.5 ft NGVD.
- For sub basin W8, the control elevation is based on permit No. 50-05283-P, Gables at Northlake Boulevard. The control elevation is 17.20 ft NGVD. The receiving water body is a nine acre lake within Gables via the wetland area between SR 710 and Gables and a 36" pipe. The nine acre lake discharges under the Turnpike via a box culvert which connects to the Steeplechase canal system and EPB-6 which eventually connects to the C-17 Canal.
- For sub basin W9, the control elevation is based on NPBCID facilities map and report for Unit 3. A 14 ft wide steel sheet pile weir within EPB 6 Canal is controlled at 12.00 ft NGVD. This weir is located at the NW corner of the Woodbine development. This assumes the discharge is to the north using the Steeplechase system of canals. If the discharge is to adjacent CSX swale, the SHGWT is based on the Geotechnical Report SHGWT estimate of 2.0 ft below existing ground.

3.3 Rainfall Data

The rainfall amount varies for the project due to the length of the project. The rainfall amount is historically greater near the coast of Florida as opposed to near Lake Okeechobee. The following table, Table 3-2, summarizes the rainfall amounts between SR 76 and Blue Heron Boulevard.



FIGURE 12
EXISTING TYPICAL SECTION

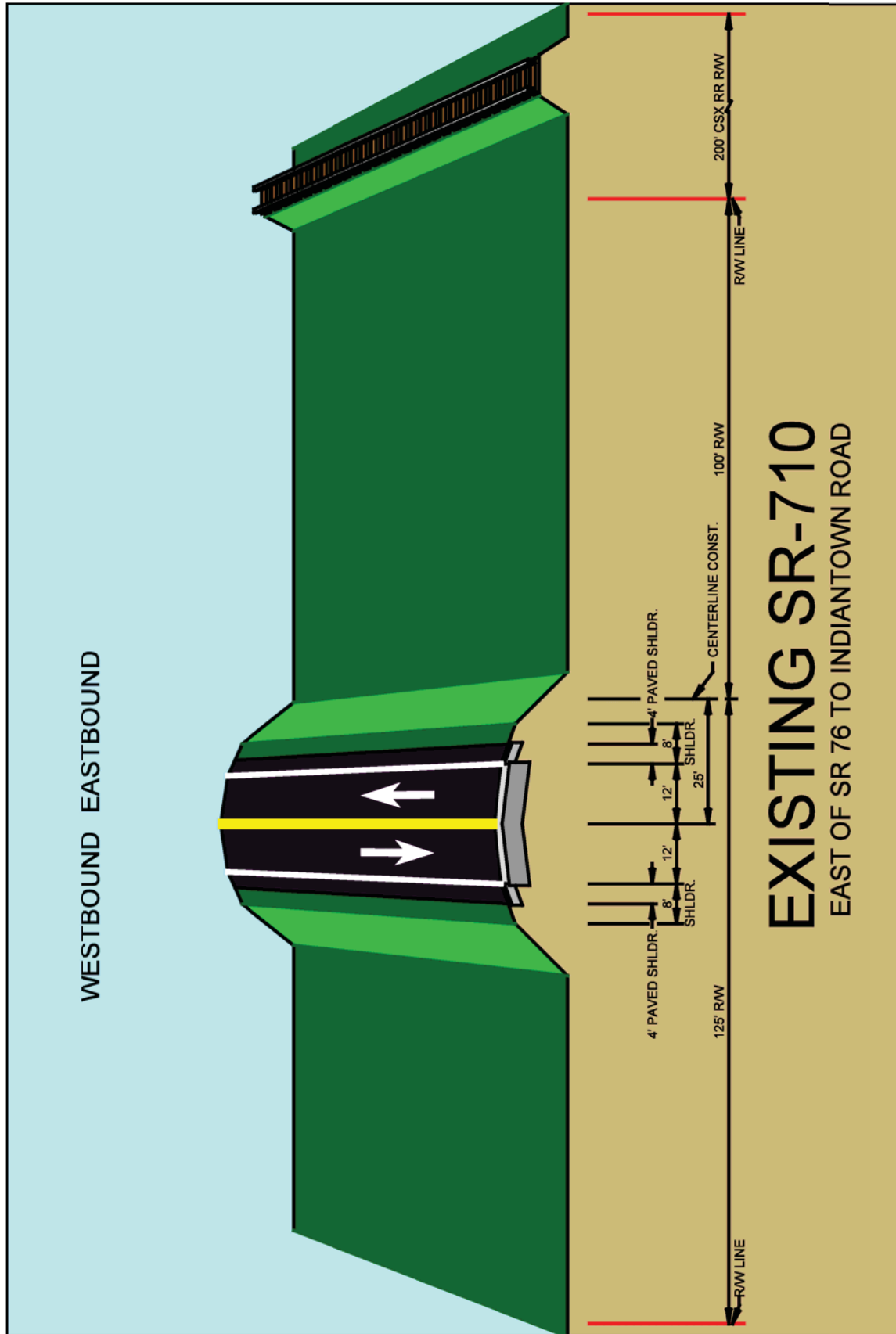
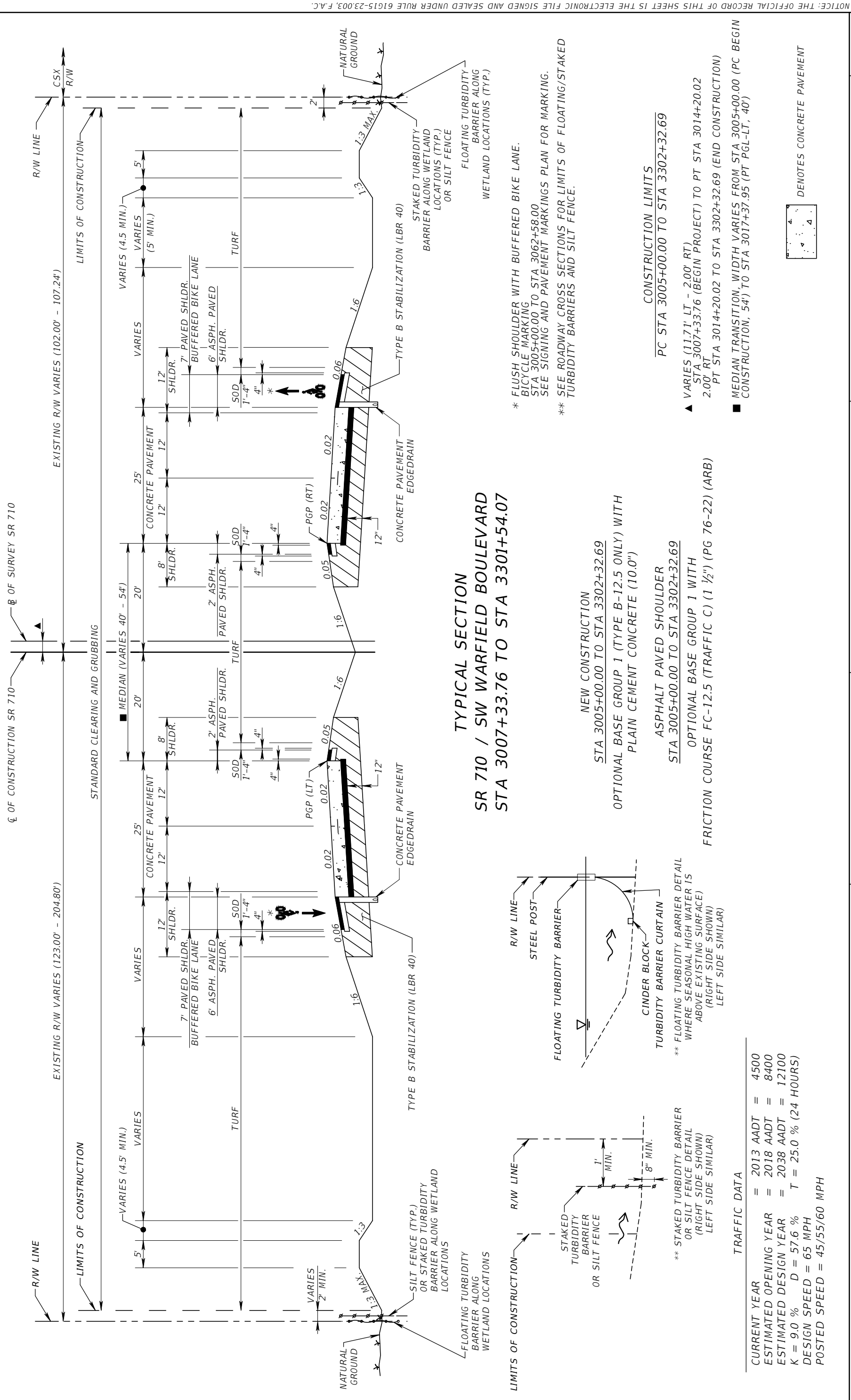


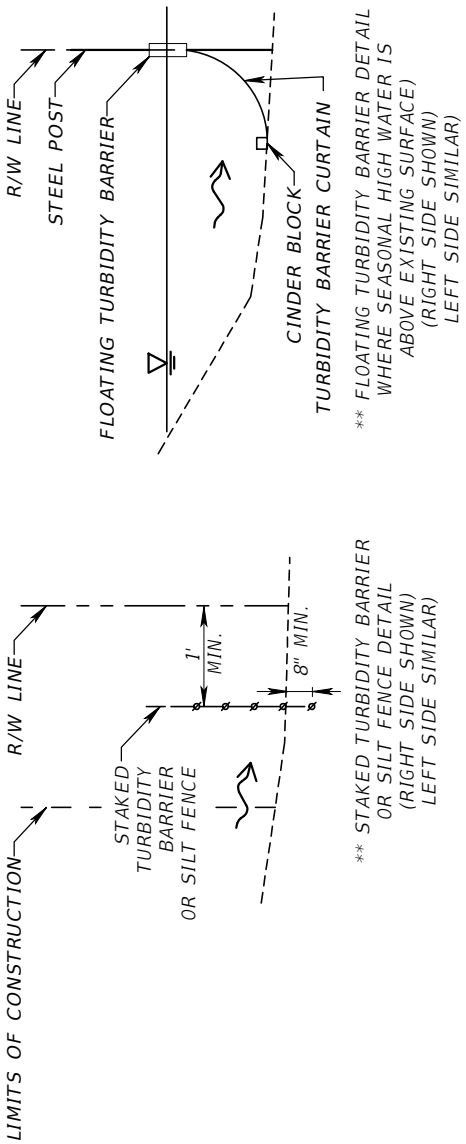
FIGURE 2: EXISTING SR 710 TYPICAL SECTION (EAST OF SR 76 TO INDIANTOWN ROAD)



FIGURE 13
PROPOSED TYPICAL SECTION



TYPICAL SECTION
SR 710 / SW WARFIELD BOULEVARD
STA 3007+33.76 TO STA 3301+54.07



TRAFFIC DATA

CURRENT YEAR	=	2013 AADT	=	4500
ESTIMATED OPENING YEAR	=	2018 AADT	=	8400
ESTIMATED DESIGN YEAR	=	2038 AADT	=	12100
K = 9.0 %	D = 57.6 %	T = 25.0 %	(24 HOURS)	
DESIGN SPEED = 65 MPH				
POSTED SPEED = 45/55/60 MPH				

NEW CONSTRUCTION
STA 3005+00.00 TO STA 3302+32.69
OPTIONAL BASE GROUP 1 (TYPE B-12.5 ONLY) WITH
PLAIN CEMENT CONCRETE (10.0")

ASPHALT PAVED SHOULDER
STA 3005+00.00 TO STA 3302+32.69
OPTIONAL BASE GROUP 1 WITH
FRICTION COURSE FC-12.5 (TRAFFIC C) (1 1/2") (PG 76-22) (ARB)

* FLUSH SHOULDER WITH BUFFERED BIKE LANE.
BICYCLE MARKING
STA 3005+00.00 TO STA 3062+58.00
SEE SIGNING AND PAVEMENT MARKINGS PLAN FOR MARKING.

** SEE ROADWAY CROSS SECTIONS FOR LIMITS OF FLOATING/STAKED
TURBIDITY BARRIERS AND SILT FENCE.

CONSTRUCTION LIMITS
PC STA 3005+00.00 TO STA 3302+32.69

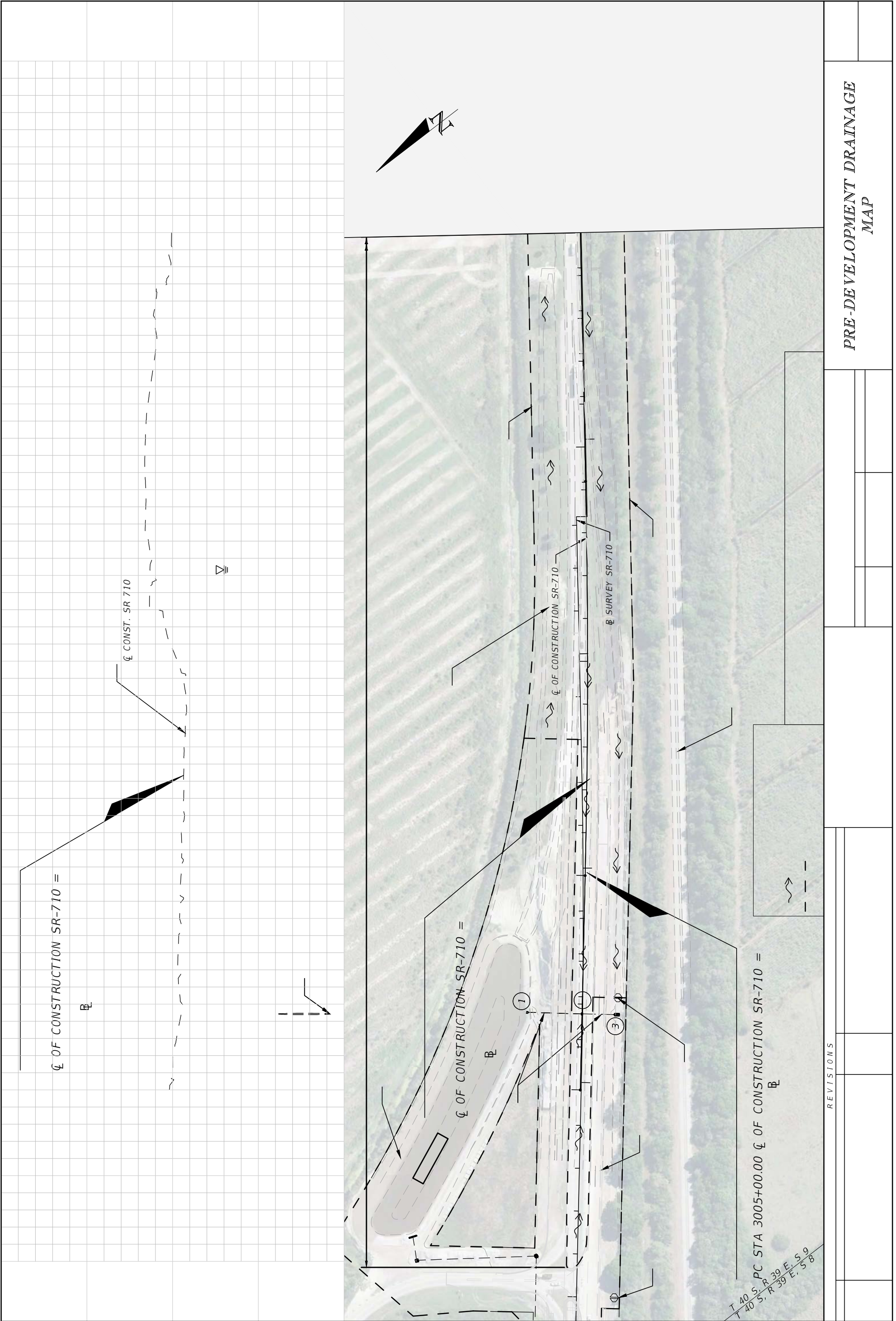
- ▲ VARIES (11.71' LT - 2.00' RT)
STA 3007+33.76 (BEGIN PROJECT) TO PT STA 3014+20.02
2.00' RT
PT STA 3014+20.02 TO STA 3302+32.69 (END CONSTRUCTION)
- MEDIAN TRANSITION WIDTH VARIES FROM STA 3005+00.00 (PC BEGIN
CONSTRUCTION, 54') TO STA 3017+37.95 (PT PGL-LT, 40')

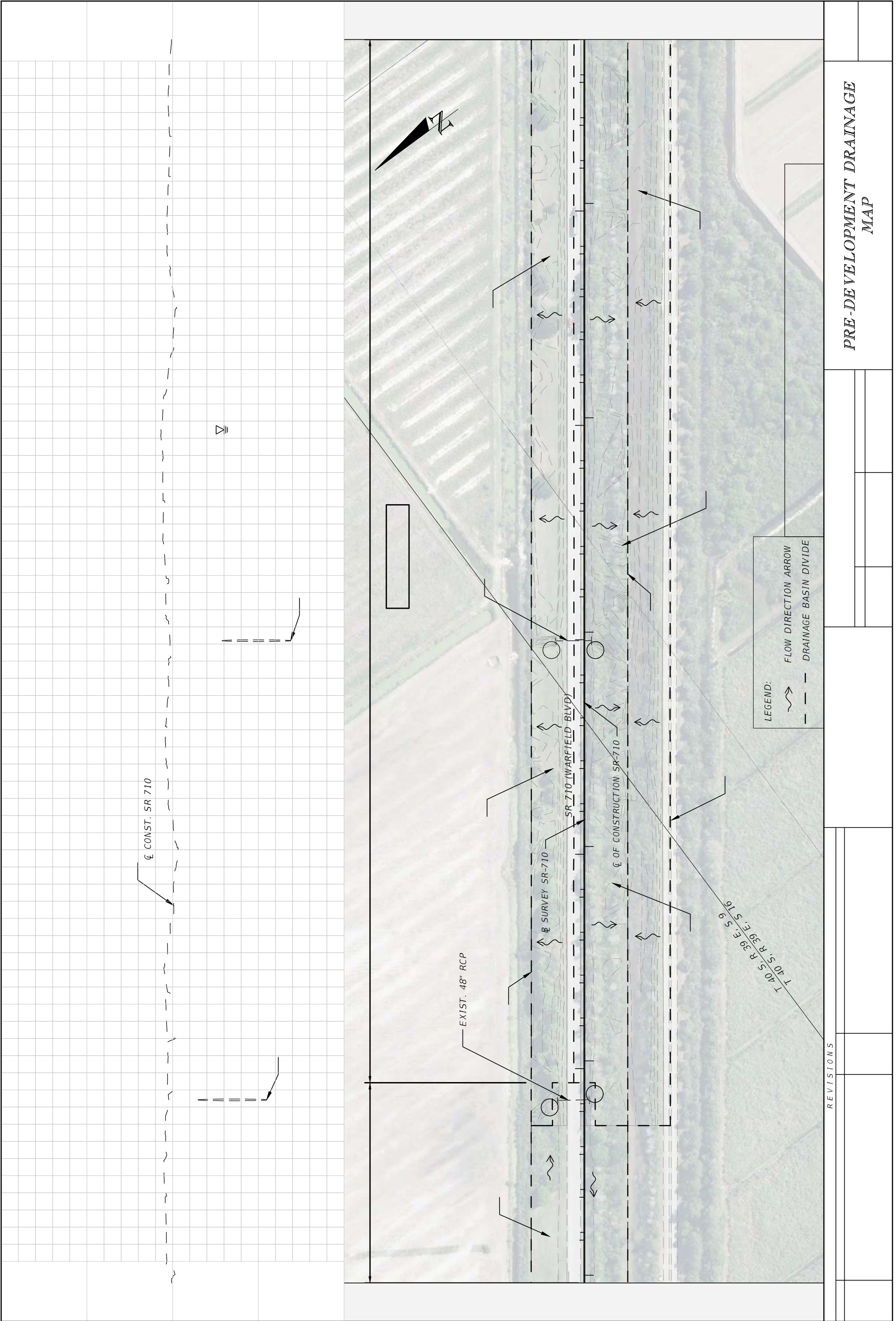


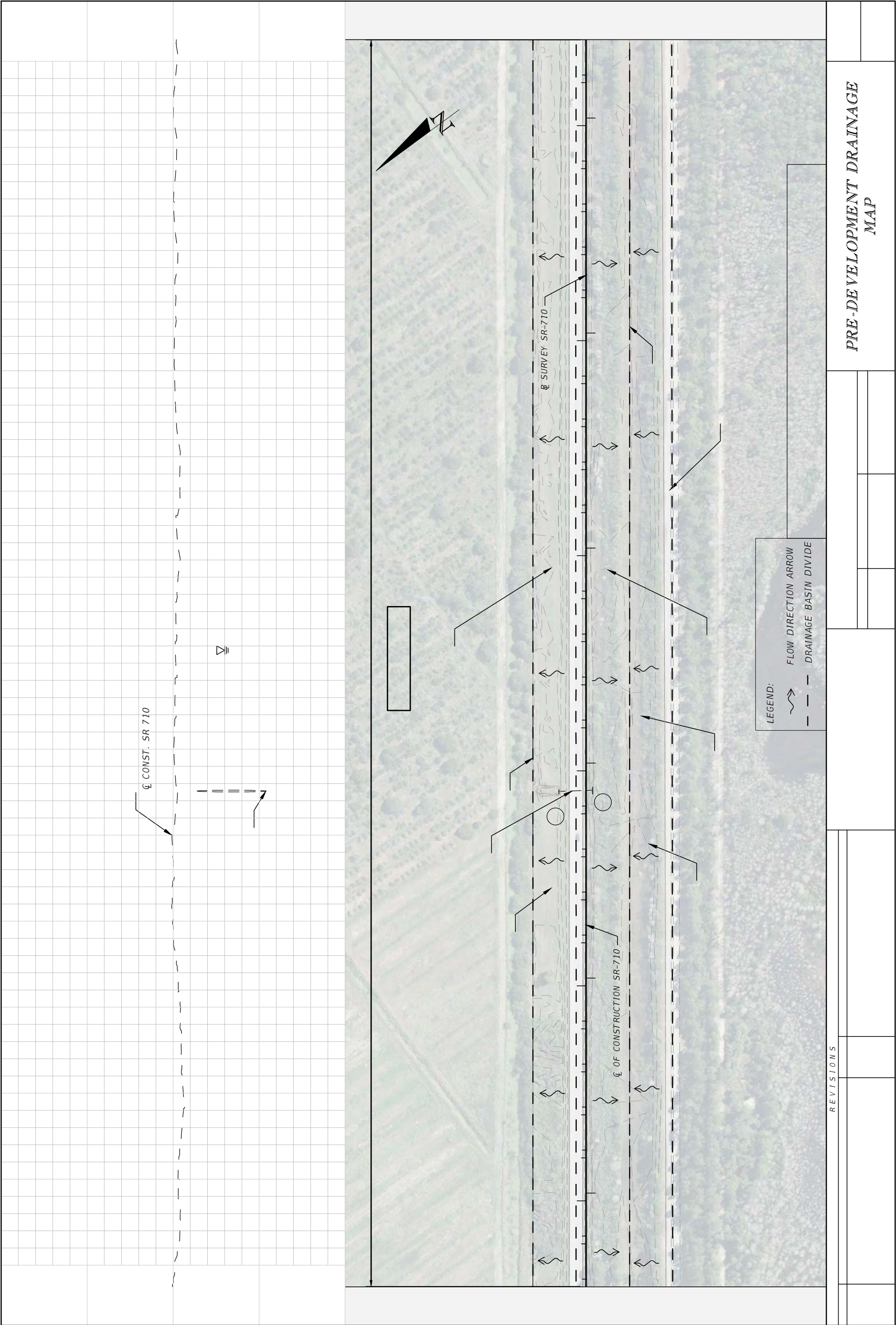
DATE		REVISIONS		C H Perez and Associates Consulting Engineers, Inc. Certificate of Authorization No. 25976 9594 NW 41 Street, Suite 201 Doral, Florida 33178 Tel: (305) 592-1070 Fax: (305) 592-1076 Alejandro G. Meltin Florida P.E. No. 44744 www.p-a.cc agm@p-a.cc	STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION		TYPICAL SECTION	SHEET NO.
DESCRIPTION		DATE			ROAD NO.	COUNTY		
DESCRIPTION		DATE			710	MARTIN		
								16

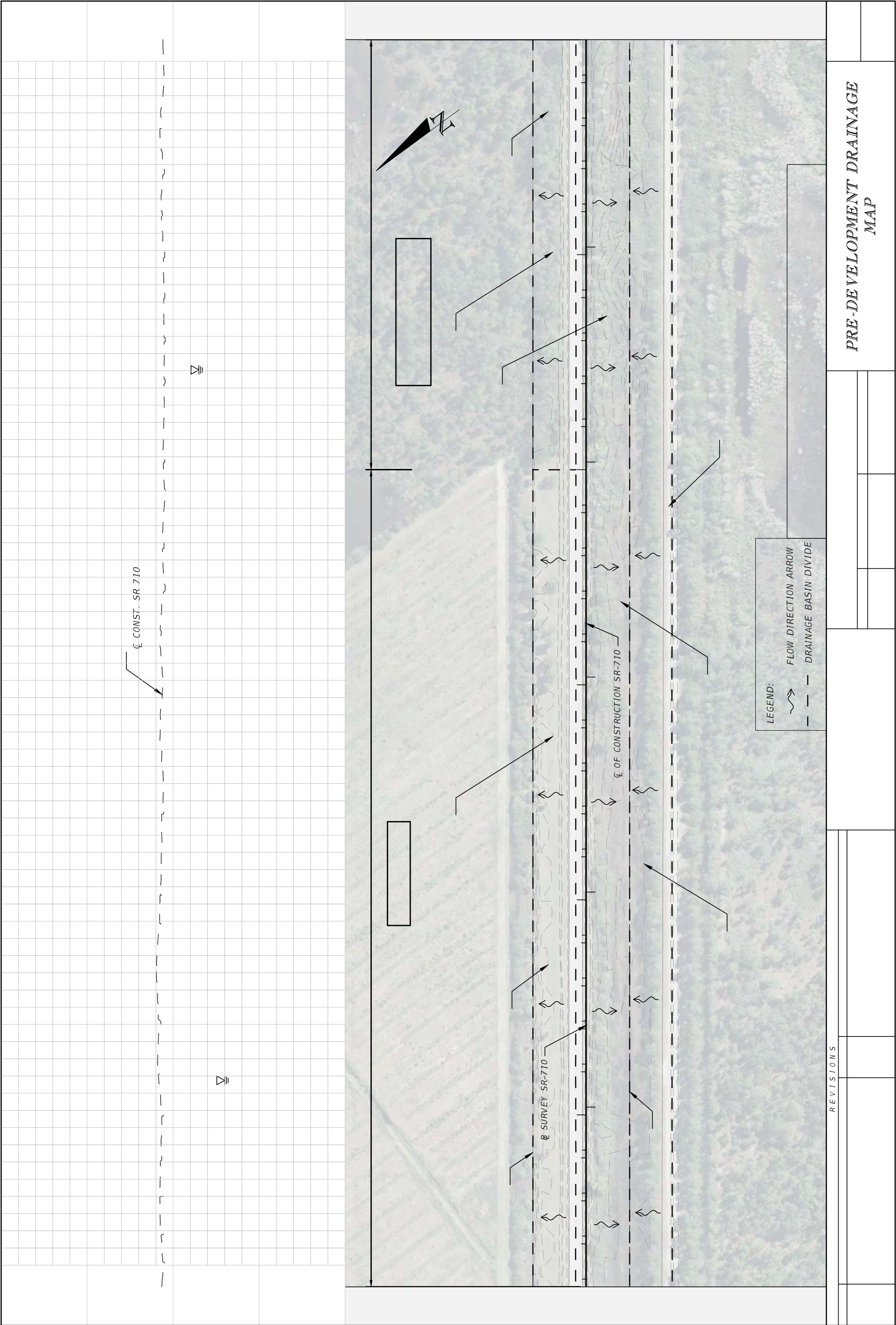
APPENDIX B
PRE-DEVELOPMENT
DRAINAGE MAPS

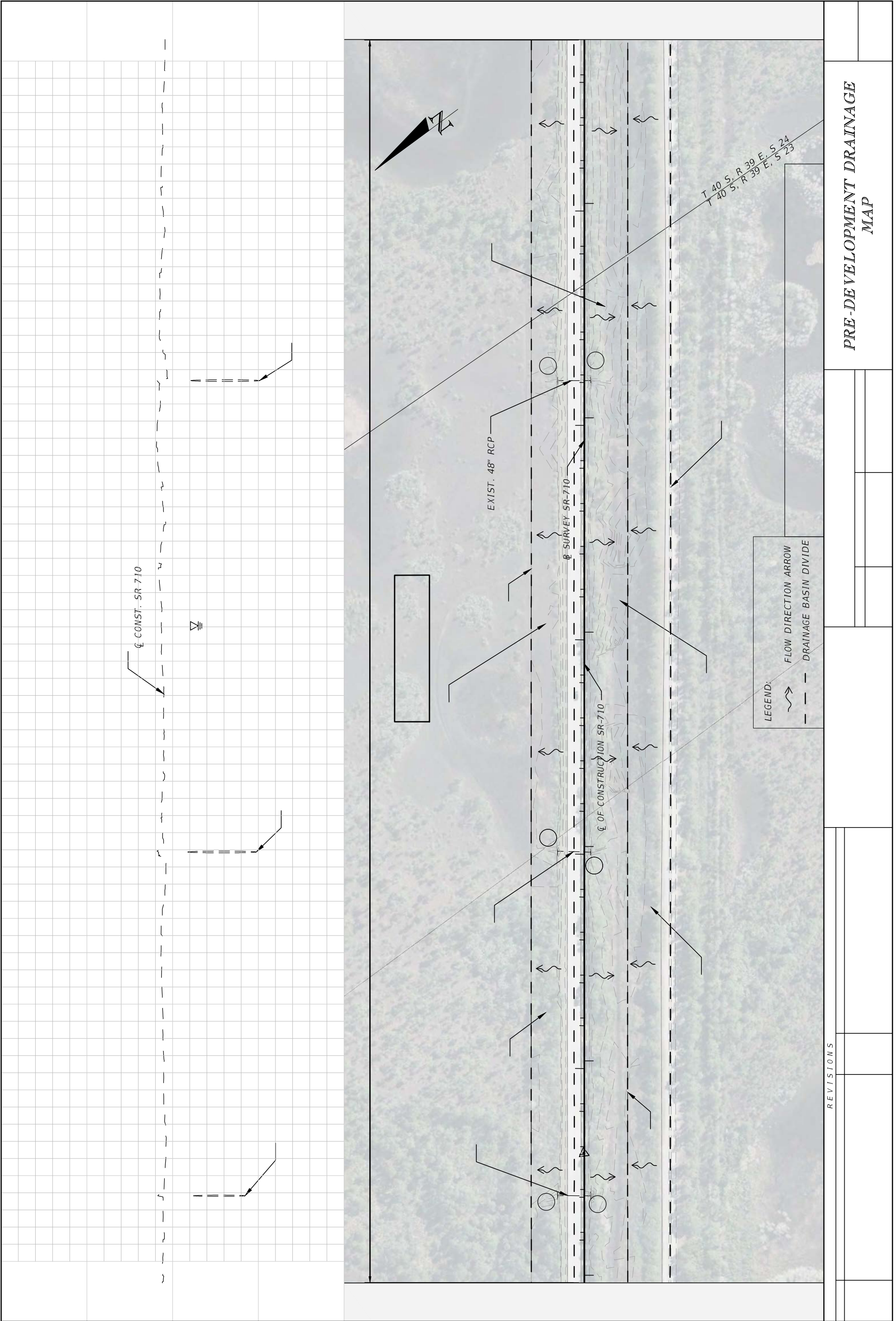


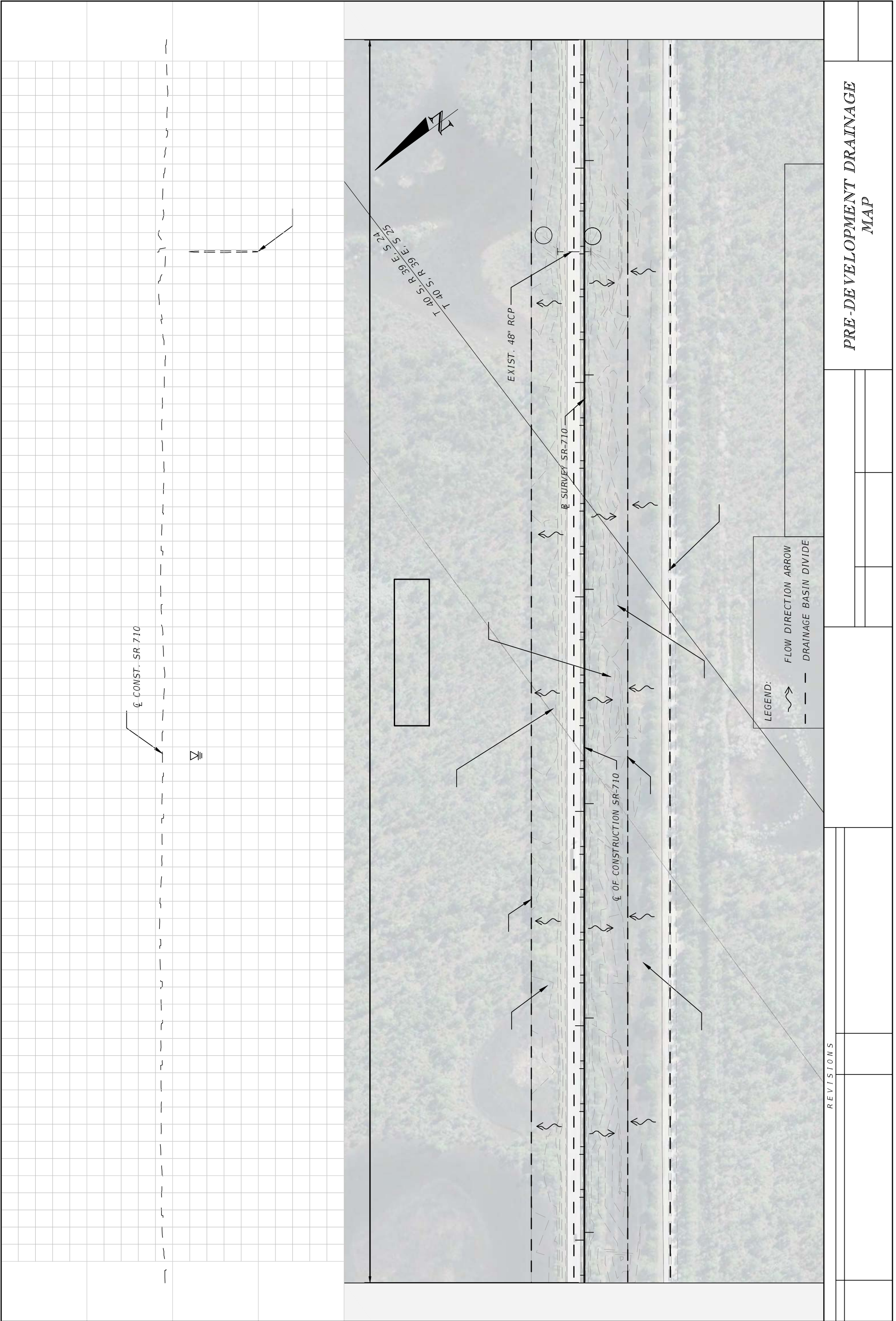


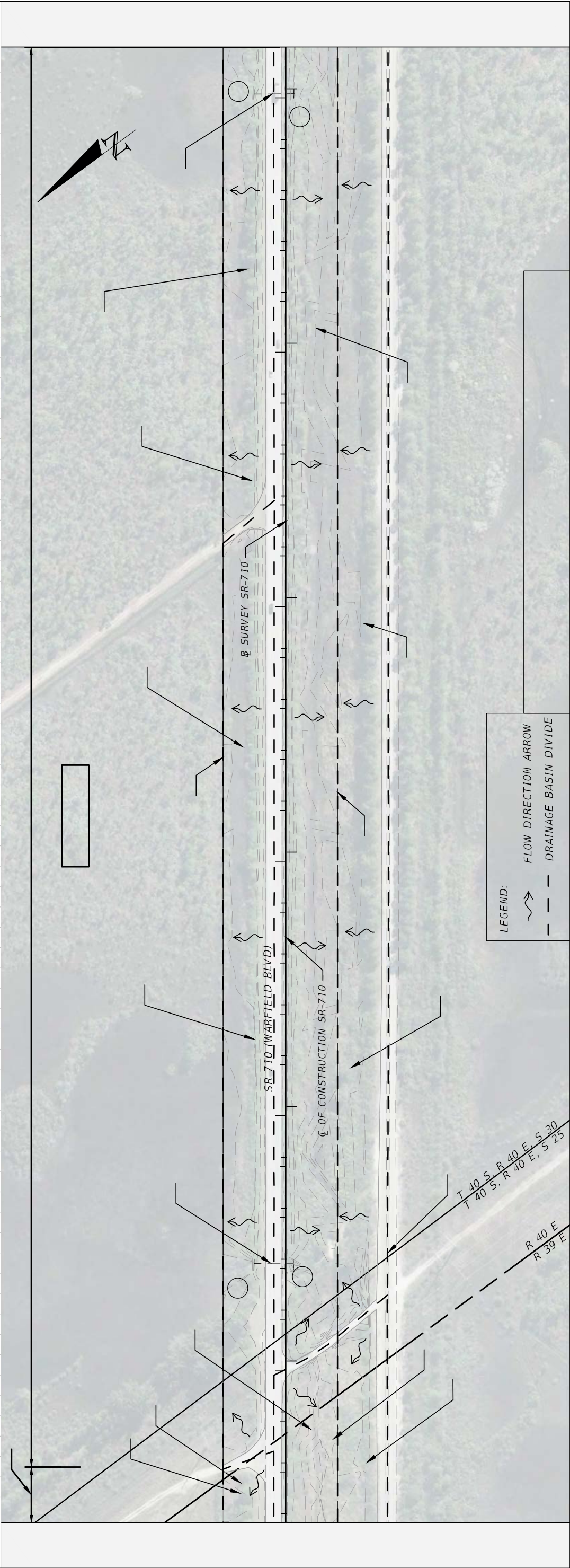
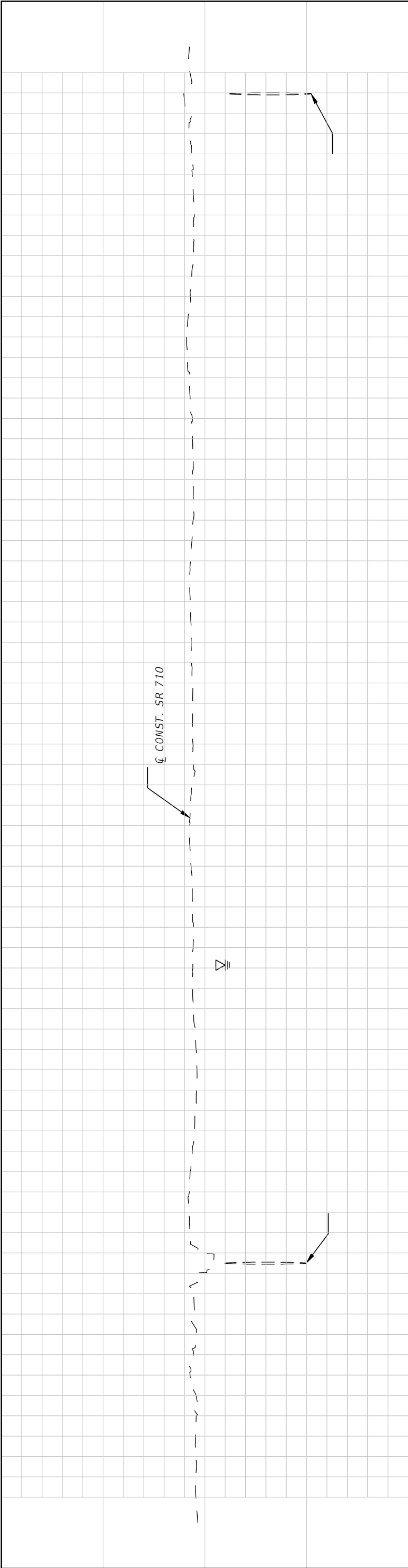












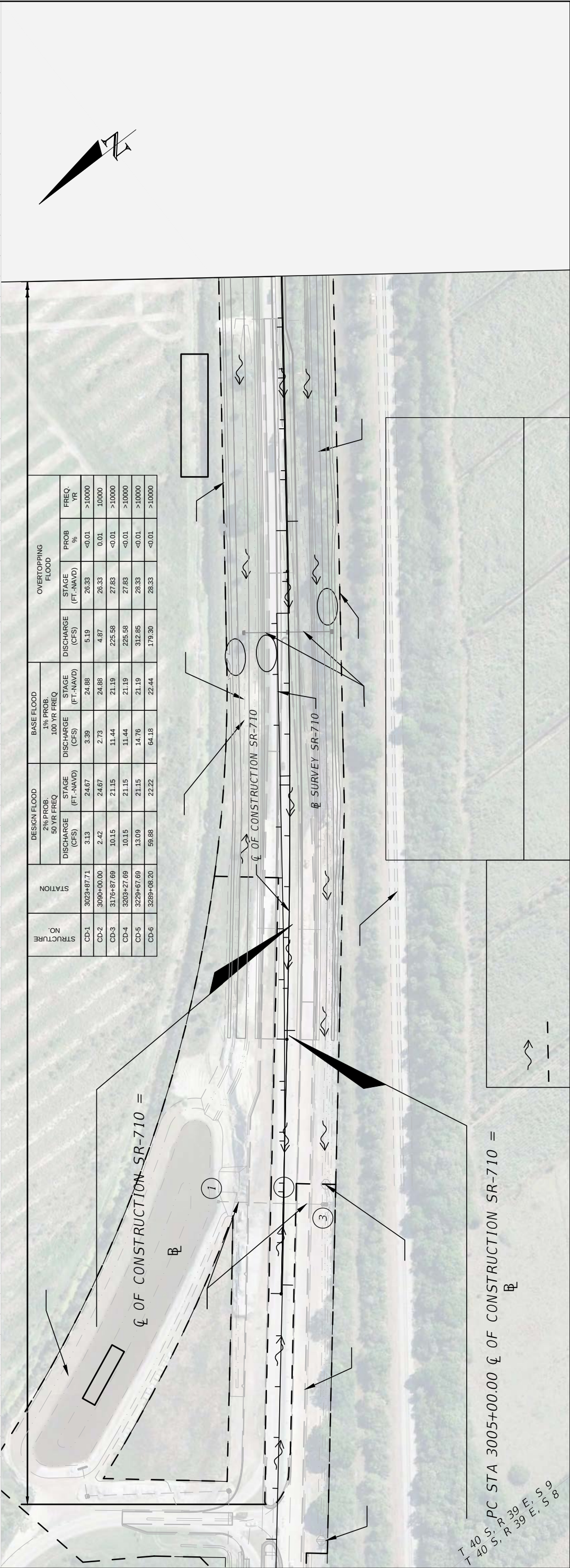
PRE-DEVELOPMENT DRAINAGE MAP		REVISIONS	

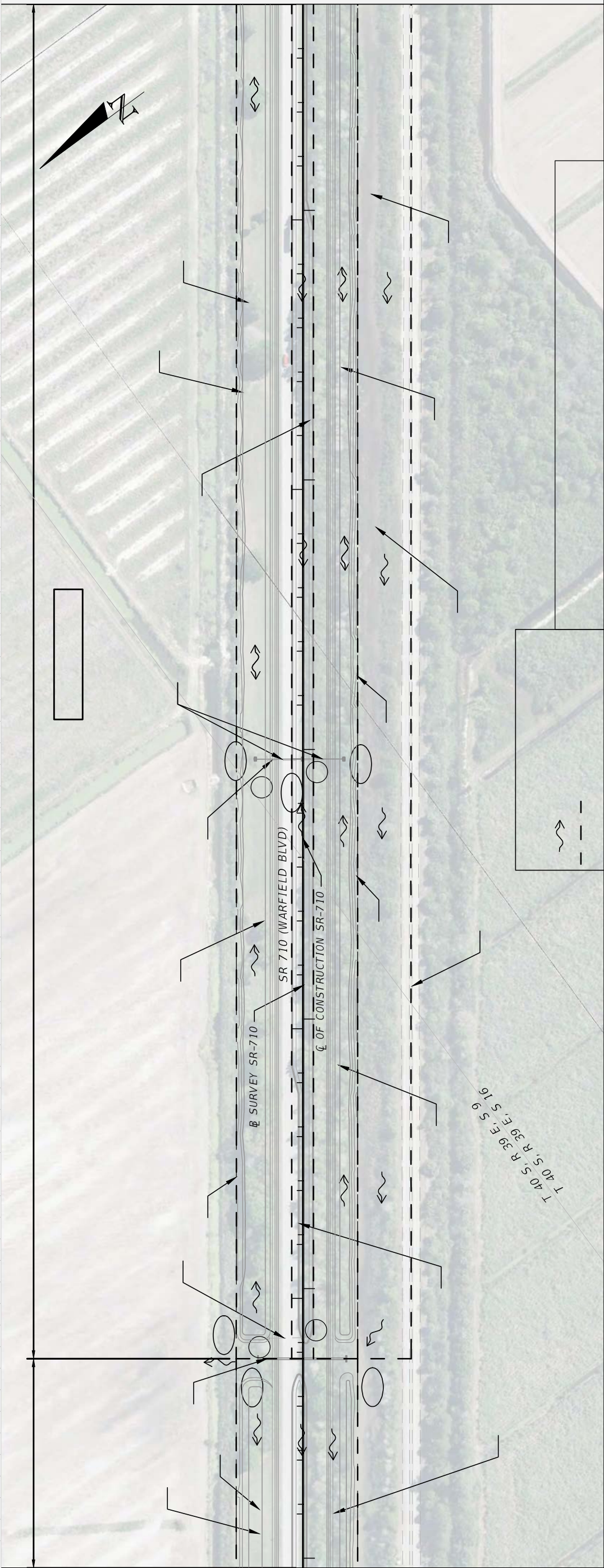
SUMMARY OF EXISTING DRAINAGE STRUCTURES:

1	DBI TYPE "D"		11	NOT USED			21	ENDWALL		31	DBI TYPE "D"
	GRATE ELEV. = 24.87	(BASED ON PLANS)						48" RCP			GRATE ELEV. = 25.90
	INV. ELEV. (S) = 15.82							INV. ELEV. (N) = 19.95			INV. ELEV. (N,S) = 21.90
2	DBI TYPE "E"		12	ENDWALL			22	ENDWALL		32	MES
	GRATE ELEV. = 24.37	(BASED ON PLANS)		48" RCP				48" RCP			24" RCP
	INV. ELEV. = 15.71 (N), 18.21 (S)			INV. ELEV. (S) = 19.60				INV. ELEV. (S) = 20.36			INV. ELEV. (S) = 19.60
3	MES		13	ENDWALL			23	ENDWALL		33	DBI TYPE "D"
	36" PIPE			48" RCP				48" RCP			GRATE ELEV. = 25.90
	INV. ELEV. (N) = 18.15			INV. ELEV. (N) = 19.29				INV. ELEV. (N) = 20.13			INV. ELEV. (S) = 21.90
4	ENDWALL		14	ENDWALL			24	ENDWALL		34	MES
	48" RCP			36" RCP				48" RCP			24" RCP
	INV. ELEV. (S) = 19.35			INV. ELEV. (S) = 19.83				INV. ELEV. (S) = 20.16			INV. ELEV. (S) = 19.60
5	ENDWALL		15	ENDWALL			25	ENDWALL		35	U-ENDWALL
	48" RCP			36" RCP				48" RCP			24" RCP
	INV. ELEV. (N) = 19.55			INV. ELEV. (N) = 21.28				INV. ELEV. (N) = 19.99			INV. ELEV. (S) = 21.50
6	ENDWALL		16	ENDWALL			26	ENDWALL		36	DBI TYPE "D"
	48" RCP			48" RCP				48" RCP			GRATE ELEV. = 25.90
	INV. ELEV. (S) = 18.94			INV. ELEV. (S) = 19.92				INV. ELEV. (S) = 20.13			INV. ELEV. (N) = 21.90
7	ENDWALL		17	ENDWALL			27	ENDWALL		37	U-ENDWALL
	48" RCP			48" RCP				48" RCP			24" RCP
	INV. ELEV. (N) = 17.89			INV. ELEV. (N) = 20.17				INV. ELEV. (N) = 19.68			INV. ELEV. (S) = 21.50
8	ENDWALL		18	ENDWALL			28	ENDWALL		38	DBI TYPE "D"
	48" RCP			48" RCP				48" RCP			GRATE ELEV. = 25.90
	INV. ELEV. (S) = 19.70			INV. ELEV. (S) = 20.05				INV. ELEV. (S) = 20.14			INV. ELEV. (N) = 21.90
9	ENDWALL		19	ENDWALL			29	ENDWALL		39	ENDWALL
	48" RCP			48" RCP				48" RCP			48" RCP
	INV. ELEV. (N) = 18.55			INV. ELEV. (N) = 19.91				INV. ELEV. (N) = 20.20			INV. ELEV. (S) = 19.65
10	NOT USED		20	ENDWALL			30	DBI TYPE "A"		40	ENDWALL
				48" RCP				GRATE ELEV. = 26.00			48" RCP
				INV. ELEV. (S) = 20.35				INV. ELEV. (S) = 22.50			INV. ELEV. (N) = 19.59

REVISIONS			RS&H, INC. 3125 W COMMERCIAL BLVD, STE 130 FT. LAUDERDALE, FL 33309-3446 FL CERT. # EB0005620 DARREN DYER, P.E. # 73951	STATE OF FLORIDA			DEPARTMENT OF TRANSPORTATION		PRE-DEVELOPMENT DRAINAGE MAP		SHEET NO.
DATE	DESCRIPTION	DATE		DESCRIPTION							
				ROAD NO.	COUNTY	FINANCIAL PROJECT ID					12
				710	MARTIN	432705-1-52-01					

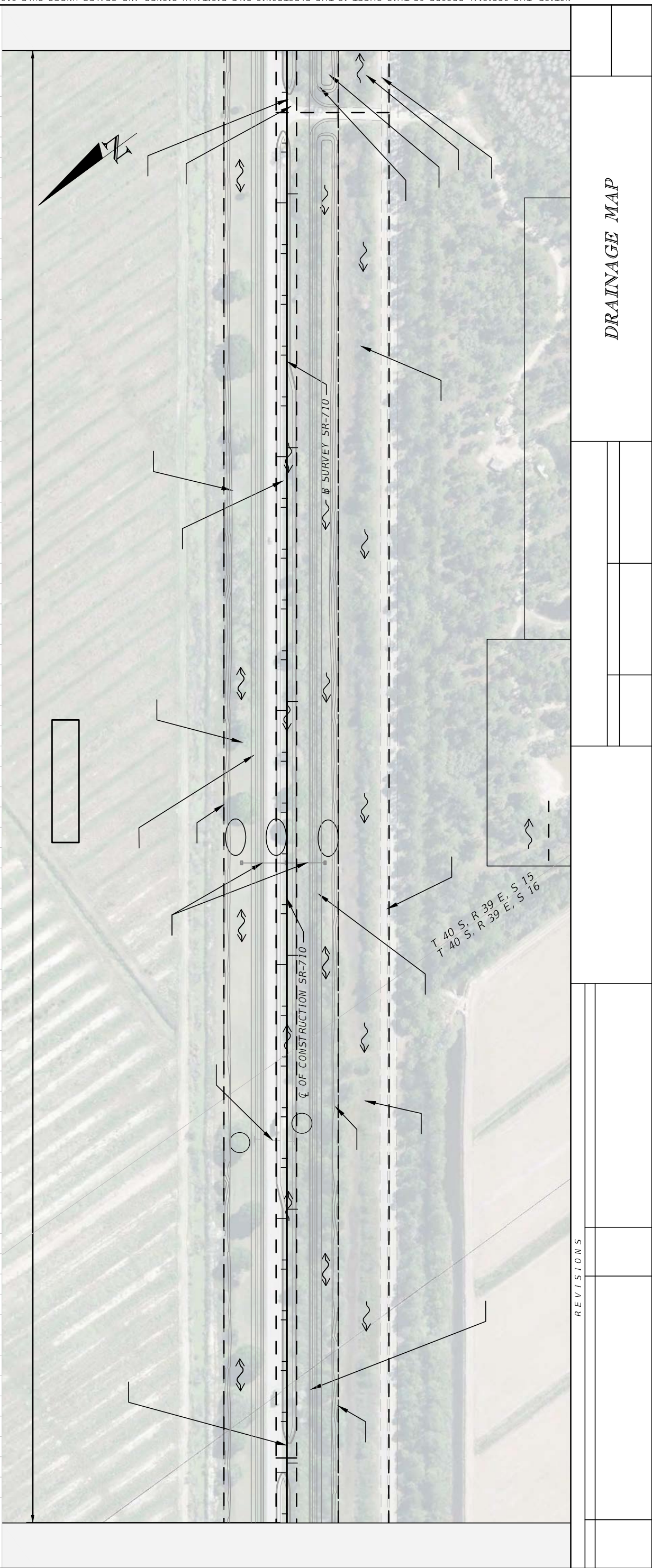
APPENDIX C
POST-DEVELOPMENT
DRAINAGE MAPS

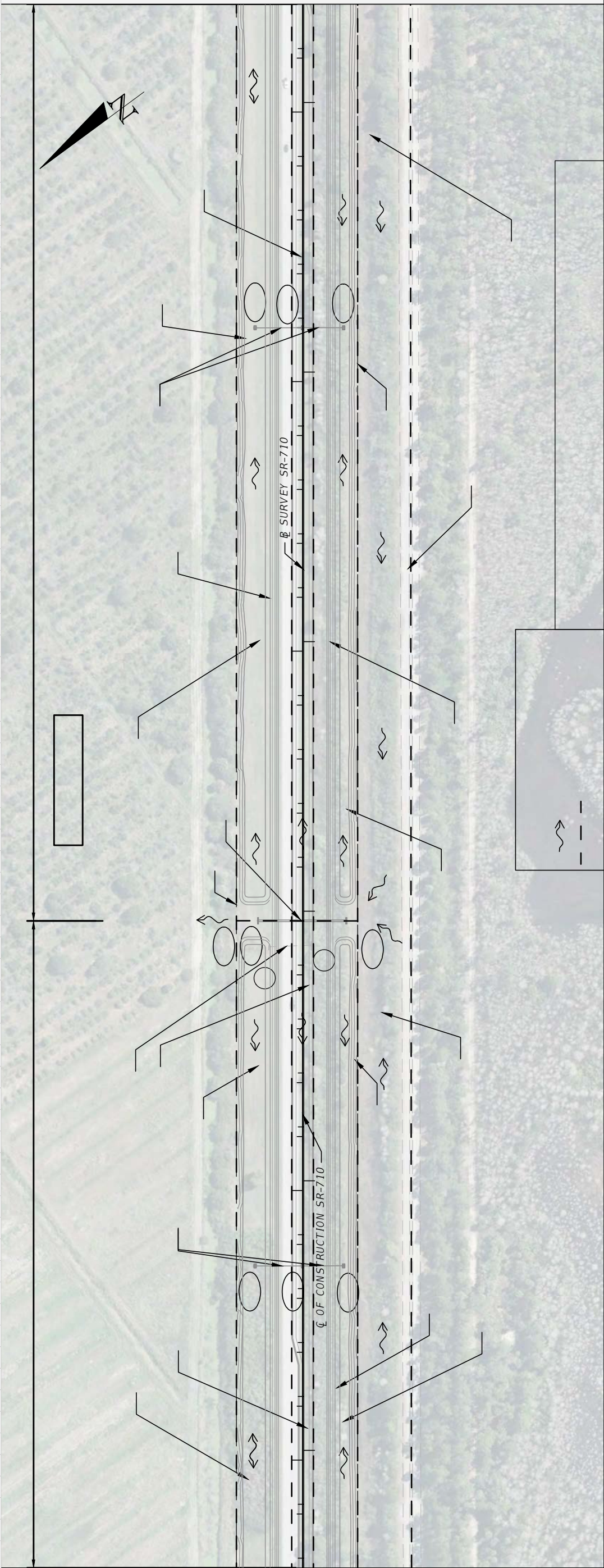
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DRAINAGE MAP

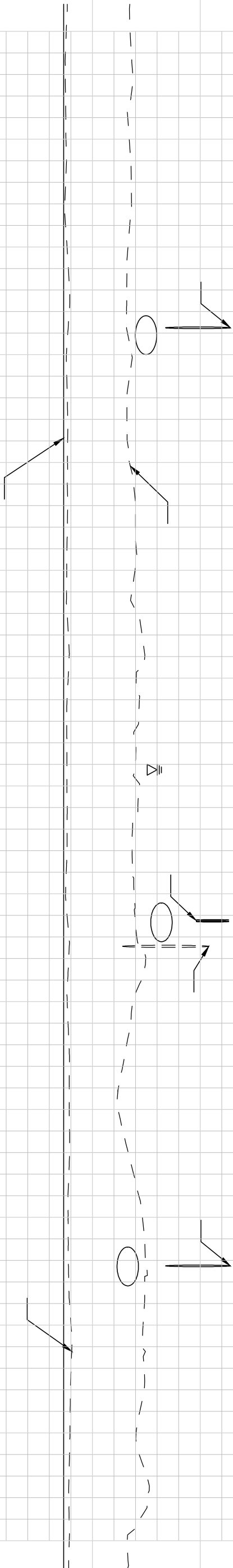
REVISIONS

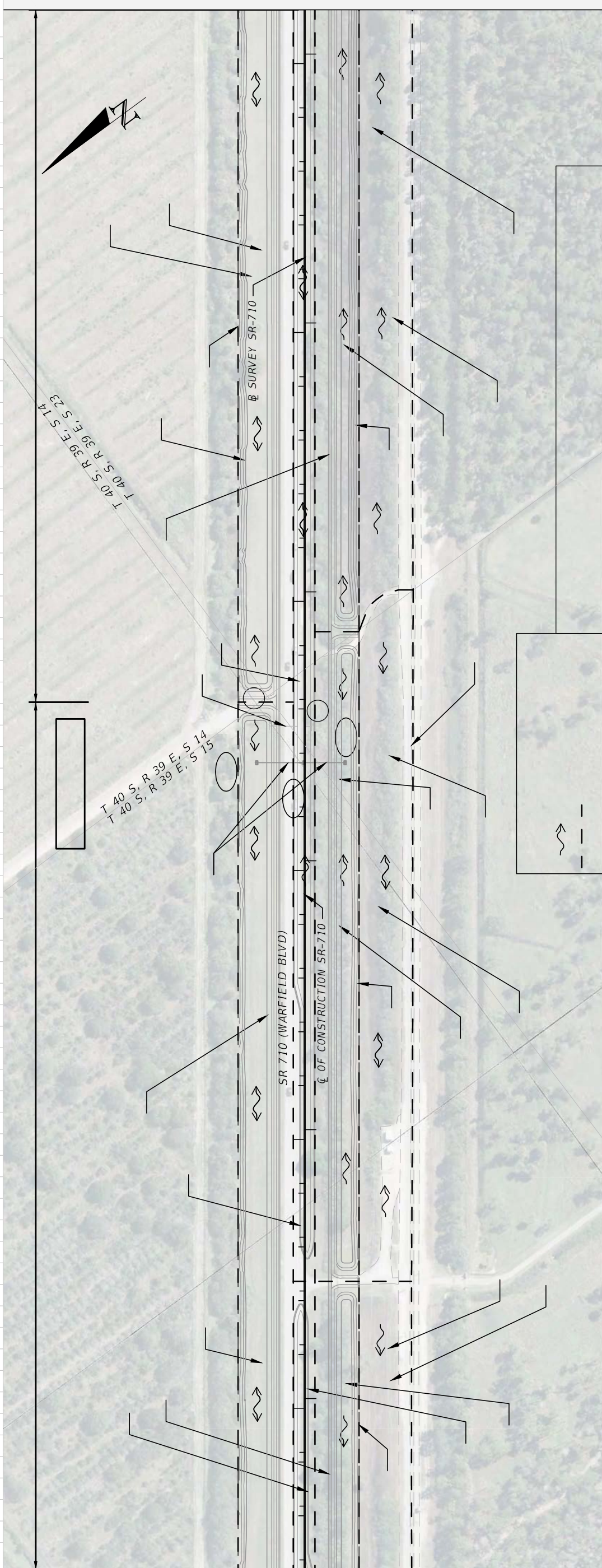
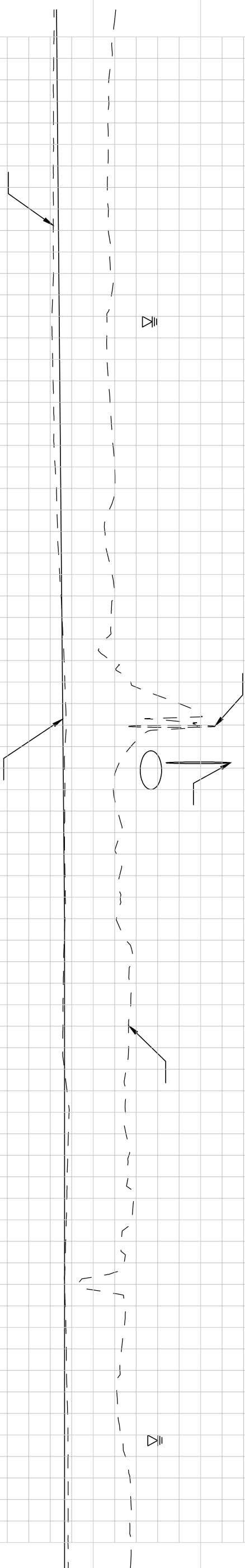




DRAINAGE MAP

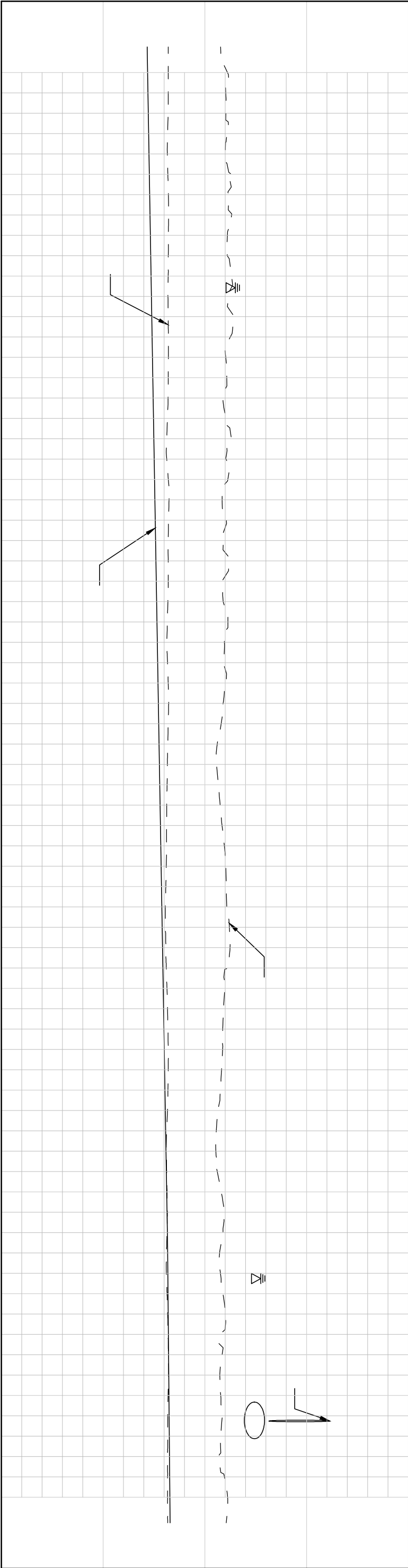
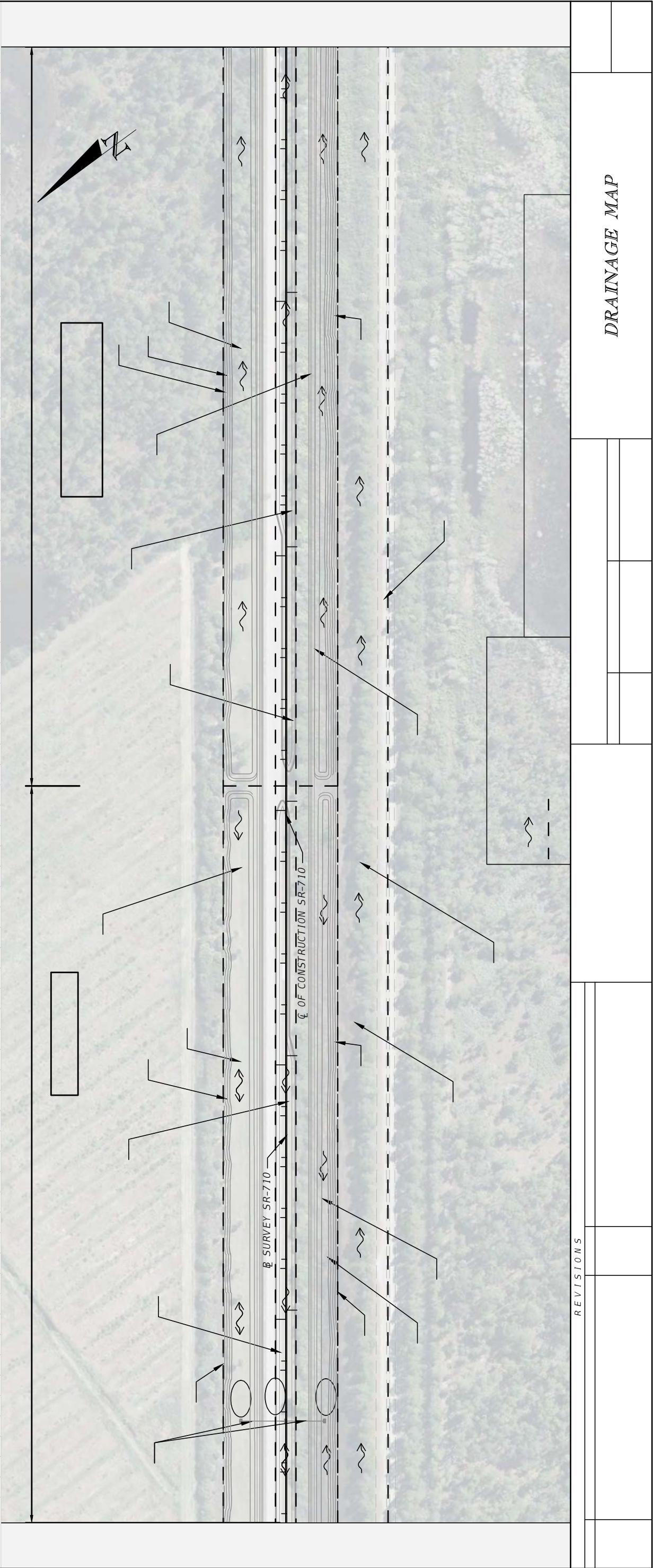
REVISIONS

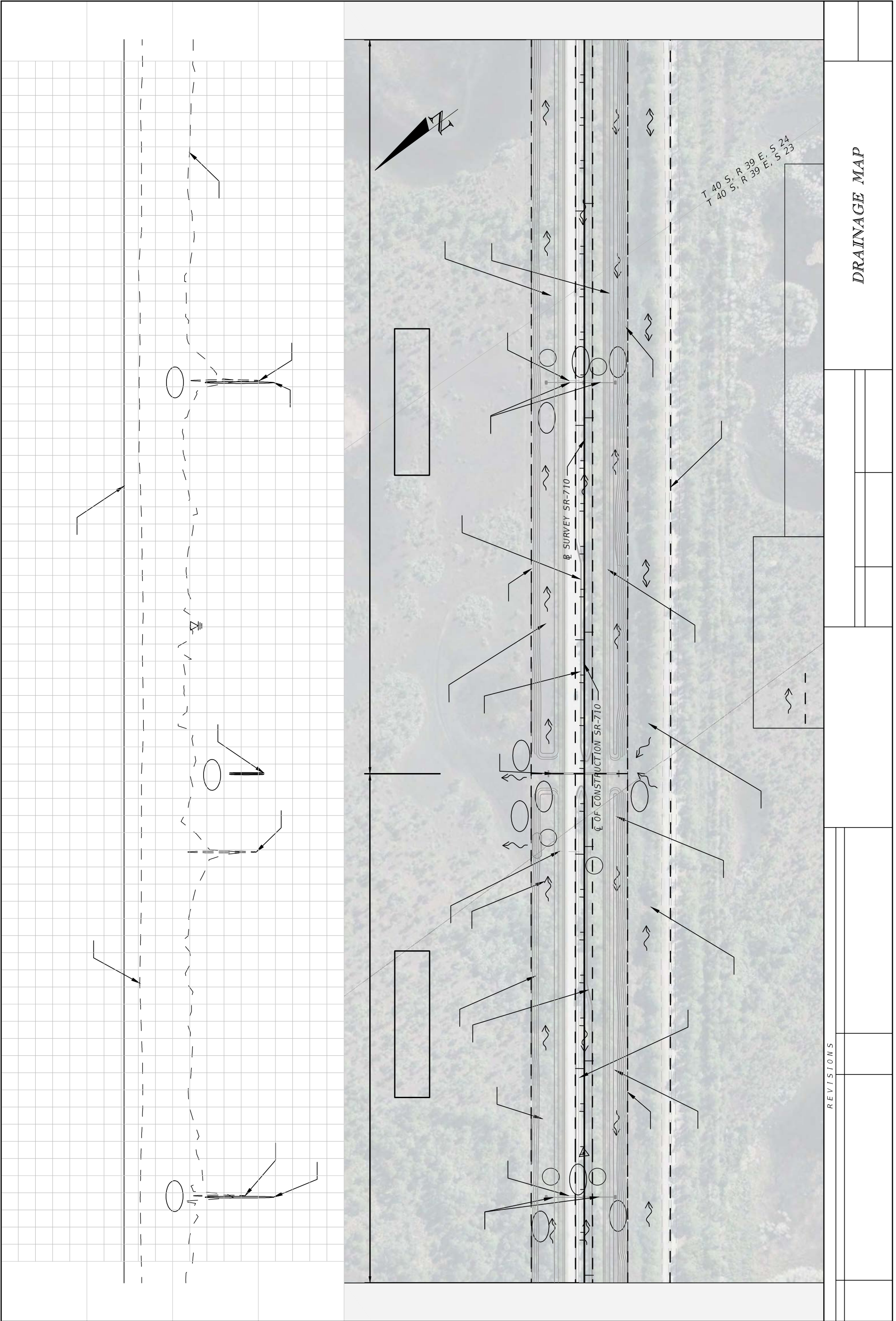


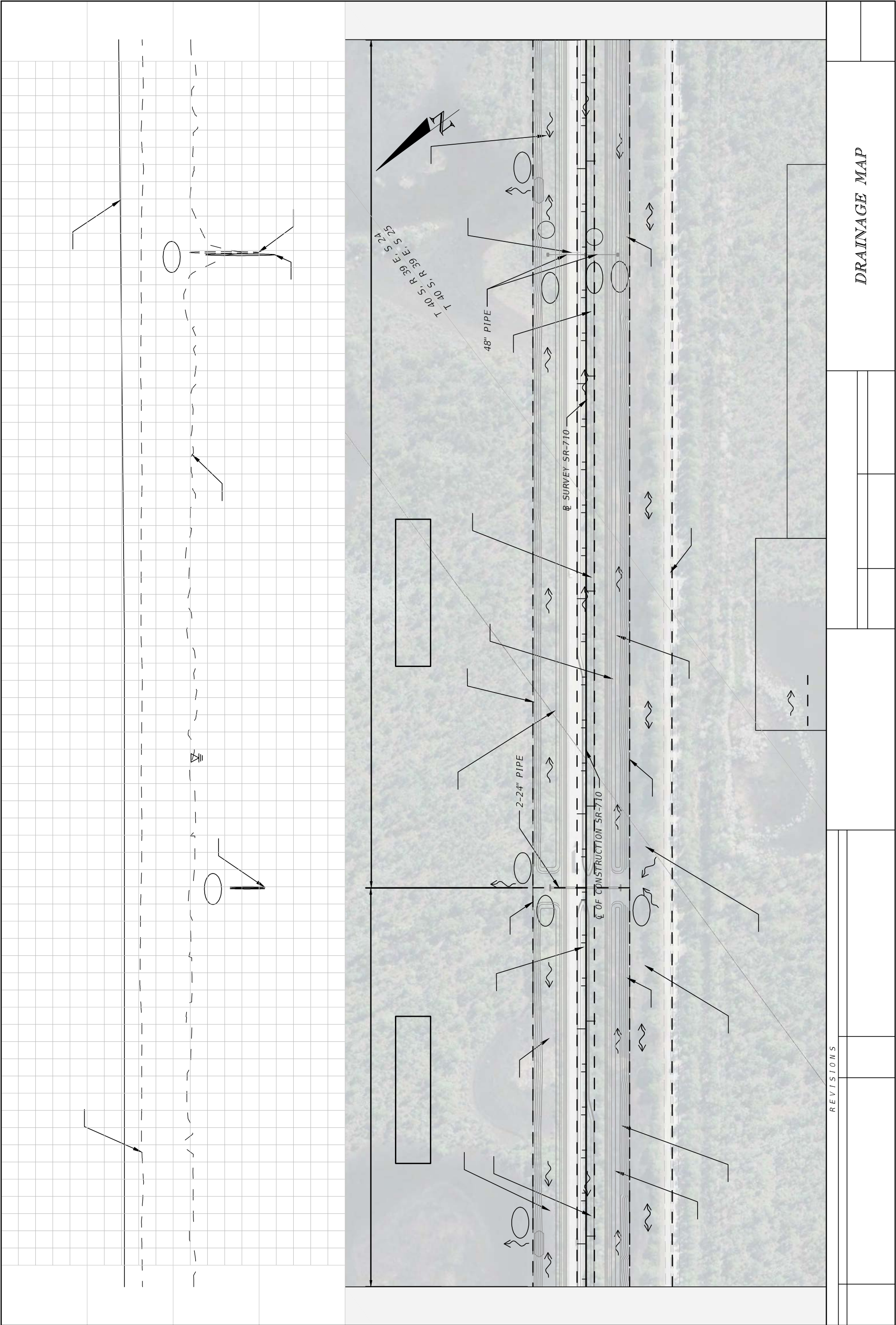


DRAINAGE MAP

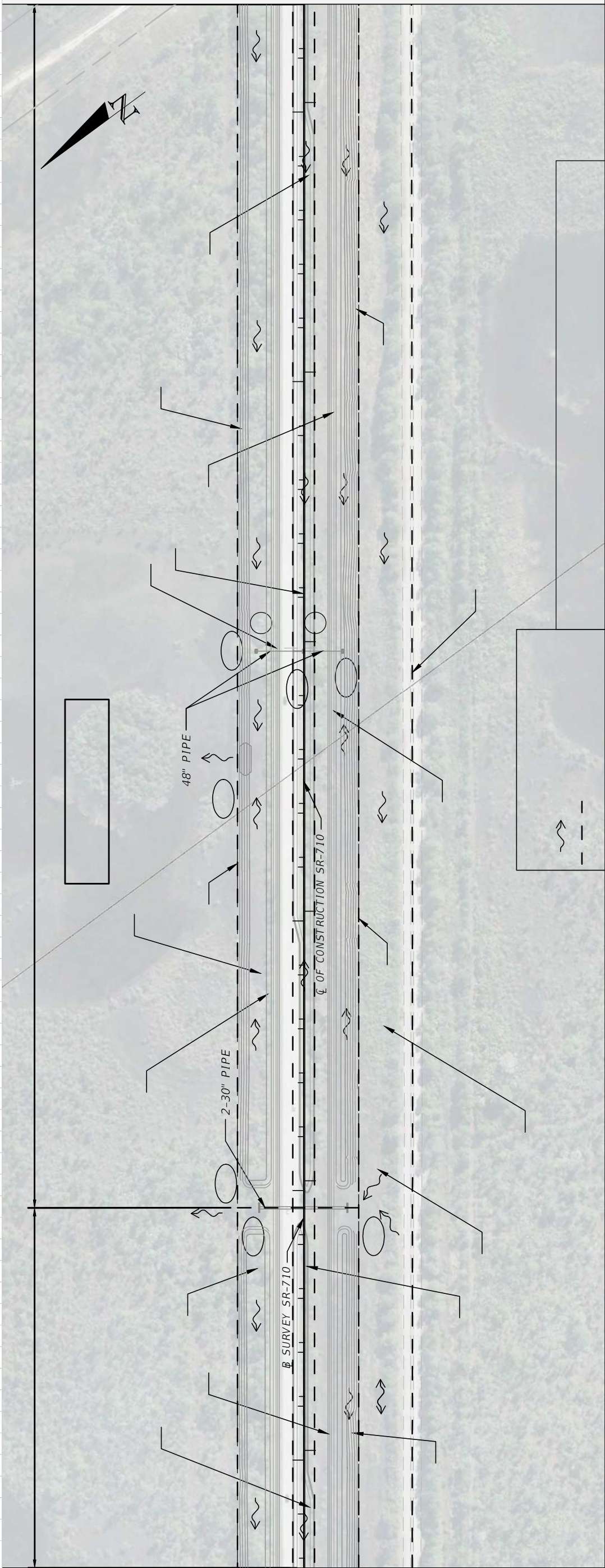
REVISIONS





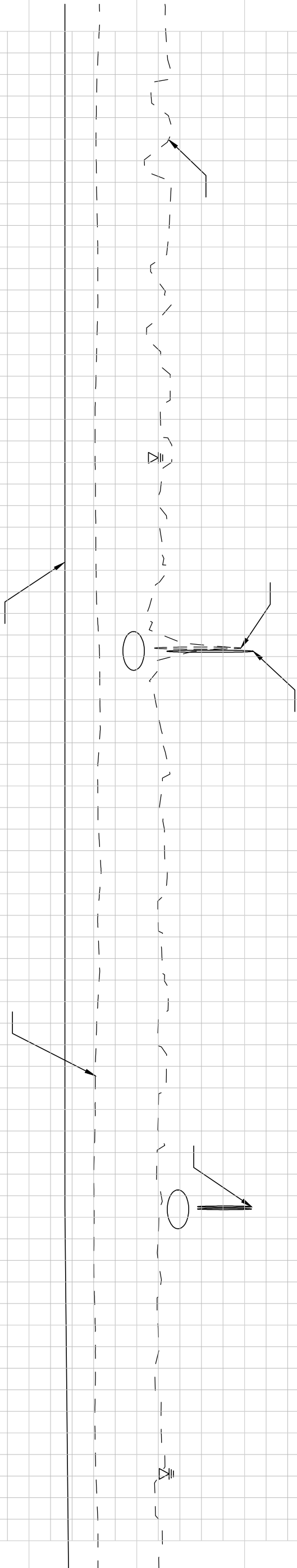


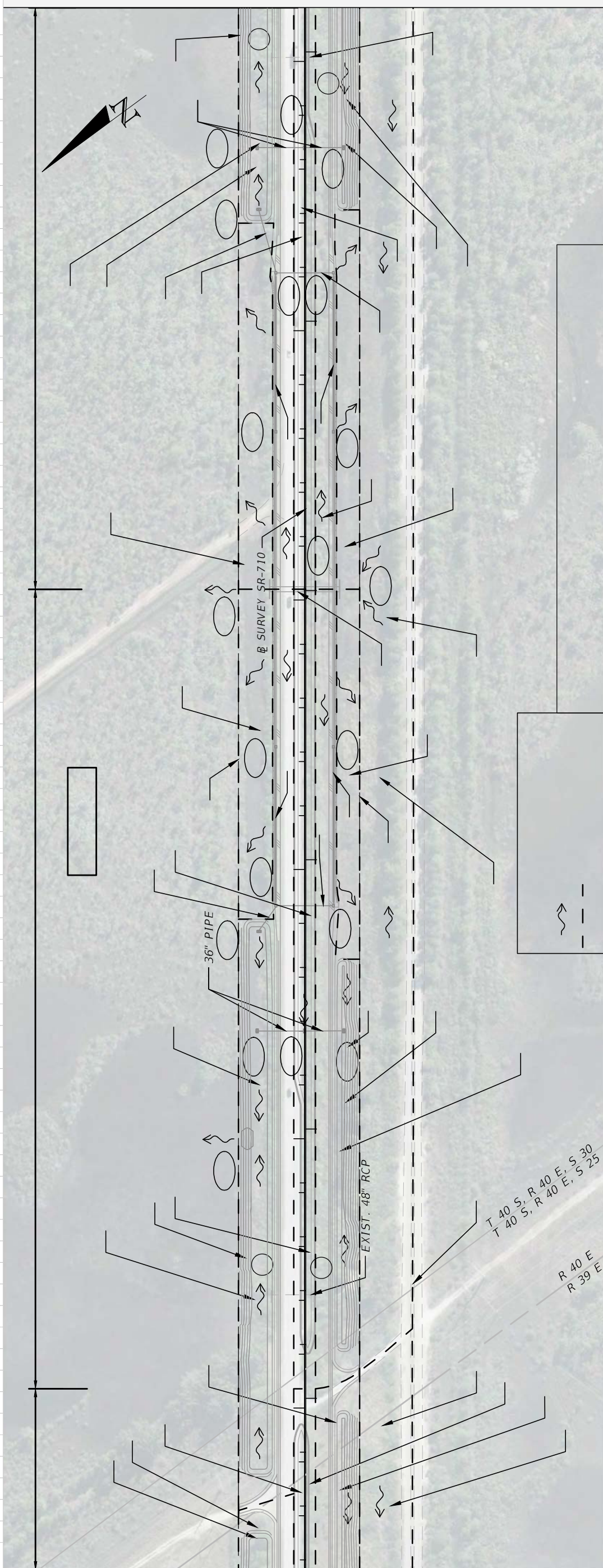
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DRAINAGE MAP

REVISIONS





DRAINAGE MAP

REVISIONS

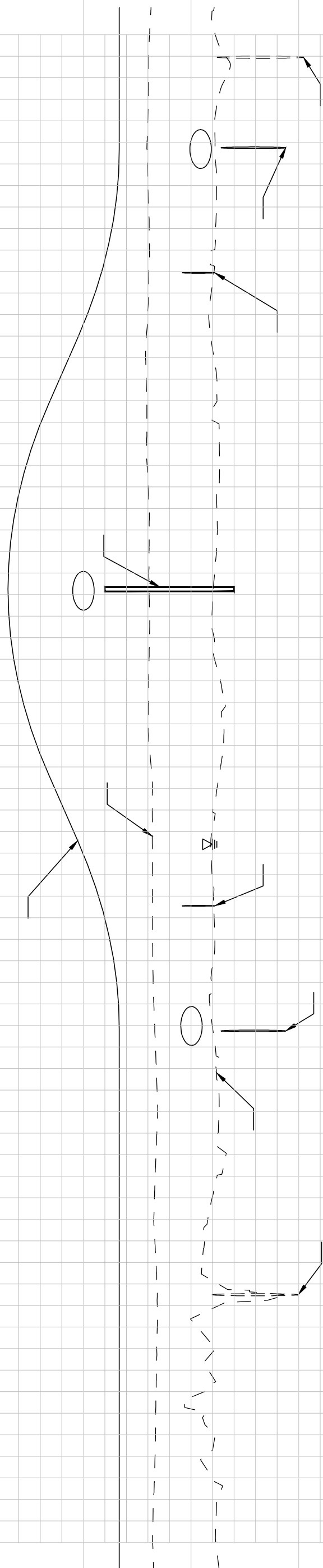
E, S 30
0 E, S 25
R 40 E
R 39 E

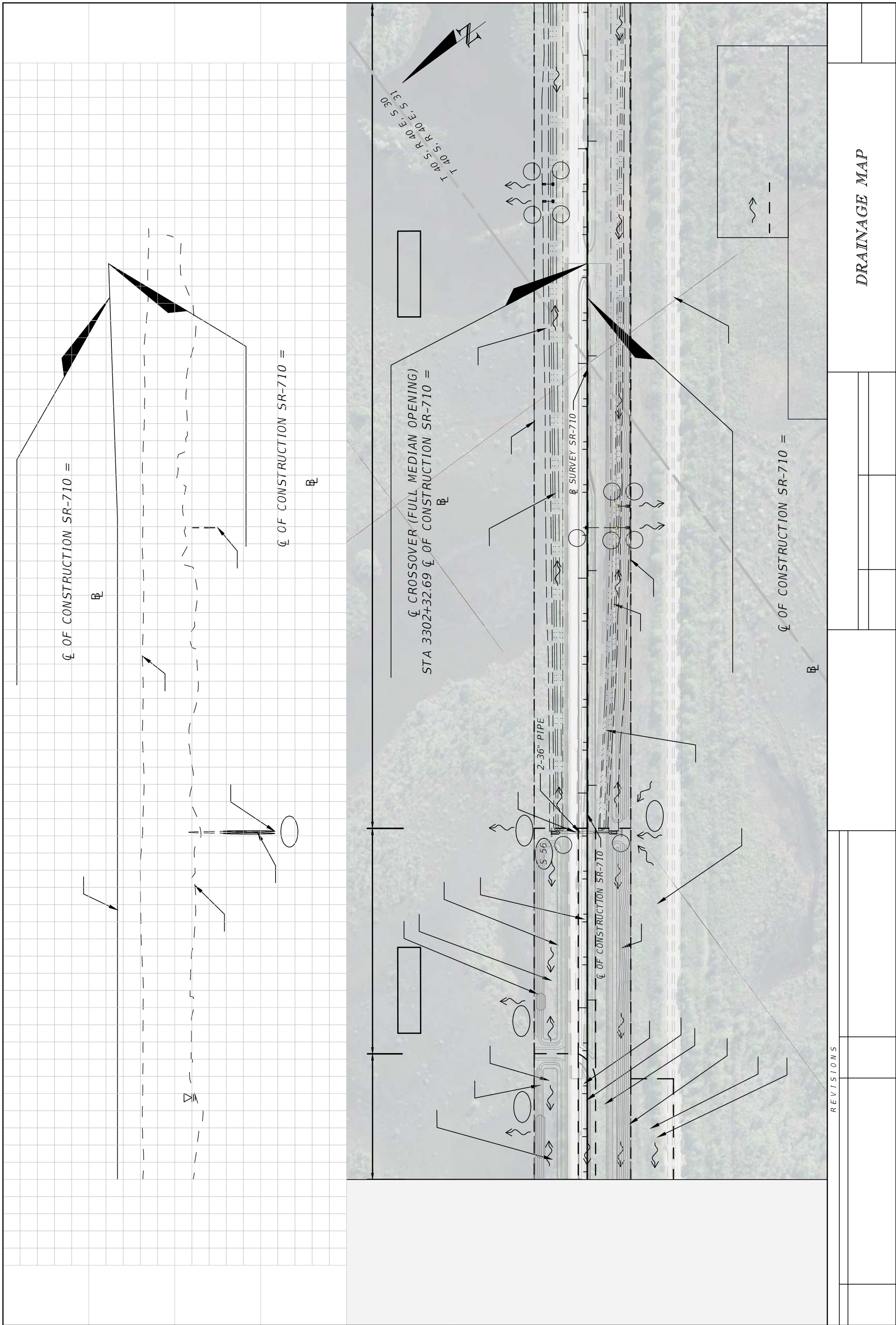
T 40 S, R 40 E, S 30
T 40 S, R 40 E, S 25

-EXIST 48" RCP

- 36" PIPE

Ø SURVEY SR-710





SUMMARY OF EXISTING DRAINAGE STRUCTURES:

1	DBI TYPE "D"		11	NOT USED			21	ENDWALL		31	DBI TYPE "D"
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2	DBI TYPE "E"		12	ENDWALL			22	ENDWALL		32	MES
	GRATE ELEV. = 24.37	(BASED ON PLANS)		48" RCP				48" RCP			24" RCP
	INV. ELEV. = 15.71 (N), 18.21 (S)			INV. ELEV. (S) = 19.60				INV. ELEV. (S) = 20.36			INV. ELEV. (S) = 19.60
3	MES		13	ENDWALL			23	ENDWALL		33	DBI TYPE "D"
	36" PIPE			48" RCP				48" RCP			GRATE ELEV. = 25.90
	INV. ELEV. (N) = 18.15			INV. ELEV. (N) = 19.29				INV. ELEV. (N) = 20.13			INV. ELEV. (S) = 21.90
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	48" RCP			36" RCP				48" RCP			24" RCP
	INV. ELEV. (S) = 19.35			INV. ELEV. (S) = 19.83				INV. ELEV. (S) = 20.16			INV. ELEV. (S) = 19.60
5	ENDWALL		15	ENDWALL			25	ENDWALL		35	U-ENDWALL
	48" RCP			36" RCP				48" RCP			24" RCP
	INV. ELEV. (N) = 19.55			INV. ELEV. (N) = 21.28				INV. ELEV. (N) = 19.99			INV. ELEV. (S) = 21.50
6	ENDWALL		16	ENDWALL			26	ENDWALL		36	DBI TYPE "D"
	48" RCP			48" RCP				48" RCP			GRATE ELEV. = 25.90
	INV. ELEV. (S) = 18.94			INV. ELEV. (S) = 19.92				INV. ELEV. (S) = 20.13			INV. ELEV. (N) = 21.90
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	48" RCP			48" RCP				48" RCP			24" RCP
	INV. ELEV. (N) = 17.89			INV. ELEV. (N) = 20.17				INV. ELEV. (N) = 19.68			INV. ELEV. (S) = 21.50
8	ENDWALL		18	ENDWALL			28	ENDWALL		38	DBI TYPE "D"
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	INV. ELEV. (S) = 19.70			INV. ELEV. (S) = 20.05				INV. ELEV. (S) = 20.14			INV. ELEV. (N) = 21.90
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	48" RCP			48" RCP				48" RCP			48" RCP
	INV. ELEV. (N) = 18.55			INV. ELEV. (N) = 19.91				INV. ELEV. (N) = 20.20			INV. ELEV. (S) = 19.65
10	NOT USED		20	ENDWALL			30	DBI TYPE "A"		40	ENDWALL
				48" RCP				GRATE ELEV. = 26.00			48" RCP
				INV. ELEV. (S) = 20.35				INV. ELEV. (S) = 22.50			INV. ELEV. (N) = 19.59

DATE ----	REVISIONS		RS&H, INC. 3125 W COMMERCIAL BLVD, STE 130 FT. LAUDERDALE, FL 33309-3446 FL CERT. # EB0005620 DARREN DYER, P.E. # 73951	STATE OF FLORIDA			DRAINAGE MAP		SHEET NO.
	DESCRIPTION	DATE		DESCRIPTION					
	DEPARTMENT OF TRANSPORTATION								
				ROAD NO. 710	COUNTY MARTIN	FINANCIAL PROJECT ID 432705-1-52-01	15		