Tarrant Regional Water District

Panther Island Canal System Manual

JULY 2025

DRAFT

Image courtesy of Lake Flato & OJB Landscape

LIST OF FIGURES

LIST OF ACRONYMS

CFW – City of Fort Worth or "The City"

FBC – Panther Island Form Based Code Zoning District

FWCC – USACE Fort Worth Central City project

PROWAG – Public Right-of-Way Accessibility Guidelines

TAS - The Texas Accessibility Standards

TCEQ – Texas Commission on Environmental Quality

TRWD – Tarrant Regional Water District (TRWD) or simply "The District"

TxDOT – Texas Department of Transportation

USACE – United States Army Corps of Engineers

INTRODUCTION, PURPOSE, AND AUTHORITY

1.1 INTRODUCTION

Panther Island offers a unique opportunity to convert a historic industrial area into a vibrant and sustainable community informed by the 2024 update of the Panther Island Vision 2.0. The Panther Island community, and neighboring communities such as Northside, Downtown, and the Historic Stockyards, will have access to the Trinity River, the USACE bypass channel, the urban lake, the interior Canal System, and open spaces (see **Figure 1**).

The Panther Island Form Based Code governs the overall development Standards and Guidelines related to urban design, buildings and sites including those on private property facing the Canal System, streetscapes, public parks and plazas, and land uses. This manual focuses on Standards, Guidelines, and processes limited to the Panther Island Canal System, also distinguished from the Interior River Channel, the Bypass Channel, and the Urban Lake.

The Canal System

The Panther Island Canal System will allow development opportunities for a mix of private and public buildings and open spaces to provide an authentic experience for residents and visitors. The Canals will link open spaces and the riverfront and fulfill infrastructure requirements throughout Panther Island. They will serve as linear pedestrian spines, function as stormwater detention and floodwater protection systems, and provide a distinctive waterfront experience to enhance connectivity and access.

Flood Protection

The Canal System is ultimately dependent on the US Army Core of Engineers (USACE) Fort Worth Central City (FWCC) Project. The USACE FWCC project includes a bypass channel, dam, isolation gates, stormwater pump station, valley storage sites, and ecosystem restoration. The FWCC dam is downstream of the Panther Island area and will set the normal water surface elevation for the bypass channel, river, and Canals. During large rain events, the FWCC isolation gates will close, and the FWCC TRWD stormwater pump station will control the 100-year flood event maximum water surface elevation for the Canal System. The Canal System, including the Paseo, is designed to be inundated during 100-year storm events. Until the USACE FWCC project is completed, and the existing levees are decommissioned, the Canals can only be constructed on the dry side of the existing levee system. **Figure 1** shows the limits of the Canal System and the location of some of the FWCC features.

The Canal System is a critical component of the Panther Island flood control system. In the Interim Condition, prior to the completion of the FWCC project, the Canals establish normal water surface elevation, provide detention for the Panther Island developments, and convey stormwater through existing outfalls to the Trinity River. In the Ultimate Condition, after completion of the FWCC project, the Canals provide detention for the Panther Island developments, convey stormwater directly to the Trinity River, and provide flood protection to Panther Island.

1.2 CANAL SYSTEM

There are four canals within Panther Island currently known as Canals A, B, C, and D (see Figure 1 – Panther Island Canal System). A portion of Canal B was the first segment of the Canal System constructed in tandem with the Encore Multifamily project in 2021.

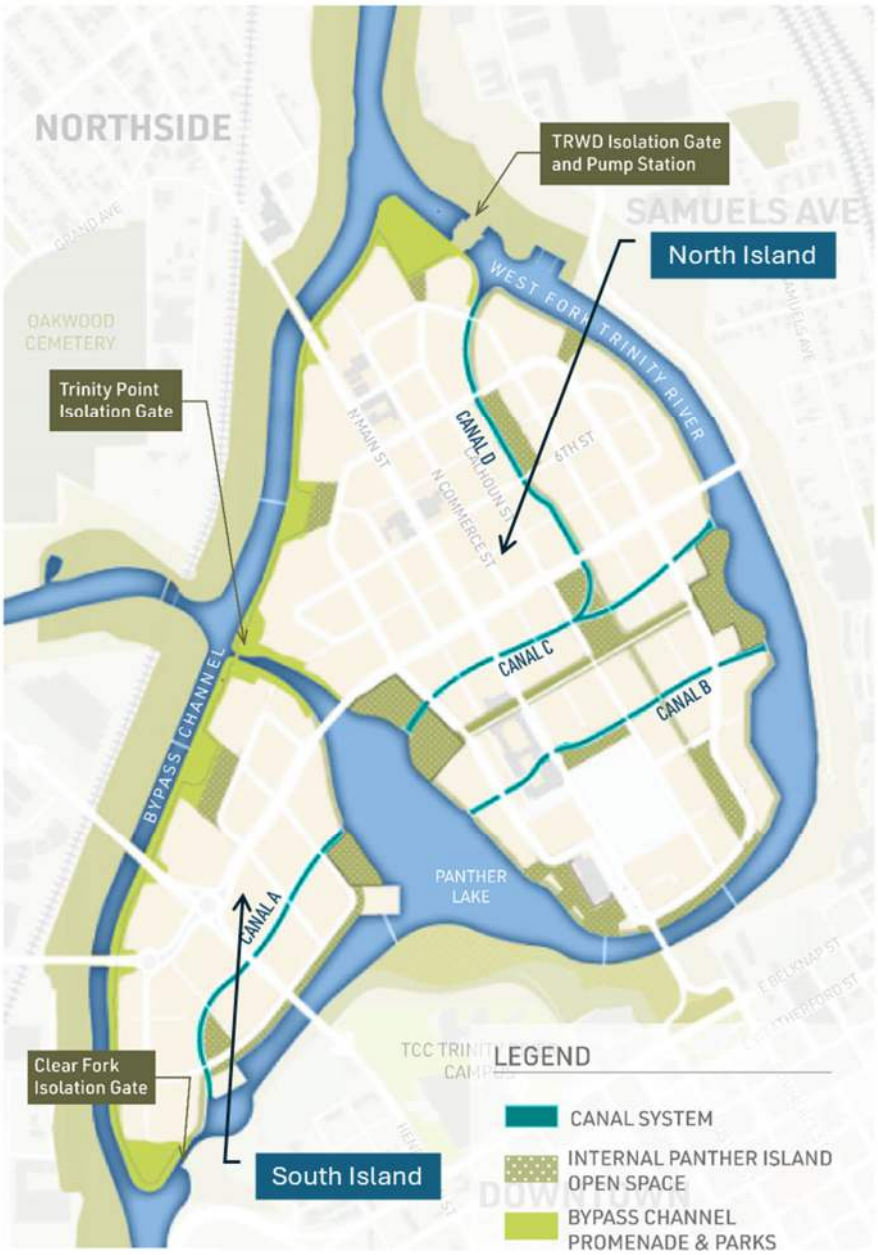


Figure 1 – Panther Island Canal System & USACE Ft. Worth Central City Features

1.3 PURPOSE OF THE CANAL SYSTEM MANUAL AND RELATED REGULATIONS

The purpose of this manual is to guide and facilitate development and waterfront access within Panther Island through implementation of the Canal System. It replaces the TRWD Canal Design Standards & Guidelines (2018 Kimley-Horn) and incorporates information from the Strategic Vision Update (2024 Lake Flato) and the Canal Value Engineering and Technical Evaluation (2024 Freese and Nichols, Inc.)

This manual will serve the following primary purposes:

- Define Canal System ownership, funding, dedication, sequencing limitations, maintenance, and contracting responsibilities and protocols
- Outline the review process and roles for development projects
- Provide design principles, Standards, and Guidelines for construction of the Canal System

The City of Fort Worth's Panther Island Form Based Code established the Canal System alignments, and the City's Panther Island Vision 2.0 provided recommendations for Canal System character and experiences.

The intended audiences for the TRWD Panther Island Canal System Manual include:

- **Developers** – Summary of requirements and procedures for development impacting the Canal System.

- **Engineers, Landscape Architects, and Designers** – Design and Operation and Maintenance requirements for the Canal System. In addition, several other sections provide relevant information, including planting palettes for vegetation selection.

- **TRWD and Adjacent Jurisdictions** – Outline of the jurisdictions, responsibilities, and design review resources.

This manual is intended to be a living document and will be updated as necessary.

1.4 APPLICABILITY AND APPROVAL AUTHORITY

This manual describes the process for funding and construction of the Canal System that is within TRWD Right-of-Way or easements on Panther Island. TRWD developed these Standards and Guidelines through the authority of its Board to govern property and public infrastructure owned and controlled by TRWD. This includes the authority to authorize construction of the Canal System, subject to the City's adopted rules and regulations, including but not limited to required building permits.

This manual also describes the process for a development project to access an existing Canal for purposes of detention and stormwater conveyance.

Review, approval, and permitting of infrastructure that conforms to the Standards and financial obligations of the developer will be assigned to designated TRWD staff.

Authority for Waivers from Standards and Financial Obligations

TRWD, through its General Manager or their designee(s), reserves the right to administratively approve any waivers or interpretations of Canal System Standards that achieve the overall objective and do not contradict requirements of the City of Fort Worth. Board approval is required for Development Agreements, Community Facilities Agreements – TRWD, or similar agreements with a value of $150,000 or more that:

- Commit the District to participate financially in the construction or oversizing of Canal System infrastructure.

- Waive ordinary financial obligations of a developer described in this Manual and other supporting documents.

[NOTE: Information regarding the Canal fee structure and additional logistical details will be added as they are developed.]

1.5 DEFINITIONS

- Canal – The 19-foot to 42-foot-wide concrete drainage structure with a normal water surface elevation of 525 feet. Also known as the Canal basin.

- Canal Right-of-Way (Canal ROW) – The area of property defined by the interim and ultimate condition 100-year flood event water surface elevation of 528 feet. The Canal ROW will be owned by TRWD. If the Canal ROW abuts a structure, TRWD's ownership will start at the face of the structure.

- Canal System – All canal segments and TRWD improvements within the Canal ROW which includes the Canal and the Paseos.

- Community Facilities Agreement – City of Fort Worth (CFA - CFW) – agreement for developer to guarantee construction of public infrastructure that will be owned and maintained by the City of Fort Worth. In some instances, City participation in the cost of oversizing is included.

- Community Facilities Agreement – Tarrant Regional Water District (CFA – TRWD) – agreement for developers to guarantee construction of public infrastructure that will be owned and maintained by the Tarrant Regional Water District. In some instances, TRWD participation in the cost of oversizing is included.

- Future Improvement Agreement – City of Fort Worth (FIA – CFW) – Contractual agreement between developer and the City to deposit funding of 125% of the estimated cost of an improvement in lieu of constructing required City public infrastructure improvements that allows the City to construct the improvements, or improvements in the vicinity, at a time convenient to the City.

- Future Improvement Agreement – Tarrant Regional Water District (FIA – TRWD) – Contractual agreement between developer and the City to deposit funding of 125% of the estimated cost of an improvement in lieu of constructing required TRWD public infrastructure improvements that allows the City to construct the improvements, or improvements in the vicinity, at a time convenient to TRWD.

- Guidelines – Subjective statements, illustrated with photographs, through which TRWD proposes additional design strategies. The guidelines should be suitable for most projects, and developers should endeavor to ensure that the intent and spirit of the design guidelines are followed to the extent possible. TRWD will work with developers to explore design approaches that maximize conformance with development guidelines and principles.

- Infrastructure Plan Review Center (IPRC) – City of Fort Worth office that is responsible for the project management of new public infrastructure improvements, also know as developer-funded infrastructure improvements, associated with residential, commercial and industrial development.
- Interim Condition – The development condition prior to the USACE completion of the FWCC project and decommissioning of the existing levees.
- Panther Island Form Based Code (FBC)– the zoning regulations for Panther Island.
- Paseo – The area between the outer boundary Canal ROW and edge of the Canal water surface including the sidewalks, pedestrian walkways, planter boxes, plantings, walls, irrigation systems, decorative features, and all other areas to which the public has access adjacent to the Canal. The Paseo will be publicly accessible.
- Standards – Objective, measurable regulations illustrated through diagrams and sketches with which all projects must comply. Unless noted as a guideline, all provisions in this document are Standards. TRWD may waive Standards.
- Stormwater Best Management Practices (BMPs) – Devices, practices, or methods that are used to manage stormwater runoff by controlling peak runoff rate, improving water quality, and managing runoff volume as described in the TRWD Water Quality Guidance Manual.
- Stormwater Laterals – Underground storm drainage improvements required per the City of Fort Worth Trinity River Vision Storm Drain Master Plan (to be linked when updated).
- Sump – Area that does not have a positive drainage outfall.
- Ultimate Condition – Development condition after USACE completion of the FWCC project and decommissioning and removal of the existing levees.

1.6 OWNERSHIP

TRWD will own, operate, and maintain, or cause to be maintained, the Canal System within the Canal ROW. The Canal ROW will include any property below the USACE Central City ultimate condition 100-year floodplain elevation of 528.00 feet. The Canal ROW is intended to end at a structural feature like a retaining wall or stairs (see **Figure 2** – Canal ROW). If the structural feature is part of the development, TRWD ownership, in most instances, is expected to end at the face of the development's structural feature. The development owner will own and maintain any structures, including footing that extends into the Canal ROW.

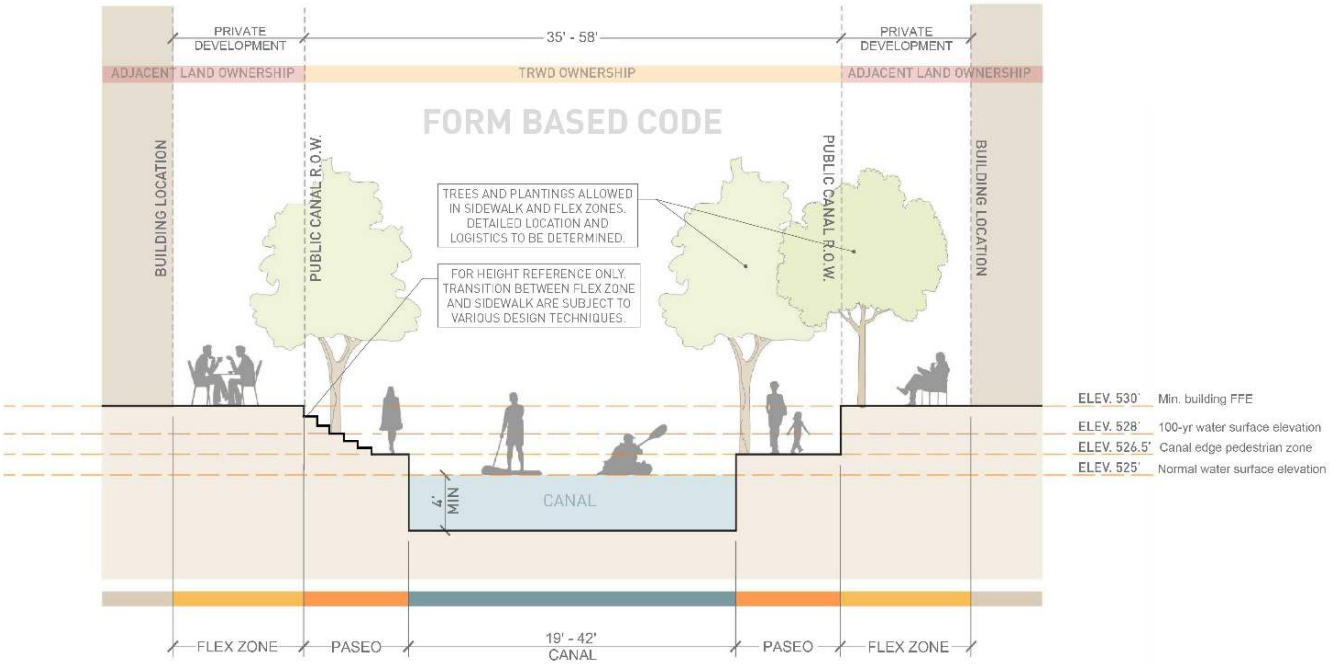


Figure 2 – Canal ROW

At locations where the Canal System crosses under City ROW, TRWD and the City will enter into a joint use and maintenance agreement for the construction and maintenance of the Canal and the Canal bridges. For N. Main Street and Henderson, TRWD and TxDOT will enter into a joint use and maintenance agreement for the construction and maintenance of the Canal and the Canal bridges.

1.7 SEQUENCING

Until the USACE FWCC project is completed, and the existing levees are decommissioned, development and Canal construction are limited on Panther Island. The Panther Island Vision 2.0 provides preliminary recommendations on sequencing of development as shown in **Figure 3**; however, final sequencing will depend on funding, developer interest, and planned disposition of publicly owned land.

- Zones 1, 2A, 2B, and 3 are areas that can be developed prior to the completion of the USACE FWCC project.
- Zone 4 represents the future phases that can be developed after the USACE FWCC project has been completed and the levees are decommissioned.
- Development within Zones 1, 2A, 2B, and 3 will require sections of Canals B, C, and D to be completed for the development to meet its stormwater detention requirements.

During the pre-application meeting with TRWD, the capacity of the existing Canal System will be evaluated to determine if the proposed development can be served without additional construction.

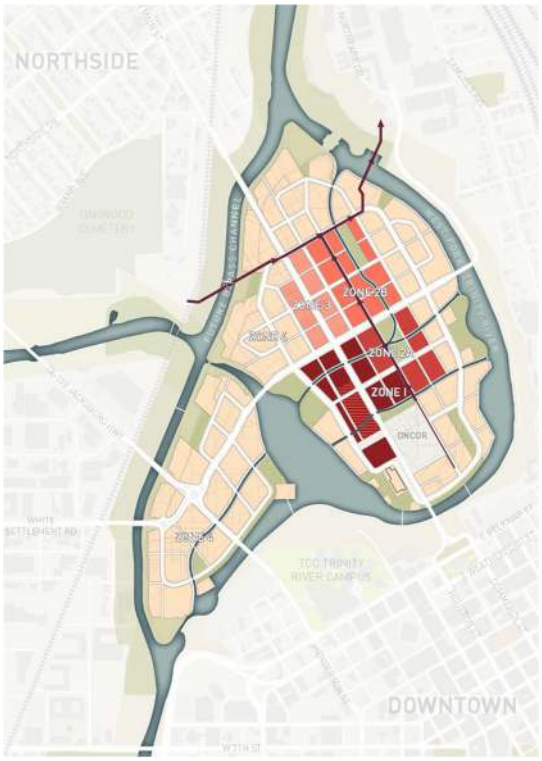


Figure 3 – Panther Island Development Sequencing

1.8 FUNDING

TRWD is designing and planning to construct the Canal, maintenance dams, access for maintenance, and limited portions of the Paseo. The construction schedule will be dictated by the availability of funding and development demand and objectives. TRWD has identified the following future funding sources for these components of the Canal System:

- Sale of TRWD public land
- Canal connection fees from development based on volume of stormwater runoff. This fee structure is being developed.

The developer and TRWD may agree that the developer will construct the Canal and receive credit against fees otherwise due. If the developer builds any portion of the Canal System, TRWD may participate in the cost based on excess detention capacity or extension of the Paseo beyond the developer's property lines . The developer and TRWD will include the construction guarantee and the terms of TRWD's participation in a separate CFA – TRWD.

The developer will be responsible for the design, construction, and/or improvement of the Paseo within the TRWD ROW adjacent to their development for any sections that have not been previously constructed by TRWD or other developers. The Paseo improvements include hardscape, landscaping, irrigation, water quality devices, illumination, boat launches, and other features. TRWD will review and approve the Paseo design for each development. The developer and TRWD will include the construction guarantee in a separate CFA – TRWD.

All developer-performed work will be subject to permitting, inspection and approval by TRWD as outlined in the CFA - TRWD.

[Note: The fee structure and full process for application of funding is under development by TRWD.]

SECTION 2 DEVELOPMENT PROCESS

2.1 ROLES AND RESPONSIBILITIES

[Interlocal Agreement for Canal System Development Processes to be adopted with the City.]

TRWD

- TRWD will own, operate, and maintain, or cause to be maintained, the Canal System (see Section 6 Maintenance Responsibilities).
- TRWD has jurisdiction over and responsibility for the Standards and Guidelines for Canal System construction.
- For the storm drain connections to the Canal System, TRWD has authority over the stormwater discharge into the Canal System for detention or conveyance. Water quality devices and standards are required by the TRWD Water Quality Guidance Manual.
- TRWD will review all facilities and materials within the Paseo explicitly for appropriateness given periodic inundation of the area. This includes hardscape, landscaping materials, furnishings, water features, etc.
- TRWD may require an adjacent property owner to agree to maintain all or portions of the Paseo for features that are not supported by TRWD baseline maintenance or the Public Improvement District. This will require a maintenance agreement between the developer and TRWD to be executed prior to the commencement of construction.

City of Fort Worth

- The City of Fort Worth has jurisdiction over zoning, platting, drainage studies, building permits, and the requirements included in the Panther Island Form Based Code (FBC).
- Deviations from the FBC Standards for land development will require both Urban Design Commission, or a similarly designated body, and City Council approval. Height and setback requests will require Board of Adjustment approval.
- For the storm drain connections to the Canal System, the City has authority over the installation of the storm drain laterals. The City will use the TRWD canal system design to guide location and sizing of laterals.
- The City will own, operate, and maintain, or cause to be maintained, the vehicular and pedestrian bridges over the Canal System and has jurisdiction and responsibility for their construction. (see Section 6 Maintenance Responsibilities)

- The City has jurisdiction over and responsibility for vehicular and pedestrian bridge construction and will coordinate with the franchise utilities to relocate their facilities within the ROW.

Private Property and Developer

- The developers of properties adjacent to the Canal System are expected to construct all or some portions of the Paseo that are not finished by TRWD. The requirements will be governed by a Community Facilities Agreement – TRWD (CFA – TRWD) and require TRWD design approval prior to construction.
- In some instances, private developers may be required to enter into an agreement to maintain features in the Paseo that exceed base requirements as a condition of approval of their plans.
- The private property owners within Panther Island will be subject to a Panther Island Public Improvement District (PID), or similar special district, assessment, if formed.
- If sufficient stormwater capacity is not available to meet CFW requirements, the developer will be required to enter into a CFA – TRWD to establish responsibilities for construction of necessary infrastructure or a Future Improvement Agreement – TRWD, as applicable.
- The developer will be responsible for paying a Canal Connection Fee, receiving appropriate credit for infrastructure that they construct.

2.2 TRWD REQUIREMENTS

This section outlines the development process for the design and construction of properties on Panther Island. This process is not intended to bypass any of the City's development processes but to provide coordinated requirements for the development of the TRWD Canal System.

TRWD Pre-Application Meeting(s) – Canal System Capacity and Requirements: The developer shall submit a site plan for the proposed development to TRWD and request a pre-application meeting with TRWD and City of Fort Worth staff (PICC Capital Project Officer, Assistant Director of Zoning and Design Review, TRWD Panther Island Program Director, IPRC representative, Stormwater Development Services representative). These meetings are meant to be "discovery" meetings to help developers in their project due diligence. The site plan should include:

- Existing property lines and improvements on and adjacent to the site.
- Proposed building(s)
- Proposed utilities
- Proposed Canal System improvements.

The following items will be discussed at a pre-application meeting:

- Platting

- CFW stormwater criteria including additional Panther Island requirements
- Drainage study
- Drainage improvements
- Requirements of the TRWD Water Quality Guidance Manual
- Detention
- Street Crossings / City Bridges
- TRWD Canal construction phasing
- Canal funding and TRWD Canal connection fee
- Public infrastructure required by IPRC
- Development agreement
- ADA access and TRWD trail connections

TRWD will determine if the existing Canal System has sufficient capacity to meet CFW detention requirements for the proposed development. A CFA – TRWD will be required to define responsibilities for construction of an extension of the Canal System if necessary.

- If sufficient capacity exists to support the proposed development, the developer will be required to pay the Canal Connection fee and construct their portion of the Paseo as necessary, with eligible expenses credited against fees otherwise due.
- If sufficient Canal segments have not been constructed to provide adequate drainage for a property, the developer or TRWD may build, at the developer's expense and credited against fees otherwise due, a minimum of one block of the Canal pursuant to a CFA-TRWD to meet the detention requirements of CFW. TRWD will participate in the cost of excess capacity if funding is available; alternatively, a front foot charge may be calculated that can be reimbursed from future development. Additional construction of the Paseo by the developer would be required if the property is adjacent to the Canal System.
- If construction of the Canal segment is not feasible due to absence of necessary bridges or other physical requirements, TRWD may allow temporary onsite detention in coordination with CFW and require a deposit of 125% of the cost pursuant to a Future Improvements Agreement - TRWD.

Other TRWD Requirements –

Canal Property Conveyance: If Canal ROW is on the developer's property, the Canal ROW and temporary construction easements for the TRWD improvements shall be conveyed to TRWD by plat or via separate instrument. A replat is anticipated after 60 percent design when the contour boundaries of the Canal System are defined. The value of any property that conveys from TRWD to the developer with the replat will be compared to the square footage of the initial plat and deducted or added to fees otherwise due. De minimus land totaling less than x square feet will not be charged or credited. TRWD will not reimburse developer for additional square feet conveyed by the developer to meet their design objectives.

Canal Construction Documents: It is anticipated that TRWD, in most instances, will design and construct the Canal unless determined otherwise in coordination with the developer. Canal construction documents will be submitted to the City and the City's development process followed.

In rare instances, if the developer constructs the Canal, the developer shall adhere to design documents provided by TRWD, if available. If unavailable, the developer shall be responsible to engage an engineer that is approved by TRWD to design the segment or any transitions to existing systems and adhere to TRWD construction design Standards. Construction documents shall be provided by TRWD. The TRWD canal construction documents will be submitted to the City and follow the City's development process.

Paseo Construction Documents: In most instances, the developer will be responsible for the design and construction of the TRWD Paseo improvements. These improvements will be constructed after completion of the TRWD Canal and the developer's infrastructure adjacent to the Canal ROW. TRWD will grant the developer a temporary construction easement to construct the Paseo improvements on TRWD property. TRWD will review and approve the plans. The developer will be responsible for obtaining any permits or encroachment agreements required by TRWD.

Note: TRWD Administrative Guides and Checklists under Development:

Canal Connection Fee
Paseo Design Submittal and Approval Process
Canal Construction Process if performed by Developer
Canal System Permitting and Inspection Process

2.3 RELATED CITY OF FORT WORTH REQUIREMENTS

The Canal System will convey public stormwater so all improvements require City review and approval. TRWD approval is also required for the following:

General Pre-Development Meeting: Following the Pre-Application meeting, it is prudent for the developer to schedule a Pre-Development meeting with the City of Fort Worth to cover building, public infrastructure and fire code requirements. TRWD Panther Island Program Director or Program Manager will attend the meeting.

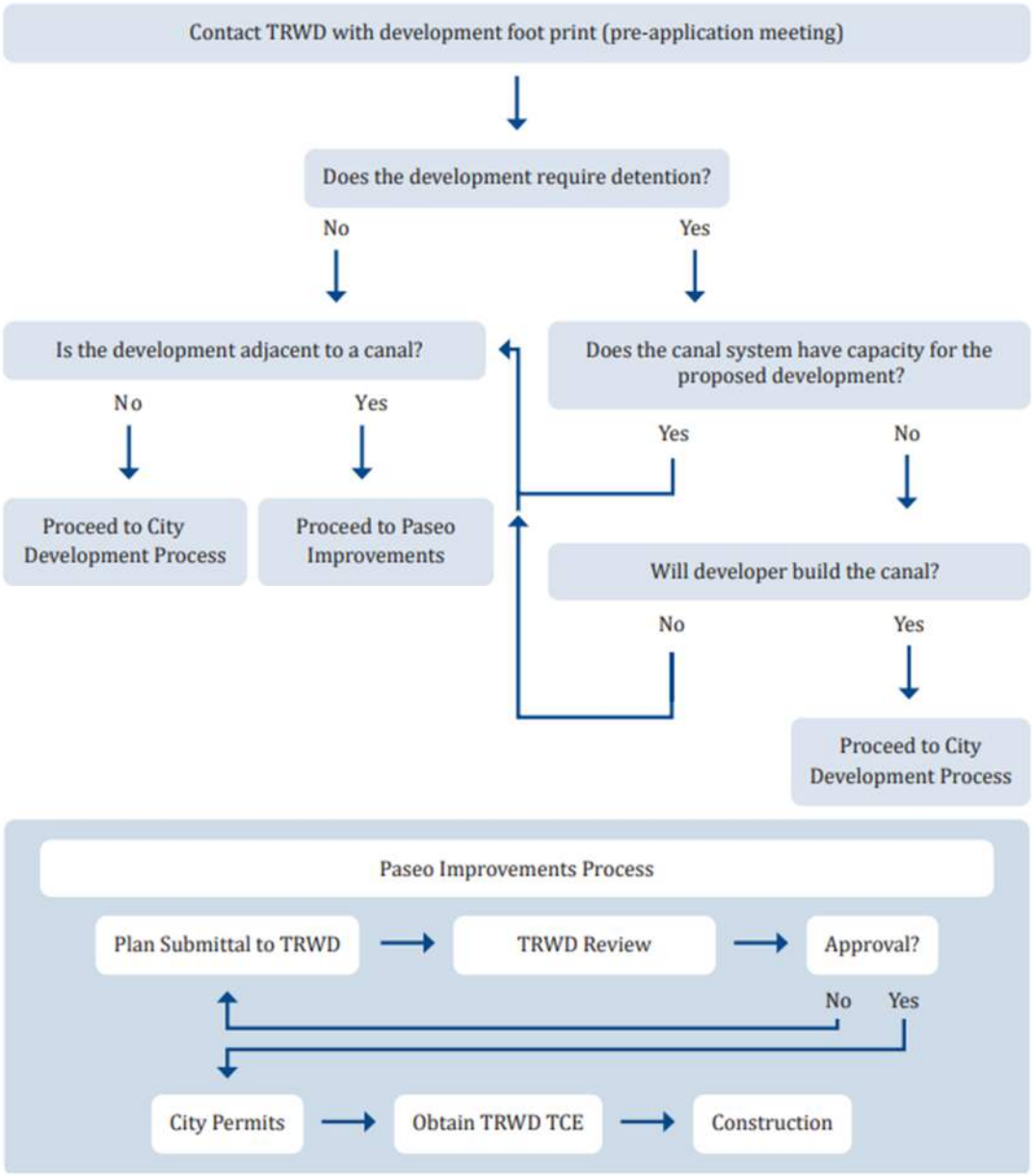
Stormwater Pre-Development Meeting: A stormwater PDC meeting will be required with City of Fort Worth stormwater staff prior to drainage study submittal. TRWD Panther Island Program Manager will attend the meeting.

Infrastructure Plan Review Center Process: IPRC provides project management of new public infrastructure improvements, also known as developer-funded infrastructure improvements, associated with development. The role includes preliminary and final plan review, contract specification review, easement document review, acceptance of plans for construction, and coordination with the developer's engineer during the construction phase of the project. More information can be found at **City of Fort Worth - Infrastructure Division**.

A representative from TRWD (PI Program Director or Manager) will attend to affirm conformance with the Canal requirements and schedule determined in the Pre-Application meeting(s).

Drainage Study: As part of the IPRC Process, the developer is required to submit a drainage study to the City which will be shared with TRWD for concurrent review. TRWD will review detention calculations and proposed storm drain connections to the TRWD Canal System and provide comments to the City to share with the developer.

A high-level diagram of the approval process is included below and following are links to the more detailed development review information for TRWD:



2.4 UTILITY RELOCATION COORDINATION

The construction of the Canal System will require relocation of City and franchise utilities located in City ROW. The City and franchise utilities, at the direction of the City, will be responsible for the relocation of their facilities. These relocations shall be completed prior to starting construction of Canal improvements.

The Canals will also cross TxDOT and the City ROW. The City will be responsible for the design and construction of the bridges over the Canals as resources are available. The bridge construction will be phased to allow two-way traffic during the construction as is practical.

For the Canals and the Canal bridges to be constructed in the existing ROWs, all the utilities within the street ROW crossing the Canal will need to be relocated. The franchise utility relocations will follow the City's franchise utility relocation process. The City will notify the franchise utilities of the required relocations as early as possible. Based on these requirements, the following is a typical sequencing of the construction within the street ROW, depending on need to limit traffic impacts:

1. Franchise and City utility relocations construction
2. Canal bridge construction
3. Canal construction

Franchise utility companies typically do not start their relocation design until they are provided with 60 percent construction plans. Designs for both the Canal and Canal bridges will need to be submitted to the utility companies for the design of the utility relocations to be completed.

SECTION 3 CANAL DESIGN AND CONSTRUCTION

3.1 CANAL SYSTEM TYPICAL CROSS SECTION

The FBC has established that the Canal will be 19 feet to 42 feet wide measured from the wall and will be in a Canal ROW between 35 feet and 58 feet. There is no minimum width for the Paseo since it will vary based on minimum widths and undulation of the Canal and other components such as walkways and landscaping. The typical width of the Canal is anticipated to be 30 feet.

Figures 4 and 5 show typical cross sections of the Canals in the north and south islands. Canal A has an additional requirement for a 25-foot-wide utility easement, which falls within Canal ROW and private property, as shown in Figure 5, below.

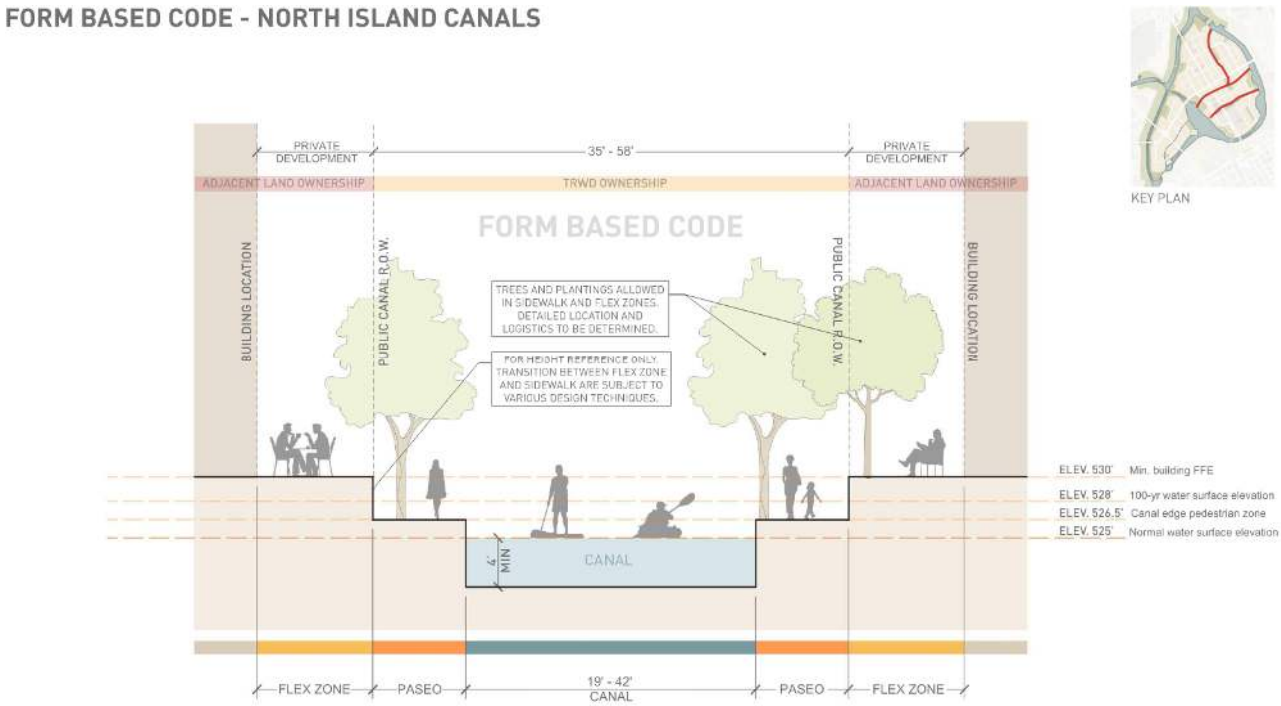


Figure 4 – North Island Canal Typical Section

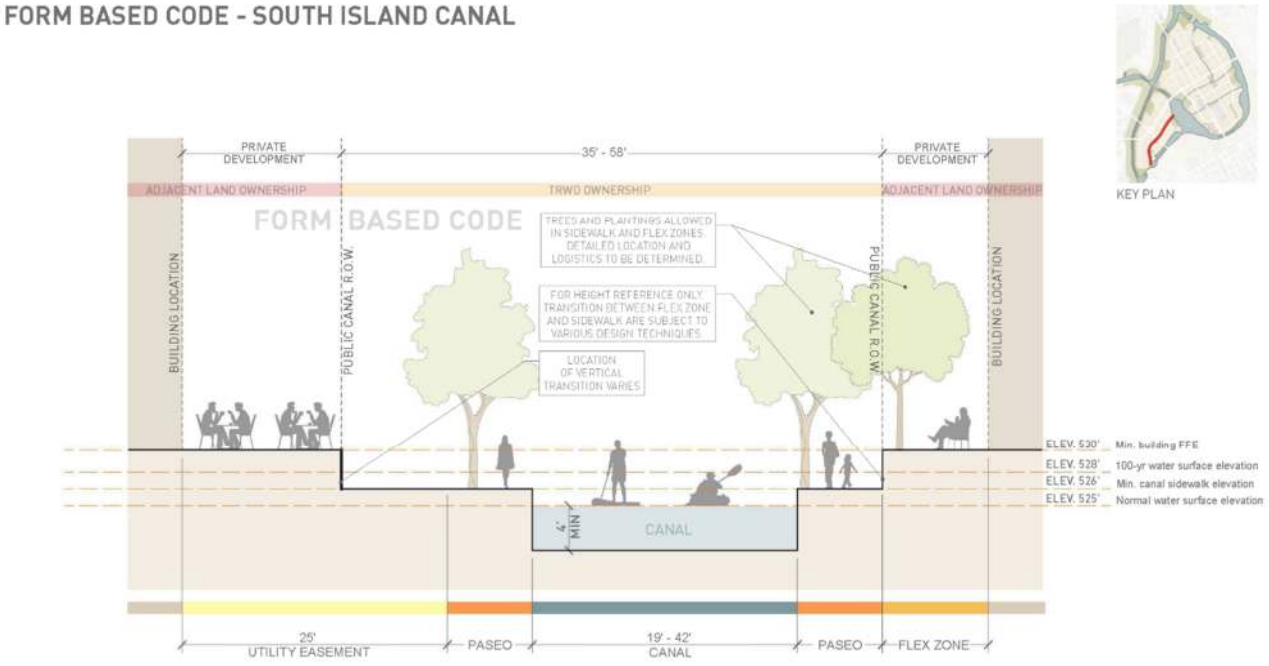


Figure 5 – South Island Canal Typical Section

3.2 CANAL CONSTRUCTION STANDARDS

The Canals are being designed by TRWD and will be primarily constructed by TRWD. The Canals shall be designed in accordance with the following Standards (see **Appendix D** – Canal Details):

Water Level Standards

- Normal water surface elevation of 525 feet.
- After completion of the USACE FWCC project (Samuels Avenue Dam), ground water elevation is expected to increase to approximately 525 feet.
- 100-year water surface elevation of 528 feet.
- Minimum normal water depth of 4 feet.

Construction Standards

- The Canals shall be U-shaped with a reinforced concrete bottom. The Canal walls can be reinforced concrete or sheet piles with concrete facing.
- Between the Canal connections to the existing river and the Canal normal width, the Canal can be sheet pile wall with concrete facing that has decorative treatment from elevation 523 to the top.
- Concrete structure shall be watertight.
- The development owner's structure is not allowed to bear, or depend structurally, on the Canal System structure in any way.
- Top of Canal wall shall have a minimum elevation of 526 feet. At locations where the Canal wall height is extended above an elevation of 526.5 feet, a 3-inch by 3-inch recessed ledge shall be installed. Refer to Appendix D, Canal Safety graphic.
- Factor of safety against flotation when Canal is dewatered shall be between 1.5 and 1.2.
- A form liner approved by TRWD shall be required on the water side of the Canal wall from the top of the wall to an elevation of 523 feet to enhance the visual aspects of the Canal walls.
- At locations upstream of a maintenance dam, the Canal footing shall have a sump for dewatering of the Canal. A minimum measurement of the sump is 2 feet by 2 feet by 2 feet deep.
- A 1-foot safety ledge shall be constructed at the bottom of the Canal with a top elevation of 522 feet. Refer to Appendix D, Canal Safety graphic.
- Canals A, B, & C shall have a 1% eastward bottom slope. Canal D shall have a 1% northward bottom slope. The result is greater depth at the low end of the Canals.

3.3 CANAL MAINTENANCE FEATURE STANDARDS

Canal maintenance operations will be different in the Interim Condition and Ultimate Condition. The Interim Condition includes development prior to the levees being removed. In the Interim Condition, stormwater will drain through connections to the existing storm drain system and outfalls.

TRWD is responsible for the following:

- For longer term maintenance, generally, each Canal is set on a 1 percent grade, to allow periodic dewatering and placement of equipment in the Canal to push water to a low point (sump) adjacent to a maintenance dam.
- Required maintenance dam locations are shown on Figure 6 with a ramp required to get street level equipment down to Canal grade. **Appendix D** includes detailed maintenance dam Standards.
- Portable pumps will dewater the Canals to clean out debris and sediment. There may be instances when a crane is necessary to lower equipment down into the Canals. Potential site locations for equipment storage and maintenance facilities are shown on **Figure 6**.

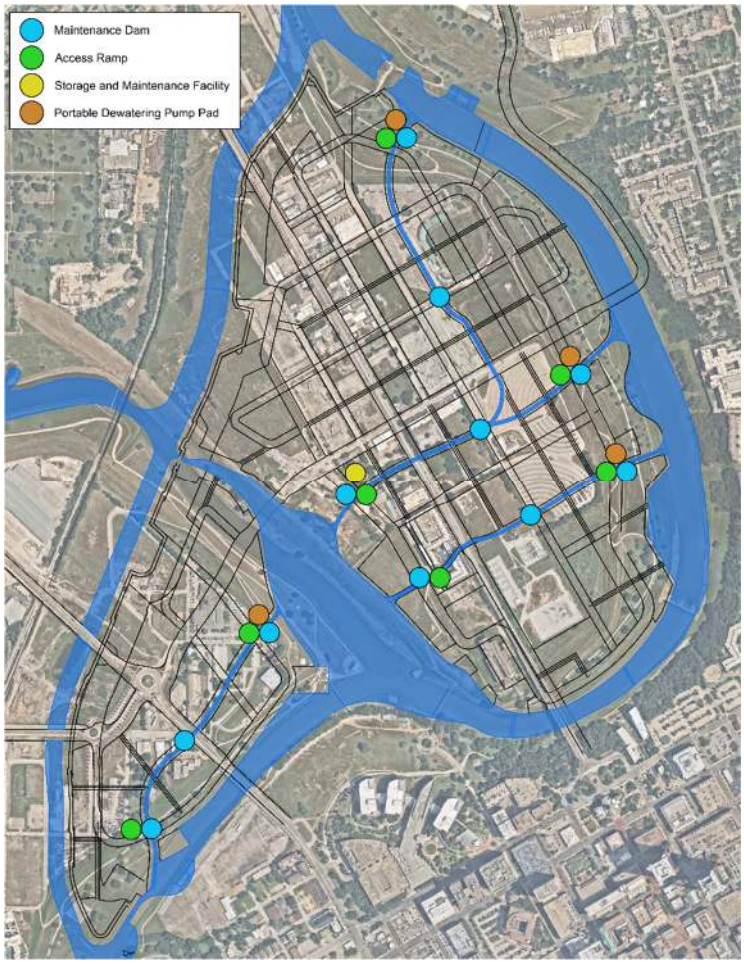


Figure 6 – TRWD Canal Operations and Maintenance Locations

3.4 STORM DRAIN CONNECTIONS

As outlined in the Trinity River Vision Storm Drain Master Plan (to be linked when updated) and as development progresses, various storm drain penetrations into the Canal System will be needed. Watertight gaskets are required in storm drain lines due to the potential stormwater back up into the storm drain lines. Storm drainage connections and storm drain lines below the elevation of 528 feet shall be watertight per USACE Engineering Manual (EM) 1110-2-1913. The storm drain outfalls into the Canals will be incorporated into the Canal design and constructed for private development to tie into as sites are developed. Stormwater connection locations are being planned to limit the number of penetrations to the Canal.

3.5 DETENTION STANDARDS

The City requires each development to detain the difference between the pre- and post-development stormwater runoff. In the Interim and Ultimate Conditions, the Canal System will be utilized to meet the detention requirements on Panther Island. In the Ultimate Condition, the Panther Island development will require a total of 34.12-acre feet of detention. The Canal System configuration based on the Panther Island Form Based Code will satisfy the total required detention for the 100-year floodplain elevation of 528 feet.

3.6 WATER QUALITY STANDARDS

To cost-effectively meet water quality goals from stormwater runoff originating from Panther Island, TRWD requires development to meet the requirements in the TRWD Water Quality Guidance Manual.

Stormwater shall also be treated before entering the Canal System. Stormwater from a development shall drain to the stormwater practices in the public ROW and into the public storm drain system. The public storm drain system shall connect into the Canal. Within the Canal ROW, the Paseo shall drain away from the Canal into a stormwater BMP as shown in Figure 7.

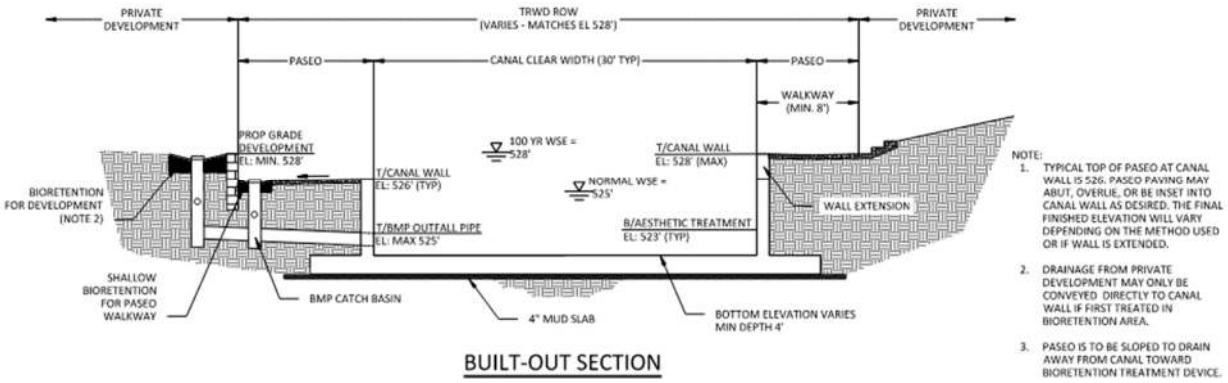


Figure 7 – Canal Water Quality

SECTION 4 BRIDGES

As shown in **Figure 8**, there are 16 proposed vehicular bridges and 10 proposed pedestrian and bike bridges crossing the Canal System; however, final determinations regarding designation of bridges for vehicles or pedestrians may evolve as development needs and funding clarifies. The vehicular Panther Island Boulevard bridges and pedestrian bridges crossing the bypass channel and the West Fork Trinity River shown in **Figure 8** have different design requirements and are not included in this Canal System Manual.

It is anticipated that the City of Fort Worth will construct and fund all bridges in coordination with partner funding agencies. The final schedule will be determined by Canal construction schedules and funding availability.

4.1 BRIDGE CONSTRUCTION STANDARDS

See Appendix B for additional details.

- For the vehicular Canal bridges, the TxDOT Prestressed Concrete Slab Beam (PCSB) bridge or approved equal will be constructed. The TxDOT standard detail for the PCSB bridge is included in Appendix.
- For the pedestrian and bike bridges, the Contech Pedestrian Truss bridge or equal will be constructed.
- Vehicular bridges maximum span length 50 feet.
- Pedestrian bridges maximum span length 60 feet.
- Roadway cross section for the bridges shall be per the FBC except for the N. Main Street (BUS 287) and Henderson (SH-199) Canal bridges, which will match the existing roadway cross section.
    - A conceptual plan and profile for Canal C at N. Main Street is included in Appendix.
- Minimum clearance over the Canal sidewalk is 7 feet.
- Minimum Canal sidewalk elevation of 526 feet.
- Normal Canal water surface elevation of 525 feet.
- 100-year flood event elevation of 528-feet.
- Future possible ground water elevation up to 525 feet.
- Piers will be designed for the future Canal construction and Canal retaining wall between the Canal sidewalk and the bridge piers.
- It is anticipated that the storm drain, water, sanitary sewer lines, and relocated franchise utilities will be placed between the bridge piers. Bridge piers will need to be designed to accommodate the relocation alignments. Clearances shall be in accordance with City infrastructure design criteria.
- For the navigable Canals, the bridges shall have a low chord elevation of 534 feet.
    - TRWD and the City envision all Canals to be navigable, subject to funding availability to modify affected streets. This is of particular concern at the Canal D bridges at NE 6th Street, NE 7th Street, and the future road north of NE 7th Street, which may require additional coordination with the developer, the City, and TRWD to meet the clearance requirements for a navigable Canal.

- The Canal B bridge at N. Main Street is adjacent to the historic N. Main Street Viaduct Bridge; therefore, it has unique requirements to make sure there are no impacts to the historic structure:
    - Maximum span length of 37 feet.
    - Roadway width of 55 feet.
- A conceptual plan and profile for Canal B at N. Main Street is included in Appendix B.

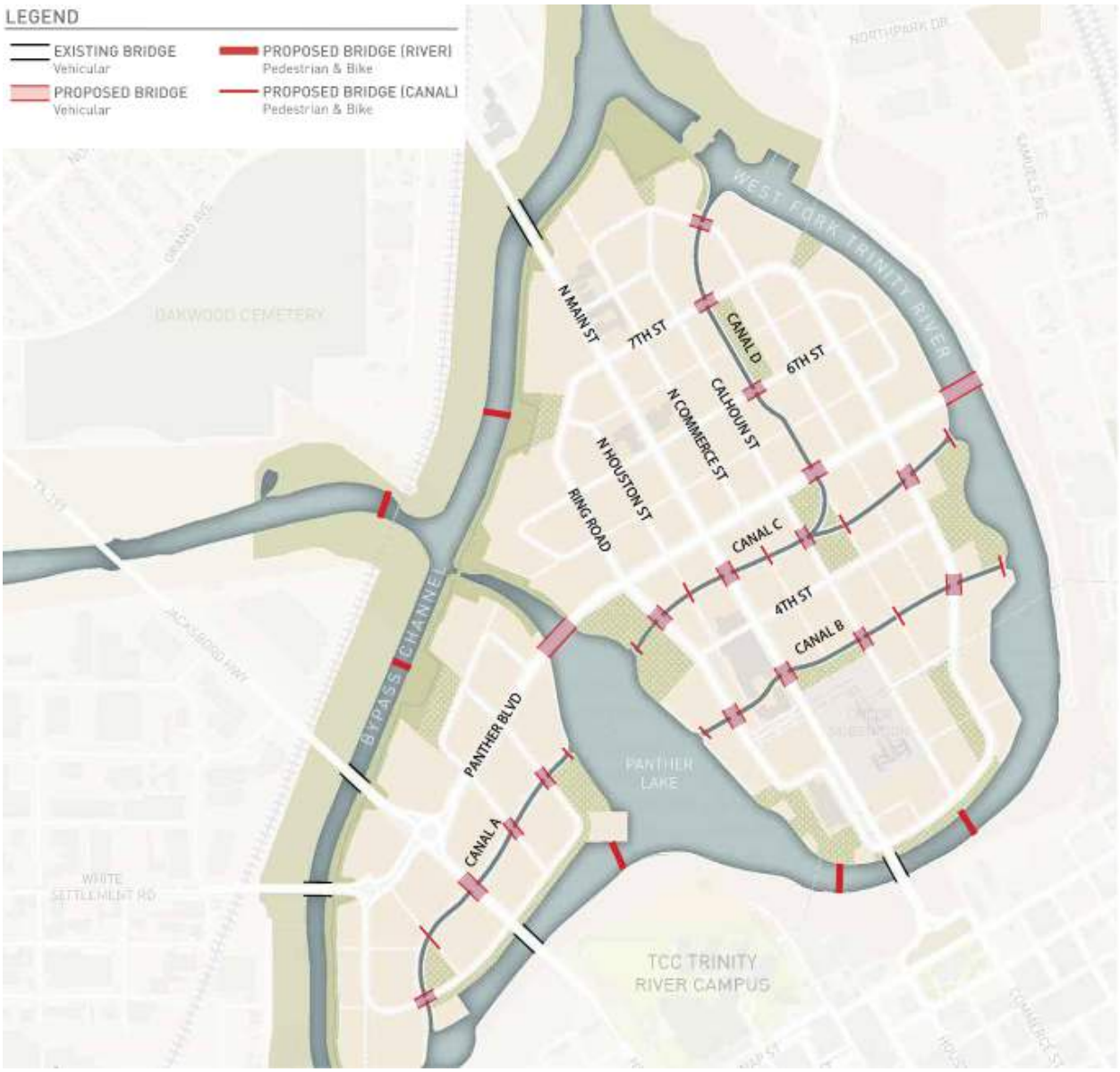


Figure 8 – Panther Island Canal Bridges

4.2 TRANSIT CONSIDERATIONS

The future Panther Island transit network also needs to be considered in Canal bridge designs. As shown in Figure 9, a future high-capacity transit line is planned for N. Main Street. The mobility loop, shown in orange in Figure 9, may also have a transit line. The bridge designs will need to accommodate these future transit lines.

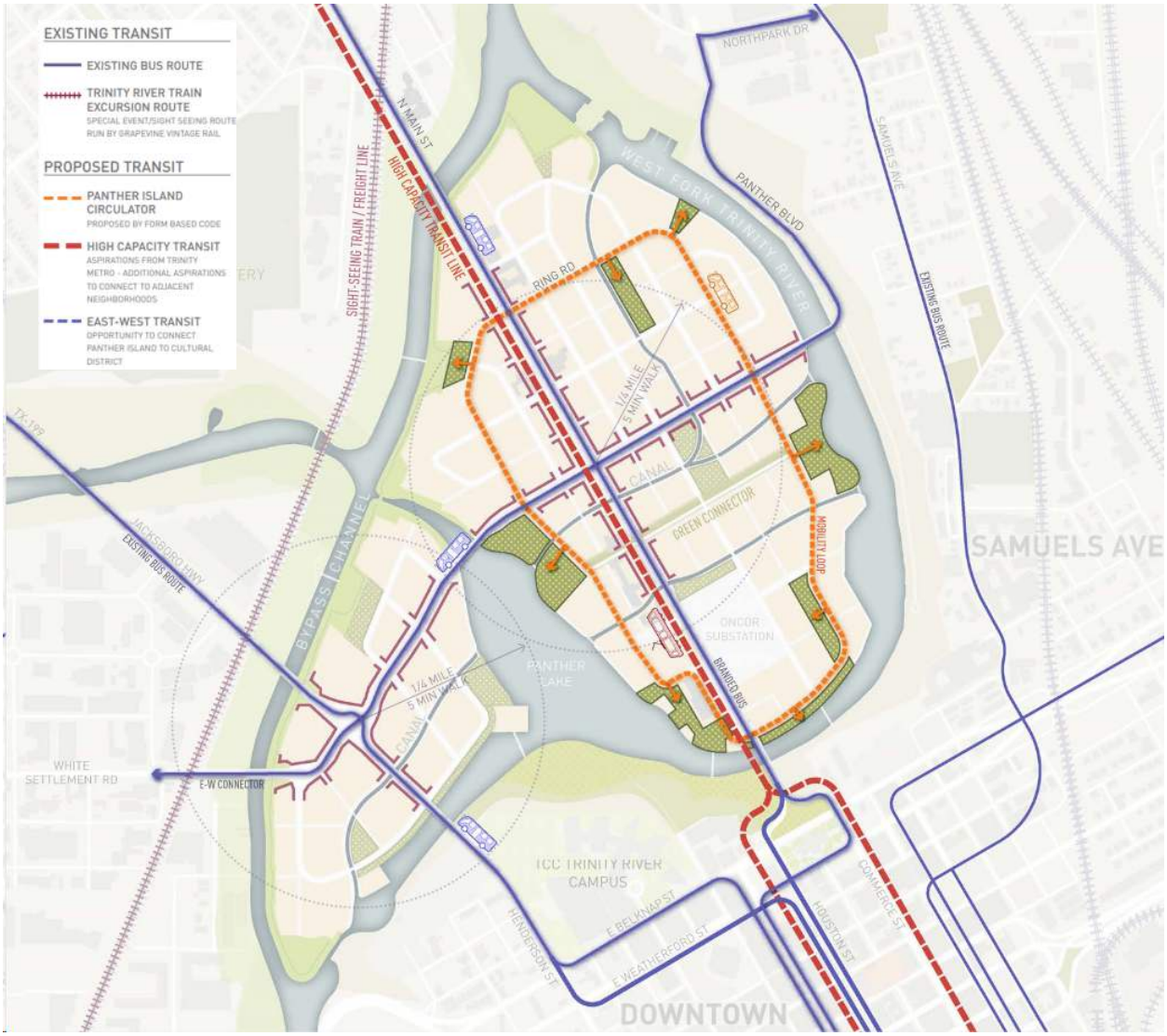


Figure 9 – Panther Island Transit Network

SECTION 5 PASEO DESIGN GUIDING PRINCIPLES, STANDARDS, AND GUIDELINES

5.1 PASEO DESIGN GUIDING PRINCIPLES

These Standards and Guidelines are intended to be a framework for design professionals based on the following guiding principles:

- *Use of **quality materials** on the Paseo that will age well over time and reflect the historical and cultural heritage of Fort Worth.*
- *Sufficient consistency of materials and design to create a **contiguous feel while providing flexibility** to create unique and interesting experiences.*
- *Development of public access and interaction with the water throughout the corridor.*
- *Support of a variety of degrees of **activation of public spaces** ranging from defined gathering spaces to quiet reflection spaces.*
- *Encouragement of the development and **activation of adjacent properties.***
- *Implementation of **sustainable designs** that strengthen the advanced water and air quality goals of the District in collaboration with its environmental partners.*

5.2 DESIGN PRECEDENTS

The length of the Canal System and the diversity of surrounding developments offer a wide range of design opportunities. The images below are intended to reflect an array of design examples while later images reflect the materials and features that will create a special atmosphere in appropriate concentrations.

River Walk, San Antonio

The Woodlands Waterway

The Pearl, San Antonio

Encore Development

Las Colinas Canal Walk

Bricktown OKC

5.3 PASEO CONCEPTS

The Paseos will be an integral part of the open space network, pedestrian environment, and waterfront recreation. **Figure 10** is a conceptual exhibit of the Canal System showing transitions for different Canal widths, landscaping, sidewalk, and pavement. Bike lanes are not shown in the Canal System concept because bikes are prohibited on the paseo. It is anticipated that TRWD will conduct public space master planning with each Canal section or development as they are constructed. This may allow TRWD to consider constructing certain Paseo elements that facilitate interaction with the water.

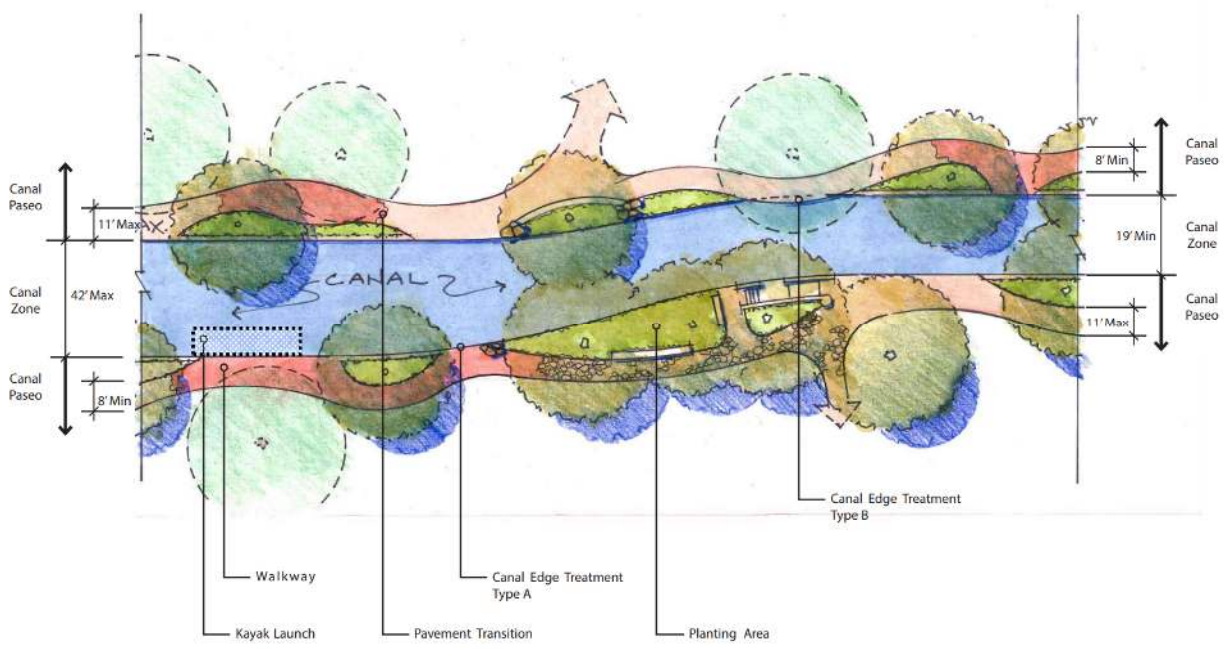


Figure 10 – Paseo Concept

5.4 PEDESTRIAN ELEMENTS

The public will have access along the Paseos and connections from the public streets and the trail system. Adjacent property owners are responsible for securing their private spaces from public access where appropriate.

All pedestrian elements shall comply with the most recently adopted Final Rule Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) as published in the Federal Register, Vol. 88, No. 151. Applicable pedestrian elements include but are not limited to:

- Sidewalks
- Ramps
- Pedestrian access routes
- Warning surfaces
- Watercraft loading zones
- Signs and pavement markings
- Street furniture
- Drinking fountains (above 528 feet)
- Tables
- Benches
- Handrails
- Stairs and elevators

TRWD also anticipates incremental planning and construction of trail connections and interim pedestrian facilities to support development as it occurs.

Public pedestrian Canal access points comply with the Texas Accessibility Standards at approximate locations described in **Figure 11**. TRWD will further identify required accessibility facilities with the master planning of each Canal segment. Accessible pedestrian access points shall be placed near intersections, transit stops, and accessible on-street parking.

- Sidewalk, ramp, and curb ramp slopes and turning spaces shall comply with the current version of the PROWAG
- Outdoor lifts shall be provided where required by the Texas Accessibility Standards.
- Variation in walking surfaces should be appropriately joined to not cause tripping hazards.

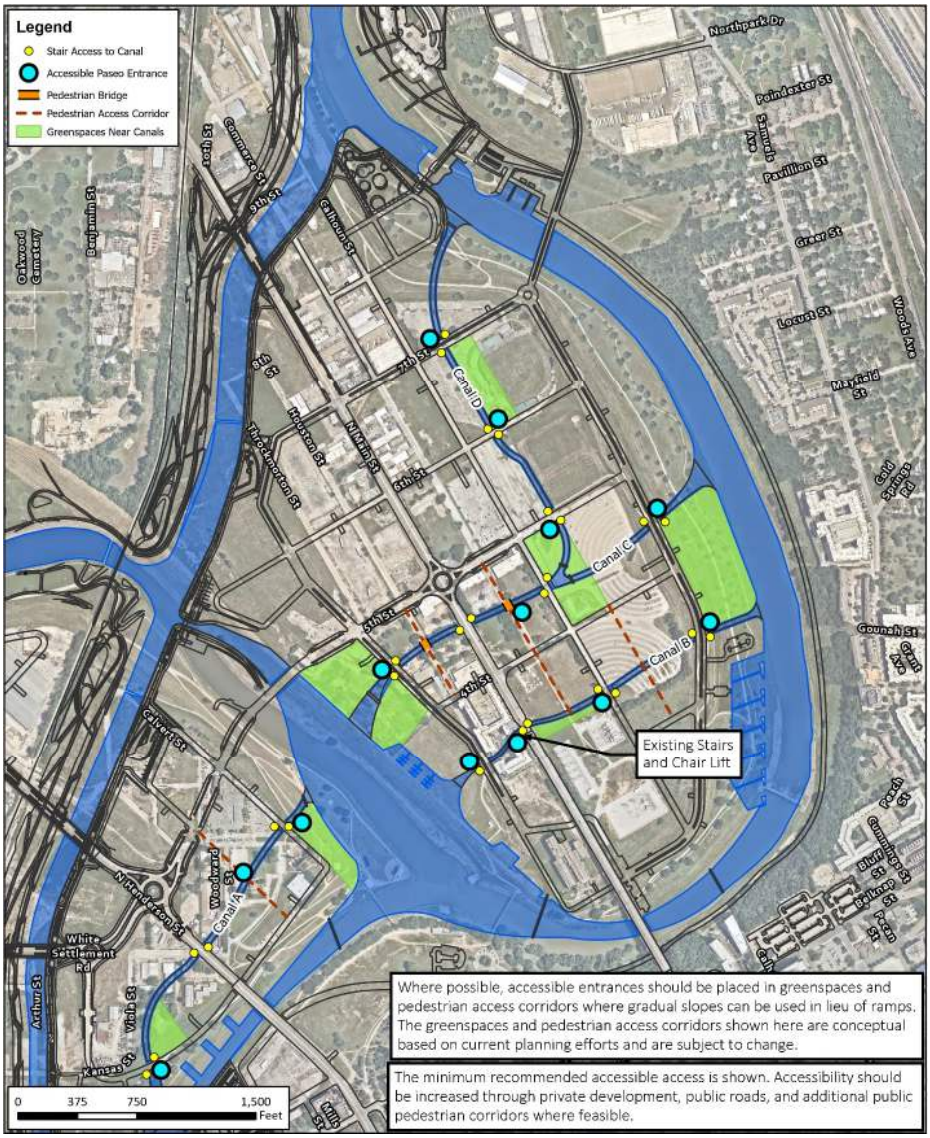


Figure 11 – Pedestrian Access

5.5 CANAL EDGE/COPING ELEMENTS

Canal Edge Guidelines

Design variations along the Canal edge are encouraged to enhance pedestrian interaction and add visual interest throughout the corridor. Where appropriate and where water interaction is desired, the coping may be stepped down to form a refuge area, set back from the main pedestrian pathway. Canal wall height will be generally consistent unless specifically approved by TRWD.

Materials used to define the Canal edge should contribute to the area's informal and organic aesthetic, with elements such as brick, stone, flagstone, or limestone block highly favored. Various elements such as fountains, planters, steps, or boulders should also be considered for incorporation wherever extra visual interest is desired.

Changes in condition should be signified through changes to colors, textures, or materials, such as when different uses or buildings are adjacent to the pedestrian path.

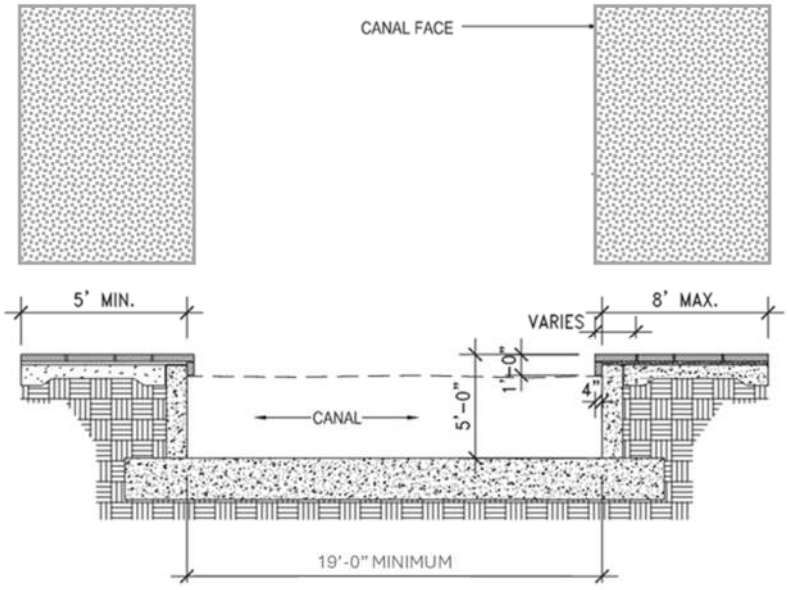
In areas where pedestrians are not interacting directly with the water, coping should serve as a visual edge that enhances pedestrian sense of physical security. Where more interaction is desired, a step-down edging can be incorporated. This could take the form of an actual step down or a naturalistic boulder edge for sitting and climbing. Additional examples can be found in Appendix G. For extensions of the Canal wall and the concrete cap for the sheet pile Canal wall, see Appendix D.

Rough Stone Block Wall/Coping

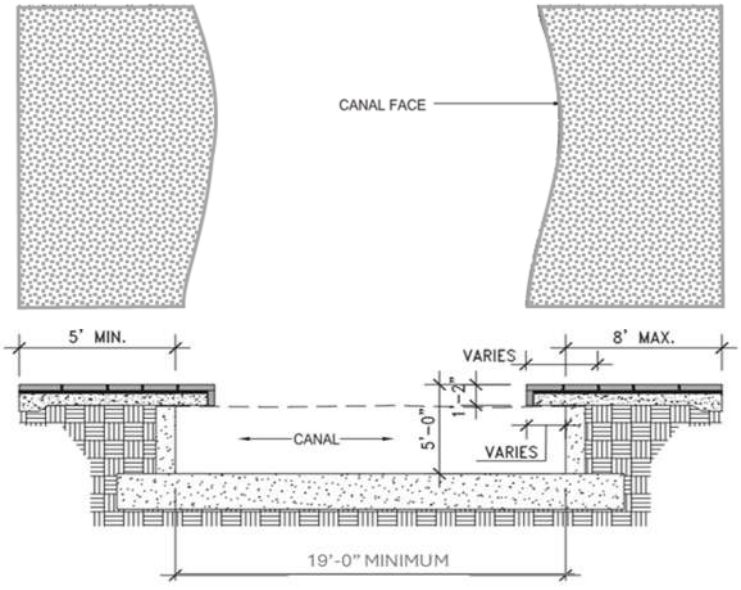
Construction Standard (See Figure 13)

- A visual edge with a change in material shall be provided where a pedestrian path directly abuts the Canal and where brick or flagstone less than 3 feet wide is used adjacent to the Canal.
- The coping can be either flush or raised where interaction with the water is not desired, as long as all Texas Accessibility Standards requirements are met. (Canal Edge Treatment Type A)

- The walkway may be cantilevered over the edge of the water, subject to TRWD review and approval for safety, design stability and maintenance of canal width. Applications that enhance the pedestrian's sense of connection to the water, create attractive shadow lines, and reduce splashing will be considered favorably. (Canal Edge Treatment Type B)
- The design of coping shall be of sufficient manner to rigidly adhere to the wall.



Canal Edge Treatment Type A



Canal Edge Treatment Type B

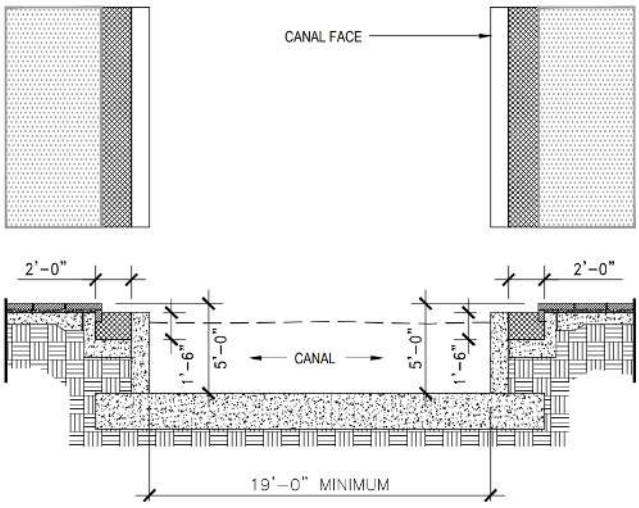


Figure 13 – Canal Edge Treatment

Material Standards

- A "natural" look is required to create a rustic, informal aesthetic. Allowable materials include brick, decorative Mexican tile, flagstone, stone block, and similar natural elements. Use of non-listed materials must be approved by TRWD on a case-by-case basis. Pavestone and concrete bricks are not allowed.
- Material must be mortared in place.
- Concrete may be used as an accent material but cannot comprise more than 25 percent of the coping length.

Railing Standards

- In areas where dining or non-fixed street furniture abuts the Canal, a minimum 42-inch railing is required to be anchored to the coping.
-

5.6 PASEO PAVING

Paseo Paving Guidelines

- Informal designs and patterns are encouraged, along with a mixture of materials, colors, and textures to create interest along the pedestrian walkway.

- Materials that reflect historic Texas and Fort Worth architecture, such as brick, limestone, and sandstone, are highly favored. Consideration shall be given to avoid excessive use of these materials where they may have consistent exposure to water resulting in deterioration over time.

- Architectural concrete is a valuable material because of the flexibility it offers in form, durability, texture, and color, and it is encouraged to be integrated with other materials—such as brick, flagstone, or cobbles—or with other contrasting patterns and colors of concrete to create a more varied and interesting visual texture.
- Variation in the width and a meandering course are desired to create an aesthetic that is loose and organic in form. Long, uninterrupted and monotonous designs are discouraged.
- Paving materials should be used to clearly define spaces, access to the waterfront, and access to various uses, such as plazas, restaurants, or building facades. Examples can be found in Appendix E.

Paving Materials Standards

- Materials shall promote a strong relationship between the surrounding neighborhood and the Paseo including building facades and spaces adjacent to the pedestrian path.
- Allowable materials include concrete (limited to 25 percent except paths as described below), brick, decorative Mexican tile, flagstone, stone block, and similar natural elements. Use of non-listed materials must be approved by TRWD on a case-by-case basis. Permeable pavers, pavestone, concrete bricks, decomposed granite, gravel, and other loose materials are not allowed.
- Paths, as described under Path Standards, do not have a limit on the use of concrete but require the use of finishes that add aesthetic texture and interest. Appropriate examples include patterns, scoring, embellishments, rock-salt or sand blast finishes. Concrete finishes should not be used to imitate other, more expensive materials.
- Integral colored concrete is permitted; concrete stains or dyes are not.
- Paving materials shall have a slip resistant surface
- Bricks shall conform to ASTM standards for Pedestrian and Light Traffic Paving.
- Paving materials shall be mortared in place on a concrete base to withstand periodic inundation.

Path Standards

- Paths are clear walkways that provide contiguous pedestrian access in the Paseo. Paths shall be a minimum of 8 feet wide and a maximum of 11 feet wide; except, the width can be reduced to 5 feet when crossing under vehicular or pedestrian bridges or other unavoidable constraints.
- Paths shall incorporate changes in width and gentle curves to create a more dynamic and engaging route, avoiding abrupt changes in width.
- Paths shall incorporate changes in width and gentle curves to create a more dynamic and engaging route, avoiding abrupt changes in width.
- Straight edges of more than 30 feet are not allowed.

- Cut-outs and refuge areas are required-to allow pedestrians to enjoy views of the Canal without blocking paths. A minimum of one per block extending at least 3 feet from the path with a width of at least 20 feet, per side should be provided.
- The pedestrian path shall be continuous along the Canals and promote access to various buildings and uses along the Canal and will be open to the public.
- Each development along the Canal shall have at least one pedestrian access point in the form of stairs or ramps that align with pedestrian refuges. These access points may be restricted to the public at the determination of the developer and concurrence of TRWD.
- Paving and landscaped areas shall incorporate green stormwater infrastructure. Where pavement is adjacent to shade trees, structural soil systems beneath the surface shall be implemented when feasible to support healthy root growth. Refer to TRWD Water Quality Guidance Manual, noting that while allowed in other settings, permeable pavers are not permissible for use in the Paseo due to periodic inundation.

Brick – Mixed Patterns

Embellished Concrete

Rock Salt and Scoring Treatments

Cascading Plant Bed at Water's Edge

5.7 SEATING AND RETAINING WALLS

Guidelines

Seating and retaining walls are an integral component of the Paseo. These elements delineate spaces, transition elevations, frame plantings and pathways, and offer places of respite to pedestrians along the path.

- Seating and retaining walls should primarily use traditional materials like stone blocks, cobbles, or brick to convey a natural aesthetic, while accents such as tile may be added to enhance visual interest and character.
- Undulations and variations in height are encouraged to establish an informal character. Examples can be found in Appendix F.
- Inclusion of design elements such as tile inlay and mixing of materials like stone walls with brick are encouraged.

Standards

- Materials shall complement adjacent paving and buildings.
- Natural materials such as stone, cobbles, and brick are required.
- Materials should have a rough appearance (e.g., tumbled stone or split face block).
- Concrete may be used as a wall material, provided it has textural treatment and a cap.
- Walls shall have variation in height and materials to create visual interest.
- Walls shall not have expanses of more than 30 feet without undulation in course and variation in height to break up their length.
- Planting beds behind retaining walls shall be a minimum of 6 feet wide where large trees are contained, 5 feet where small trees are contained and 4 feet wide where no trees are present. Variation in the width of the bed is required to create an informal appearance.
- Seat walls shall have sufficient clearance to allow free movement of pedestrians along the pathway. Seats that are recessed back a minimum of 18 inches to create a sense of refuge are required. The height of seat walls shall be 16 to 21 inches.

5.8 WATER FEATURES

Water features are encouraged to enhance the pedestrian experience, create connections to the Canal's water elements, and offer soothing sound and natural cooling.

In addition, the use of channels that can be walked over provide unique experiences for the public. Such elements can add creativity to defining the outdoor spaces along the canals.

Standards

If placed in the 100 year floodplain, water features must include special filters/shut offs to aid in the success and long life of the fountain fixture.

5.9 PLANTERS AT CANAL EDGE

Standards

- Planters placed between the pedestrian walkway and the Canal edge at periodic intervals are required to break up the edge of the walkway and provide planting space for shade trees.
- These planters shall encompass 15 percent of the frontage unless in conflict with the TRWD Water Quality Guidance Manual which will prevail. The planters shall have a minimum width of 4 feet, with conformance to space required for small and large trees. Coping Treatment Type C (Figure 13) may count toward reaching the15 percent of frontage.

5.10 LANDSCAPE

This section is intended to guide the planting of trees and landscaping along the Canal to provide a strong canopy of native and adapted trees that provides shade and a sense of enclosure for the site. Well-designed landscaping can help mitigate urban heat islands, enhance the quality of stormwater entering the Canal System and rivers, and promote sustainability using native, adapted, and drought-tolerant plant species. Trees should be provided with the greatest possible soil volume to support healthy root development, enhance long-term vitality, and minimize maintenance needs.

Plantings and landscaping should be informal in nature; the design intent is to create a space that feels as if it has evolved and developed over many years. Strict geometry and rigid lines in plantings should be the exception rather than the rule.

Cedar Elm

Standards

- All plant material and landscape shall comply with the TRWD Allowable Species List and an approved Paseo improvement plan.
- A minimum of 30 percent of the Paseos will be set aside as planting area. Each development shall be individually subject to this Standard unless it is achieved in combination with an existing adjacent development within the same block and approved by TRWD.
- Existing trees of allowable species should be preserved where possible. Note the City Tree Ordinance does not apply to the Paseo.
- One canopy shade tree shall be required for every 30 feet on center except where vehicular bridges cross.
    - Shade trees can be clustered, but gaps shall not exceed 300 feet.
    - Three ornamental trees may be substituted for each required canopy tree where appropriate to address size constraints and approved by TRWD. This is in addition to the required ornamental trees noted below.
- Shade trees shall be a minimum of four-inch caliper when planted and have a 7-foot, 6-inch minimum clearance.
- No more than one-third of canopy shade tree plantings shall be from the same genus/sub-genus to ensure healthy diversity.
- One ornamental tree shall be provided every 50 linear feet, in addition to required canopy shade trees.

- Ornamental trees will need to be maintained to have a 7-foot clearance, if they encroach upon a path.
- Ornamental trees, if multi-trunked, shall have a minimum of 3 canes.
- Planting methods and soil requirements shall conform to TRWD's Planting Standards.
    - Trees shall be planted in open planters, except where space restrictions make this requirement unfeasible, as approved by TRWD on a case-by-case basis.
    - TRWD may approve tree grates where adequate shade canopy over the Paseo is necessary and open planters are impractical, jeopardize pedestrian safety, and cannot be addressed with other solutions, such as a suspended pavement system (like silva cells) or native river gravel. Any approved tree grates shall conform to equipment specifications established by TRWD.
    - Stormwater management systems may be incorporated under pavement adjacent to planters to provide space for root growth and drainage, as approved by TRWD staff.
- Landscape areas within the Paseo shall limit the use of hardwood mulch or other floatable material to 1.5" of topdressing.

[Note: TRWD Planting Standards under development.]

5.11 IRRIGATION

An irrigation system is required to sustain the landscaping installed within the Paseos. The developer will include an irrigation design with the Paseo improvements plan that conforms to standards established by TRWD. The design will be completed by a licensed professional irrigator and will connect to the City's water system. TRWD will be the owner of the irrigation water lines and meters. Power for the timer controller will be from TRWD's electric meter. The location of the electric meter will be coordinated with the developer's electrical transformers and meters. Water from the river or the Canals cannot be used for the irrigation system.

[Note: TRWD is developing irrigation equipment and installation standards including quick coupler valves for power washing.]

5.12 ILLUMINATION

The Canal System shall be illuminated and meet TRWD design specifications and safety standards for pedestrian walkways. The developer can apply the lighting from adjacent development to comply with illumination requirements. If illumination fixtures are designed within the Paseo, they shall follow TRWD specifications. Festival lighting is also permitted along the Canal. Temporary seasonal tree wrapping with lights is allowed and requires TRWD approval.

[Note: TRWD is developing illumination standards and specifications.]

5.13 SIGNAGE

Along the Paseo there should be informational signage. This includes but is not limited to wayfinding, hours of operation, emergency contacts, and prohibited activities. All signage along the Canals shall be approved by TRWD.

[Signage standards will be developed by TRWD as Canal development progresses.]

SECTION 6 Canal System Maintenance

Within the Canal System, responsibility for maintenance is shared among the following organizations. Responsibilities of the PID and the adjacent property owner will be established by separate written agreement with TRWD.

[Interlocal Agreement for Canal System Funding and Maintenance to be adopted with City.]

6.1 TRWD RESPONSIBILITIES

- Canal basin.
- Repairs of damaged or failed equipment as soon as possible considering the circumstances of the repair.
- Canal water depth is generally set at 4-foot to keep algae and bacterial growth from occurring. During the Interim Condition, periodic water filling, mixing, and dewatering to keep water fresh in the Canals will be required.
- Addition of water to Canal from the river to maintain a standard water surface elevation during extended dry weather conditions.
- Water quality devices.
- Monitoring of water quality parameters during the routine cycle data collection. If water quality is a problem, TRWD Environmental staff will address using methods acceptable to local, state, and federal regulations.
- On a yearly basis, TRWD will evaluate the sediment at the bottom of the Canal system to determine if removal of the sediment is required. If required, TRWD will install the maintenance dams, drain the water from the Canal, and remove the sediment from the bottom of the Canal. TRWD will make repairs to the Canal structure if necessary with appropriate notice to adjacent property owners.
- Restoration of landscape and hardscape areas after a flood event that inundates Paseo including desilting following mud removal from Paseo that is directed into the Canals.
- Mowing and care of any sections of the Paseo that do not have permanent improvements.
- Routine capital maintenance of the Paseo retaining walls, planters, seating, and walkways with the expectation that significant capital investments in the long-term will be negotiated in good faith with the City.
- Any water features assigned to TRWD for maintenance via separate agreement.

6.2 PUBLIC IMPROVEMENT DISTRICT (PID) RESPONSIBILITIES

Frequencies will be established and scheduled by the PID.

- Routine maintenance and necessary replacements of landscape set in any of the hardscaped areas to include weeding, mulching, tree care (pruning, fertilizing,

replacement), plant and groundcover care, irrigation system checks and repair on a frequency established by the PID.
- Seasonal plantings in locations approved by the PID.
- Seasonal system modifications/inspections of irrigation systems and ongoing maintenance (eg. broken heads needing immediate attention) vs a system check
- Routine litter removal from the Canal.
- Litter collection on the Paseo with goal of prevention of litter settling in the Canal.
- Water and electric service for the Paseo.
- Replacement or repair of non-fixed seating that is not owned by adjacent property owner.
- Any water features assigned to PID for maintenance via separate agreement.
- Annual inspection and maintenance of any approved tree grates.

[Note: These responsibilities to be further defined upon creation of the PID, an informal advisory committee of property owners, and the permanent governance structure. Assumed responsibilities will be documented in a Service and Assessment Plan.]

6.3 ADJACENT PROPERTY OWNER RESPONSIBILITIES

Responsibilities will be established via a development agreement or as a condition of permitting.

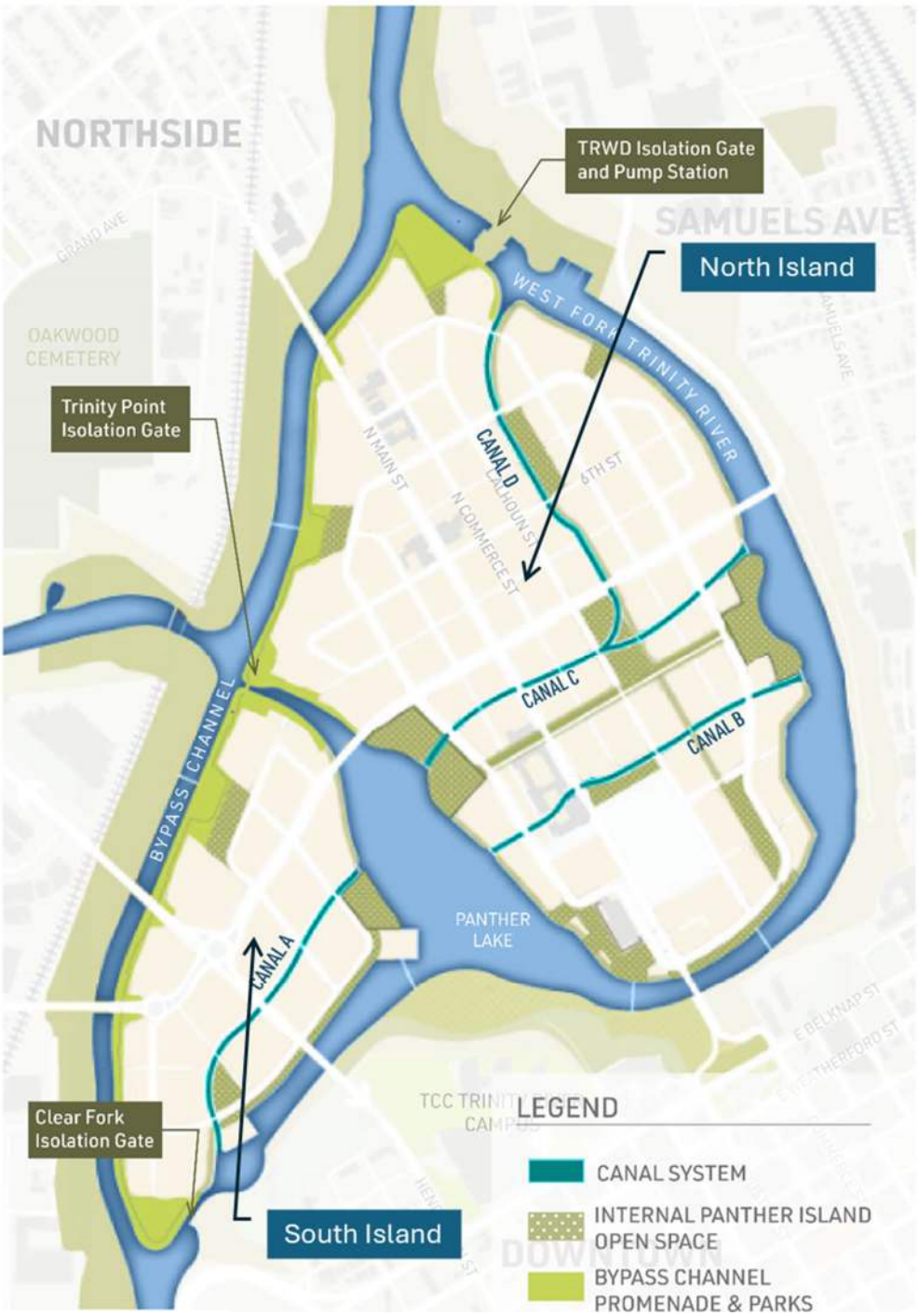
- Amenities such as water features and specialized materials that cannot be maintained by the PID or are at extraordinary risk of damage during inundation at the discretion of TRWD at the time of permitting.
- The developer or property owner may hire a vendor to perform the litter or flood event clean up in the Paseo at their own expense if they desire a more timely remedy or higher level of service. A developer may also request to assume contractual responsibility to maintain any element in the public realm that they believe requires a higher standard of care than contracted to be provided by TRWD or the PID. The developer or property owner will be required to execute an agreement with TRWD to perform, or allow a third party to perform, these activities on TRWD property.
- Any desired litter abatement or power-washing that exceeds the PID schedule.
- Securing or removal of any moveable furniture or fixtures that serve their development as needed daily or in preparation for anticipated inundations. Unless otherwise agreed in writing, the PID and TRWD will not be responsible for replacement or repair of these features.

6.4 CITY RESPONSIBILITIES

- Future collaboration on funding for capital maintenance and improvements of the Paseo based on economic and tourism impact to the City.
- Capital maintenance of pedestrian and vehicular bridges.

Appendix A

Conceptual Canals Plan and Profiles


NORTHSIDE
TRWD Isolation Gate and Pump Station
SAMUELS AVE
North Island
WEST FORK TRINITY RIVER
OAKWOOD CEMETERY
Trinity Point Isolation Gate
CANAL D
N MAIN ST
N COMMERCE ST
6TH ST
CANAL C
CANAL B
BYPASS CHANNEL
PANTHER LAKE
CANAL A
Clear Fork Isolation Gate
South Island
LEGEND
CANAL SYSTEM
INTERNAL PANTHER ISLAND OPEN SPACE
BYPASS CHANNEL PROMENADE & PARKS

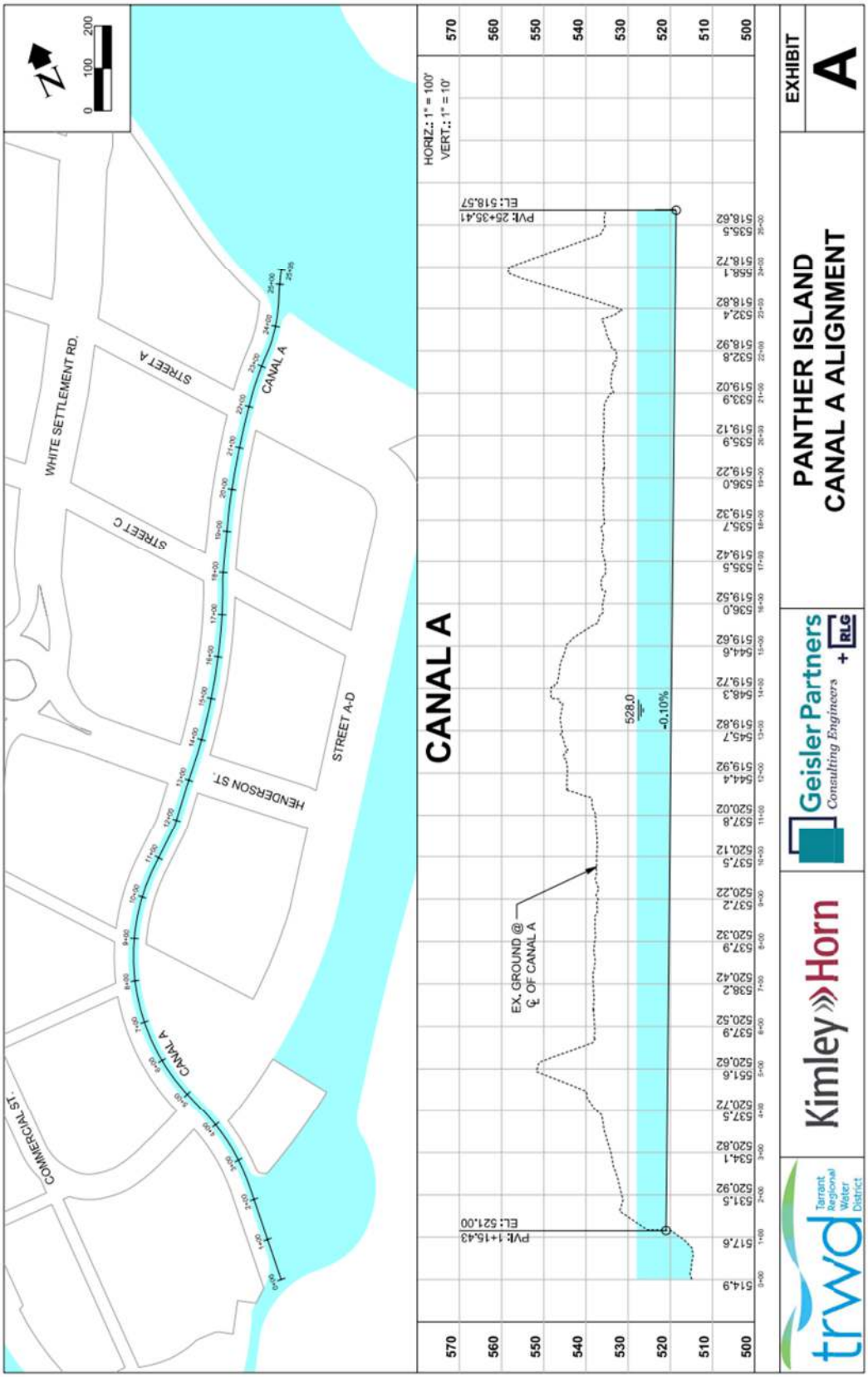


EXHIBIT
A
PANTHER ISLAND
CANAL A ALIGNMENT
Kimley»Horn
Geisler Partners
Consulting Engineers
RLG
trwd
Tarrant Regional Water District
CANAL A
HORIZ.: 1" = 100'
VERT.: 1" = 10'
PVI: 1+15.43
EL: 521.00
PVI: 25+35.41
EL: 518.57
EX. GROUND @ ℄ OF CANAL A
528.0
-0.10%
WHITE SETTLEMENT RD.
STREET A
STREET C
HENDERSON ST.
STREET A-D
COMMERCIAL ST.
CANAL A
N
0
100
200

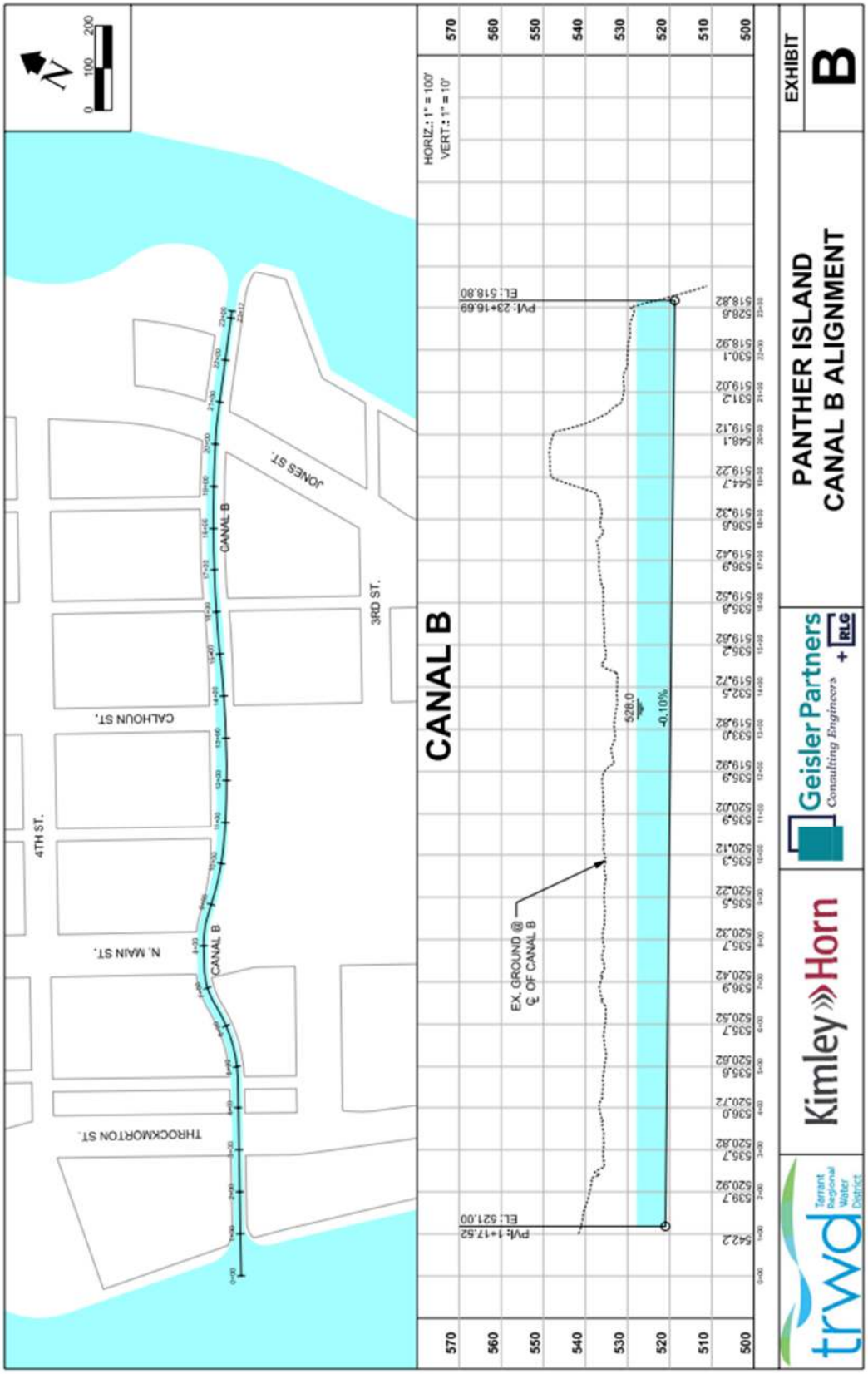


EXHIBIT
B
PANTHER ISLAND
CANAL B ALIGNMENT
Geisler Partners
Consulting Engineers
RLG
Kimley»Horn
trwd
Tarrant Regional Water District
CANAL B
HORIZ.: 1" = 100'
VERT.: 1" = 10'
PVI: 23+16.69
EL: 518.80
PVI: 1+17.52
EL: 521.00
528.0
-0.10%
EX. GROUND @
℄ OF CANAL B
JONES ST.
3RD ST.
CALHOUN ST.
N. MAIN ST.
4TH ST.
THROCKMORTON ST.
CANAL B
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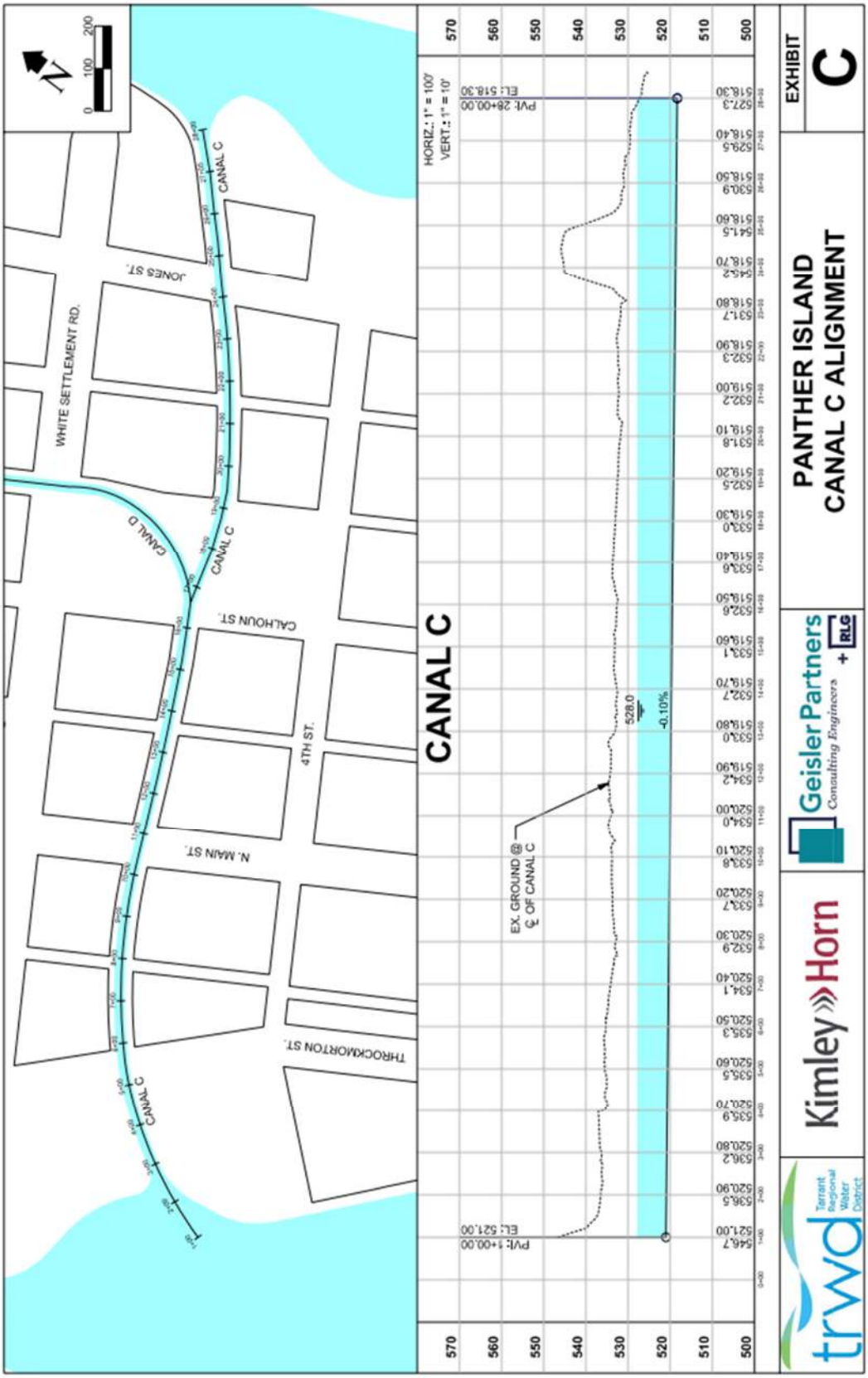
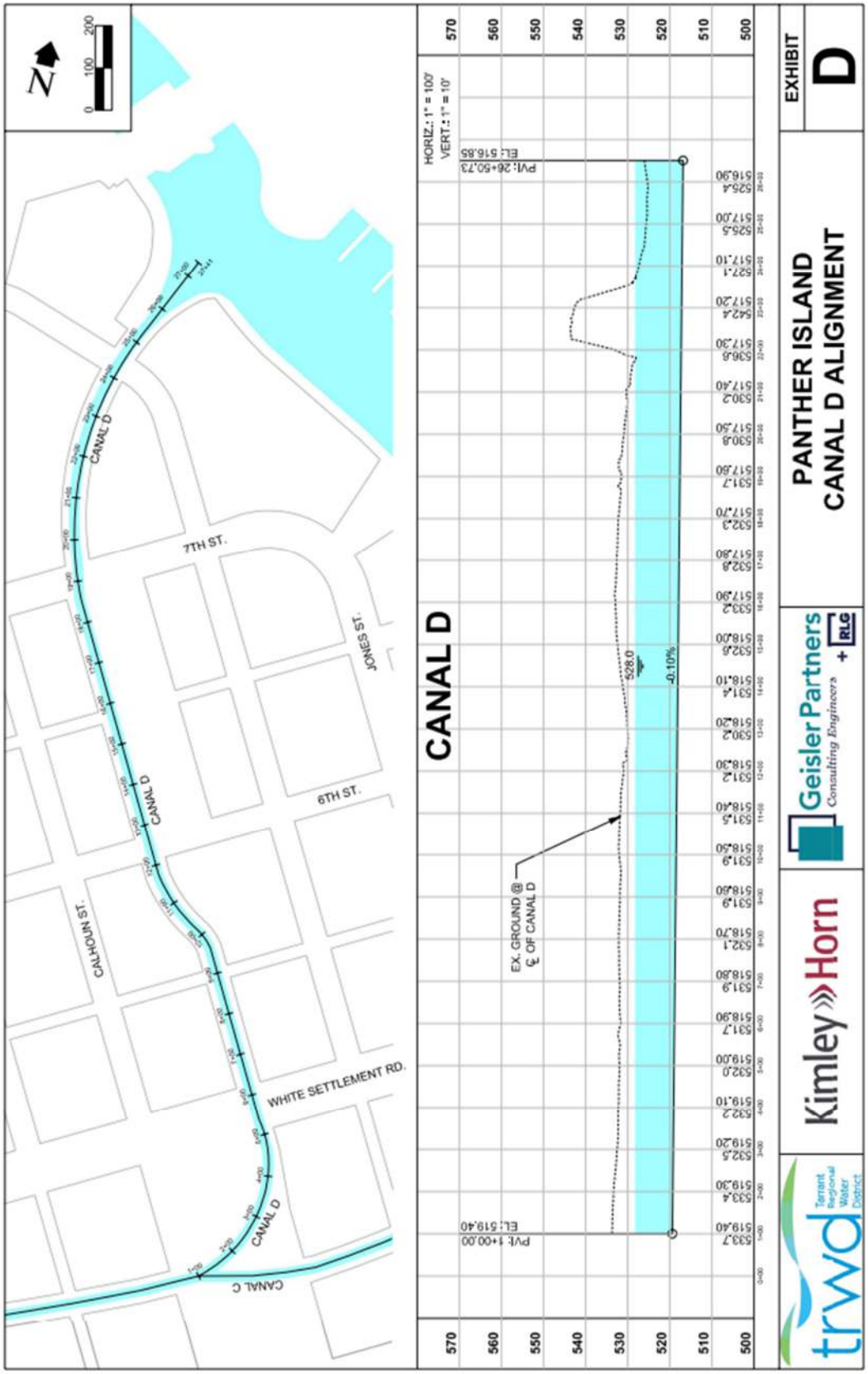
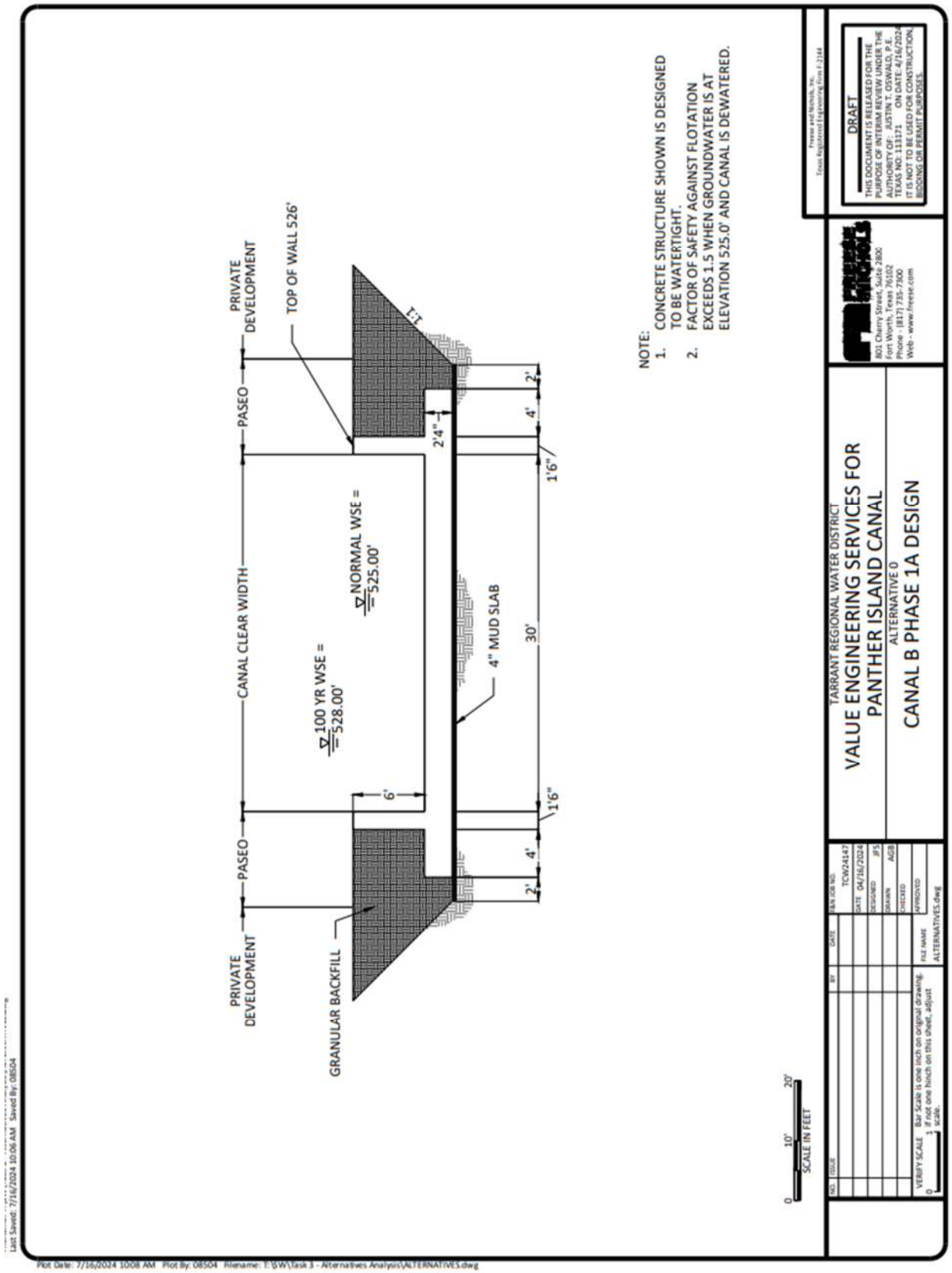


EXHIBIT
C
PANTHER ISLAND
CANAL C ALIGNMENT
Geisler Partners
Consulting Engineers
RLG
Kimley»Horn
trwd
Tarrant Regional Water District
CANAL C
HORIZ.: 1" = 100'
VERT.: 1" = 10'
PVI: 28+00.00
EL: 518.30
PVI: 1+00.00
EL: 521.00
528.0
-0.10%
EX. GROUND @ ℄ OF CANAL C
WHITE SETTLEMENT RD.
JONES ST.
CALHOUN ST.
4TH ST.
N. MAIN ST.
THROCKMORTON ST.
CANAL C
CANAL D
CANAL C
CANAL C


N
0
100
200
7TH ST.
6TH ST.
JONES ST.
CALHOUN ST.
WHITE SETTLEMENT RD.
CANAL D
CANAL C
CANAL D
CANAL D
HORIZ.: 1" = 100'
VERT.: 1" = 10'
PVI: 26+50.73
EL: 516.85
PVI: 1+00.00
EL: 519.40
528.0
-0.10%
EX. GROUND @ ℄ OF CANAL D
EXHIBIT
D
PANTHER ISLAND
CANAL D ALIGNMENT
Geisler Partners
Consulting Engineers
+ RLG
Kimley»Horn
trwd
Tarrant Regional Water District

Appendix B

Canal Details


PRIVATE DEVELOPMENT
TOP OF WALL 526'
PASEO
CANAL CLEAR WIDTH
NORMAL WSE = 525.00'
100 YR WSE = 528.00'
4" MUD SLAB
GRANULAR BACKFILL
1:1
2'4"
2'
4'
1'6"
30'
6'
NOTE:
1. CONCRETE STRUCTURE SHOWN IS DESIGNED TO BE WATERTIGHT.
2. FACTOR OF SAFETY AGAINST FLOTATION EXCEEDS 1.5 WHEN GROUNDWATER IS AT ELEVATION 525.0' AND CANAL IS DEWATERED.
TARRANT REGIONAL WATER DISTRICT
VALUE ENGINEERING SERVICES FOR PANTHER ISLAND CANAL
ALTERNATIVE 0
CANAL B PHASE 1A DESIGN
DRAFT
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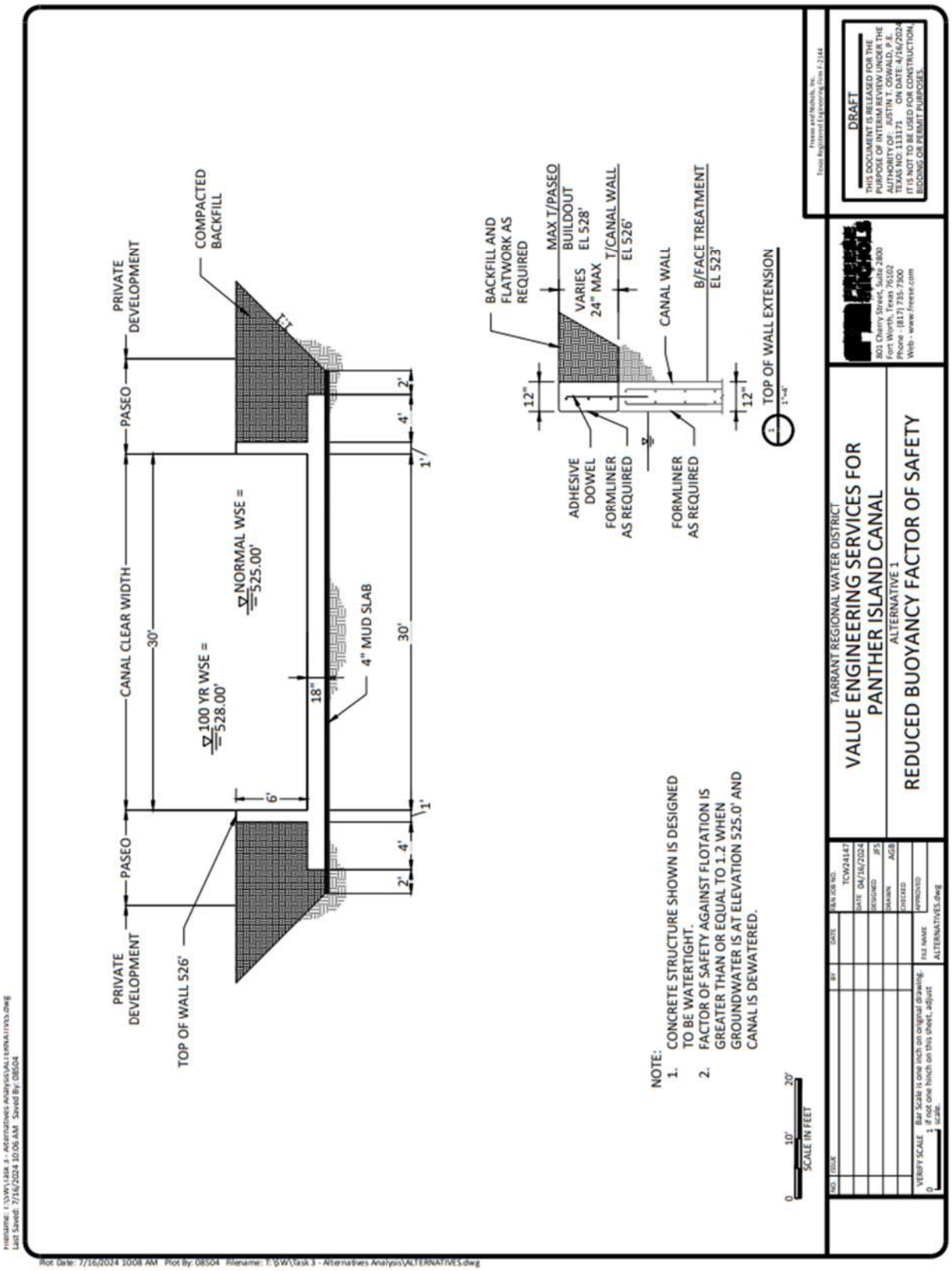
801 Cherry Street, Suite 2800
Fort Worth, Texas 76102
Phone - (817) 735-7300
Web - www.freese.com
SCALE IN FEET
0
10'
20'
VERIFY SCALE Bar Scale is one inch on original drawing. If not one inch on this sheet, adjust scale.
FILE NAME ALTERNATIVES.dwg
TCW24147
04/16/2024
Last Saved: 7/16/2024 10:06 AM Saved By: 08504
Plot Date: 7/16/2024 10:08 AM Plot By: 08504 Filename: T:\SW\Task 3 - Alternatives Analysis\ALTERNATIVES.dwg


PRIVATE DEVELOPMENT
PASEO
COMPACTED BACKFILL
CANAL CLEAR WIDTH
30'
100 YR WSE = 528.00'
NORMAL WSE = 525.00'
6'
18"
4" MUD SLAB
2'
4'
1'
30'
TOP OF WALL 526'
BACKFILL AND FLATWORK AS REQUIRED
MAX T/PASEO BUILDOUT EL 528'
VARIES 24" MAX
T/CANAL WALL EL 526'
CANAL WALL
B/FACE TREATMENT EL 523'
12"
ADHESIVE DOWEL
FORMLINER AS REQUIRED
TOP OF WALL EXTENSION
NOTE:
1. CONCRETE STRUCTURE SHOWN IS DESIGNED TO BE WATERTIGHT.
2. FACTOR OF SAFETY AGAINST FLOTATION IS GREATER THAN OR EQUAL TO 1.2 WHEN GROUNDWATER IS AT ELEVATION 525.0' AND CANAL IS DEWATERED.
SCALE IN FEET
TARRANT REGIONAL WATER DISTRICT
VALUE ENGINEERING SERVICES FOR PANTHER ISLAND CANAL
ALTERNATIVE 1
REDUCED BUOYANCY FACTOR OF SAFETY
Freese and Nichols, Inc.
801 Cherry Street, Suite 2800
Fort Worth, Texas 76102
Phone - (817) 735-7300
Web - www.freese.com
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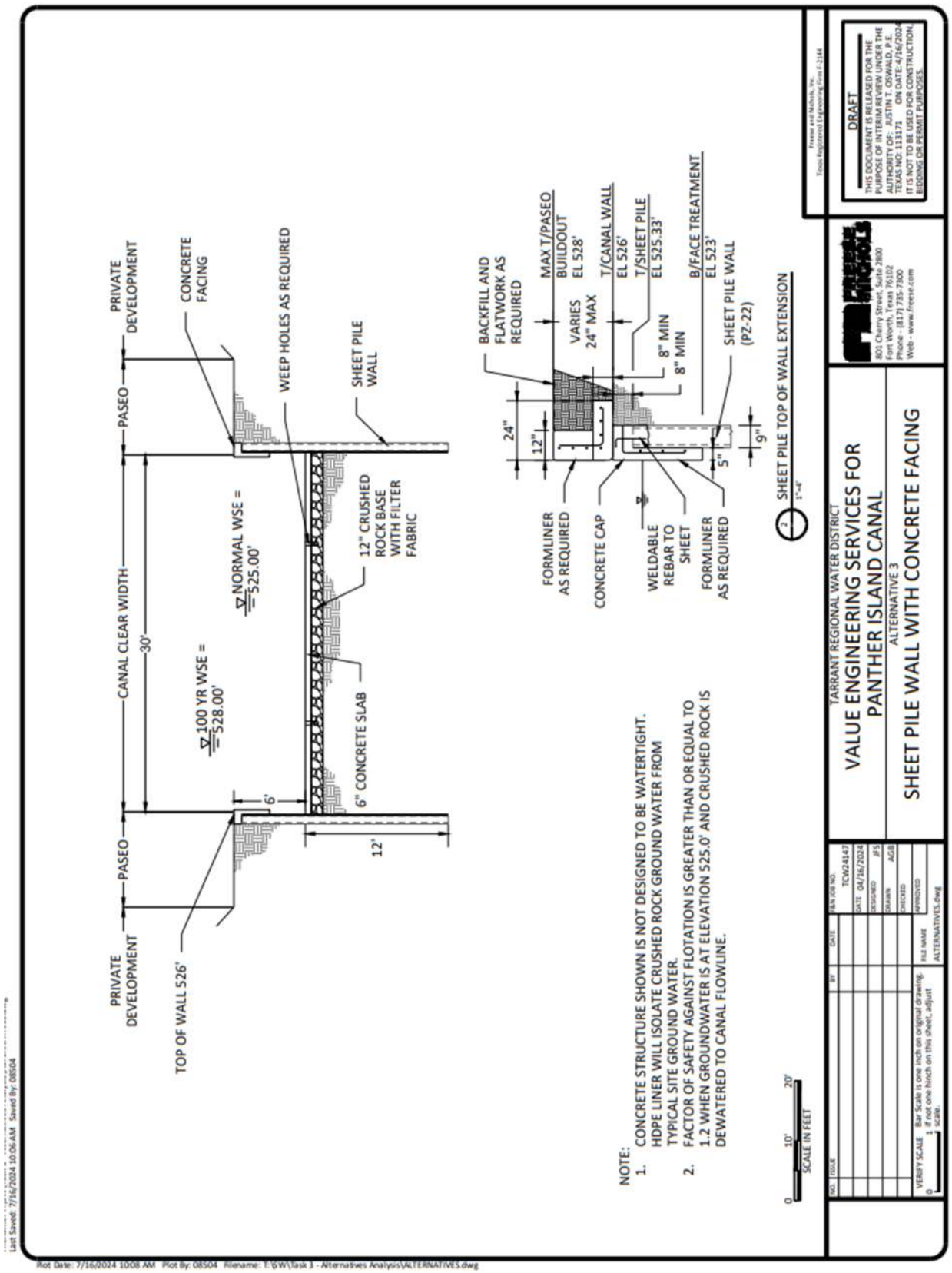
PLAN JOB NO. TCW24147
DATE 04/16/2024
DESIGNED JFS
DRAWN AGB
CHECKED
APPROVED
FILE NAME ALTERNATIVES.dwg


PRIVATE DEVELOPMENT
CONCRETE FACING
WEEP HOLES AS REQUIRED
SHEET PILE WALL
PASEO
CANAL CLEAR WIDTH
30'
NORMAL WSE = 525.00'
100 YR WSE = 528.00'
12" CRUSHED ROCK BASE WITH FILTER FABRIC
6" CONCRETE SLAB
6'
12'
TOP OF WALL 526'
BACKFILL AND FLATWORK AS REQUIRED
MAX T/PASEO BUILDOUT EL 528'
VARIES 24" MAX
T/CANAL WALL EL 526'
T/SHEET PILE EL 525.33'
8" MIN
8" MIN
B/FACE TREATMENT
EL 523'
SHEET PILE WALL (PZ-22)
24"
12"
5"
9"
FORMLINER AS REQUIRED
CONCRETE CAP
WELDABLE REBAR TO SHEET
FORMLINER AS REQUIRED
SHEET PILE TOP OF WALL EXTENSION
1"=4"
NOTE:
1. CONCRETE STRUCTURE SHOWN IS NOT DESIGNED TO BE WATERTIGHT. HDPE LINER WILL ISOLATE CRUSHED ROCK GROUND WATER FROM TYPICAL SITE GROUND WATER.
2. FACTOR OF SAFETY AGAINST FLOTATION IS GREATER THAN OR EQUAL TO 1.2 WHEN GROUNDWATER IS AT ELEVATION 525.0' AND CRUSHED ROCK IS DEWATERED TO CANAL FLOWLINE.
SCALE IN FEET
0
10'
20'
TARRANT REGIONAL WATER DISTRICT
VALUE ENGINEERING SERVICES FOR PANTHER ISLAND CANAL
ALTERNATIVE 3
SHEET PILE WALL WITH CONCRETE FACING
DRAFT
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Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144
801 Cherry Street, Suite 2800
Fort Worth, Texas 76102
Phone: (817) 735-7300
Web: www.freese.com
VERIFY SCALE Bar Scale is one inch on original drawing. If not one inch on this sheet, adjust scale.
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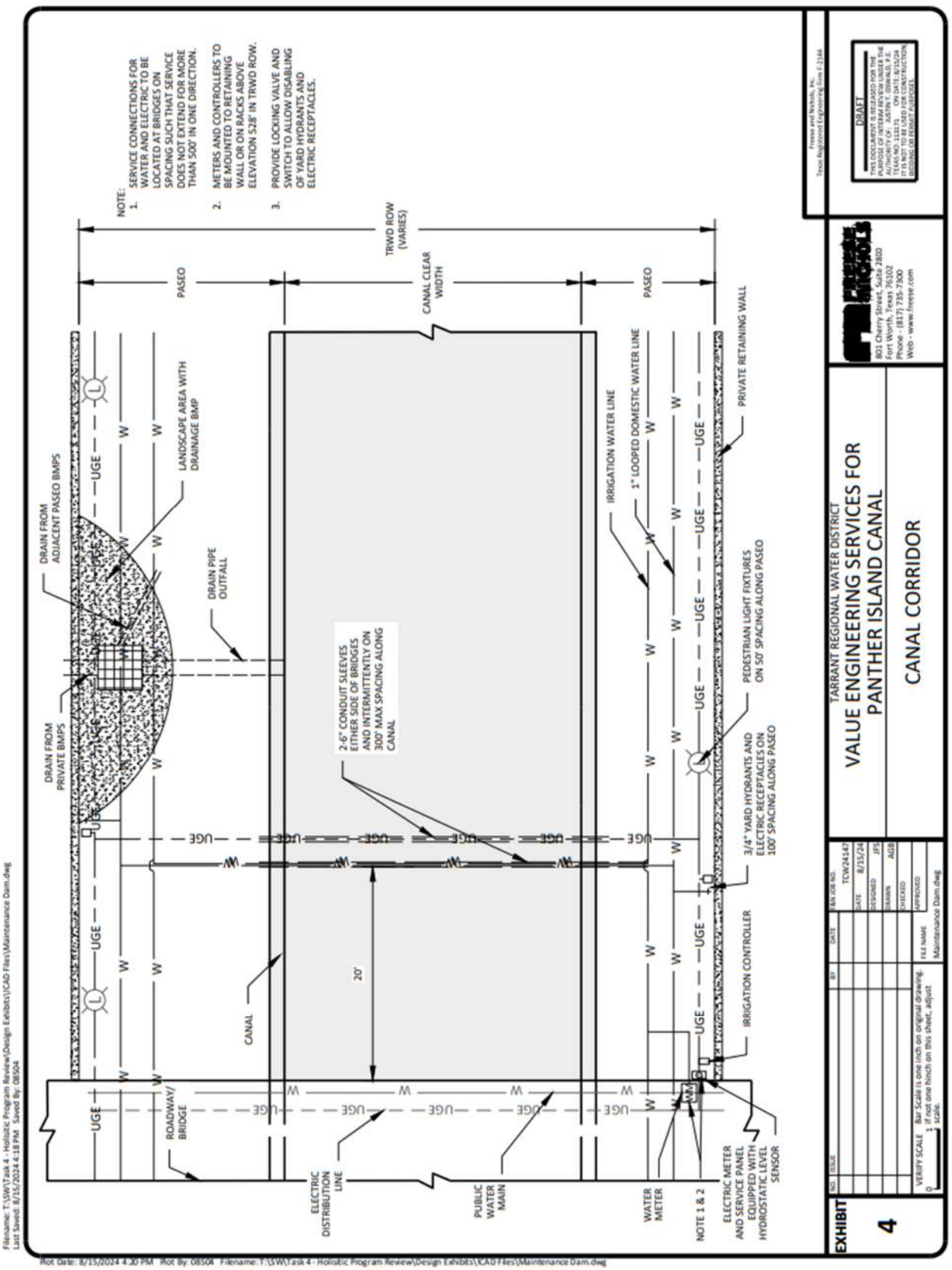
Last Saved: 7/16/2024 10:06 AM Saved By: 08504
Plot Date: 7/16/2024 10:08 AM Plot By: 08504 Filename: T:\SW\Task 3 - Alternatives Analysis\ALTERNATIVES.dwg


NOTE:
1. SERVICE CONNECTIONS FOR WATER AND ELECTRIC TO BE LOCATED AT BRIDGES ON SPACING SUCH THAT SERVICE DOES NOT EXTEND FOR MORE THAN 500' IN ONE DIRECTION.
2. METERS AND CONTROLLERS TO BE MOUNTED TO RETAINING WALL OR ON RACKS ABOVE ELEVATION 528' IN TRWD ROW.
3. PROVIDE LOCKING VALVE AND SWITCH TO ALLOW DISABLING OF YARD HYDRANTS AND ELECTRIC RECEPTACLES.
TRWD ROW (VARIES)
PASEO
CANAL CLEAR WIDTH
PASEO
DRAIN FROM ADJACENT PASEO BMPS
LANDSCAPE AREA WITH DRAINAGE BMP
DRAIN PIPE OUTFALL
DRAIN FROM PRIVATE BMPS
2-6" CONDUIT SLEEVES EITHER SIDE OF BRIDGES AND INTERMITTENTLY ON 300' MAX SPACING ALONG CANAL
IRRIGATION WATER LINE
1" LOOPED DOMESTIC WATER LINE
PRIVATE RETAINING WALL
PEDESTRIAN LIGHT FIXTURES ON 50' SPACING ALONG PASEO
3/4" YARD HYDRANTS AND ELECTRIC RECEPTACLES ON 100' SPACING ALONG PASEO
IRRIGATION CONTROLLER
CANAL
20'
ROADWAY/ BRIDGE
ELECTRIC DISTRIBUTION LINE
PUBLIC WATER MAIN
WATER METER
NOTE 1 & 2
ELECTRIC METER AND SERVICE PANEL EQUIPPED WITH HYDROSTATIC LEVEL SENSOR
UGE
W
L
Freese and Nichols, Inc.
Texas Registered Engineering Firm F-2144
DRAFT
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Fort Worth, Texas 76102
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Web - www.freese.com
TARRANT REGIONAL WATER DISTRICT
VALUE ENGINEERING SERVICES FOR PANTHER ISLAND CANAL
CANAL CORRIDOR
EXHIBIT
4
TCW24147
DESIGNED JPS
DRAWN AGB
CHECKED
APPROVED
VERIFY SCALE Bar Scale is one inch on original drawing. If not one inch on this sheet, adjust scale.
0
1"
File Name: Maintenance Dam.dwg
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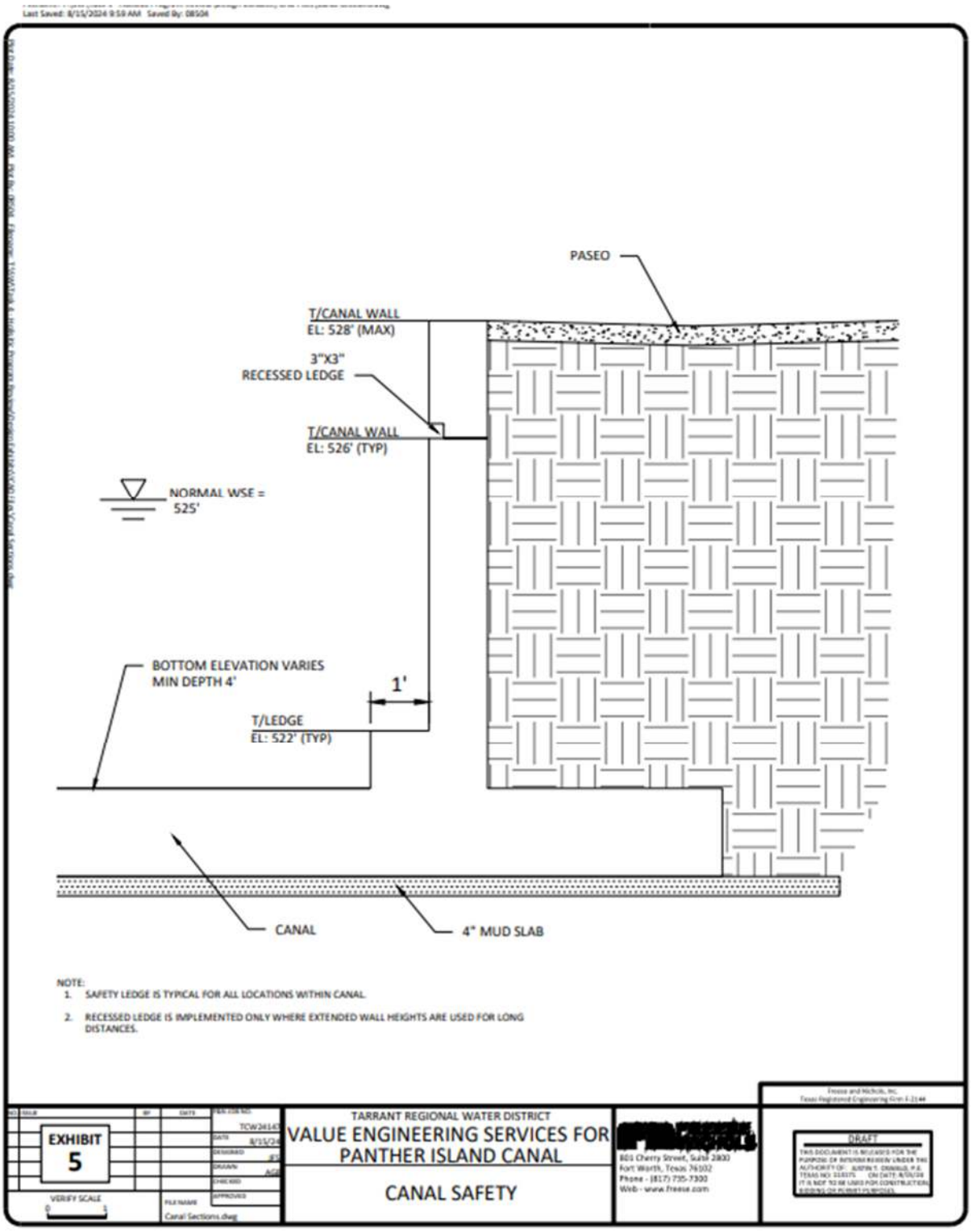
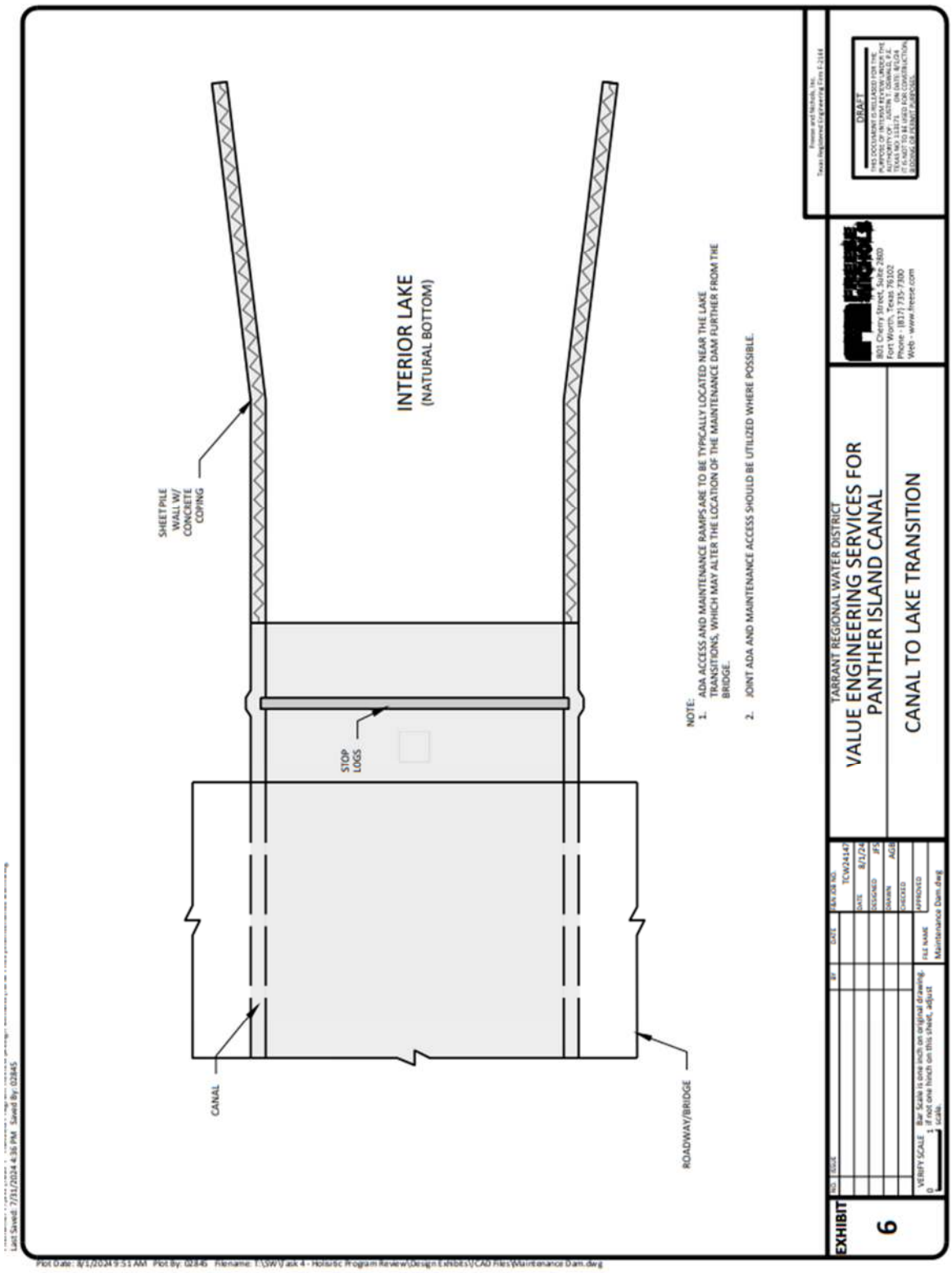

PASEO
T/CANAL WALL
EL: 528' (MAX)
3"X3"
RECESSED LEDGE
T/CANAL WALL
EL: 526' (TYP)
NORMAL WSE =
525'
BOTTOM ELEVATION VARIES
MIN DEPTH 4'
1'
T/LEDGE
EL: 522' (TYP)
CANAL
4" MUD SLAB
NOTE:
1. SAFETY LEDGE IS TYPICAL FOR ALL LOCATIONS WITHIN CANAL.
2. RECESSED LEDGE IS IMPLEMENTED ONLY WHERE EXTENDED WALL HEIGHTS ARE USED FOR LONG DISTANCES.
EXHIBIT
5
TARRANT REGIONAL WATER DISTRICT
VALUE ENGINEERING SERVICES FOR
PANTHER ISLAND CANAL
CANAL SAFETY
DRAFT


INTERIOR LAKE
(NATURAL BOTTOM)
SHEET PILE WALL W/ CONCRETE COPING
STOP LOGS
CANAL
ROADWAY/BRIDGE
NOTE:
1. ADA ACCESS AND MAINTENANCE RAMPS ARE TO BE TYPICALLY LOCATED NEAR THE LAKE TRANSITIONS, WHICH MAY ALTER THE LOCATION OF THE MAINTENANCE DAM FURTHER FROM THE BRIDGE.
2. JOINT ADA AND MAINTENANCE ACCESS SHOULD BE UTILIZED WHERE POSSIBLE.
TARRANT REGIONAL WATER DISTRICT
VALUE ENGINEERING SERVICES FOR PANTHER ISLAND CANAL
CANAL TO LAKE TRANSITION
EXHIBIT
6
DRAFT

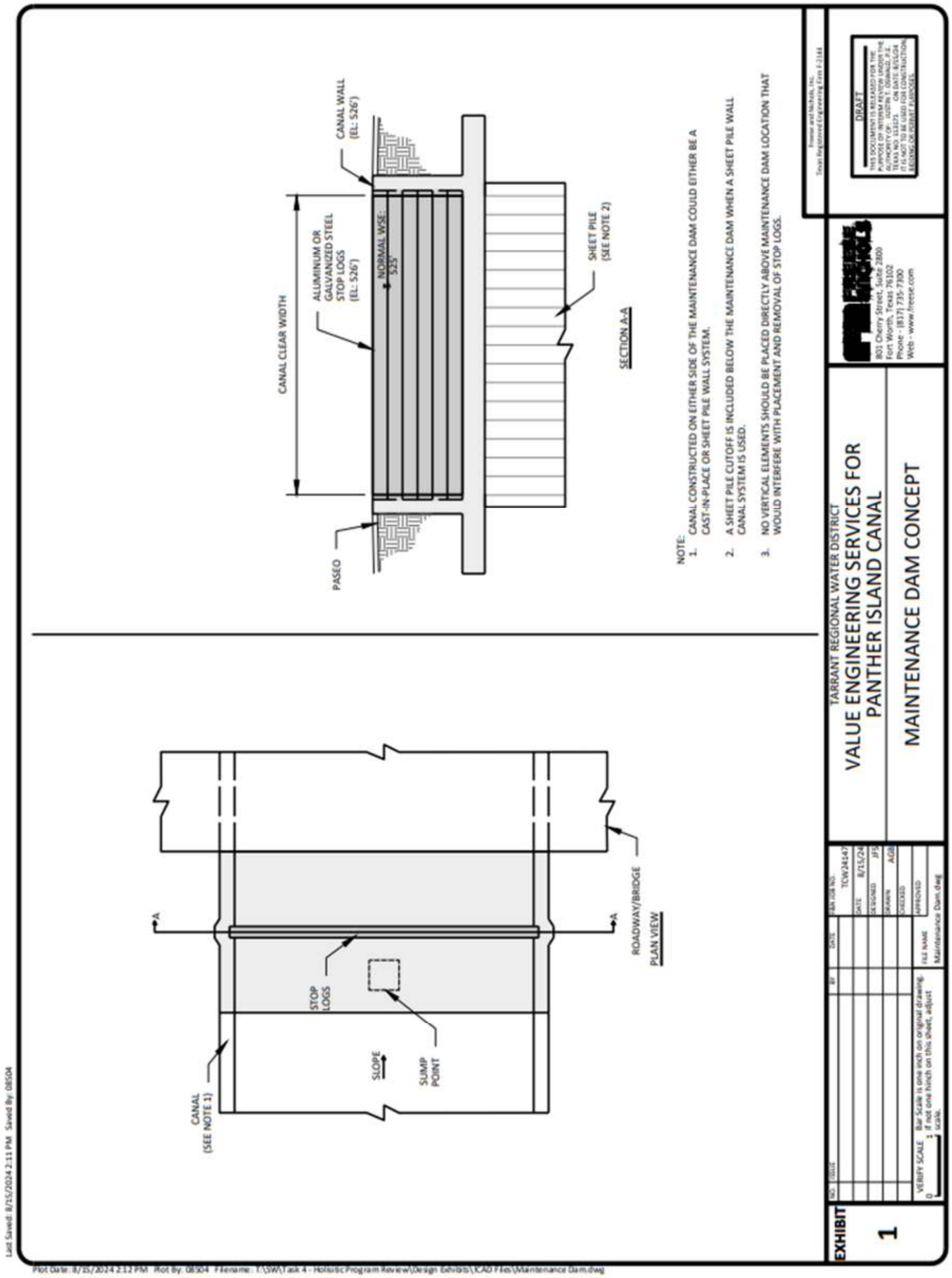

CANAL WALL (EL: 526')
CANAL CLEAR WIDTH
ALUMINUM OR GALVANIZED STEEL STOP LOGS (EL: 526')
NORMAL WSE: 525'
SHEET PILE (SEE NOTE 2)
PASEO
SECTION A-A
NOTE:
1. CANAL CONSTRUCTED ON EITHER SIDE OF THE MAINTENANCE DAM COULD EITHER BE A CAST-IN-PLACE OR SHEET PILE WALL SYSTEM.
2. A SHEET PILE CUTOFF IS INCLUDED BELOW THE MAINTENANCE DAM WHEN A SHEET PILE WALL CANAL SYSTEM IS USED.
3. NO VERTICAL ELEMENTS SHOULD BE PLACED DIRECTLY ABOVE MAINTENANCE DAM LOCATION THAT WOULD INTERFERE WITH PLACEMENT AND REMOVAL OF STOP LOGS.
CANAL (SEE NOTE 1)
STOP LOGS
SLOPE
SUMP POINT
ROADWAY/BRIDGE
PLAN VIEW
TARRANT REGIONAL WATER DISTRICT
VALUE ENGINEERING SERVICES FOR PANTHER ISLAND CANAL
MAINTENANCE DAM CONCEPT
801 Cherry Street, Suite 2800
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EXHIBIT
1
DRAFT

Appendix C

Canal Bridges

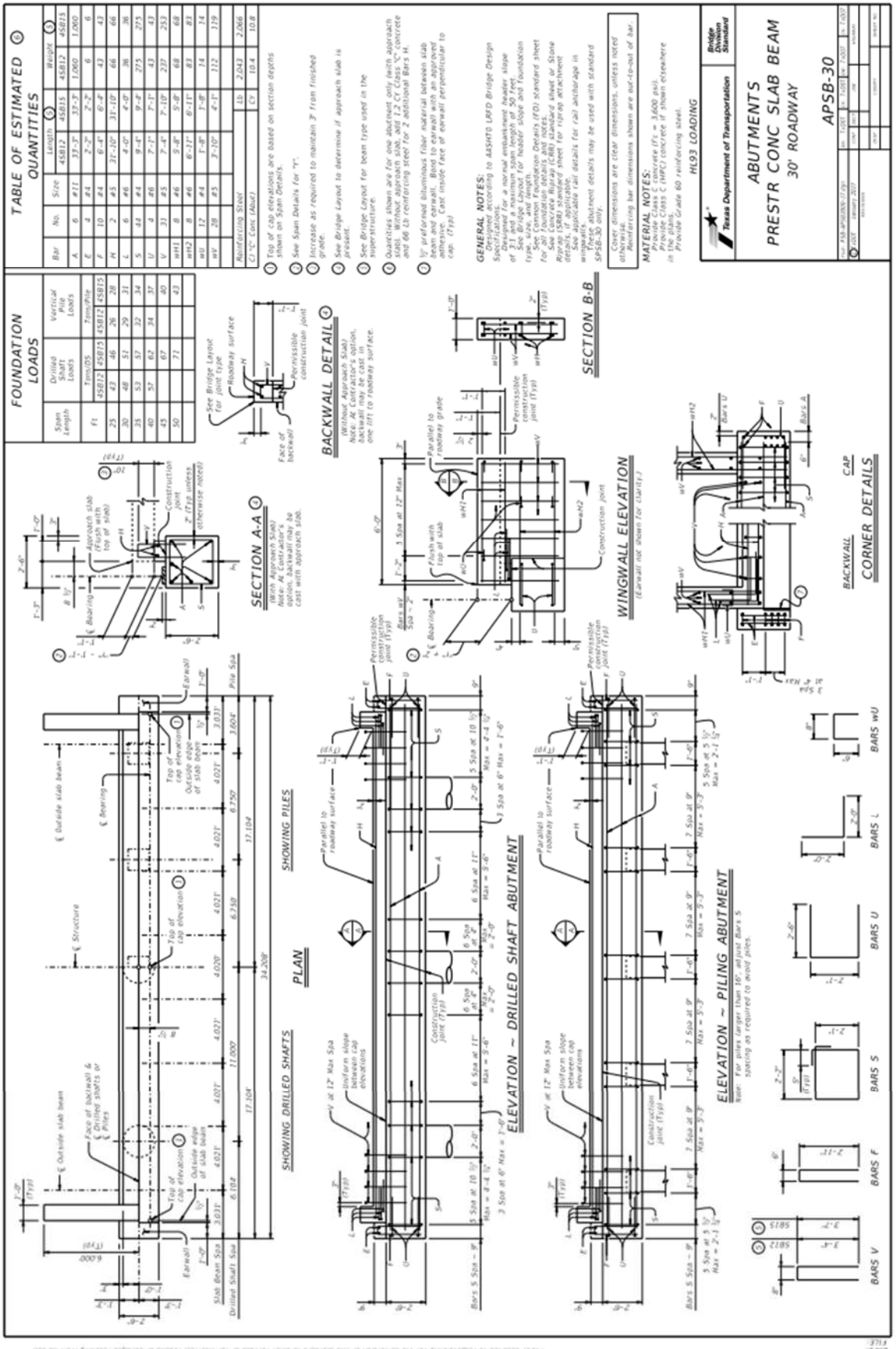


TABLE OF ESTIMATED QUANTITIES
FOUNDATION LOADS
GENERAL NOTES:
MATERIAL NOTES:
HL93 LOADING
Texas Department of Transportation
Bridge Division Standard
ABUTMENTS
PRESTR CONC SLAB BEAM
30' ROADWAY
APSB-30
SECTION A-A
BACKWALL DETAIL
SECTION B-B
WINGWALL ELEVATION
CORNER DETAILS
PLAN
SHOWING DRILLED SHAFTS
SHOWING PILES
ELEVATION ~ DRILLED SHAFT ABUTMENT
ELEVATION ~ PILING ABUTMENT

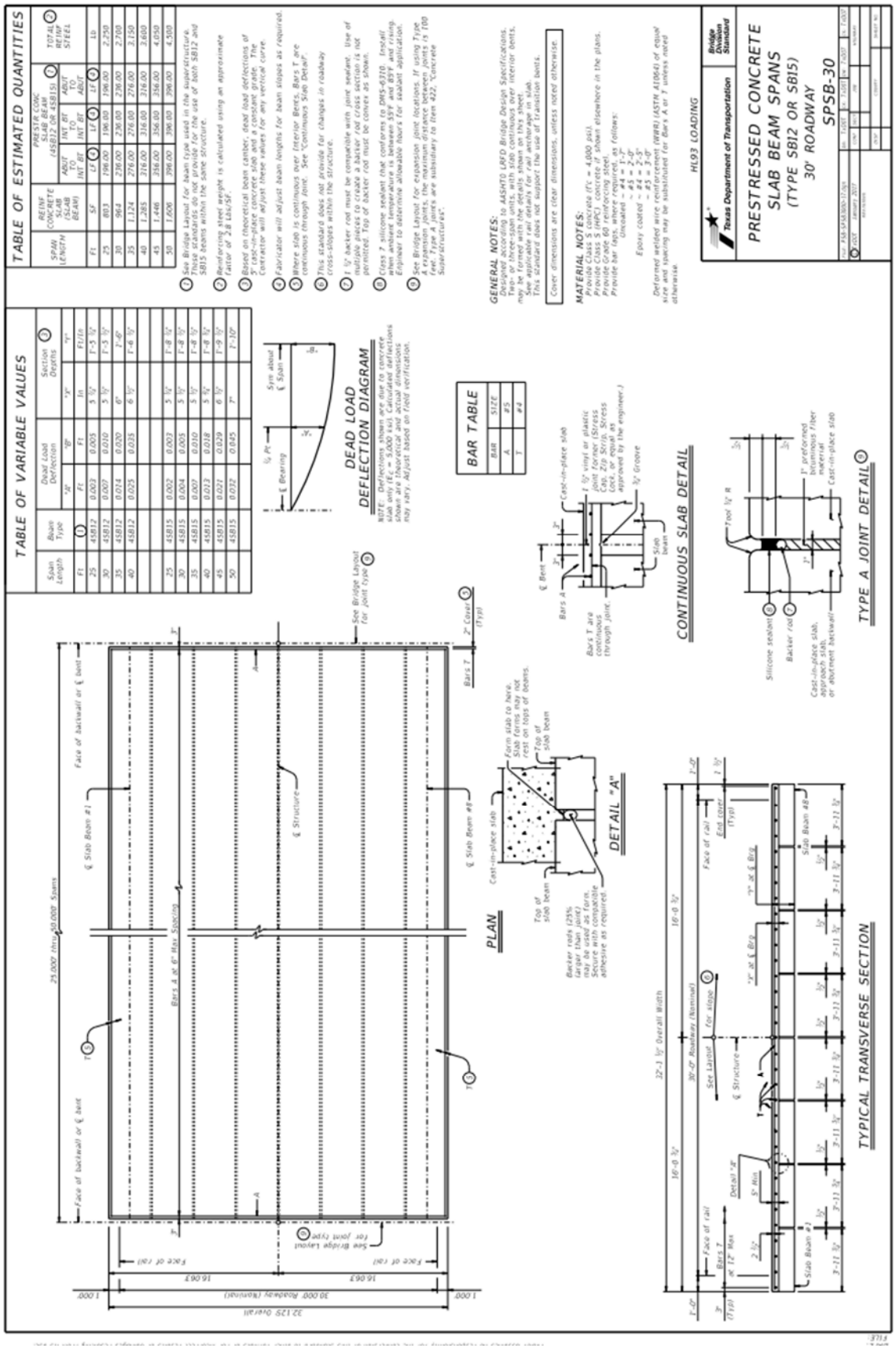
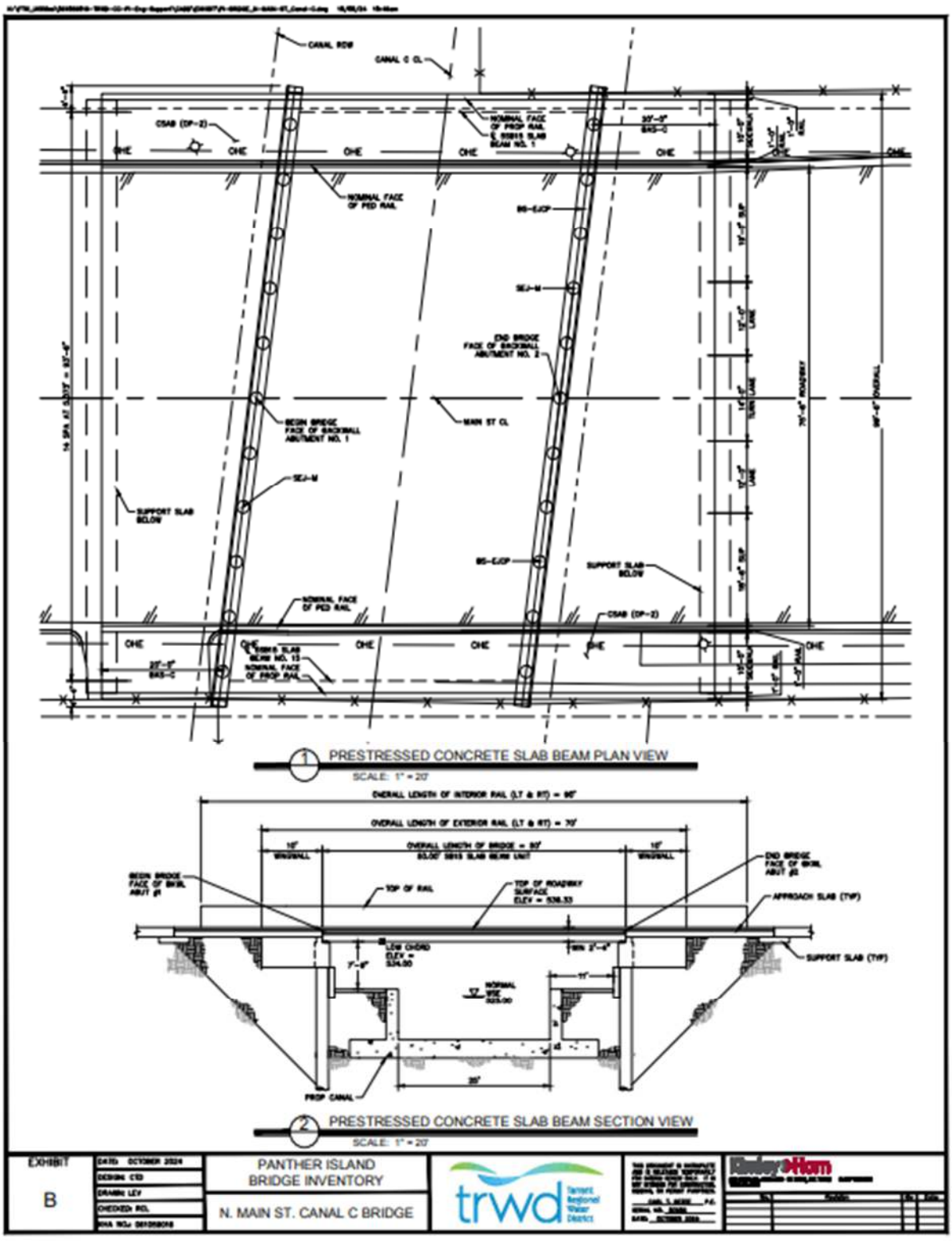
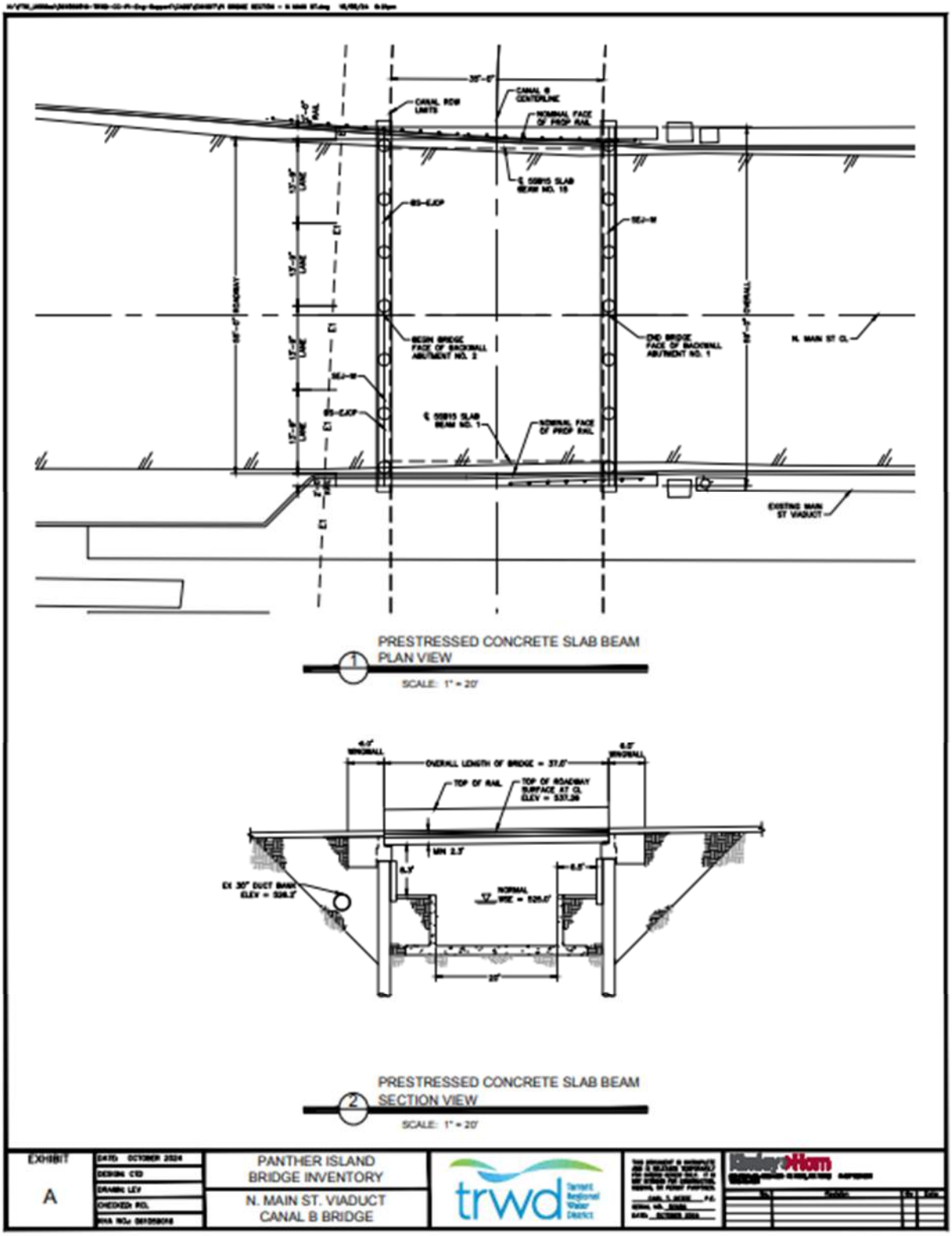


TABLE OF ESTIMATED QUANTITIES
TABLE OF VARIABLE VALUES
PRESTRESSED CONCRETE SLAB BEAM SPANS (TYPE SB12 OR SB15) 30' ROADWAY SPSB-30
Texas Department of Transportation
Bridge Division Standard
HL93 LOADING
GENERAL NOTES:
MATERIAL NOTES:
DEAD LOAD DEFLECTION DIAGRAM
BAR TABLE
PLAN
DETAIL "A"
CONTINUOUS SLAB DETAIL
TYPE A JOINT DETAIL
TYPICAL TRANSVERSE SECTION


PRESTRESSED CONCRETE SLAB BEAM PLAN VIEW
SCALE: 1" = 20'
PRESTRESSED CONCRETE SLAB BEAM SECTION VIEW
SCALE: 1" = 20'
EXHIBIT
B
PANTHER ISLAND
BRIDGE INVENTORY
N. MAIN ST. CANAL C BRIDGE
trwd


CANAL ROW LIMITS
CANAL B CENTERLINE
NOMINAL FACE OF PROP. RAIL
BEGIN BRIDGE FACE OF BACKWALL ABUTMENT NO. 2
END BRIDGE FACE OF BACKWALL ABUTMENT NO. 1
N. MAIN ST CL
EXISTING MAIN ST VIADUCT
PRESTRESSED CONCRETE SLAB BEAM
PLAN VIEW
SCALE: 1" = 20'
OVERALL LENGTH OF BRIDGE = 37.0'
TOP OF RAIL
MIN 2.3'
NORMAL
PRESTRESSED CONCRETE SLAB BEAM
SECTION VIEW
SCALE: 1" = 20'
EXHIBIT
A
PANTHER ISLAND
BRIDGE INVENTORY
N. MAIN ST. VIADUCT
CANAL B BRIDGE
trwd

Appendix D

Design Precedents Examples

Texas Limestone

Historic Red Brick

Tile Inlay Paver Detail

Hot Oil Dipped Iron Paver Inlay

Tile Inlay Detail

Cast Iron French Drain

Tile and Limestone Detailing

Suspended Lights

Mixed Materials and Textures

Appendix E

Paving Examples

Brick – Herringbone

Flagstone Paving Pattern

Brick – Fan Pattern

Mixed Materials

Flagstone Paving Pattern

Sandstone Pavers

Variation in Patterns and Edges Creates Visual Interest

Mixing Finishes can Create a Varied, Eclectic Aesthetic

Appendix F

Seating and Retaining Walls

Concrete Wall with Cap

Precast Concrete Seat Wall

Limestone Block Wall

Mexican Cobblestone – Accent

Limestone Wall

Cobble Stone Wall with Brick Coping

Bright Tile Creates a Colorful Contrast

Wood and Stone bench

Brick Wall with Mexican Tile Accents

Stone with Mortar

Dry Stack Stone

Lueder Limestone Natural Shell Finish

Appendix G

Canal Edge/Coping Elements

Coping along a Canal

Boulder/Natural Edge Treatment

Bioretention Drainage with a Stone Edge

Corten Edging Creates an Interesting material contrast

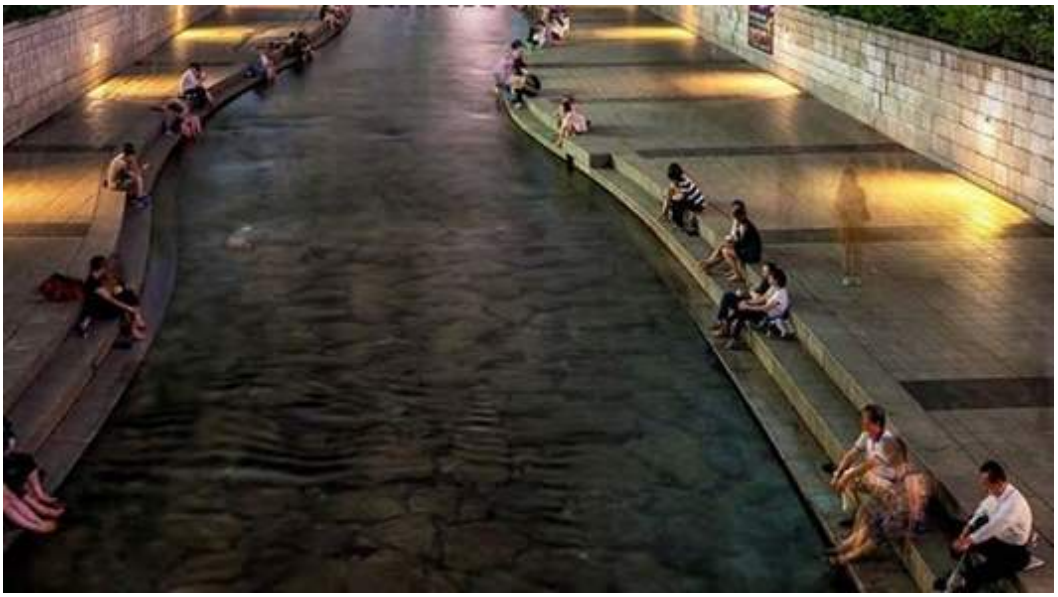
Brightly Colored Tile Contrasts with Rough Stone Steps

Cantilevers Bring Pedestrians Closer to the Water

Rough Stone Block Wall/Coping

Stone Mosaic Creates an Interesting Edge that Contrasts with the Pavement

Step Down Coping Allows Access to Water

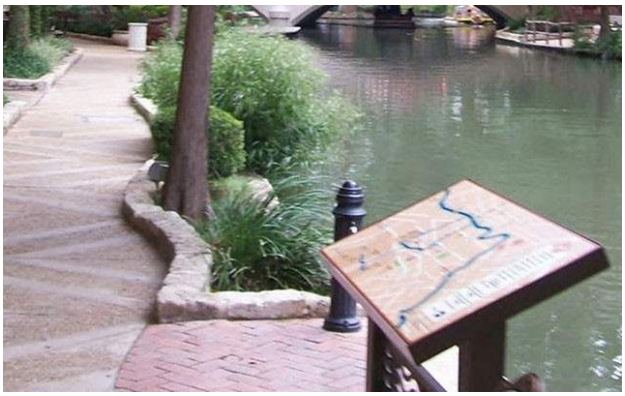


Steps Down to the Water Create Areas to Interact with the Water out of the Way of Other Pedestrians

Rough Flagstone Coping

Raised Limestone Coping

Corten Edging



Areas of Refuge Allow Pedestrians to Look at Maps

trwd Tarrant Regional Water District