DART ORANGE LINE
DFW AIRPORT EXTENSION

RE-EVALUATION OF DART ORANGE LINE DFW AIRPORT EXTENSION IRVING-3 ENVIRONMENTAL ASSESSMENT

FINAL • APRIL 2012

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APPENDICES

APPENDIX A – FTA AND FAA FONSI DOCUMENTATION

Dallas Area Rapid Transit

Orange Line DFW Airport Extension (Irving-3)

Irving and Grapevine, Texas

Finding of No Significant Impact (FONSI)

by the

U.S. Department of Transportation

Federal Transit Administration

The Federal Transit Administration (FTA) has determined, in accordance with 23 C.F.R. Part 771.121, that the proposed Orange Line DFW Airport Extension Light Rail Transit Project will have no significant adverse impacts on the environment.

This Finding of No Significant Impact (FONSI) is based on the Orange Line DFW Airport Extension (Irving-3) Environmental Assessment (EA), issued in September 2011 and incorporated by reference, other documents and attachments as itemized in this FONSI, and the findings herein. The EA and these other documents have been independently evaluated by the FTA and determined to accurately discuss the project purpose, need, environmental issues, impacts of the proposed project, and appropriate mitigation measures. It provides sufficient evidence and analysis for determining that an Environmental Impact Statement is not required.

FEDERAL TRANSIT ADMINISTRATION
REGION 6

Finding of No Significant Impact

Project: **Orange Line DFW Airport Extension (Irving-3)**

Applicant: **Dallas Area Rapid Transit**

Project Location: **Irving and Grapevine, Texas**

Introduction

This document provides the basis for a determination by the Federal Transit Administration (FTA), U.S. Department of Transportation, of a Finding of No Significant Impact (FONSI) for the Orange Line DFW Airport Light Rail Transit Extension project. This determination is made in accordance with the provisions of the National Environmental Policy Act (NEPA), Pub. L. 91-190, as amended; the Council on Environmental Quality's implementing NEPA regulation (4O C.F.R. Part 1500); and the Federal Transit Administration's implementing NEPA regulation (23 C.F.R. Part 771).

The DART Orange Line DFW Airport Extension is a culmination of planning efforts to bring light rail transit (LRT) service to Dallas/Fort Worth International Airport (DFW Airport). This project is consistent with the North Central Texas Council Government's (NCTCOG) *Mobility 2030: The Metropolitan Transportation Plan for the Dallas-Fort Worth Area, 2009 Amendment* and *Mobility 2035: The Metropolitan Transportation Plan for North Central Texas*. The project evaluation and analysis has been compiled into an Environmental Assessment (EA) that has been reviewed by FTA.

The FTA is lead agency for the proposed action – the DART Orange Line DFW Airport Extension Project. The proposed federal action for the FTA would be federal grant assistance for the project from FTA's Urbanized Area Formula Program authorized by 49 U.S.C. §5307. The project is located almost entirely within the boundaries of DFW Airport; therefore, the Federal Aviation Administration (FAA) is participating as a cooperating agency. The proposed federal action for the FAA would be approval of a revision to the DFW Airport Layout Plan (ALP). Pursuant to 49 U.S.C. §47107(a)(16), the FAA Administrator must approve any revision or modification to an ALP that FAA believes may adversely affect the safety, efficiency, or utility of the airport before the revision or modification takes effect; therefore, the FAA is issuing a separate FONSI for the proposed action.

Proposed Project

The proposed action consists of a 5.17-mile LRT, double track alignment that extends northwest from the Belt Line Station (current terminus of the Orange Line) before turning south along International Parkway to end near Terminal A. The alignment is primarily at-grade but also consists of portions of

retained earth and aerial structures. A storage yard, the DFW Airport LRT Station and its pedestrian linkages are included as part of the proposed action.

Alternatives Considered

In an effort to respond to transportation needs expressed by the community and political representation and also to fully consider and provide for regional travel patterns, several alternative concepts were proposed to provide rail service to DFW Airport. Alternatives considered are documented in Chapter 2 of the EA. Each of the proposed concepts was evaluated based on utility, operational scenarios, and associated costs. The evaluation concluded that the proposed action best met the immediate need of direct service into DFW Airport. Other alternatives were not selected as they did not directly serve the central terminal area, were too expensive, or added unnecessary travel time.

In addition to the proposed action, a No-Build Alternative was evaluated in the EA. The No-Build Alternative would not meet the regional connectivity, capacity, and transportation demand needs of the corridor.

Public Involvement

Public participation took place throughout the project and documentation is included in Chapter 6 of the EA. A public scoping meeting was held on October 20, 2009 at the Marriott-DFW North in Irving, Texas. Two additional public meetings were held during the project. The EA was made available to the public through a notice published in the local newspapers of general circulation and on the DART Website. The EA was also distributed to interested groups and organizations that participated in the planning phase of the project. An additional bilingual outreach method was utilized to ensure full and fair access to public involvement. Written comments on the EA were accepted during a 32-day time period from May 16 through June 17, 2011. A public hearing was held on June 2, 2011 at the Marriott-DFW North in Irving, Texas. Substantive comments received during the public comment period have been incorporated into the Final EA.

Agency Coordination

Agency coordination took place throughout the project and documentation is included in Chapter 6 of the EA. Prior to initiation of the EA phase of the project, extensive coordination took place between DART, the Fort Worth Transportation Authority (the T), DFW Airport and the North Central Texas Council of Governments (NCTCOG). This coordination helped define the project and eliminate alternatives that did not meet the goals of the project. Additional early coordination took place between DART, DFW Airport, FTA and FAA to establish roles and responsibilities for the project. An agency scoping meeting was held on October 19, 2009 at DART Headquarters. A total of 15 individuals representing eight agencies attended.

Throughout the planning phase of the project DART has had continual coordination with DFW Airport. These coordination meetings also included representatives of FAA, the T, and the Texas Department of Transportation (TxDOT). Additionally, coordination took place between DART and tribal organizations and various state and federal regulatory agencies.

Comments on the EA

Seven substantive comments were received at the public hearing and during the 32-day comment period by DART and FTA via mail, email, the project website (**www.dart.org/dfwextension)**, and fax. These comments and responses are documented in the EA.

Following the public comment period, minor changes were made to correct minor verbiage and grammatical errors throughout the EA. Additional changes were made to reflect changes in occupancy to an impacted structure and the proposed change to an adjacent land use. The cultural resources section was modified at TxDOT's request to provide fewer specific details on archeological sites.

Environmental Consequences/Findings

The Orange Line DFW Airport Extension EA thoroughly investigated the environmental consequences associated with proposed action. The EA addresses project compliance with all applicable statutory, regulatory, and federal requirements, including Section 106, Section 4(f), Air Quality Conformity and Environmental Justice.

Section 106: In compliance with Section 106 of the National Historic Preservation Act of 1966 and Antiquities Code of Texas, potential impacts to archaeological and historic-age resource within an area of potential effect (APE) for the proposed action were investigated and coordinated with the Texas Historical Commission (THC). These investigations concluded that no archaeological or historic resources would be impacted by the proposed LRT alignment and no further investigations need be required. In letters dated November 17, 2009 and December 21, 2009, the THC concurred with this assessment.

Section 4(f): Section 4(f) of the Department of Transportation Act of 1966, codified at 49 U.S.C. 303, declares a national policy that a special effort should be made to preserve the natural beauty of public parks, recreational areas, wildlife and waterfowl refuges, and historic sites. The Secretary of Transportation may not approve transportation projects that adversely affect such resources unless a determination is made that there is no feasible and prudent alternative, and that all possible planning has been done to minimize harm (23 C.F.R. Part 774). No direct or constructive use of Section 4(f) resources are associated with the proposed action; therefore, the requirements of Section 4(f) do not apply.

Air Quality Conformity: Under the 1990 federal Clean Air Act Amendments (CAAA), no federal agency or department may support, license, permit, or approve any activity that does not conform to the state implementation plan (42 U.S.C. §7506(c)). The proposed action is an extension of the larger Northwest Corridor LRT Line to Irving and DFW Airport that has been included in the previous 2006-2008 Transportation Improvement Plan (TIP) and the current TIP conformity analysis. The project is consistent with the policies and purpose of the conforming transportation plan and would not interfere with other projects in the transportation plan. The 2008–2011 TIP and the 2030 Metropolitan Transportation Plan for the DFW Area were found to conform by the NCTCOG on April 2009 and by the U.S. Department of Transportation in July 2009.

Environmental Justice: *Environmental Justice*: Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, calls for federal agencies to identify and address, as appropriate, disproportionately high and adverse human health and environmental effects of federal programs on minority and low-income populations. As detailed in the

EA, this atypical transit corridor is located almost entirely on DFW Airport property and there are no populations within proximity to the proposed project. Therefore, there are no environmental justice populations.

The resource categories discussed below were investigated and determined to be potentially affected through implementation of the proposed action. The project will result in only limited impacts to these environmental issue areas, all of which will be mitigated as outlined in the following paragraphs.

***Industrial/Commercial Activity*:** Implementation of the proposed action would require the full or partial displacement of a logistics facility and a partial displacement of a Federal Express tractor trailer and employee parking facility. Additionally, the proposed project would penetrate the line-of-site path of a Chesapeake communications tower. **Mitigation**: Appraisals would be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act. Relocation benefits would be available to eligible parties. The Federal Express trailer storage area would be reconfigured and employee parking would be relocated to a newly constructed lot south of North Airfield Drive. The communication tower impact would be mitigated by increasing the antenna tower height to an aeronautically approved height above the planned DART Rail Infrastructure.

***Visual Aesthetic Resources*:** Potential visual impacts due to aerial structures, Traction Power Substations, and rail storage yard. **Mitigation**: DART would maintain or replace existing vegetative screening and install chain link fencing with PVC slats to soften views of TPSS #9 through #11. The use of screening should be considered for the storage yard during final design. DART would comply with DFW Airport Design Criteria.

LRT Noise and Vibration: Intersection safety signaling for passing trains and proximity to tracks would create moderate noise impacts to two adjacent hotel properties. **Mitigation:** No mitigation required.

***Traffic Flow*:** LRT operations would impose some restrictions to traffic flow on the North Service Road and Crossunder #2. **Mitigation:** To address safety concerns, DART proposes that signaling be implemented to stop all traffic on the North Service Road for both lanes upstream of Crossunder #2 during LRT crossing events.

***Parking*:** ROW needs would create a direct impact to 30 parking stalls and 50 tractor trailer stalls at Federal Express facility. **Mitigation:** Reconfiguration of remaining parking area for trailer storage and relocation of employee parking to a newly constructed lot south of North Airfield Drive.

Vegetation/Wildlife: Due to the footprint of the rail bed and construction efforts, the project would result in some loss of vegetation. **Mitigation:** Disturbed vegetated areas would be replanted with replacement vegetation that would utilize native species, yet not create an unacceptable wildlife attractant for aeronautical operations. DART will coordinate with DFW Airport to identify appropriate plant species.

Water Resources: Due to the footprint of bridge support columns, an impact to 0.06 acres of area considered waters of the U.S. would occur. **Mitigation:** DART and its contractors would follow the guidelines of the United States Army Corp of Engineers (USACE) Nationwide Permit 14.

***Hazardous Materials*:** As a result of past materials handling practices, moderate to high concerns for the potential to disturb past hazardous materials within Central Terminal Area (CTA) Agreed Order area exist, as well as Moderate concerns within the Northeast (NE) Cargo Voluntary Cleanup Program (VCP) area. Adjacent natural gas drill and production sites also create high concerns for current and future hazardous materials exposures and disturbances. **Mitigation:** In order to limit liability and exposure for DART, DFW Airport would be responsible for earthwork within CTA. Prior to construction in other areas, appropriate Phase I/II Environmental Site Assessments would be conducted, as needed, to assess the environmental condition of all properties contemplated for use as right-of-way. These assessments would also identify and quantify existing hazardous materials contamination in order to create appropriate cleanup and mitigation plans, as needed. DFW Airport would continue to monitor the NE Cargo VCP and soil disturbing activities in the area would conform to a DFW Airport approved soil management plan. Coordination with DFW Airport staff, including review and approval of construction plans and procedures by the DFW Airport Environmental Affairs Department, and coordination with Chesapeake Energy regarding gas well drilling/operation activities would occur throughout the final design and construction phases of the project.

Construction Impacts: Temporary and limited duration impacts due to construction would occur. **Mitigation:** DART would comply with all codes and standards as set forth in the reference documents listed in Appendix A of the *DART Design Standards Volume 1* and institute best management practices provided by the most current Construction Storm water regulations (NPDES or TPDES), Chapter 8 of the *Texas Nonpoint Source Management Program*, *National Menu of Stormwater Best Management Practices* developed by the U.S. Environmental Protection Agency, and the *Integrated Storm Water Management Design Manual for Construction* developed by the NCTCOG.

The following resource categories were thoroughly investigated and were determined <u>not</u> to be substantially affected through implementation of the proposed action: zoning and land use, residential and community resources, demographic characteristics, political jurisdictions, pedestrian movements, public services, safety and security, electromagnetic fields, parklands, air quality, geology and soils, cultural resources, environmental justice, utility disruption, and cumulative impacts. Additional information for all resource categories may be found in Chapters 4 and 5 of the EA.

<u>Airport Factors/Findings</u>

As a cooperating agency, the FAA assumes responsibility to independently review the environmental documents prepared for the proposed project to assess whether the documentation meets the standards of adequacy under NEPA. FAA focuses its efforts on those issues and subject areas in the EA pertaining to and related to airport planning and potential effects on the airport.

As part of the planning process for the proposed project, an aeronautical assessment for implementing LRT on DFW Airport property was conducted. The proposed project was assessed and analyzed for various aeronautical aspects to understand potential affects, the resulting impacts, and potential mitigation strategies. The analysis addressed the following subject areas: Airport Design Standards, Objects Affecting Navigable Airspace, Terminal Instrument Procedures, Area Navigation, Significant Airport Features, Human Factors, and Safety Risk Management. The aeronautical assessment has been incorporated into Appendix L of the EA. The analysis made several recommendations that would allow construction and operation of the proposed project to avoid adversely affecting airport or aircraft operations.

Aeronautical Analysis Impacts: Displacement and relocation of a high-mast tower hosting the Low Level Windshear Alert System #4 and Airport Surface Detection Equipment Remote Unit #2 is necessary because it currently lies within the footprint of the proposed LRT alignment. Presence of the LRT vehicles and infrastructure may negatively impact pilot discrimination and the visual scene. **Mitigation**: Maintain continuous operation of FAA equipment through relocation using a "hot cut-over" procedure to re-establish operations. Relocated high-mast tower is being evaluated as a connected action. The termination of an existing lease of the property currently housing the high-mast tower may require FAA to complete an Environmental Due Diligence Audit if a waiver is not deemed appropriate. Place red obstruction lights at the tops of catenary poles and establish a visual screening: fence with PVC slats in selected areas.

Aeronautical Analysis Construction Impacts: The construction process will require equipment (cranes, drilling rigs, etc.) that may affect FAA Aeronautical clearance surfaces and associated instrument procedures for the airport. Prior to the start of construction, FAA Construction Airspace Studies would be submitted for FAA review, conditional requirements, and approval.

The EA has been prepared in accordance with FTA guidance but includes all elements required for compliance with FAA guidance on federal actions as it relates to evaluating environmental impacts. This guidance can be found in *FAA Order 1050.1E, Environmental Impacts: Policy and Procedures and FAA Order 5050.4B, the National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*.

FAA environmental impact assessment guidance recommends consideration of impact to the following resource categories in determining the significance of airport-related impacts: Air Quality, Coastal Barriers, Coastal Zones, Compatible Land Use, Construction Impacts, Section 4(f), Farmlands, Fish, Wildlife, and Plants, Floodplains, Hazardous Materials, Historical, Architectural, Archaeological, Cultural, Light Emissions and Visual Effects, Natural Resources and Energy Supply, Noise, Secondary (Induced) Impacts, Socioeconomic, Environmental Justice, Children's Health and Safety Risks, Water Quality, Wetlands, and Wild and Scenic Rivers. Impacts to most resources in these categories do not meet the significance threshold established by F*AA Order 5050.4B*. All environmental impacts not meeting FAA threshold have been previously identified under FTA guidance and will be mitigated as detail under the Environmental Consequences/Findings section.

Information regarding airport factors including the aeronautical analysis and the FAA environmental impact assessment may be found in Chapter 3 of the EA. As a cooperating agency, FAA will independently issue a separate finding for the proposed action.

<u>Environmental Permits, Commitments, and Mitigation Measures</u>

The Orange Line DFW Airport Light Rail Transit Extension Project will be built in a manner consistent with the EA, this FONSI, and a FONSI to be issued by FAA. DART will implement the mitigation measures described in the EA, this FONSI, and a FONSI to be issued by FAA. The EA is incorporated by reference into this FONSI, and detailed mitigation measures are attached as the Mitigation Monitoring Program for Orange Line DFW Airport Light Rail Transit Extension Project. This Attachment describes the Environmental permits, commitments, and mitigation measures that are required of DART as conditions of this FONSI. These commitments are based on the potential mitigation identified in the EA. The FTA finds that with the implementation of these measures all parties have taken all reasonable, prudent, and feasible means to avoid or minimize impacts from the proposed action.

FTA NEPA Finding

Based on the environmental assessment and its associated supporting documents, the Federal Transit Administration finds pursuant to 23 C.F.R. Part 771.121 that there are no significant impacts on the environment associated with the construction and operation of the proposed Orange Line DFW Airport Extension (Irving-3) Project.

DATE 10/11/11

Robert Patrick
Regional Administrator

U.S. Department of Transportation
Federal Aviation Administration
Southwest Region

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

DART Orange Line
DFW Airport Extension IRVING-3

September 2011

I. INTRODUCTION

The Federal Transit Administration (FTA) and Dallas Area Rapid transit (DART) propose to extend the Orange Line Light Rail Transit line on Dallas/Fort Worth International Airport (DFW Airport). The proposed extension will connect the Belt Line Station, located in the southeast corner of the airport to the airport terminal area. Potential environmental impacts associated with the proposed action were evaluated in the DART Orange Line DFW Airport Extension Irving-3 Environmental Assessment in accordance with the requirements of the National Environmental Policy Act (NEPA).

The Federal Aviation Administration (FAA) is a cooperating agency with FTA in the preparation of the DART Orange Line DFW Airport Extension Irving-3 Environmental Assessment under the National Environmental Policy Act (NEPA) because of its statutory responsibility for promoting safe flight of civil aircraft in air commerce. The proposed federal action for the FTA would be federal grant assistance for the project from FTA's Urbanized Area Formula Program authorized by 49 USC §5307. The purpose of FAA action in connection with the proposed construction of the DART Orange Line Light Rail transit line project is to ensure that the proposed alterations to the airport do not adversely affect the safety, utility, or efficiency of the airport. FAA action is necessary in connection with proposed use of airport residual property because, pursuant to 49 USC §47107(a) (16), the FAA Administrator (under authority delegated from the Secretary of Transportation) must approve any revision or modification to an Airport Layout Plan (ALP) before the revision or modification take effect. The Administrator's approval includes a determination that the proposed alterations to the airport, reflected in the ALP revision or modification, do not affect adversely the safety, utility, or efficiency of the airport. Another proposed federal action for the FAA would be in connection with the relocation of a high-mast pole hosting one Low Level Windshear Alert System (LLWAS NE # 4) and one Airport Surface Detection Equipment (ASDE-X) Remote Unit (RU) #2 in order to accommodate the proposed LRT alignment. The relocation of the LLWAS and ASDE-X RU #2 will also require changes to the Terminal Doppler Weather Radar System (TDWR), the Integrated Weather Information System (ITWS). The DART contractor would establish the new high-mast pole infrastructure and have the FAA install and integrate the associated electronic equipment.

Because the sensor relocation is a direct result of the DART proposed action, all of the costs incurred as a result of the relocation, including costs associated with mitigating impacts to other airport facilities, systems, equipment and/or their infrastructures will be paid by DART as part of their mitigation commitments under this EA.

The FAA federal action requires an environmental determination that meets the requirements of FAA Order 5050.4B: National Environmental Policy Act (NEPA) Implementing Instructions for Airport Projects and FAA Order 1050.1E: Policies and Procedures for Considering Environmental Impacts. Appendix A of the FAA Order 1050.1E requires the evaluation of specific resource categories as part of an EA. Each of these impact categories has been evaluated against FAA's thresholds of significance as indicated in the order.

The draft DART Orange Line DFW Airport Extension IRVING-3 EA was issued on March 26, 2011, a public hearing was held on June 2, 2011 and the final EA was accepted by FAA on August 23, 2011.

II. PURPOSE AND NEED

DART is proposing to implement the final line section of the Northwest Corridor LRT Line to Irving/DFW (referred to by DART as the DFW Airport Extension) from Belt Line Station, the current terminus of LRT service on the DART Orange Line, to the DFW Airport Terminal A-B area. The purpose of Phase I of the DFW Airport Extension and the FTA/DART action is to increase regional connectivity and offer an alternative to single-occupancy vehicle travel, provide a seamless interface to DFW Airport Central Terminal Area (CTA), and to improve mobility in the northwest region of the DART Service Area. The purpose of Phase II of the DFW Airport Extension is to provide direct opportunities for regional connectivity serving both the western and eastern portions of the Dallas/Fort Worth (DFW) Metroplex. Both phases are intended to increase the people carrying capacity in the transportation corridor and support increased economic development opportunities through improved accessibility and regional connectivity, as well as linking major activity centers.

The needs fulfilled by the proposed action include needs related to regional connectivity, capacity, economic development, and transportation demand.

> *Regional Connectivity* - The proposed action would provide a direct link between the airport and the DART Service Area by extending the Orange Line (currently under construction). This link would also enhance regional connectivity. Currently, DART and the Fort Worth Transportation Authority (The T) connect via the Trinity Railway Express (TRE). The Denton County Transportation Authority (DCTA) is constructing a commuter rail line that would interface with DART at the Downtown Carrollton Station.
>
> *Capacity* - The proposed action would increase transit capacity to DFW Airport. Currently, DART bus routes provide service to the periphery of

DFW Airport with Terminal Link, and an on airport shuttle bus, providing internal circulation between the terminals and ancillary airport facilities.

Economic Development - The proposed project would increase access for residents and visitors to employment, education, and entertainment centers throughout the region. This increased accessibility would strengthen economic conditions at existing activity centers and provide an opportunity for further economic development in the project area.

Transportation Demand - DFW Airport is a destination for a varied group of travelers, including airport and airline employees, business and vacation travelers, and contractors working on airport property. The proposed action provides an alternative to using a single occupancy vehicle to a broad range of people from every social and economic class. By connecting to regional transit services, that choice is also provided to commuters traveling from one side of the DFW Metroplex to the other. Preliminary analysis using the North Central Texas Council of Governments (NCTCOG) new regional transportation model estimates that by the year 2030, 14,600 rail passengers a day would pass through the DFW Airport LRT Station. Approximately 3,680 passengers would transfer between LRT at Terminal A and The T's Rail line at Terminal B.

The purpose of FAA action in connection with the proposed construction of the DART Orange Line Light Rail transit line project is to ensure that the proposed alterations to the airport do not adversely affect the safety, utility, or efficiency of the airport. FAA action is necessary in connection with proposed use of airport residual property because, pursuant to 49 USC §47107(a) (16), the FAA Administrator (under authority delegated from the Secretary of Transportation) must approve any revision or modification to an Airport Layout Plan (ALP) before the revision or modification take effect.

In order to accommodate the proposed LRT alignment, it is necessary to relocate a high-mast pole hosting one Low Level Windshear Alert System (LLWAS NE # 4) and one Airport Surface Detection Equipment (ASDE-X) Remote Unit (RU) #2. The proposed project would require the establishment of a new high-mast pole with associated electronic equipment, tested and operationally integrated into the existing networks, prior to the removal of the existing high-mast pole. The relocation of the LLWAS and ASDE-X RU #2 will also require changes to the Terminal Doppler Weather Radar System (TDWR), the Integrated Weather Information System (ITWS). The proposed relocation site would be co-located at an existing FAA communications facility, the Remote Transmit Receiver (RTR) 1E, as shown in figure 1-3. The DART contractor would establish the new high-mast pole infrastructure and have the FAA install and integrate the associated electronic equipment. Because the sensor relocation is a direct result of the DART proposed action, all of the costs incurred as a result of the relocation, including costs associated with mitigating impacts to other airport facilities, systems, equipment and/or their infrastructures will be paid by DART as part of their mitigation commitments under this EA.

III. PROPOSED ACTION AND FEDERAL ACTION

As stated, under the proposed action, the Federal Transit Administration (FTA) and Dallas Area Rapid transit (DART) propose to extend the Orange Line Light Rail Transit line on Dallas/Fort Worth International Airport (DFW Airport). The proposed extension will connect the Belt Line Station, located in the southeast corner of the airport to the airport terminal area. The proposed federal action for the FTA would be federal grant assistance for the project from FTA's Urbanized Area Formula Program authorized by 49 USC §5307.

The proposed federal action for the Federal Aviation Administration (FAA) would be approval of a revision to the DFW Airport Layout Plan (ALP) to reflect the extension of the light rail line to the terminal and necessary relocation of NAVAIDs as discussed as discussed in Chapter 3 of the EA. Pursuant to 49 USC §47107(a)(16), the FAA Administrator (under authority delegated from the Secretary of Transportation) must approve any revision or modification to an ALP that FAA believes may adversely affect the safety, efficiency, or utility of the airport before the revision or modification takes effect. Any FAA determination to approve revision of the ALP to accommodate the proposed alterations to the airport for the LRT project would have to take into consideration the effect such changes would have on the safety, utility, or efficiency of the airport. As a result, FAA has been invited to participate as a cooperating agency.

A second proposed federal action is the relocation of a high-mast pole hosting one Low Level Windshear Alert System (LLWAS NE # 4) and one Airport Surface Detection Equipment (ASDE-X) Remote Unit (RU) #2 in order to accommodate the proposed LRT alignment. As a result of the relocation, the DART contractor would establish the new high-mast pole infrastructure and FAA would install and integrate the associated electronic equipment. The establishment of a new high-mast pole with associated electronic equipment tested and operationally integrated into the existing networks, prior to the removal of the existing high-mast pole.

The relocation of the LLWAS and ASDE-X RU #2 will also require changes to the Terminal Doppler Weather Radar System (TDWR), the Integrated Weather Information System (ITWS). Adequate time must be planned to allow for the development of the Software Adaptation, testing and integration for the LLWAS, TDWR, ITWS and ASDE-X system. The high-mast pole would be relocated approximately 2,000 feet east southeast of the existing location on North Airfield Drive. The proposed relocation site would be co-located at an existing FAA communications facility, the Remote Transmit Receiver (RTR) 1E, as shown in figure 1-3. The proposed location for the high-mast pole would meet FAA's requirements for wind coverage and detection of wind shears. The existing and proposed sites are along the northeastern boundary of the airport with access from North Airfield Drive.

Because the sensor relocation is a direct result of the DART proposed action, all of the costs incurred as a result of the relocation, including costs associated with mitigating impacts to other airport facilities, systems, equipment and/or their infrastructures will be paid by DART as part of their mitigation commitments under this EA.

IV. ALTERNATIVES

Development and Evaluation of Alternatives

As discussed in Chapter 2 of the EA, the DFW Airport Extension is a culmination of planning efforts to bring LRT service to DFW Airport that began in the spring of 1998. The first step was the Northwest Corridor MIS completed in October 2000. The Northwest Corridor LRT Line to Irving/DFW Airport Final Environmental Impact Statement (EIS) was completed in July 2008. This volume documented LRT planning and preliminary engineering for the DART Orange Line from where it diverges from the DART Green Line to an interim terminus at Belt Line Station.

The Fort Worth Transportation Authority (the T) is also planning a passenger rail service on the DART-owned Cotton Belt rail corridor in Tarrant County, the TEX Rail formerly the Southwest to Northeast (SW2NE) Southwest-to-Northeast Rail Corridor (SW2NE Rail). When completed, the two rail projects will be incorporated into the overall public transportation program at DFW Airport and would provide service to employees, air passengers, and other commuters in the North Central Texas region.

Coordinating these two capital investments in transportation infrastructure became a topic of regional focus during the spring and summer of 2009. In an effort to respond to transportation needs expressed by the community and political representation and fully consider and provide for regional travel patterns, five alternative concepts were proposed that incorporated the DFW Airport Extension with the TEX Rail project. These build concepts alternatives are as follows:

Terminal A-B Concept

This concept includes an LRT line that connects directly to the DFW Airport Terminal A by traveling roughly parallel to SH 114 before turning south to the terminal. In this concept TEX Rail terminates at the DFW Airport Terminal B.

DFW Airport North Concept

This concept responded to the need for regional connections and proposed that LRT, commuter rail service and DART rail service along the Cotton Belt rail corridor would terminate at a DFW Airport North Station. From this station, passengers and airport employees would access the terminal areas by using a shuttle service provided by DFW Airport. A transfer from LRT or commuter rail service would be required to reach the airport.

DFW Airport North/Terminal B Concept

This concept mirrored the alignments proposed in the DFW Airport North Concept. However, the shuttle connecting passengers from the DFW Airport North Station to the terminal area would include an LRT line which would terminate at Terminal B. Both LRT and commuter rail passengers arriving at the DFW Airport North Station would be required to transfer to the LRT shuttle.

Shuttle Concept

In this option, LRT does not extend all the way to the proposed DFW Airport North Station; rather it terminates on DFW Airport property south of SH 114. A shuttle would connect these two termini to the CTA. In this concept, all passengers would be required to transfer to the shuttle in order to reach the airport. Passengers would also be required to use the shuttle service to transfer between commuter rail and LRT service.

LRT Cotton Belt Approach Concept

This concept proposed one single continuous LRT line that travels from the Belt Line Station northward to the Cotton Belt rail corridor, stopping at the aforementioned DFW Airport North Station. Passengers from TEX Rail and DART Express Rail along the Cotton Belt rail corridor would be required to transfer to LRT service to continue their trip into the airport.

From December 2008 through June 2009, several multi-agency meetings were held to discuss the relative merit of the various alternative concepts to serve DFW Airport. Representatives from DART, the T, NCTCOG, DFW Airport, and interested DART member cities attended these meetings. Also during this time, DART also met with FTA and FAA, individually and collectively, to discuss airport service.

Each of the proposed concepts was evaluated based on utility, operational scenarios, and associated costs. Consideration was also given to other issues such as airport development, member city preferences, and public acceptance. The DART Board of Directors was briefed on four occasions and a public meeting was held on June 17, 2009. Representative of member cities and the general public also provided input for a June 23, 2009 DART Board Meeting.

These concepts proposed various methods of providing system linkages between the TEX Rail project, the DFW Airport Extension, and a future DART Express Rail alignment along the Cotton Belt rail corridor. Concepts that required LRT passengers to transfer before reaching the CTA were deemed unacceptable by the DART member cities and the community in general. Concepts involving a fixed guide-way shuttle were considered to be too expensive.

The evaluation concluded that the Terminal A-B Concept met the immediate need of direct service into DFW Airport, but did not adequately address the longer term needs for east-west travel across the north end of the metropolitan area. The LRT Cotton Belt Approach appeared to address the deficiencies of the Terminal AB Concept, but added unnecessary travel time and operational expense in the short term. Ultimately, a concept that would initially provide direct service into DFW Airport while providing for future regional connectivity along the Cotton Belt Corridor emerged. The Phased Approach, described in detail below, was determined to best meet the purpose and need for the project by combining elements of the Terminal A-B Concept and the LRT Cotton Belt Approach.

On June 23, 2009 the DART Board of Directors approved a Phased Approach Concept, which included portions of the Terminal A-B Concept (Phase I) and the LRT Cotton

Belt Approach Concept (Phase II). The two phases, which FTA and DART determined have independent utility, are planned to operate concurrently once both phases are complete. This long-term strategy is intended to serve the transportation needs of the region, today and in the future.

Phase I includes an LRT line that connects directly to the DFW Airport Terminal A by traveling roughly parallel to SH 114 before turning south to the terminal. Phase I would extend 5.17 miles from Belt Line Station to its DFW Airport Terminal A-B area. TEX Rail terminates at the DFW Airport Terminal B.

Phase II spurs from the Phase I alignment near Freeport Road to extend to the Cotton Belt before turning south to rejoin the Phase I alignment before the DFW Airport LRT Station. DART Cotton Belt rail corridor passengers would be required to transfer to LRT service to continue their trip into the airport. The Phase II alignment measures approximately 4.5 miles. Phase II is a future project with independent utility to be implemented in conjunction with the Cotton Belt rail corridor and not part of the proposed action. A separate environmental review would be prepared for Phase II at the appropriate time.

Phase I would be designed to accommodate future implementation of the Phase II project. By providing LRT service both directly into the airport and providing an option for passengers to directly transfer between LRT, TEX Rail and DART Express Rail along the Cotton Belt rail corridor, regional transportation patterns are served and more choices are offered to transit patrons.

Only the first phase of this approach is addressed in this EA because the second phase is a future project to be implemented in conjunction with the Cotton Belt rail corridor, providing a future LRT extension to a multi-modal station along the Cotton Belt rail corridor. According to the current transit system plan, this multi- modal station is anticipated in 2030. Chapter 1 of the environmental assessment further defines the phased approach approved by the DART Board of Directors.

The EA carried forward for further detailed impact analysis the following alternatives:

No-Build Alternative

The No Build Alternative would include no additional transportation investments in the corridor and would require no FAA ALP approval. Orange Line LRT service would terminate at the DART Belt Line Station. Transit access to DFW Airport would continue to be provided only by DART's bus service to remote parking lots and the DFW Airport's Terminal Link shuttle service. Neither the relocation of the high-mast pole hosting the LLWAS #4 and ASDE-X RU #2 nor the associated changes to the LLWAS, ASDE-X system, TDWR or ITWS would need to be done.

The No-Build would not meet the regional connectivity, capacity and transportation demand needs of the corridor.

Proposed LRT Alternative

The FTA/DART proposed build alternative being reviewed for FAA ALP approval is a 5.17-mile LRT double track alignment that extends northwest from the Belt Line Station (current terminus of the Orange Line) before turning south along International Parkway to end near Terminal A. The LRT line would connect directly to the DFW Airport Terminal A by traveling roughly parallel to SH 114 before turning south to the terminal, which is more particularly described in Chapter 2 of the EA. The proposed action would also include relocation of the high-mast pole hosting the LLWAS #4 and ASDE-X RU #2 and the associated changes to the LLWAS, ASDE-X system, TDWR or ITWS at DFW International Airport as described in more detail in Chapter 3 of the EA.

V. ENVIRONMENTAL CONSEQUENCES

The FAA evaluated the potential impacts associated with the Proposed Action by following the guidance in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures* and *FAA Order 5050.4B, the National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* in accordance with NEPA and CEQ regulations. FAA Orders require the evaluation of specific environmental impact categories. Because of FAA's status as a co-operating agency, the FAA focused its efforts on those issues and subject areas in the EA pertaining to and related to airport planning and potential effects on the airport. Paragraphs 3.2.2 – 3.2.3 (pages 27 – 35) of the EA provide an analysis of anticipated environmental impacts resulting from the proposed action, including operations and facilities at DFW International Airport. In accordance with NEPA, the FAA compared the Proposed Action to the no build alternative in evaluating potential impacts. Implementation of the Proposed Action has the potential to impact the following resource categories:

- **Air Quality**

  Potentially significant air quality impacts associated with an FAA project or action would occur if the project exceeded one or more of the National Ambient Air Quality Standards (NAAQS) for any time periods analyzed. This project has been included in the previous 2006-2008 Transportation Improvement Plan (TIP), and the current TIP conformity analysis. The analysis results indicate the proposed action would not cause or contribute to any new localized air quality violations or increase the frequency or severity of existing violations in the nine-county ozone nonattainment area. Therefore, the proposed action conforms to the goals set forth in the Clean Air Act Amendments of 1990 and is in conformity with the State Implementation Plan (SIP).

- **Compatible Land Use**

  A portion of two business properties is needed to provide adequate right-of-way for LRT operations along Airfield Drive between Esters Road and Freeport Parkway. The two properties are a Federal Express facility and a warehouse

building located at 3010 North Airfield Drive currently occupied by IAS Air. The cities of Dallas and Fort Worth own the land occupied by these two business facilities. The DFW Airport Board has authority granted by the two cities to enter into long term leases for the properties. The Federal Express facility and warehouse at 3010 North Airfield Drive are under a long term lease to AFCO and Aeroterm, respectively. These two firms specialize in the leasing and management of airport properties. AFCO and Aeroterm have leasehold interests giving them controlling interest in the land and improvements until the lease expiration at which time DFW Airport becomes the owner of leasehold improvements.

AFCO currently subleases its facility to Federal Express and Aeroterm subleases its facility to IAS Air. Federal Express is a logistics service company that uses the impacted property for employee parking and tractor trailer storage. This impact will be mitigated by providing replacement parking. IAS Air is also a logistics service company that has used the 3010 North Airfield Drive property to provide mail handling services to the United States Post Office on a contract basis. IAS Air has informed DART that they currently do not have a contract and the facility is not being used. As discussed in section 4.2 of the EA, an independent appraisal of the properties will be conducted to determine legal rights and interests of each of the parties involved.

No aviation-related noise changes or associated compatible land use are anticipated as a result of the proposed action.

- **Construction Impacts**

  Construction impacts would be temporary and limited in duration and therefore not result in any significant impacts. DART would institute best management practices (BMPs) in its construction activities to minimize any undesirable affects.

- **Floodplains**

  Minor encroachment into floodplain by the proposed action would be anticipated. Due to the linear nature of the proposed LRT alignment and the constraints on ROW availability due to the adjacent airfield or the requirements for safe airfield operation, no practicable alternatives were available for connecting the DART Orange Line to the DFW Airport Terminal A. The design of the proposed LRT alignment would ensure that neither the 100-year base flood elevation nor the floodwater velocity is increased by-spanning all floodplain areas and placing only support columns within the floodplain. Additional details regarding the location and lengths of floodplain encroachment can be found in section 4.16.3, Impacts to Floodplains. The FAA finds that he proposed action would not have a high probability of loss of human life, would have no effect on any vital transportation facility and would not cause substantial impacts to the natural or beneficial values of the floodplain.

- **Light Emissions and Visual Effects**

  Light emissions from the proposed project would not create an annoyance to interfere with normal activity. Potential impacts from aerial structure, Traction Power Substations (TPSS), and the storage yard have been identified and are discussed in detail in section 4.6 of this EA. Three areas for visual effects were identified.

  Possible visual impacts were identified where new elevated structures for LRT infrastructure would be constructed near the Hawthorn Suites hotel. Vegetation is currently employed at that location to screen views of the airfield and any disturbance of the existing screening material would be replaced once construction activities are complete.

  A second area where a visual impact is possible is at the location of the rail storage facility adjacent to the northbound service road of International Parkway. Construction of the rail storage facility would constitute a change in visual conditions in the area. DFW Airport has requested that DART provide visual screening of the facility by preserving existing vegetation in the area and incorporating screening methods consistent with DFW Airport guidance. DART will include DFW Airport image elements into the final design and comply with DFW Airport Design Criteria.

  While not considered potentially significant, DFW Airport has requested that DART provide screening of TPSS sites near public areas such as roadways by installing chain link fencing with PVC slats.

- **Water Quality**

  The proposed LRT alignment crosses streams or water bodies in six locations as listed in Table 4-27 in section 4.16, Water Resources. These six crossings are of three different creeks and primary tributaries of those creeks: Grapevine Creek, Hackberry Creek, and Mud Springs Creek. Coordination with the United States Army Corp of Engineers (USACE) and Texas Commission on Environmental Quality (TCEQ) began during the initial environmental evaluation for the project and has been ongoing through project design. According to information provided by TCEQ, Grapevine Creek is an impaired water body due to bacterial contamination. The proposed action does not include activities which will contribute bacterial materials or nutrients for such organism and therefore will not affect the water quality status of Grapevine Creek.

  During construction activities, there would be the potential to create impacts to the three creeks due to runoff from grading activities, other dirt moving activities, or incidental/accidental spills of mechanical fluids. As directed by the DART Design Standards, a baseline Storm Water Pollution Prevention Plan (SW3P) shall be prepared in accordance with the most current Construction Storm water regulations (Federal National Pollutant Discharge Elimination System [NPDES] or Texas Pollutant Discharge Elimination System [TPDES]) and reflect the General Construction Storm Water Permit Checklist, published by the Environmental

Protection Agency (EPA). All construction and related activities shall comply with the requirements of NPDES or TPDES. All temporary and permanent erosion controls shall comply with the latest revision of Storm Water Quality Best Management Practices Manual for Construction, prepared by NCTCOG (7-77). These measures for erosion control, sedimentation control and control of total suspended solids would be incorporated into the project design in order to minimize impacts to water quality.

Once in operation, the proposed LRT alignment would result in impacts to surface water quality due to the creation of impervious surfaces including the track alignment and ballast, bridges and associated support structures, TPSS sites, and one station platform and associated pedestrian areas. Storm water runoff from these areas would be directed by site grading into swales and appropriately dispersed according to BMPs and site conditions.

The proposed action would not threaten any public drinking water supply, sole source aquifers, or waters of national significance. The construction of the proposed project would be conducted with TPDES requirements.

- **Wetlands**

FAA Order 1051.1E requires FAA to make a finding that there is no practicable alternative to construction in wetlands, and that all practicable measures to minimize harm have been included. The proposed project does not encroach into wetlands as defined in 33 Code of Federal Regulations (CFR) 328; therefore, no wetland resources would be impacted as a result of the project. Four waters of the U.S. are crossed by the proposed LRT alignment. Two of those crossings are located nearby areas determined as wetlands. Both wetland areas are associated with crossings of Grapevine Creek. Neither crossing impacts the wetland areas negatively because the areas are avoided completely. In both cases, the water channel is spanned by elevated sections of the LRT infrastructure and support column placement would avoid these areas as shown in the 10% design plans found in Appendix J. The proposed action would not alter the hydrology needed to sustain the functions and values of the nearby wetlands, would not reduce the ability of nearby wetlands to retain floodwaters or storm-associated runoff, would not negatively affect the maintenance of natural systems that support wildlife and fish habitat or other environmental resources within the nearby wetlands.

- **Waters of the U.S.**

  Within the proposed LRT alignment, there are four bodies of water that could be considered potentially jurisdictional waters of the U.S., while only one of the four waters of the U.S would potentially include wetlands. Based on the 10 percent design plans, the proposed alignment would span all water resources except for ED-1. At this location, approximately 2,632 square feet of waters of the U.S. (0.06 acres) would be impacted due to the placement of support columns within this water (columns would be located at Civil Stations 643+00, 644+00 and 645+00 as depicted in the EA on page 106, figure 4-16. This area is an ephemeral drainage area and not a wetland.

  As detailed under Mitigation Measures in section 4.16.2 of the EA, any avoidance alternative would be costly and would likely result in greater environmental impacts. At this highly constrained location, direct impact to ED-1 could not be avoided. Placing the rail on aerial structure minimizes harm by limiting the impact to a few column locations. Additionally, column locations were adjusted during preliminary design in order to further minimize the area of the water impacted.

  Due to the small area of the impact (less than one half of an acre), construction activities meet the criteria for a USACE Nationwide Permit 14.

VI. PUBLIC INVOLVEMENT

The DFW Airport Extension IRVING-3 Public and Agency Involvement Plan divided the project into four milestones.

- Milestone 1 included project inception through the scoping process.
- Milestone 2 included the 5% design and administrative draft EA. In this milestone, public meetings were held to facilitate engagement in the planning process.
- Milestone 3 included the 10% design and public comment period for the draft PE/EA. During this milestone, a formal public hearing was held on June 2, 2011 to inform the public of the contents of the draft EA and provide an opportunity for interested parties to comment on the project.
- Milestone 4 consisted of finalization of the EA document completed in August, 2011.

Additional coordination efforts occurred through periodic meetings to update DFW Airport Extension stakeholders and discuss potential issues and solutions throughout the project process. Chapter 6 of the EA describes in detail the public involvement process.

VII. CONDITIONS

FTA has made a commitment in the EA that the Orange Line DFW Airport Light Rail Transit Extension Project will be built in a manner consistent with the EA. The EA, including Table 3-1, makes a commitment that DART will implement at its expense the mitigation measures described in the EA. The FAA's FONSI and ALP approval is conditioned on DART obtaining necessary environmental permits and fulfilling commitments and mitigation measures set forth in the EA and FAA's FONSI. Chapter 3 of the EA, Table 3-1, also identifies aeronautical mitigation measures DART agrees to pay for in connection with addressing impacts to airport facilities and operations.

Additional conditions for ALP approval associated with this project are listed below.

A. Solid and hazardous wastes must be collected and disposed of at an approved facility as mandated by the county, state and Federal requirements. Discussion of hazardous materials and solid waste can be found on page 30 of Chapter 3 in the EA.

B. All practicable measures to avoid and minimize harm to all wetlands and waters (jurisdictional or otherwise) of the United States will be included in implementation of the proposed project, and the design and construction of any new wastewater components must be in accordance with USACE and state design guidelines and standards as described in section 4.16.2 of the EA.

C. During construction, appropriate measures and actions specified by Part 6. *Temporary Traffic Control of the Texas Manual on Uniform Traffic Control Devices* (TMUTCD) and Part 6. *Temporary Traffic Control* of the federal Manual on Uniform Traffic Control Devices shall be implemented to prevent, minimize, and mitigate potential impacts to surrounding land uses and businesses due to construction activities with an emphasis on maintaining access to and signage for businesses during the construction period. Specifics related to these mitigation measures are described in section 5.1 of the EA.

D. DFW Airport staff will be afforded the opportunity to review and approve visual elements resulting from construction of the proposed action as described in section 4.6 of the EA.

E. Because of the unique ownership and lease structure of the two impacted business properties, an independent appraisal of the properties will be conducted to determine legal rights and interests of each of the parties involved as described in Section 4.2 of the EA. This appraisal will be conducted in accordance with the DART Board of Directors' Real Estate Policy and Procedures, as amended, and the Uniform Relocation Assistance and Real Property Acquisition Policies Act (URA) of 1970 (42USC 4601).

Mitigation measures for displacements resulting from the proposed project will include fair compensation for the property acquired, relocation assistance, or other assistance, in accordance with the URA. Relocation benefits will be afforded to eligible businesses (owner occupants and tenants) that would be displaced by the proposed action. DFW Airport and DART are currently developing a Memorandum of Agreement (MOA) to govern any property displacements or disputes.

A mitigation plan has been developed to alleviate impacts to business operations at the Federal Express facility. DART has devised a recommended plan for reconfiguring the remainder of the existing Federal Express parking area to accommodate all trailer storage needs. Additional parking to accommodate the displaced employee parking will be provided.

As there is no current activity at 3010 North Airfield Drive facility, no mitigation plan has been developed for the business impact. DART will work with DFW Airport to ultimately determine the practicality of salvaging a portion of the structure.

F. The EA in Table 3-1 *Aeronautical Assessment Areas of Concern* identifies 18 issues to avoid adversely affecting airport or aircraft operations. Details of this mitigation, which are to be paid for by DART, are further discussed in Appendix L of the EA. These issues must be addressed to FAA's satisfaction, and formalized in a document such as a Memorandum of Agreement, prior to project implementation.

VIII. DECISION CONSIDERATIONS AND ADDITIONAL FINDINGS

Throughout the development of the airport, including the proposed improvements described above, the FAA has made every effort to adhere to the policies and purposes of NEPA, as stated in CEQ Regulations for Implementing NEPA 40 CFR § 1500-1508.

The FAA has concentrated on the truly significant issues related to the action in question. In its determination whether to prepare an Environmental Impact Statement (EIS) or process the EA as a FONSI, the FAA weighed its decision based on an examination of the EA, comments from Federal, state, and local agencies, as well as all other evidence available to the FAA.

I have carefully and thoroughly considered the facts contained in the attached EA. Based on that information, I find the proposed Federal action is consistent with existing national environmental policies and objectives of Section 101(a) of the National Environmental Policy Act of 1969 (NEPA) and other applicable environmental requirements. I also find the proposed Federal action, with the required mitigation referenced above, will not significantly affect the quality of the human environment or

include any condition requiring any consultation pursuant to section 102(2)(C) of NEPA. As a result, FAA will not prepare an EIS for this action.

RECOMMENDED
FOR APPROVAL: _____ DATE: Oct. 11, 2011

J. Michael Nicely
Manager, Texas Airports Development Office

APPROVED: _____ DATE: 10/11/11

Kelvin L. Solco
Manager, Southwest Region Airports Division

APPENDIX B - CORRESPONDENCE

URS

January 16, 2012

Mr. Mark Wolfe
Executive Director
Texas Historical Commission
1511 Colorado Street
Austin, Texas 78701

Re: Supplemental Cultural Resources Coordination for Historic Architectural and Archaeological Resources under the Antiquities Code of Texas and Section 106 (16 U.S.C. 470 et seq.) of the National Historic Preservation Act (NHPA) of 1966, for Phase I of the Dallas Area Rapid Transit (DART) Irving-3 60% Design, Tarrant and Dallas Counties, Texas (URS Project Number 25338801, T.O. 35; Reference THC Track Number 201002501).

Dear Mr. Wolf,

URS Corporation (URS), on behalf of the Dallas Area Rapid Transit (DART), requests Section 106 and Antiquities Code of Texas re-coordination from the Texas Historical Commission (THC) on the above referenced project. The project was previously coordinated with the Texas Historical Commission for both archaeological and historic resources (Turner-Pearson and Dobson-Brown to Wolfe, October 26, 2009; Denton to Turner-Pearson and Dobson-Brown, November 17, 2009; Emery to Wolfe, December 15, 2009; Wolfe to Emery, December 21, 2009 [Reference THC Track Number 201002501]). Previous coordination documents are located in Appendix A.

The project (for which prior coordination was undertaken) consists of the Phase I advancement of the final railway section of the Orange Line (referred to by DART as Irving-3) to its terminus at the Dallas-Fort Worth (DFW) International Airport. The Fort Worth Transportation Authority (The T) is currently advancing the Southwest to Northeast Corridor on the DART-owned Cotton Belt rail corridor located north of State Highway (SH) 114. Upon completion, the two rail projects will be incorporated into the overall public transportation program at DFW Airport and will provide service to air passengers, employees, and North Central Texas commuters.

Supplemental coordination for archaeological and historic resources is required due to modifications found necessary during the 30% and 60% design processes. The modifications primarily consist of the proposed use of box culverts instead of clear spans, and the relocation of the preferred alignment south of North Airfield Drive that will cause a shift of turnouts. Exhibit 1 illustrates the differences between the alignment proposed at the 10% design phase, as previously coordinated with the THC and the current proposed alignment. The main alignment shift from 10% design is between sta. 630+00 and sta. 700+00. The reasons to shift the alignment are: to avoid the relocation of the Federal Aviation Administration Low Level Windshear Alert System (FAA LLWAS) Tower, eliminate bridge structures going over Freeport Parkway and North Airfield Drive to minimize the impact to pilot "human factor" concern, eliminate a "pinch point" issue between DART alignment and the future TxDOT SH-114 widening, and eliminate the skewed at-grade crossing at Plaza Drive and North Airfield Drive.

URS Corporation
1950 N. Stemmons Freeway Suite 6000
Dallas, TX 75207
Tel: 214.741.7777
Fax: 214.741.9413

This project is under the authority of the FAA and requires that the project be reviewed under Section 106 of the National Historic Preservation Act of 1966, as amended, and the Antiquities Code of Texas.

URS, on behalf of DART, requests concurrence that no further archaeological or historic resources investigations are necessary within the proposed project area, and that DART be allowed to proceed with the project within those boundaries.

Description of Undertaking

The proposed project will advance the final line section of the DART Orange Line (Irving-3) railway to its terminus at DFW International Airport, and eventually allow it to connect to the Cotton Belt rail corridor north of SH-114. The Cotton Belt rail will soon be connected by the Southwest to Northeast Corridor of The T. These additional railway sections will allow passengers and employees of DFW to travel by railway to the terminals, decreasing the number of cars traveling to and from the airport on a daily basis. The connection of railways will also allow commuters to pass through DFW Airport and continue on the railway to Dallas, and Dallas commuters to travel north past the airport. This line of railway travel to and through DFW Airport should provide an additional capacity for travel among North Texans, reduce congestion, enhance the quality and reliability of the transit service, and improve the safety and operating efficiency of the railway system. This is a two phase project, and only the DART Irving-3 Phase I railway is discussed in this coordination. Phase II will be coordinated at a later date.

The proposed Irving-3 railway segment will start at the end of the Orange line at the southeast property line of the airport at Valley View Road and Beltline in Dallas County, Texas, and continue northward toward the main terminal complex. The railway will intersect and run adjacent to SH-114 on the northeast side of the airport terminal and then turn westward and loop south to join the terminal on the east side of the American Airlines parking facility, ending at Terminal A (Exhibit 1).

The proposed railway width is approximately 17 meters (m) (55 feet [ft]) wide, and 8,443 m (27,700 ft) long. The entire railway construction footprint is 14.5 hectares (35 acres).

The majority of the proposed railway is at grade level or slightly raised 0.6 m (2 ft) above the natural grade. In some areas the railway will be elevated, with load bearing pier beams up to 2.7 m (9 ft) below ground level, and a height of about 8 m (25 ft) above the natural horizon. There are two stream crossings along the railway route; northeast of Emergency Road close to Beltline Road; and along the corner of Esters and Cabell Road (see Appendix B). The depths of impacts at the stream crossings are expected to exceed one meter in depth.

Background Information

The project area is on DFW Airport property in both Tarrant and Dallas counties, Texas. The airport encompasses 18,000 acres (7,284 hectares), which lies in a segment of land outlined by SH-121, Interstate Highway (IH-635), SH-360, SH-183, and SH-161. The city of Grapevine lies to the northwest, Euless to the southwest, and Irving to the southeast. The Fort Worth metroplex is directly west of the airport, and the Dallas metroplex is to the east. The major water shed at the airport is Big Bear Creek, which runs through the western portion of the airport property and empties into the West Fork River.

URS

Project Setting

Topography and Drainage

Located in northeast Texas, Dallas County covers 233,617 hectares (577,280 acres). The topography of the county is relatively flat, inclining slightly eastward, with dark, thick, plastic clayey soils with poor permeability. The Trinity River is the main watershed, which drains southeast across the county. The river has a well documented history of flooding and is currently surrounded by a levee system. The county has three natural underground aquifers, though most water for urban uses comes from reservoirs in and around the Trinity River (Coffee et al. 1980).

Tarrant County, located west of Dallas County, is considered to be in the north-central part of the state. The county encompasses 232,581 hectares (574,720 acres), which slopes east and southeastward. The main watershed is also the Trinity River drainage system, with small creeks and streams emptying into the West Fork, Clear Fork, and Elm Fork tributaries. The topography of Tarrant County varies from nearly level to hilly, with its top elevation 293 m (960 ft) above mean sea level (amsl) at the Parker County line (Ressel 1981).

Geology and Soils

The DFW Airport property is situated on the dividing line between the Blackland Prairie and the Eastern Cross Timbers vegetation and environmental zones as defined by Blair (1950). The line between these two distinct environmental zones coincides with the dividing line between the two geological formations that make up the airport property. This geological divide is just east of Big Bear Creek, running northwest to southwest as it joins Bear Creek (Barnes 1988; Shelton, et al. 2008). The geology on the eastern side of creek is the Eagle Ford Geologic Formation of Late Cretaceous shale, sandstone, and limestone, while the western side is the Woodbine Geologic Formation of sandstone, clay, and shale (Barnes 1988). This undertaking is entirely on the eastern side of the creek and situated entirely on the Eagle Ford Formation.

The majority of the overlying soils in the project area are part of the Ferris-Heiden series, Houston Black-Heiden series, or the Houston Black-Navo-Heiden series. The Ferris-Heiden soil series are deep, gently sloping to strongly sloping, clayey soils that are usually found on uplands. The Houston Black-Heiden soil series are also deep, but ranging from nearly level to strongly sloping, clayey soils found on uplands. The Houston Black-Navo-Heiden soil series are deep, clayey and loamy soils also found on uplands (Coffee 1980; Ressel 1981). A detailed listing of the soils in the projected APE is found in Table 1.

Vegetation

The climate in the Dallas and Tarrant Counties is humid subtropical, with summer highs averaging 96° Fahrenheit (F), and the winters averaging a mild 35°F (TSHA 2009). The Blackland Prairie is typically rolling grasslands. Wildlife in the area includes various songbirds and raptures, deer, raccoon, fox, and armadillo. Native trees found along the lowland creeks include post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), American Elm (*Ulmus americana*) Pecan (*Carya illinoinensis*), and hickory (*Carya buckleyi*). The vegetation in the rolling hills includes a variety of tall grasses (Blair 1950). Buffalo and Antelope were reported in the area in the early 1800s, but no large mammals continue to occupy the area (Shelton et al. 2008).

Archaeological Resources

A review of the Texas Archeological Sites Atlas (TASA) (2009, 2012) indicated five archaeological surveys and three archaeological sites located within 1,000 m of the project's previously coordinated archaeological APE (Tables 2 and 3; and Appendix A).

A 1984 linear survey by the Texas Highway Department (THD) was situated south of the proposed project, a 1986 Federal Highway Administration (FHWA) linear survey ran northeast of the project, a 2004 Texas Department of Transportation (TxDOT) areal survey was conducted northeast of the project, a 2004 TxDOT survey in the area of SH-114 was to the east of the project, and there was also a small 2006 TxDOT areal survey northeast of the project area.

The archaeological sites are all historic farmsteads or dairies and are greatly disturbed. The reports for sites 41DL398 and 41DL403 indicate that they would most likely be destroyed during the construction of the International Commerce Park at DFW. This project has since been built and it is assumed that the sites were subsequently destroyed or further disturbed during its construction. Site 41DL492 is a historic dairy farm that was reported as being greatly disturbed. This site lies just south of the southern end of the proposed Phase I railway.

While not entirely within 1,000 m of the previously coordinated project APE (Appendix A), a 2008 report of investigations on DFW property by AR Consultants, Inc. was reviewed, and recommendations for future work on the airport property were considered (Shelton et al. 2008). In the report, the investigators concluded that approximately 70 percent of the airport property had been impacted by development and construction, and an "Area of Impacts" was delineated where the potential for undisturbed archaeological remains were low (Shelton et al 2008:127). The THC concurred with these results (Oaks to Shelton, December 17, 2008).

During prior coordination for the 10% Design phase of the DART I-3 project, the THC agreed with the recommendation that because the potential for archaeological remains were low in the Shelton et al. "Area of Impacts" (2008), that the DART Irving-3 project area "does not likely contain archaeological sites that meet NRHP eligibility requirements set forth in 36 CFR 60.4 – Criteria of Eligibility, nor any sites that merit designation as State Archaeological Landmarks (SALs), as outlined in 13 TAC 26.8, Criteria for Evaluating Archaeological Sites… [and that] no further archaeological investigations [were] warranted." (Turner-Pearson and Dobson-Brown to Wolfe, October 26, 2009; Denton to Turner-Pearson and Dobson-Brown, November 17, 2009; Appendix A). The location of the project area investigated by Shelton et al. (2008) is shown in relationship to the previously coordinated DART Irving-3 alignment and the currently proposed alignment on Exhibit 2. This corresponds with the Grapevine, Tex. and Carrollton, Tex. 7.5-minute USGS topographic quadrangles.

Table 1. Soil Names within the Project Area and Their Characteristics

Series	*Soil name and description*	*Average depth centimeters (inches)*	*Landform location*	*Underlying geologic formation*
Burleson	Burleson Clay, 0-1% slopes, deep, nearly level, well drained	203 (80)	Old stream terraces	Upper Cretaceous - Eagle Ford Formation
Ferris & Heiden	Ferris-Heiden complex 5-12% slopes, deep, well drained	198 (78)	Gently rolling and rolling soils on hillsides	Upper Cretaceous - Eagle Ford Formation
Heiden	Heiden clay, 1-3% slopes, deep, well drained, subclass IIe	198 (78)	Gently sloping on uplands	Upper Cretaceous - Eagle Ford

				Formation
Heiden	Heiden clay, 2-5% slopes, deep, well drained	198 (78)	Gently sloping on uplands	Upper Cretaceous - Eagle Ford Formation
Houston Black	Houston Black clay, 0-1% slopes, deep well drained	178 (70)	Nearly level soil on smooth uplands	Upper Cretaceous - Eagle Ford Formation
Houston Black	Houston Black clay, 1-3% slopes, deep, moderately well drained	203 (80)	Gently sloping on smooth uplands	Upper Cretaceous - Eagle Ford Formation
Leson	Leson clay, 1-3% slopes, deep, well drained	178 (70)	Gently sloping soil on uplands	Upper Cretaceous - Eagle Ford Formation
Ovan	Ovan clay, frequently flooded, deep, moderately well drained	203 (80)	Nearly level on flood plains	Upper Cretaceous - Eagle Ford Formation
Unknown	Urban land, 75% covered with buildings or pavement, unable to identify, 10% residential areas	unknown	Urban land areas	Upper Cretaceous - Eagle Ford Formation

Source: (Coffee et al. 1980; Ressel 1981; and Barnes 1988)

Table 2. Archaeological Surveys within 1,000 Meters of the Project APE

Type & Number	*Date*	*Agency*	*Investigating Firm*
Linear/ Unknown	June 1984	THD	Unknown
Linear/ Unknown	Feb. 1986	FHWA	Unknown
Areal / #3427	Jul. 2004	FHWA/TxDOT	Parsons
Areal/ #3561	Oct .2004	TxDOT	Geo-Marine
Linear/ #3910	Feb. 2006	TxDOT	Parsons

Source: Texas Archaeological Sites Atlas (2009, 2012)

Table 3. Archaeological Sites within 1,000 Meters of the Project APE

Trinomial	*Type*	*Condition*	*Investigating Firm*
41DL398	Historic Farmstead	Disturbed/ destroyed	Geo-Marine
41DL403	Historic Farmstead	Disturbed/ destroyed	Geo-Marine
41DL492	Historic Dairy	Disturbed	AR Consultants

Source: Texas Archaeological Sites Atlas (2009, 2012)

Historic Resources

A historic resources reconnaissance survey was prepared for the project at the 5% design phase. *Historic Resource Reconnaissance Survey for DART Phase I Irving-3 Rail Project, Tarrant and Dallas Counties, Texas* (Emery 2009) took into account previously documented buildings, structures, objects, and state markers, as well as attempted to identify undocumented historic resources within 150 ft of the proposed project as identified in December 2009.

The reconnaissance survey was performed by an architectural historian meeting the Secretary of the Interior's qualifications. The resulting survey report included the following information:

- Project description
- Project area background and historic context
- Previously documented historic-age resources within and immediately adjacent to the APE
- Documentation of each historic-age resource within the APE including:
    - Address or location,
    - Historic and current name, if any,
    - Date of construction,
    - Style,
    - Historic and current use,
    - Property type and subtype,
    - Preliminary NRHP eligibility recommendations,
    - Condition, and
    - Digital photographs (minimum of two views) of each historic-age resource
- Summary and Recommendations

No previously documented historic resources were identified during the survey, nor were any historic resources newly recorded as part of the effort. A draft report resulting from the historic-age resources survey and containing these findings was submitted to DART and the THC for comment. Concurrence with the report was issued on December 21, 2009 (Wolfe to Emery December 21, 2009, Appendix A).

Review of current aerial and topographic maps shows that there are no previously unidentified standing structures within 150 ft of the proposed new alignment area.

Recommendations for Archaeological Resource Investigations

The project area for Phase I of the revised Irving-3 project lies on a narrow strip of DFW property that is mostly disturbed by previous airport construction and development. It also lies in the "Areas of Impacts" described by Shelton et al. (2008) as being so disturbed that there would be an extremely low probability of finding intact archaeological remains in the area (Exhibit 2). Based on background research and current development, the project area does not likely contain archaeological sites that meet NRHP eligibility requirements set forth in 36 CFR 60.4 – Criteria of Eligibility, nor any sites that merit designation as State Archaeological Landmarks (SALs), as outlined in 13 TAC 26.8, Criteria for Evaluating Archaeological Sites. Therefore, it is recommended that the project should have no adverse effect on historic properties or SALs, and no further archaeological investigations are warranted.

In the event that unanticipated archaeological materials are encountered during the construction phase of the proposed project, work in the immediate area will cease and the State Historic Preservation Officer will be notified to initiate post-review procedures.

Recommendations for Historic Resource Investigations

It is proposed that since a reconnaissance-level survey of historic-age resources within 150 ft of the proposed right-of-way (ROW) for Phase I of the Irving-3 project was conducted in December 2009 and no historic resources were identified as part of that effort, and since no previously unidentified resources appear to be within 150 ft of the proposed new alignment area, that no further work be conducted.

URS

Request for Concurrence

Archaeological Resources

On behalf of DART, URS requests concurrence of the THC that no further archaeological resources investigations within the Phase I project APE are necessary, and DART may proceed with Phase I of the project.

Historic Age Resources

On behalf of DART, URS requests concurrence of the THC that no further historic resources investigations within the Phase I project APE are necessary, and DART may proceed with Phase I of the project.

CONCUR
by
for Mark Wolfe
State Historic Preservation Officer
Date 21 February 2012

Respectfully,

James M. Welch, RPA
Principal Investigator & Senior Archaeologist
URS Corporation
1950 North Stemmons Freeway
Suite 6000
Dallas, Texas 75207
(214) 672-2998

Sherry N. DeFreece Emery
Senior Architectural Historian
URS Corporation
1950 North Stemmons Freeway
Suite 6000
Dallas, Texas 75207
(214) 672-2984

Attachments: Exhibits 1, 2, Appendices A, B

Cc: John Hoppie, DART
Lori Molitor, URS
Jerry Smiley, URS

TEXAS PARKS & WILDLIFE

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September 11, 2009

Charlie Andrews
URS Corporation
1950 North Stemmons Freeway, Suite 6000
Dallas, TX 75207

RE: Proposed DART Irving-3 Phase I & II DFW Airport LRT Line (Dallas County)

Dear Mr. Andrews:

On behalf of Dallas Area Rapid Transit (DART), URS Corporation is preparing an Environmental Assessment (EA) for the project referenced above and has requested information regarding rare, threatened, and endangered species for Dallas and Tarrant Counties. The Texas Parks and Wildlife Department (TPWD) reviewed the preliminary project information and offers the following comments and recommendations to minimize impacts to natural resources of the state including rare, threatened, and endangered species and their habitat.

Stream Crossings and Riparian Habitat

Riparian areas are vegetated corridors along drainages that generally provide nesting habitat for birds, soil stabilization for enhanced water quality, and food, cover, and travel corridors for wildlife. Because many species of wildlife travel along riparian corridors it is important to reduce disturbance and fragmentation to riparian corridors. Riparian habitat is a priority for conservation by TPWD across the state.

Recommendation. The amount of vegetation removed, trampled, or disturbed should be minimized in riparian areas. To avoid soil disturbances, machinery and other vehicles should utilize nearby roadways and bridges when crossing drainages, wetlands, and creeks.

Recommendation. Where riparian areas would be crossed using bridge spans, the design should allow usable vertical and horizontal space beneath the bridges for local terrestrial wildlife to cross under the facility. Crossings should also be perpendicular to the stream to minimize loss of riparian habitat.

4200 SMITH SCHOOL ROAD
AUSTIN, TEXAS 78744-3291
512.389.4800
www.tpwd.state.tx.us

The proposed project would involve constructing Phase I and Phase II Light Rail Transit (LRT) lines north, northeast, and east of the DFW Airport within DFW Airport Property. Mud Springs Creek is one of four streams that would be crossed, but it consists of a concrete lined channel with no adjacent riparian vegetation. The remaining three streams contain wooded riparian vegetation that would be cleared to construct and operate the facilities. The majority of clearing would occur along Cottonwood Branch Creek at the northern limit of the project, whereas the other crossings have only small amounts of riparian woodlands present.

> Recommendation. TPWD prefers that necessary stream crossings be placed in exiting open spaces where the riparian buffer is narrow or previously cleared to minimize the amount of riparian habitat disturbance. It appears that the southern crossing of Cottonwood Branch Creek has been placed at a narrow point in the riparian woodlands to minimize impacts.

The Phase II line would split into two routes just after crossing Cottonwood Branch Creek at the northern extent of the proposed project. The LRT would follow two separate routes for a short distance before meeting back up again, though it is not clear the reason why this would be necessary. Splitting the line into two separate routes would require clearing the woodlands that buffer Cottonwood Branch Creek for two alignments.

> Comment. Placement of two separate lines through the woodlands along Cottonwood Branch Creek should be eliminated to minimize impacts to natural resources. Impacts may be minimized if the two tracks for LRT Phase II are collocated on one bridge then proceed to follow alongside the existing Cotton Belt rail corridor. The EA needs to address the issue of splitting the line into two separate routes near the northern crossing of Cottonwood Branch Creek rather than using one alignment shared by two tracks.

Rare Resources

The TPWD Annotated County Lists of Rare Species are available at http://gis.tpwd.state.tx.us/TpwEndangeredSpecies/DesktopDefault.aspx. These lists provide information regarding rare species that have **potential** to occur within each county. Rare species could potentially be impacted if suitable habitat is present at or near the project site.

Recommendation. The county list(s) should be used as a reference to determine if suitable habitat occurs within the proposed project ROW and to determine if the project would impact the species or habitats. The project should be designed and constructed to avoid or minimize adverse impacts and to mitigate any impacts when rare plant and animal species and their habitat are found within or near the project area.

TXNDD

The Texas Natural Diversity Database (TXNDD) is intended to assist users in avoiding harm to rare species or significant ecological features. Given the small proportion of public versus private land in Texas, the TXNDD does not include a representative inventory of rare resources in the state. Absence of information in the database does not imply that a species is absent from that area. Although it is based on the best data available to TPWD regarding rare species, the data from the TXNDD do not provide a definitive statement as to the presences, absence or condition of special species, natural communities, or other significant features within your project area. These data are not inclusive and **cannot be used as presence/absence data**. They represent species that could potentially be in your project area. This information cannot be substituted for on-the-ground surveys. The TXNDD is updated continuously based on new, updated and undigitized records; for questions regarding a record, please contact txndd@tpwd.state.tx.us.

A search of the TXNDD indicated no known occurrences of rare resources within 5 miles of the project.

Landscaping and Water Conservation

There has been a dramatic increase in water demand across North Texas associated with increased development and population growth, thus water conservation is essential to this area. Native vegetation is adapted to the soil and climate of the area and usually requires less maintenance and watering than introduced species. The disease tolerance of native vegetation provides longevity to the landscape without high cost. Native landscapes provide an enjoyable outdoor space for passengers while also benefiting wildlife such as birds and butterflies. Mature trees and shrubs provide nesting, loafing, and forage habitat for birds and other wildlife.

Recommendation. Site planning and construction techniques should be designed to avoid and preserve existing mature native trees and shrubs. Native replacement trees should be planted as mitigation for trees removed.

Recommendation. To enhance the value of the proposed project to both wildlife and passengers and to aid in water conservation, native vegetation beneficial to fish and wildlife should be used for landscaping. The following websites can offer help in finding appropriate native vegetation for the project area: http://www.tpwd.state.tx.us/huntwild/wild/wildscapes/ and http://tpid.tpwd.state.tx.us/.

The information you requested and our project reviews are normally not part of the Open Records process as no document exists for your project area and each project has to be evaluated individually. All projects should be addressed to Kathy Boydston, TPWD Wildlife Division, Wildlife Habitat Assessment Program, 4200 Smith School Road, Austin, TX 78744.

If you have any questions, please contact me at (512) 917-4155.

Sincerely,

Karen B. Hardin
Wildlife Habitat Assessment Program
Wildlife Division

kbh/14328

Dallas Area Rapid Transit
P.O. Box 660163
Dallas, Texas 75266-0163
214/749-3278

March 23, 2012

Ms. Karen B. Hardin
TPWD Wildlife Division
Wildlife Habitat Assessment Program
4200 Smith School Road,
Austin, TX 76137-4298

RE: DART Orange Line DFW Airport Extension Irving-3 Supplemental Environmental Assessment

Dear Ms. Hardin:

Thank you for taking the time to discuss the DART rail project with Sandy Lancaster of DFW airport. Enclosed, for your use are excerpts from the Supplemental Environmental Assessment (EA) for the DFW Airport Extension Project which is currently in development. As you are aware, a Final EA for the project was prepared in September 2011 and both FAA and FTA independently issued a FONSI in October 2011. Please note that the EA and Supplemental EA focus on the Phase I project.

The Supplemental EA excerpts are relevant to TPWD concerns for the project. They included: 1) portions of Section 1 which identifies the project changes; 2) Section 2.2 which summarized environmental resource categories per FAA environmental impact assessment guidance; 3) relevant portions of Section 3 which examined environmental resource categories per FTA guidance; 4) relevant portions of Section 4 which identify temporary construction impacts; and 5) previous correspondence from TPWD.

DART appreciates your previous input and has incorporated your recommendations into the design of the project and the environmental documentation. This is balanced by the practicalities of implementing a major rail project in an airport setting. The proposed project must avoid impacts aviation and public safety. As such there is a need to maintain lowest profile alignment possible. Additionally, the use of vegetation that is attractive to birds is generally discouraged at airport since birds represent a safety risk to aircraft.

Riparian Areas

In your letter dated September 11, 2009, you emphasized the need to minimize the amount vegetation disturbed by the project. The construction of box culverts instead of bridges does not represent a significant difference in the impact to riparian areas presented in the original EA. As indicated in this letter, there are only small amounts of riparian woodlands associated with the crossings of Mud Springs Creek and Hackberry Creek Tributary #3. The crossing of Grapevine Creek (Referred to as Cottonwood Branch in letter) is now perpendicular to the stream and located directly adjacent to North Airfield Drive in a previously disturbed area. The disturbed riparian area west and south of the crossing is similar to the area identified in the original EA.

Stream Crossings

The three channels that will be altered by the construction of box culverts are all located in areas that have been previously disturbed. Each creek has culverts elsewhere along the channel. Both Mud Springs Creek and Grapevine Creek have been previously rechanneled. DFW has reviewed the hydrology reports and has requested that the higher velocities that could be experienced in the immediate vicinity of the outfalls be mitigated with channel protection at the outfall.

Correspondence from TWPD on previous projects recommended that channel reconstruction of streams adjacent to the culverts consist of natural materials, where possible. In order to both comply with TPWD recommendations and mitigate higher velocities, the total amount of erosion protection has been minimized. Boulder type riprap, in lieu of concrete lining, will provide a more natural appearance. Over time, the vegetation will envelop the rock riprap and should encourage wooded growth and riparian development. The planting scheme would consist of native vegetation.

The aerial structure over Hackberry Creek has been designed to allow for local terrestrial wildlife cross under the infrastructure.

Construction Impacts

The placement of construction staging areas has carefully avoided riparian areas. These areas and any construction access roads will be restored to their original condition upon completion of the project. As stipulated by DART's construction specifications and best management practices, DART will minimize the disturbance of vegetation and use existing roads where possible.

Migratory Birds

Although covered in our original survey, DFW has requested that a discussion of Migratory Birds be included in the Supplemental EA,

The completion of the Supplemental EA is a critical path item for DART's construction of the rail line and DFW's construction of the station. As such we are requesting that you submit any comments as expeditiously as possible. Any questions should be directed to me at jhoppie@dart.org; (214) 749-2525 or Sandy Lancaster of DFW at slancaster@dfwairport.com; (972) 973-5573.

Sincerely,

John Hoppie
Project Manager

enclosure

c: Sandy Lancaster

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Fort Worth

Carter P. Smith
Executive Director

March 28, 2012

John Hoppie
Project Manager
DART
P.O. Box 660163
Dallas, TX 75266-0163

RE: Supplemental EA for the DART Orange Line DFW Airport Extension (Irving-3) Project (Dallas County)

Dear Mr. Hoppie:

The Texas Parks and Wildlife Department (TPWD) has reviewed the relevant excerpts from the Supplemental Environmental Assessment (EA) for the project referenced above which involves construction and operation of the Phase I Dallas Area Rapid Transit (DART) Orange Line DFW Airport Extension of the light rail transit (LRT). Phase I would extend 5.17 miles from the existing Belt Line Station to the proposed DFW Terminal A-B area. Modifications of the design include an alignment shift, use of box culverts instead of clear spans at some water crossings, relocation of North Airfield Drive, proposed access roads and temporary construction roads, modification to staging area locations, and relocation of TPSS.

TPWD has reviewed the excerpts from the Supplemental EA and have no objections or concerns with the modifications to the design. TPWD recommendations for minimizing impacts to fish and wildlife resources have been incorporated into the project where feasible. Based on the information presented, TPWD does not anticipate significant adverse impacts to rare, threatened, and endangered species, or other fish and wildlife resources.

Thank you for coordinating with TPWD regarding the project changes. If you have any questions, please contact me at (903) 322-5001.

Sincerely,

Karen B. Hardin

Karen B. Hardin
Wildlife Habitat Assessment Program
Wildlife Division

kbh/ERCS-124

4200 SMITH SCHOOL ROAD
AUSTIN, TEXAS 78744-3291
512.389.4800
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Inman, Megan

From: Wang, Wendong <Wendong.Wang@parsons.com>
Sent: Wednesday, February 29, 2012 8:40 AM
To: Jonathan.Kempfer@kiewit.com; Scott.Rustan@kiewit.com; brian.larson@kiewit.com; Dooley, William
Subject: FW: Final FedEx parking layout 2-22-2012 - DFW

FYI

From: Darrell G. Wodowski [mailto:dgwodowski@fedex.com]
Sent: Wednesday, February 29, 2012 8:11 AM
To: 'Hope, Doug'
Cc: 'John Northcott'; Wang, Wendong; Phebia Williams; Greg Ford; Steve Shores
Subject: RE: Final FedEx parking layout 2-22-2012 - DFW

Doug: Yes, FedEx is satisfied with the most recent parking relocation plan.

Many thanks to the entire project team for attending numerous meetings, listening to our concerns, recommending alternatives and turning around revised concepts on a timely basis.

Our only concern right now is the staging of the project to ensure that FedEx has adequate parking and access to our facilities throughout the duration of the project. Please let us know when to expect a project staging plan for our review.

We look forward to continuing to work with the project team.

Email or call me at 901-434-8967 if you have any questions.

Thanks,
Darrell

From: Hope, Doug [mailto:DoHope@dfwairport.com]
Sent: Tuesday, February 28, 2012 3:20 PM
To: 'Darrell G. Wodowski '
Cc: 'John Northcott'
Subject: FW: Final FedEx parking layout 2-22-2012

Darrell,

Hope all is well.

Now that Dart is in the final stages of design we want to make sure that Fed X is satisfied with the most recent plan. It is my understanding that Fed X (at least locally) is on board with the plan. Could you please verify that you are and let me know. I want to make sure we're addressing any issues Fed X may have now, because once the plans are finalized the Contractor will want to proceed with the project.

Thanks,

Doug

From: Wang, Wendong [mailto:Wendong.Wang@parsons.com]
Sent: Wednesday, February 22, 2012 9:41 PM
To: Steve Shores; brian.larson@kiewit.com; Phebia Williams; Royster, Gregory; Jonathan.Kempfer@kiewit.com; Witte, Mark; Hope, Doug; Greg Pyle; Don Millender; Scott.Rustan@kiewit.com; Dooley, William; Greg Ford; jnorthcott@afco.com; Jessica.Sanders@kiewit.com; Darrell Wodowski; Wood, Christina; Greg Althoff; Rodriguez, Robert
Subject: Final FedEx parking layout 2-22-2012

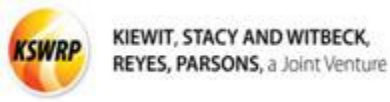
To all,

We made some minor revisions on FedEx parking layout to address several comments we received. See below for the list of revisions.

1. Provide hammer head at the end of the truck parking. With hammer head, we lose one long truck parking, so we add one short one. The total is 82 long and 2 short. The hammer head design is accepted by DFW DPS.
2. Move the sliding gate from west of the vacant lot to east of the lot to provide access to the vacant lot.
3. Chesapeake driveway location move further to the south.

Thank you all for working closely with us FedEx parking re-configuration. We are going to send our 60% design package for you to review and comment in the next two weeks.

Wendong Wang
Kiewit, Stacy and Witbeck, Reyes, Parsons, a Joint Venture
8700 Freeport Parkway Suite 160
Irving, TX 75063
Office- 972-374-4800
Fax- 972-374-4449
Cell- 214-934-5419



From: Wang, Wendong
Sent: Wednesday, February 15, 2012 11:49 PM
To: 'Steve Shores'; brian.larson@kiewit.com; Phebia Williams; groyster@dfwairport.com; Jonathan.Kempfer@kiewit.com; mwitte@dfwairport.com; dohope@dfwairport.com; Greg Pyle; Don Millender; Scott.Rustan@kiewit.com; Dooley, William; Greg Ford; jnorthcott@afco.com; Jessica.Sanders@kiewit.com; Darrell Wodowski; cwood@dfwairport.com; Greg Althoff; Rodriguez, Robert
Subject: RE: revised FedEx parking layout 2-8-2012

Steve,
Thanks for the comments. See below for our response.

Wendong

From: Steve Shores [mailto:sshores@fedex.com]
Sent: Tuesday, February 14, 2012 2:50 PM
To: Wang, Wendong; brian.larson@kiewit.com; Phebia Williams; groyster@dfwairport.com; Jonathan.Kempfer@kiewit.com; mwitte@dfwairport.com; dohope@dfwairport.com; Greg Pyle; Don Millender; Scott.Rustan@kiewit.com; Dooley, William; Greg Ford; jnorthcott@afco.com; Jessica.Sanders@kiewit.com; Darrell Wodowski; cwood@dfwairport.com; Greg Althoff; Rodriguez, Robert
Cc: Steve Shores
Subject: RE: revised FedEx parking layout 2-8-2012

Wendong,

I have just a few questions and comments. Some of these may have been addressed during the last two weeks while I have been out.

1. The employee parking lot does not appear to have a gate and is open to the public. Has the automatic gate and a few visitor parking spaces been eliminated? As we discussed in the last meeting, the new gate will not close, just like the current condition. So no visitor parking needed outside the gate.
2. There is a gate (currently kept open) that is behind the new truck lot. Is this to be permanently locked in its current position? The gate will be locked since the lot adjacent to it is vacant.
3. If so, how does the owner of the vacant lot access his building? If in the future the vacant lot is developed, then the gate can be moved to the east of the vacant lot, so the they still have access to the lot.
4. Is there adequate turnaround radius for fire truck to get in and out of the truck lot? They typically do not allow configurations where they have to stop and back up to get out of a lot. If a larger turnaround is require, it appears some parking spaces will be lost. Besides turnaround, hammerhead is another acceptable configuration at the dead end per International Fire Code. We are currently working with DFW traffic engineer and Fire Department for the final hammer head configuration. Our current design will accommodate 120 ft long hammer head, but DFW recommend 150 ft long hammer head, so it may need minor adjustment to get it finalized.
5. Will you be providing phase drawings that will show how the construction will be staged? This could be helpful for all. Yes, we will provide construction phase drawing for FedEx to review during the design phase.

Steve Shores, PMP
Properties Project Management
3300 Rider Trail South
Suite 350
Earth City, MO 63045
314-770-3620

From: Wang, Wendong [mailto:Wendong.Wang@parsons.com]
Sent: Thursday, February 09, 2012 11:42 AM
To: brian.larson@kiewit.com; Phebia Williams; groyster@dfwairport.com; Jonathan.Kempfer@kiewit.com; mwitte@dfwairport.com; dohope@dfwairport.com; Greg Pyle; Don Millender; Steve Shores; Scott.Rustan@kiewit.com; Dooley, William; Greg Ford; jnorthcott@afco.com; Jessica.Sanders@kiewit.com; Darrell Wodowski; cwood@dfwairport.com; Greg Althoff; Rodriguez, Robert
Subject: revised FedEx parking layout 2-8-2012

Dear All,

I received a few good comments regarding my last layout. Attached are the most updated parking layout and an colored exhibit to show the final configuration of this area to help people visualize. The only revision on the truck parking is the re-arrangement of non-parking spots. Most of the revisions occur at Employee parking to avoid an existing electrical box. Let me know if you have any further questions by end of tomorrow. I hope this is the last version.

Thanks,

Wendong Wang

Kiewit, Stacy and Witbeck, Reyes, Parsons, a Joint Venture

8700 Freeport Parkway Suite 160

Irving, TX 75063

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Fax- 972-374-4449

Cell- 214-934-5419

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

<<REVISED_2-8-12_Fedex Parking Option 2.pdf>> <<Fedex Parking Final Configuration_02-08-2012.pdf>>

From: Wang, Wendong
Sent: Monday, February 06, 2012 3:03 PM
To: 'brian.larson@kiewit.com'; 'pqwilliams@fedex.com'; 'groyster@dfwairport.com'; 'Jonathan.Kempfer@kiewit.com'; 'mwitte@dfwairport.com'; 'dohope@dfwairport.com'; 'glpyle@fedex.com'; 'dcmillender@fedex.com'; 'Clay.Parry@kiewit.com'; 'sshores@fedex.com'; 'Scott.Rustan@kiewit.com'; Dooley, William; 'gregory.ford@fedex.com'; 'jnorthcott@afco.com'; 'Jessica.Sanders@kiewit.com'; 'dgwodowski@fedex.com'; 'cwood@dfwairport.com'
Subject: revised FedEx parking layout 2-6-2012

To All,

Greg Ford pointed out there was one slot lack of 75 ft of clearance. So we made the first parking space on the south side row to be 28 ft parking. We also re-arranged the striping at west end of the parking for better maneuver. I consider this to be the final version if I don't hear any further comments by end of tomorrow.

Thanks,

Wendong Wang

Kiewit, Stacy and Witbeck, Reyes, Parsons, a Joint Venture

8700 Freeport Parkway Suite 160

Irving, TX 75063

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Fax- 972-374-4449

Cell- 214-934-5419

<< OLE Object: Picture (Device Independent Bitmap) >>

<< File: Fedex Parking Option 2_2-6-12.pdf >>

From: Wang, Wendong
Sent: Friday, February 03, 2012 12:44 PM
To: 'brian.larson@kiewit.com'; 'pqwilliams@fedex.com'; 'groyster@dfwairport.com'; 'Jonathan.Kempfer@kiewit.com'; 'mwitte@dfwairport.com'; 'dohope@dfwairport.com'; 'glpyle@fedex.com'; 'dcmillender@fedex.com'; 'Clay.Parry@kiewit.com'; 'sshores@fedex.com'; 'Scott.Rustan@kiewit.com'; Dooley, William; 'gregory.ford@fedex.com'; 'jnorthcott@afco.com'; 'Jessica.Sanders@kiewit.com'; 'dgwodowski@fedex.com'; 'cwood@dfwairport.com'
Subject: revised FedEx parking layout

All,

Attached is the revised FedEx Parking layout plan. The total truck parking is 84 long parking slots. Please let me know if you have any comments.

Thanks,

Wendong Wang

Kiewit, Stacy and Witbeck, Reyes, Parsons, a Joint Venture

8700 Freeport Parkway Suite 160

Irving, TX 75063

Office- 972-374-4800

Fax- 972-374-4449

Cell- 214-934-5419

<< OLE Object: Picture (Device Independent Bitmap) >>

<< File: Fedex Parking layout_2-2-12.pdf >>

Inman, Megan

From: Jonathan.Kempfer@kiewit.com
Sent: Thursday, March 08, 2012 1:00 PM
To: Jhoppie@dart.org
Cc: Smiley, Jerry; abeene@dart.org
Subject: FW: Update Exhibit for Oncor Power Feed to the Airport Water Pumps

John,

After meeting with DFW yesterday, we have supplemented the information regarding the Oncor power feeds to the DFW water pumps below. Please let me know if you have any questions.

Thanks,

Jonathan

From: Jason.Walker
Sent: Thursday, March 08, 2012 12:30 PM
To: Jonathan.Kempfer
Subject: RE: Update Exhibit for Oncor Power Feed to the Airport Water Pumps

Information about the dual feeds into the pump station was given to DFW at yesterday's meeting by Oncor. Ronald Jordan, Auebry Allen, and Chris Campbell were present to explain how the routing of power is through the N. Airfield area. Oncor representative Auebry Allen, showed how each feed ties-into the pump station and how that there would be no effect to the station when work is being done on the power lines. Oncor explained to DFW that they would never be out of service. Also proper notice would be given when work in the area would be happening to give DFW plenty of heads up.

From: JonathanKempfer
Sent: Thursday, March 08, 2012 12:18 PM
To: Jason.Walker
Subject: FW: Update Exhibit for Oncor Power Feed to the Airport Water Pumps

Jason,
Please update the info below based on our meeting yesterday with DFW and shoot back to me. Thx

---

From: JonathanKempfer
Sent: Tuesday, March 06, 2012 1:27 PM
To: 'John Hoppie'
Cc: Allen Beene; Jerry_Smiley@URSCorp.com
Subject: RE: Update Exhibit for Oncor Power Feed to the Airport Water Pumps

John,

Here is a little more information on the Oncor dual feeds.

The water pump station at DFW is fed with dual feeds from the northwest and the southeast. The only time that the Oncor feed from the northwest will be down is when tie-in splicing occurs. There are 2 tie-in splices required that

will take about 4 hours each with the total down time expected to be 1 to 2 days. During that time frame the pump station will be fed from the southeast. This will allow us to work and the pump station will not experience any down time. The other utility relocations in the area will not have an impact to the pump station. Coordination with DFW will be on-going prior to the construction date and a schedule will be made available so that all parties are aware when work will happen .

A representative from Oncor will be at tomorrow's meeting with DFW to explain any additional questions or concerns they may express. I will update you again after that meeting.

Thanks,

Jonathan

From: John Hoppie [mailto:Jhoppie@dart.org]
Sent: Tuesday, March 06, 2012 11:13 AM
To: Jonathan.Kempfer
Cc: Allen Beene; Jerry_Smiley@URSCorp.com
Subject: Re: Update Exhibit for Oncor Power Feed to the Airport Water Pumps

After your meeting we will need a paragraph describing dual feeds, indicating that one feed will remain active continuously, utility relocation will be coordinated with DFW/, downtime will be minimized, etc. (Include any decisions reached at your meeting).

John

>>> <Jonathan.Kempfer@kiewit.com >

3/6/2012

11:02 AM

> > >

John,

Attached is an exhibit showing the dual Oncor feeds into the Airport water pumps. As we understand from Oncor, there is a feed into the pumps from the SE quadrant of the pump site, as well as a feed in from the NW quadrant. While the project will impact the feed from the NW quadrant, there will be no impact to the SE feed from the I-3 Project.

We will be meeting with DFW representatives tomorrow on this topic.

Please let me know if you have any questions.

Thanks,

Jonathan

Inman, Megan

From: Jonathan.Kempfer@kiewit.com
Sent: Thursday, March 15, 2012 7:35 AM
To: Jhoppie@dart.org
Cc: Smiley, Jerry; abeene@dart.org
Subject: FW: AC Tower Height
Attachments: Chesapeake_tower exhibit AC path added.pdf; DFW Aero text (2)-ww-3-13-2012.doc

John,

We have reached conclusion on the coordination with Chesapeake on the SCADA tower at the AC site. Please see below.

Thanks,

Jonathan

From: Wang, Wendong [mailto:Wendong.Wang@parsons.com]
Sent: Thursday, March 15, 2012 12:28 AM
To: Jonathan.Kempfer
Cc: Dooley, William; brian.larson
Subject: FW: AC Tower Height

Jonathan,
Here is the e-mail from Chesapeake to confirm AC tower does not need to be raised. We can close table 2.2 item 13.

Wendong

From: Perry Johnston [mailto:perry.johnston@chk.com]
Sent: Wednesday, March 14, 2012 10:14 PM
To: Wang, Wendong
Cc: Steven Anderson; JJackson@dfwairport.com; Rod Weatherby; Jeff Weides; David Orth
Subject: RE: AC Tower Height

Thanks for the updated exhibit.

I have added the approximate path from the AC tower (should be 340 degrees) and attached the updated document.

Based on the updated elevations shown on this exhibit of 548 feet at the point where the communications path crosses the DART rail line, it will **not** be necessary for the height of the AC tower to be increased by 20 feet. I also believe that the OCS poles will not cause any significant blockage of the path.

If there are any future significant changes to the DART rail design in this area, Chesapeake will need to review the changes to determine if they will impact the communications from this site.

Thanks,

Perry Johnston
Technical Advisor
Chesapeake Energy Corporation

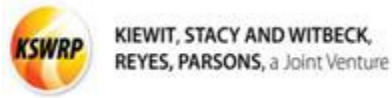
Office: (432) 687-2992 ext. 86150
Mobile: (432) 296-3833
E-Mail: perry.johnston@chk.com

From: Wang, Wendong [mailto:Wendong.Wang@parsons.com]
Sent: Wednesday, March 14, 2012 1:49 PM
To: Perry Johnston
Cc: Steven Anderson; JJackson@dfwairport.com; Rod Weatherby; Jeff Weides; David Orth
Subject: RE: AC Tower Height

Perry,
Please use the attached exhibit to verify if Tower still need to be raised. The elevation is to the top of the DART rail. As you can see, DART alignment is at grade going by Chesapeake Site AC. Let me know if you have any questions.

Thanks,

Wendong Wang
Kiewit, Stacy and Witbeck, Reyes, Parsons, a Joint Venture
8700 Freeport Parkway Suite 160
Irving, TX 75063
Office- 972-374-4800
Fax- 972-374-4449
Cell- 214-934-5419



From: Perry Johnston [mailto:perry.johnston@chk.com]
Sent: Tuesday, March 13, 2012 6:14 PM
To: Wang, Wendong
Cc: Steven Anderson; 'JJackson@dfwairport.com'; Rod Weatherby; Jeff Weides; David Orth
Subject: Re: AC Tower Height

The elevations are top of the bridge structure.

I agree the OCS poles should not be a problem.

Perry Johnston
Mobile (432) 296-3833
Sent from my Blackberry

From: Wang, Wendong [mailto:Wendong.Wang@parsons.com]
Sent: Tuesday, March 13, 2012 04:56 PM
To: Perry Johnston
Cc: Steven Anderson; Jackson, Jim <JJackson@dfwairport.com>; Rod Weatherby; Jeff Weides; David Orth
Subject: RE: AC Tower Height

Perry,

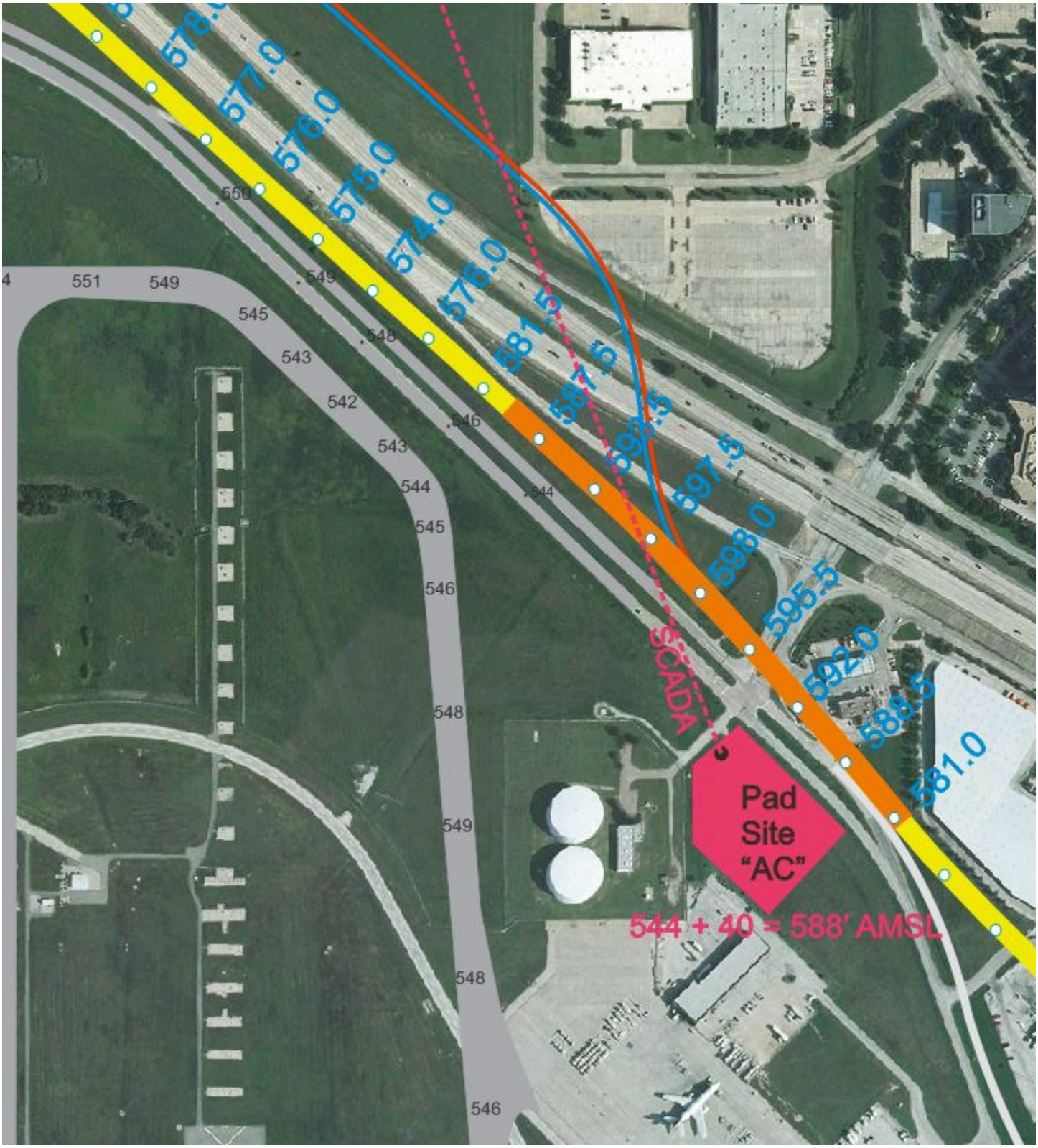
As I told you, the current elevation has changed significantly in this area, we don't have the bridge crossing Freeport anymore. So I will prepare a similar exhibit to show the new elevations. One thing I need to know from you, the elevations shown in your exhibit is the top of bridge structure or top of the OCS pole? I assume it should be top of the bridge, OCS pole is every 240 ft apart, so it should not block any signals. Please confirm.

Thanks,

Wendong

From: Perry Johnston [mailto:perry.johnston@chk.com]
Sent: Tuesday, March 13, 2012 8:16 AM
To: Wang, Wendong
Cc: Steven Anderson; Jackson, Jim; Rod Weatherby; Jeff Weides; David Orth
Subject: RE: AC Tower Height

In June 2010 I was sent the following picture with the elevations shown for the DART rail bridge in the AC pad area. The pink line in the picture represents the path of our communications link. Based on the elevation of the DART rail bridge at 597 ft compared to the elevation of the tower at AC at 588 ft and allowing for proper clearance of the communication path, the recommended height of the tower at the AC pad should be increased by 20 ft.



Perry Johnston
Technical Advisor
Chesapeake Energy Corporation
Office: (432) 687-2992 ext. 86150
Mobile: (432) 296-3833
E-Mail: perry.johnston@chk.com

From: Wang, Wendong [mailto:Wendong.Wang@parsons.com]
Sent: Monday, March 12, 2012 11:24 PM
To: Perry Johnston
Cc: Steven Anderson; Jackson, Jim; Rod Weatherby
Subject: RE: AC Tower Height

Perry,
Per the e-mail I got from Steven, Chesapeake will need to raise the tower for 20 ft. Would you please let us know which part of the DART alignment is in conflict with the tower to trigger this? We would like to get a little more information for the purpose of our design record.

Thanks very much.

Wendong Wang
Kiewit, Stacy and Witbeck, Reyes, Parsons, a Joint Venture
8700 Freeport Parkway Suite 160
Irving, TX 75063
Office- 972-374-4800
Fax- 972-374-4449
Cell- 214-934-5419

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

From: Steven Anderson [mailto:steven.anderson@chk.com]
Sent: Monday, March 12, 2012 1:12 PM
To: Wang, Wendong; 'Jackson, Jim'; Lynne Poole (External); Rod Weatherby
Subject: FW: AC Tower Height

Wendong:

Here is the information I received. The particulars of this system are beyond my knowledge level. I could put you in contact with our “experts” if you desire?

Steven Anderson
Production Superintendent- DFW Field Office - Barnett Shale
Chesapeake Energy Corporation
Office: (972) 456-0800 Ext. 82973
Mobile: (817) 659-0287
E-mail: steven.anderson@chk.com

Chesapeake ENERGY

From: Perry Johnston
Sent: Friday, March 09, 2012 3:08 PM
To: Rod Weatherby; Steven Anderson

Cc: Jeff Weides; David Orth
Subject: RE: AC Tower Height

With the addition of the DART rail in the DFW AC pad area, CHK would require increasing the tower height from 40 feet to 60 feet. The increase in tower height would require to get DFW/FAA approval.

FYI to Jeff W. – All we would do is to move the 1-foot panel antenna (not the entire radio) from the 40 foot level to the 60-foot level. No significant additional load would be added to the tower.

If you require more information , please let me know.

Perry Johnston
Technical Advisor
Chesapeake Energy Corporation
Office: (432) 687-2992 ext. 86150
Mobile: (432) 296-3833
E-Mail: perry.johnston@chk.com

From: Rod Weatherby
Sent: Friday, March 09, 2012 2:56 PM
To: Perry Johnston
Cc: Steven Anderson; Rod Weatherby
Subject: AC Tower Height

Thank you,
Rod Weatherby
Production Foreman
Chesapeake Energy Corporation
Office: 972-456-0800 ext 2958
Cell: 682-478-6670
E-mail: rod.weatherby@chk.com

This email (and attachments if any) is intended only for the use of the individual or entity to which it is addressed, and may contain information that is privileged, confidential and exempt from disclosure under applicable law. If the reader of this email is not the intended recipient, or the employee or agent responsible for delivering this message to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify the sender immediately by return email and destroy all copies of the email (and attachments if any).

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Herman, Reggie

From: Jonathan.Kempfer@kiewit.com
Sent: Friday, March 16, 2012 1:46 PM
To: Jhoppie@dart.org
Cc: Smiley, Jerry; abeene@dart.org
Subject: FW: DART I-3 access road crossing

FYI—DFW ADE concurrence on their alternative construction access to Gate 210.

From: San Miguel, Albert [mailto:asanmigu@dfwairport.com]
Sent: Friday, March 16, 2012 1:14 PM
To: Jonathan.Kempfer; Rodriguez, Robert; Royster, Gregory
Cc: McLaurin, Wade; Haines, Todd; wendong.wang@parsons.com
Subject: RE: DART I-3 access road crossing

This solution meets our needs for construction access to the northeast side of the airfield and sharing this road with construction of the DART alignment is not a problem.
Thank you for your effort and input in getting this issue resolved.

Albert San Miguel
Senior Project Manager
Airport Development and Engineering
DFW International Airport
Office: 972-973-1884
Cell: 817-675-9564

From: Jonathan.Kempfer@kiewit.com [mailto:Jonathan.Kempfer@kiewit.com]
Sent: Friday, March 16, 2012 11:51 AM
To: Rodriguez, Robert; Royster, Gregory
Cc: San Miguel, Albert; McLaurin, Wade; Haines, Todd; wendong.wang@parsons.com
Subject: RE: DART I-3 access road crossing

All,

Thanks for your feedback regarding what is and isn't possible for the DFW construction access to Gate 210 as we continue to work to find a solution that meets everyone's needs. I believe that based on the coordination so far, the best possible scenario will be for KSWRP to construct a construction access road that would run from the DFW water tanks over to the access road leading to Gate 210. This construction access road would closely parallel the DART I-3 alignment. Please see the attached exhibit.

This road would be a crushed concrete base on compacted subgrade construction road only. KSWRP would request use of the access road during construction of the DART alignment in that area of the "pinch point," and would coordinate with DFW as needed to make sure we did not impact its use of the access road for DFW construction operations. This road would be left behind for DFW to use for however long it sees fit.

The tie-in point into the existing access road to Gate 210 would be right where the previously discussed hammer head would have been constructed. I would assume that this new construction access tie-in would serve the same general purpose of the hammer head. We would continue to provide a DPS personnel gate on both sides of the DART ROW as previously agreed.

Please let me know if this solution is feasible for all and any other comments you may have. I hate to press for an immediate answer, but time is so short and we need to move forward quickly with a solution into the Supplemental EA. Please provide comments today if at all possible.

Thank you so much for your ongoing support of this project.

Sincerely,

Jonathan Kempfer
817-2223-8697

From: Rodriguez, Robert [mailto:rrodriguez@dfwairport.com]
Sent: Thursday, March 15, 2012 2:19 PM
To: Jonathan.Kempfer
Cc: San Miguel, Albert; Royster, Gregory; McLaurin, Wade
Subject: FW: DART I-3 access road crossing

Jonathan,

Based on our conversation this morning, please see Albert's email below on why DPS # 3 is not their solution for an access construction gate and route.

Robert Rodriguez, III, P.E.
Civil and Traffic Engineer
Airport Development and Engineering Department
Dallas / Fort Worth International Airport
3003 South Service Road
(P.O. BOX 612008)
DFW Airport, Texas 75261-2008
(T) 972.973-1783
(M) 972.948-7070
(F) 972.973-1780
email: rrodriguez@dfwairport.com

From: San Miguel, Albert
Sent: Thursday, March 15, 2012 1:49 PM
To: Rodriguez, Robert
Subject: DART I-3 access road crossing

Bobby, the reason we don't have the option of using the Fire Station 3 gate for construction access is because DPS will not allow us (safety and response) and when the contractor is ready to go into the AOA at the start of a shift there can be as many as 10 to 15 various construction vehicles and pieces of equipment which would block the road and entrance to the gate. Also, it would be a logistic difficulty to get the vehicles and equipment through the gate and across the airfield in a timely manner when the work is at the taxiways and parallel runways next to the Central Terminal Area, which the currently scheduled projects will be. The nature of the construction work on the AOA and the logistics of getting equipment and workers into the AOA requires that we have enough room to stage the vehicles and equipment prior to going in through the AOA gate. The location of gate 210 and the existing road leading into gate 210 allows us to do this.

Let me know if you have questions.
Thanks,

Albert

From: San Miguel, Albert
Sent: Wednesday, March 14, 2012 10:02 AM
To: Royster, Gregory
Cc: Marincasiu, Vasile; Rodriguez, Robert; Hughes, Lisa
Subject: RE: DART I-3 access road crossing

The concern I raised is that we need to maintain access to gate 210 since this is the only non-terminal AOA gate that we can use to access the east side of the airfield for construction projects. The FAA also uses this gate to access their FAA equipment in the northeast quadrant of the Airport.
A staging area is not the need. The need is to maintaining the use of this gate. The entrance road doesn't have to stay at its present location. A suggestion would be to reroute and extend the road to the water pump station entrance next to Chesapeake's gas well pad AC. This way the access to the AOA gate can be maintained.
The reconstruction of Taxiway L and Runway 17C/35C are schedule to be done in the next two years and access to gate 210 would greatly facilitate this construction.
Let me know if you have questions.
Thanks,

Albert San Miguel
Senior Project Manager
Airport Development and Engineering
DFW International Airport
Office: 972-973-1884
Cell: 817-675-9564

From: Royster, Gregory
Sent: Tuesday, March 13, 2012 6:17 PM
To: San Miguel, Albert
Cc: Marincasiu, Vasile; Rodriguez, Robert; Hughes, Lisa
Subject: DART I-3 access road crossing

Albert,

Last Wednesday at the North Airfield Drive Relocation Meeting held at KSWRP Offices, you raised a concern over restricting access to the access road outside the AOA shown in the attachment. My understanding is this is used by ADE contractors as a staging area. Please confirm. Maintaining this access road would be problematic for traffic flow entering/ exiting North Airfield Drive and raise safety issues with crossing the DART rail.

If a staging area in this vicinity is important, we could work with you to find other staging areas that would not have to cross the DART Rail thereby eliminating traffic safety issues.

<< File: Access off of N. Airfield (Albert SM).pptx >>

Greg J. Royster, P.E.
Senior Airport Planner
Planning Department
DFW INTERNATIONAL AIRPORT
DFW Business Center North Tower
2200 South Service Road
P.O. Box 619428
DFW Airport, Texas 75261-9428
groyster@dfwairport.com
T: 972.973.4677

Before you print, please think about the environment

Herman, Reggie

From: Jonathan.Kempfer@kiewit.com
Sent: Friday, March 16, 2012 1:44 PM
To: Jhoppie@dart.org
Cc: Smiley, Jerry; abeene@dart.org
Subject: FW: DART I-3 access road crossing

FYI—DFW DPS concurrence with alternative construction access to Gate 210.

From: Haines, Todd [mailto:THaines@dfwairport.com]
Sent: Friday, March 16, 2012 1:36 PM
To: Jonathan.Kempfer; Rodriguez, Robert; Royster, Gregory
Cc: San Miguel, Albert; McLaurin, Wade; wendong.wang@parsons.com
Subject: RE: DART I-3 access road crossing

agree

From: Jonathan.Kempfer@kiewit.com [mailto:Jonathan.Kempfer@kiewit.com]
Sent: Friday, March 16, 2012 1:35 PM
To: Haines, Todd; Rodriguez, Robert; Royster, Gregory
Cc: San Miguel, Albert; McLaurin, Wade; wendong.wang@parsons.com
Subject: RE: DART I-3 access road crossing

Todd,

This new construction access would tie-in to the existing access to Gate 210 at roughly the same point we would have provided the hammerhead. I have assumed that it will fulfill the same need as the hammerhead, so the hammerhead should no longer be necessary. Please let me know if you think otherwise.

Thanks,

Jonathan
817-223-8697

From: Haines, Todd [mailto:THaines@dfwairport.com]
Sent: Friday, March 16, 2012 1:30 PM
To: Jonathan.Kempfer; Rodriguez, Robert; Royster, Gregory
Cc: San Miguel, Albert; McLaurin, Wade; wendong.wang@parsons.com
Subject: RE: DART I-3 access road crossing

Will you see a need for the hammerhead anymore or this times in so not needed

Todd

Todd Haines
Planning Chief/Fire Protection Engineer
Dallas/Fort Worth International Airport
Department of Public Safety
Fire Prevention & Planning Division
P.O. Box 610687

DFW Airport, TX 75261
(972) 973-3582 - Office
(972) 948-3754 - Cell

"Failing to plan is planning to fail" - Winston Churchill

From: Jonathan.Kempfer@kiewit.com [mailto:Jonathan.Kempfer@kiewit.com]
Sent: Friday, March 16, 2012 11:51 AM
To: Rodriguez, Robert; Royster, Gregory
Cc: San Miguel, Albert; McLaurin, Wade; Haines, Todd; wendong.wang@parsons.com
Subject: RE: DART I-3 access road crossing

All,

Thanks for your feedback regarding what is and isn't possible for the DFW construction access to Gate 210 as we continue to work to find a solution that meets everyone's needs. I believe that based on the coordination so far, the best possible scenario will be for KSWRP to construct a construction access road that would run from the DFW water tanks over to the access road leading to Gate 210. This construction access road would closely parallel the DART I-3 alignment. Please see the attached exhibit.

This road would be a crushed concrete base on compacted subgrade construction road only. KSWRP would request use of the access road during construction of the DART alignment in that area of the "pinch point," and would coordinate with DFW as needed to make sure we did not impact its use of the access road for DFW construction operations. This road would be left behind for DFW to use for however long it sees fit.

The tie-in point into the existing access road to Gate 210 would be right where the previously discussed hammer head would have been constructed. I would assume that this new construction access tie-in would serve the same general purpose of the hammer head. We would continue to provide a DPS personnel gate on both sides of the DART ROW as previously agreed.

Please let me know if this solution is feasible for all and any other comments you may have. I hate to press for an immediate answer, but time is so short and we need to move forward quickly with a solution into the Supplemental EA. Please provide comments today if at all possible.

Thank you so much for your ongoing support of this project.

Sincerely,

Jonathan Kempfer
817-2223-8697

From: Rodriguez, Robert [mailto:rrodriguez@dfwairport.com]
Sent: Thursday, March 15, 2012 2:19 PM
To: Jonathan.Kempfer
Cc: San Miguel, Albert; Royster, Gregory; McLaurin, Wade
Subject: FW: DART I-3 access road crossing

Jonathan,

Based on our conversation this morning, please see Albert's email below on why DPS # 3 is not their solution for an access construction gate and route.

Robert Rodriguez, III, P.E.
Civil and Traffic Engineer
Airport Development and Engineering Department
Dallas / Fort Worth International Airport
3003 South Service Road
(P.O. BOX 612008)
DFW Airport, Texas 75261-2008
(T) 972.973-1783
(M) 972.948-7070
(F) 972.973-1780
email: rrodriguez@dfwairport.com

From: San Miguel, Albert
Sent: Thursday, March 15, 2012 1:49 PM
To: Rodriguez, Robert
Subject: DART I-3 access road crossing

Bobby, the reason we don't have the option of using the Fire Station 3 gate for construction access is because DPS will not allow us (safety and response) and when the contractor is ready to go into the AOA at the start of a shift there can be as many as 10 to 15 various construction vehicles and pieces of equipment which would block the road and entrance to the gate. Also, it would be a logistic difficulty to get the vehicles and equipment through the gate and across the airfield in a timely manner when the work is at the taxiways and parallel runways next to the Central Terminal Area, which the currently scheduled projects will be. The nature of the construction work on the AOA and the logistics of getting equipment and workers into the AOA requires that we have enough room to stage the vehicles and equipment prior to going in through the AOA gate. The location of gate 210 and the existing road leading into gate 210 allows us to do this.
Let me know if you have questions.
Thanks,

Albert

From: San Miguel, Albert
Sent: Wednesday, March 14, 2012 10:02 AM
To: Royster, Gregory
Cc: Marincasiu, Vasile; Rodriguez, Robert; Hughes, Lisa
Subject: RE: DART I-3 access road crossing

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A staging area is not the need. The need is to maintaining the use of this gate. The entrance road doesn't have to stay at its present location. A suggestion would be to reroute and extend the road to the water pump station entrance next to Chesapeake's gas well pad AC. This way the access to the AOA gate can be maintained.
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Let me know if you have questions.

Thanks,

Albert San Miguel
Senior Project Manager
Airport Development and Engineering
DFW International Airport
Office: 972-973-1884
Cell: 817-675-9564

From: Royster, Gregory
Sent: Tuesday, March 13, 2012 6:17 PM
To: San Miguel, Albert
Cc: Marincasiu, Vasile; Rodriguez, Robert; Hughes, Lisa
Subject: DART I-3 access road crossing

Albert,

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If a staging area in this vicinity is important, we could work with you to find other staging areas that would not have to cross the DART Rail thereby eliminating traffic safety issues.

<< File: Access off of N. Airfield (Albert SM).pptx >>

Greg J. Royster, P.E.
Senior Airport Planner
Planning Department
DFW INTERNATIONAL AIRPORT
DFW Business Center North Tower
2200 South Service Road
P.O. Box 619428
DFW Airport, Texas 75261-9428
groyster@dfwairport.com
T: 972.973.4677

Herman, Reggie

From: Smiley, Jerry
Sent: Tuesday, March 20, 2012 4:29 PM
To: Inman, Megan; Herman, Reggie
Subject: FW: DFW DART track re-alignment

Jerry Smiley, AICP . Vice President
URS Corporation
1950 N. Stemmons Freeway, Suite 6000
Dallas, Texas 75207
214.672.2842 Direct | 214.741.7777 Main | 214.437.2055 Cell

jerry.smiley@urs.com

From: Jonathan.Kempfer@kiewit.com [mailto:Jonathan.Kempfer@kiewit.com]
Sent: Tuesday, March 20, 2012 4:13 PM
To: Jhoppie@dart.org
Cc: Smiley, Jerry; abeene@dart.org; Wendong.Wang@parsons.com; Richard.Compton@jacobs.com; William.Dooley@parsons.com; Steve.Medina@kiewit.com
Subject: Fwd: DFW DART track re-alignment

FYI

Sent from my iPhone

Begin forwarded message:

> **From:** <Missy.Nelson@faa.gov>
> **Date:** March 20, 2012 4:08:35 PM CDT
> **To:** <Jonathan.Kempfer@kiewit.com>
> **Cc:** <Pamela.Durrant@faa.gov>, <Missy.Nelson@faa.gov>
> **Subject: Fw: DFW DART track re-alignment**
>
> Jonathan,
>
> See below for the last comment I received on the DART track re-alignment. FAA agrees that with the new alignment, the LLWAS and ASDEX RU will not have to be relocated. Make sure to work closely with the local SSC for any risk management and equipment outage events. Also, include details in your drawings for the modifications to the LLWAS parking lot.
>
> Let me know if you have any questions.
>
> Thanks,
>
> Missy Nelson
> Lead Planner, NAS Planning & Integration
> North Texas Area

FAA, ATO CSA Service Center
Planning & Requirements Group, AJV-C34
(817) 222-4614 office
(817) 304-0865 cell
(817) 222-4633 fax
missy.nelson@faa.gov

----- Forwarded by Missy Nelson/ASW/FAA on 03/20/2012 03:48 PM -----

From: Julie Horner/ACE/FAA
AJW-C11E, Surv/Weather Eng Ctr - Fort Worth
To: Missy Nelson/ASW/FAA@FAA
Cc: Pamela Durrant/ASW/FAA@FAA, Sheryl Bowers/ASW/FAA@FAA, Frank D Gualillo/AGL/FAA@FAA
Date: 03/16/2012 09:10 AM
Subject: Fw: DFW DART track re-alignment

Missy,
Per Chris Turner, the LLWAS site does not need to be relocated with this new DART track alignment. The ASDEX RU co-located at that site will not need to be relocated either.

However, during the DART construction and Airfield Dr reconstruction, power outages for that site and communication telco for the ASDEX RU will be disrupted. Coordinate the work closely with the local SSC personnel for risk management and equipment outage events.

Thanks,

Julie Horner
Federal Aviation Administration
Surveillance/Weather Engineering Center
Engineering Services, Central Service Area
816-329-3613

----- Forwarded by Julie Horner/ACE/FAA on 03/16/2012 09:03 AM -----

From: Chris M Turner/AMC/FAA
AJW-14A, Weather Processors and Sensors Team
To: Julie Horner/ACE/FAA@FAA
Cc: Frank D Gualillo/AGL/FAA@FAA
Date: 03/14/2012 02:20 PM
Subject: Re: DFW DART track re-alignment

Julie,

After reviewing the documents you provided and speaking with Frank (thanks for all your input Frank), I have determined that the DART rail in the proposed alignment you provided will have no impact on the DFW LLWAS-NE++ (Remote Station #4). The proposed height of the DART rail at the highest point surrounding #4 will be approximately 25 feet at a distance of approximately 1,000 feet away. Adding in the approximate height of a rail car (12.5 feet), that 37.5 feet is more than compensated for by the 100 foot pole currently utilized by DTW LLWAS-NE++ #4.

If you have any further questions, don't hesitate to contact me.

Thanks,

Chris M Turner
Meteorologist, Weather Sensors and Display Systems
FAA AJW-1444
(405) 954-0974

Herman, Reggie

From: Jonathan.Kempfer@kiewit.com
Sent: Monday, March 26, 2012 9:45 AM
To: Jhoppie@dart.org
Cc: Smiley, Jerry; abeene@dart.org; Herman, Reggie; Inman, Megan
Subject: FW: DFW Airport pipeline

John,

Here is the requested feedback from Chesapeake regarding their gas line and confirmation that we are okay to proceed.

Thanks,

Jonathan

From: Jason.Walker
Sent: Monday, March 26, 2012 9:21 AM
To: Jonathan.Kempfer
Subject: FW: DFW Airport pipeline

Encase I sent you the wrong one.

From: Sarah Hodges [mailto:sarah.hodges@chk.com]
Sent: Friday, March 23, 2012 2:50 PM
To: Jason.Walker
Subject: RE: DFW Airport pipeline

Jason,

Okay, I just got off the phone with Chris. All is good. You are cleared to do what you need to do. Chris gave me the back story and in terms of the new road being built, that is part of the stipulations within the Pipeline License that the airport has the right to build over our pipeline.

If you have any questions, comments, or concerns, please feel free to contact me and I will be happy to assist. I apologize for any confusion.

Take care and good luck!

Have a wonderful day!

Sarah Hodges
Sr. Title Agent
Coates Field Service, Inc.
www.coatesfieldservice.com
Contracted by Chesapeake Midstream
Office: (405) 935-2937
Mobile: (405) 933-3722
E-mail: sarah.hodges@chk.com

CM Encroachment

Office: (405) 935-2948
Toll Free: (855) 245-2300
E-mail: CMEncroachment@chk.com

From: Jason.Walker@kiewit.com [mailto:Jason.Walker@kiewit.com]
Sent: Friday, March 23, 2012 2:41 PM
To: Sarah Hodges
Subject: RE: DFW Airport pipeline

Need it by Monday morning. We are planning to start construction in April

---

From: Sarah Hodges [mailto:sarah.hodges@chk.com]
Sent: Friday, March 23, 2012 2:37 PM
To: Jason.Walker
Subject: RE: DFW Airport pipeline

Jason,

I'm going to get legal advice on this one, because we laid our pipeline under exclusive oil & gas lease rights with a Pipeline License agreement from DFW Airport Board. From reading the oil & gas lease and the memorandum of oil & gas lease, it appears we have exclusive rights. However, the Pipeline License agreement doesn't state either way.

I know you're under a deadline, but I need to verify our rights before I can give you a definite answer as to an encroachment agreement. Either way, I would not be able to get the encroachment agreement signed off and approved until next week.

What is your deadline? When are you expecting to start construction on this particular tract?

Thanks,

Sarah

From: Jason.Walker@kiewit.com [mailto:Jason.Walker@kiewit.com]
Sent: Friday, March 23, 2012 1:37 PM
To: Sarah Hodges
Subject:

Jason Walker
D - 972.374.4800
C - 817.897.7924
Jason.Walker@kiewit.com

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Herman, Reggie

From: Jonathan.Kempfer@kiewit.com
Sent: Tuesday, March 27, 2012 2:43 PM
To: Jhoppie@dart.org; SLancaster@dfwairport.com; Smiley, Jerry; Herman, Reggie
Subject: Fwd: Agreement for DFW 4E RTR Access Road

FYI

Sent from my iPhone

Begin forwarded message:

> **From:** <Missy.Nelson@faa.gov>
> **Date:** March 27, 2012 2:36:32 PM CDT
> **To:** <Jonathan.Kempfer@kiewit.com>
> **Cc:** "Royster, Gregory" <groyster@dfwairport.com>, <Doug.Keeffe@faa.gov>, <Curtis.Batie@faa.gov>, <Therrell.Clark@faa.gov>, <William.P.Schmidt@faa.gov>, <Wayne.Sims@faa.gov>, <Pamela.Durrant@faa.gov>, <Missy.Nelson@faa.gov>
> **Subject: Agreement for DFW 4E RTR Access Road**
>
> Jonathan,
>
> The FAA agrees to the following concerning the 4E RTR access road:
>
> 1. Main access for FAA will be utilizing option 2 (this option will NOT require FAA personnel to cross active DART tracks):
>   - access through AOA gate 203
>   - using existing NAVAIDS road to the 17L FFM road
>   - new road to cross under the Hackberry Creek bridge (bridge to be maximum height possible; design to allow for fire truck/emergency vehicle access)
>   - new DART construction road parallel to tracks (DART to leave in place for FAA to use; DFW will maintain these new access roads)
>   - connect to existing 4E access road
>
> 2. Secondary access to be used for large equipment/vehicles & emergencies
>   - access through AOA gate 209
>   - using existing 4E RTR access road
>   - fencing and locked gates across tracks (at grade)
>   - establish standard operating procedures (SOP) for FAA to use this access
>   a) one procedure for scheduled activities requiring large crane or vehicles to access site
>   b) second procedure for emergency situations (this should require a minimum time to access site and an escort through the gates)
>
> Let me know if you have any questions or need additional information.
>
> Thanks,
>
> Missy Nelson
> Lead Planner, NAS Planning & Integration
> North Texas Area

FAA, ATO CSA Service Center
Planning & Requirements Group, AJV-C34
(817) 222-4614 office
(817) 304-0865 cell
(817) 222-4633 fax
missy.nelson@faa.gov

Inman, Megan

From: John Hoppie <Jhoppie@dart.org>
Sent: Thursday, January 19, 2012 10:19 AM
To: Clay.Parry@kiewit.com
Cc: Dan Murphy; Rick K. Compton; Jonathan.Kempfer@kiewit.com; Smiley, Jerry; Inman, Megan
Subject: Re: FW: DART I-3 Supplemental EA - Floodplain Impact Analysis

Clay,

DFW has told us that the Cities are the floodplain administrators. Can you tell me which floodplains we will encroach? See figure 4-15 of the EA. Originally we crossed over Hack bery Creek Flooplain and Grapevine Creek flood plain. Does placing a culvert in the channel automatically mean a floodplain encroachment? It appears the revised alignment move the line out of the Grapevine Creek floodplain although we will be in the channel. We should also consider if the proposed changes to North Airfield Drive and if the changes will encroach the Grapevine Floodpalin or ED -1.

John

>>> "Murphy, Dan" <Dan.Murphy2@jacobs.com> 1/19/2012 10:01 AM >>>
John:

Please see Clay Parry's email below providing information regarding the floodplain analysis. Per Clay's information, KSWRP will be completing the analysis summary soon, immediately followed by the complete report. This information will be provided to you once it has been completed. Please let us know if you have any questions regarding this matter.

Dan Murphy
JACOBS
Environmental Group Manager
817.735.6009 Direct
817.735.6000 Main Office
817.932.2447 Mobile
817.735.6148 Fax Line
Dan.Murphy2@jacobs.com

777 Main Street
Fort Worth, TX 76102
www.jacobs.com

From: Clay.Parry@kiewit.com [mailto:Clay.Parry@kiewit.com]
Sent: Thursday, January 19, 2012 9:03 AM
To: Murphy, Dan; Jonathan.Kempfer@kiewit.com
Cc: jerry.smiley@urs.com; megan.inman@urs.com
Subject: Re: DART I-3 Supplemental EA - Floodplain Impact Analysis

What we are working on is a drainage analysis or "drainage model" for the 4 drainage areas or Box Culverts on the project. A summary will be complete by the end of the week and the complete report will follow shortly after that. I will forward this as soon as I get it from the designers. I believe that the information that you need will be in it. If you think that I am missing something then let me know. If you have an example of what your desired report would look like then please send it but hopefully we are just using a different name for the same info.
I also plan to send this to the flood plain administrators at DFW, Irving, and Grapevine. So far Irving and Grapevine have both told me that DFW has jurisdiction over this area but they will look at our info to be sure and provide any feedback that they can. I don't have any plans to formally document this, just emails. We may need to discuss this further.

From: Murphy, Dan [mailto:Dan.Murphy2@jacobs.com]
Sent: Thursday, January 19, 2012 07:32 AM
To: Clay.Parry; Jonathan.Kempfer
Cc: Smiley, Jerry <jerry.smiley@urs.com>; Inman, Megan <megan.inman@urs.com>
Subject: DART I-3 Supplemental EA - Floodplain Impact Analysis

Clay and Jonathan:

John Hoppie just called me and inquired on the status of the floodplain impact analysis. John asked for us to provide him with the results of the analysis for his use in preparing the Prudent and Reasonable Alternatives section of the Supplemental EA. Do you have readily available information on the analysis that you can provide to John at this time?

Dan Murphy
JACOBS
Environmental Group Manager
817.735.6009 Direct
817.735.6000 Main Office
817.932.2447 Mobile
817.735.6148 Fax Line
Dan.Murphy2@jacobs.com

777 Main Street
Fort Worth, TX 76102
www.jacobs.com

Think Green! Please consider the environment before printing this email.

Inman, Megan

From: Clay.Parry@kiewit.com
Sent: Thursday, January 19, 2012 9:03 AM
To: dan.murphy2@jacobs.com; Jonathan.Kempfer@kiewit.com
Cc: Smiley, Jerry; Inman, Megan
Subject: Re: DART I-3 Supplemental EA - Floodplain Impact Analysis

What we are working on is a drainage analysis or "drainage model" for the 4 drainage areas or Box Culverts on the project. A summary will be complete by the end of the week and the complete report will follow shortly after that. I will forward this as soon as I get it from the designers. I believe that the information that you need will be in it. If you think that I am missing something then let me know. If you have an example of what your desired report would look like then please send it but hopefully we are just using a different name for the same info.
I also plan to send this to the flood plain administrators at DFW, Irving, and Grapevine. So far Irving and Grapevine have both told me that DFW has jurisdiction over this area but they will look at our info to be sure and provide any feedback that they can. I don't have any plans to formally document this, just emails. We may need to discuss this further.

From: Murphy, Dan [mailto:Dan.Murphy2@jacobs.com]
Sent: Thursday, January 19, 2012 07:32 AM
To: Clay.Parry; Jonathan.Kempfer
Cc: Smiley, Jerry <jerry.smiley@urs.com>; Inman, Megan <megan.inman@urs.com>
Subject: DART I-3 Supplemental EA - Floodplain Impact Analysis

Clay and Jonathan:

John Hoppie just called me and inquired on the status of the floodplain impact analysis. John asked for us to provide him with the results of the analysis for his use in preparing the Prudent and Reasonable Alternatives section of the Supplemental EA. Do you have readily available information on the analysis that you can provide to John at this time?

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Dan.Murphy2@jacobs.com

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From: Murphy, Dan
Sent: Wednesday, January 18, 2012 9:57 AM
To: Clay.Parry@kiewit.com
Subject: RE: DART I-3 Supplemental EA

Ok will do. As related to our telecon the other day with Megan regarding the floodplain coordination and permitting activities per FAA requirements, just let me know if you need to have URS and Jacobs involved in the process as you proceed in coordination with John Hoppie. You may recall in John's 1/12 email to Megan Inman providing the FAA Environmental Desk Reference link he indicated that a Public Hearing would need to be conducted. It will be important to confirm these requirements for project scheduling purposes with John because my understanding on the discussion during the FAA meeting was that rather than going straight to a Public Hearing it would be acceptable to advertise (30 day period) the availability of the draft Supplemental EA for public review and comment.

Dan Murphy
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Environmental Group Manager
817.735.6009 Direct
817.735.6000 Main Office
817.932.2447 Mobile
817.735.6148 Fax Line
Dan.Murphy2@jacobs.com

777 Main Street
Fort Worth, TX 76102
www.jacobs.com

From: Clay.Parry@kiewit.com [mailto:Clay.Parry@kiewit.com]
Sent: Wednesday, January 18, 2012 7:19 AM
To: Murphy, Dan
Subject: RE: DART I-3 Supplemental EA

He has nothing to add. Give them to URS.

From: Murphy, Dan [mailto:Dan.Murphy2@jacobs.com]
Sent: Monday, January 16, 2012 5:25 PM
To: Clay.Parry
Subject: RE: DART I-3 Supplemental EA

Clay:

I just got off the phone with Megan and she said that URS is fine with the information they have for the floodplain section of the Supplemental EA and they do not anticipate needing any other informaton from KSWRP at this time. Will you be coordinating with DART (John Hoppie) regarding the floodplain permitting as you move forward with that process?

I'd like to be able to send the meeting notes information from the FTA and FAA meetings to URS soon. Have you determined with Jonathan yet how that information is to be distributed?

Dan Murphy
JACOBS
Environmental Group Manager
817.735.6009 Direct
817.735.6000 Main Office
817.932.2447 Mobile
817.735.6148 Fax Line
Dan.Murphy2@jacobs.com

777 Main Street

Fort Worth, TX 76102
www.jacobs.com

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From: Clay.Parry@kiewit.com [mailto:Clay.Parry@kiewit.com]
Sent: Monday, January 16, 2012 4:14 PM
To: megan.inman@urs.com; Murphy, Dan
Cc: jerry.smiley@urs.com
Subject: RE: DART I-3 Supplemental EA

I'm still available if you guys are.

From: Inman, Megan [mailto:megan.inman@urs.com]
Sent: Monday, January 16, 2012 4:07 PM
To: Murphy, Dan; Clay.Parry
Cc: Smiley, Jerry
Subject: RE: DART I-3 Supplemental EA

Dan and Clay,

I apologize for missing the window for the call. I was leading a conference call from 3-4 on another project. I just spoke to my environmental folks in Austin and they have everything they need. I forwarded the write-ups on the creek crossings and a few other things, so I think we're good to go regarding the floodplains….at least for now. I will let you know ASAP if that changes.

Thanks,
Megan

From: Murphy, Dan [mailto:Dan.Murphy2@jacobs.com]
Sent: Monday, January 16, 2012 3:02 PM
To: Inman, Megan; Clay.Parry@kiewit.com
Subject: DART I-3 Supplemental EA
Importance: High

Megan:

Clay and I would like to conference call with you to discuss your information needs from URS for the floodplain section of the Supplemental EA. Would you please let me know if you can be available for a 3:30 - 4:00 p.m. conference call today. I left you a telephone message regarding this matter as well.

Dan Murphy
JACOBS
Environmental Group Manager
817.735.6009 Direct
817.735.6000 Main Office
817.932.2447 Mobile
817.735.6148 Fax Line
Dan.Murphy2@jacobs.com

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Inman, Megan

From: Clay.Parry@kiewit.com
Sent: Tuesday, January 24, 2012 12:50 PM
To: dan.murphy2@jacobs.com; Inman, Megan; Smiley, Jerry
Subject: RE: Emailing: DART I-3_Hydraulic Report.pdf
Attachments: DART I-3_Hydraulic Report 1-24-2012.pdf

It appears that we have already found an error, here is the revised summary. Please disregard the previous summary and use this one for review.
Thanks
Clay

-----Original Message-----
From: Clay.Parry
Sent: Monday, January 23, 2012 6:02 PM
To: Dan Murphy (dan.murphy2@jacobs.com); Megan Inman; Jerry Smiley
Subject: FW: Emailing: DART I-3_Hydraulic Report.pdf

I have forwarded this summary to Irving, Grapevine, and DFW for coordination. Take a look and see if it has any of the information that you are needing.
Clay

-----Original Message-----
From: Clay.Parry
Sent: Monday, January 23, 2012 5:58 PM
To: Garry Fennell
Cc: Chris Collier
Subject: FW: Emailing: DART I-3_Hydraulic Report.pdf

Here is the Drainage Summary for the 4 proposed Box Culverts on the project. It is not intended to be a complete or even a draft report. It is just a quick summary so that we can start coordination and get some quick feedback while the report is being written. Please let me know your thoughts as quickly as you can so that we can make any adjustments that may be necessary during the drafting of the report.
Thanks
Clay

-----Original Message-----
From: Wang, Wendong [mailto:Wendong.Wang@parsons.com]
Sent: Monday, January 23, 2012 5:12 PM
To: Clay.Parry
Subject: Emailing: DART I-3_Hydraulic Report.pdf

<<DART I-3_Hydraulic Report.pdf>>
The message is ready to be sent with the following file or link attachments:

DART I-3_Hydraulic Report.pdf

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Herman, Reggie

From: Clay.Parry@kiewit.com
Sent: Monday, February 06, 2012 11:46 AM
To: John Hoppie; Smiley, Jerry; Herman, Reggie
Cc: Jonathan.Kempfer@kiewit.com
Subject: FW: Emailing: DART I-3_Hydraulic Report.pdf
Attachments: Header

For your use.

From: John Robertson [mailto:Jrobertson@grapevinetexas.gov]
Sent: Wednesday, January 25, 2012 10:31 AM
To: Clay.Parry
Cc: Deborah Wood; Scott Dyer
Subject: RE: Emailing: DART I-3_Hydraulic Report.pdf

Clay:

Thank you for the information. This appears to all fall within DFW airport jurisdiction.

I would want to see where on the map the existing and proposed WSEL meet up after the HW increase and what potential impacts the proposed increase would have on the adjacent property. I'd also require more detailed modling information and a CD of the models.

However, this is airport jurisdiction and my comments are most likely moot. We don't even have this creek's information on file at the City of Grapevine.

Sincerely,
John

John D. Robertson, P.E.
Manager of Engineering
City of Grapevine
817-410-3136
817-410-3003 (fax)
jrobertson@grapevinetexas.gov

>>> <Clay.Parry@kiewit.com> 1/24/2012 12:48 PM >>>
John, it appears that we have already found an error, here is the revised summary. Please disregard the previous summary and use this one for review.
Thanks
Clay

-----Original Message-----
From: Clay.Parry
Sent: Monday, January 23, 2012 6:00 PM
To: John Robertson
Subject: FW: Emailing: DART I-3_Hydraulic Report.pdf

Here is the Drainage Summary for the 4 proposed Box Culverts on the project. It is not intended to be a complete or even a draft report. It is just a quick summary so that we can start coordination and get some quick feedback while the report is being written. Please let me know your thoughts as quickly as you can so that we can make any adjustments that may be necessary during the drafting of the report.
Thanks
Clay

-----Original Message-----
From: Wang, Wendong [mailto:Wendong.Wang@parsons.com]
Sent: Monday, January 23, 2012 5:12 PM
To: Clay.Parry
Subject: Emailing: DART I-3_Hydraulic Report.pdf

<<DART I-3_Hydraulic Report.pdf>>
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attachments:

DART I-3_Hydraulic Report.pdf

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Herman, Reggie

From: Clay.Parry@kiewit.com
Sent: Monday, February 06, 2012 11:46 AM
To: John Hoppie; Smiley, Jerry; Herman, Reggie
Cc: Jonathan.Kempfer@kiewit.com
Subject: FW: Drainage Model Study
Attachments: Grapevine LOMR.PDF; LOMR Profile.PDF; Header

For your use.

From: Garry Fennell [mailto:gfennell@cityofirving.org]
Sent: Wednesday, January 18, 2012 3:14 PM
To: Clay.Parry
Cc: Christopher Chouffet; Daniel Vedral
Subject: RE: Drainage Model Study

Clay,
Attached is the 2005 LOMR for DFW Airport. The FEMA study ends before you get to the SH114 bridge on Grapevine Creek. The last page of the LOMR shows this on the map and in the LOMR profile (separately attached) you will notice that the SH114 bridges are not shown.
The City of Irving has no jurisdiction upstream of the studied floodplain and no building permits will be required from the City.
I did check the preliminary 2010 FIRM maps for Dallas County and the City of Irving, and the floodplain is shown the same as the attached LOMR.
Thanks,
Garry

From: Clay.Parry@kiewit.com [mailto:Clay.Parry@kiewit.com]
Sent: Wednesday, January 11, 2012 10:54 AM
To: Garry Fennell; Chris Collier
Cc: wendong.wang@parsons.com; Amir.Shammet@parsons.com
Subject: FW: Drainage Model Study

Garry or Chris can you help us with this. Do you know who prepared the report discussed below and shown in the attachments or do you have a copy that you can send us.
Thanks
Clay

From: Erskine, Russell [mailto:rerskine@Halff.com]
Sent: Wednesday, January 11, 2012 10:12 AM
To: Clay.Parry
Cc: Amir.Shammet@parsons.com; wendong.wang@parsons.com
Subject: RE: Drainage Model Study

Clay,

I'm still waiting to hear from a few others, but from the way it sounds, this LOMR was prepared by someone else. You may need to contact Irving (Garry Fennell) to see what he can tell/give you or make a formal request to FEMA for the models.

Sorry I can't be of more help. If I hear anything differently from the others I am waiting on, I'll let you know.

Russell

From: Clay.Parry@kiewit.com [mailto:Clay.Parry@kiewit.com]
Sent: Tuesday, January 10, 2012 6:52 PM
To: Erskine, Russell
Cc: Amir.Shammet@parsons.com; wendong.wang@parsons.com
Subject: Drainage Model Study

Russell looks like I need help again.
Looks like there is some new Drainage Model information available since we last emailed you about the DART I-3 Project. The designers are telling me that Halff did the work. Do you think you could help us get a copy. We are presently designing this work and could really use the help.
Thanks
Clay

From: Shammet, Amir [mailto:Amir.Shammet@parsons.com]
Sent: Tuesday, January 10, 2012 9:34 AM
To: Clay.Parry
Cc: Wang, Wendong
Subject: FW: DRAT I-3

Clay,

Please check the attachment regarding revisions for FEMA studies in the City of Irving.

Would you please check if you can help us obtain the revised hydraulic study and models (HEC-RAS) for:

Hackberry-Trib-3 Creek,
Mud Springs creek,
Hackberry Creek, and
Grapevine Creek.

Thanks

Amir Shammet, P.E.
PARSONS
(972) 374-4872 (KSWRP)
(972) 244-6045 (Richardson)
www.parsons.com

APPENDIX C – FINAL H&H REPORT

DART

IRVING/DFW CORRIDOR

LINE SECTION I-3

HYDRAULIC REPORT

HACKBERRY CREEK – TRIBUTARY 3

Prepared for:

Dallas Area Rapid Transit

DALLAS, TEXAS

DRAFT

February 2012

Prepared by:

BRIDGEFARMER & ASSOCIATES, INC.

Registration No. 264

TABLE OF CONTENTS

INTRODUCTION

The purpose of this study is to determine the length, location and elevation of the proposed Phase 1 DART Light Rail Transit – Line Section I-3, culvert at the crossing of Hackberry Creek Tributary 3 that is required to pass the discharge of a storm event with a probability of exceedance of 1% in any given year (100 year storm) without excessive velocity or harmful backwater effects.

For this particular location, it is proposed to have two (8' by 6') box culverts, along with some grading needed to level the bottom of the channel. This culvert will meet DARTs current design standards and will help to optimize the operational efficiency of the facility. The culvert headwalls will be extended to an elevation that will allow for 3:1 side slopes from the ballasts.

The structure will be analyzed to pass the 100 year storm event, to ensure that there will be no adverse effects to adjacent property, cause any rise in floodplain elevation, reduce any capacity or impede the movement of floodwater within the stream due to its placement.

Project Location

Phase 1 of the DART Light Rail Transit System crosses Belt Line Road from the east and enters the north end of the DFW Airport continuing south where it terminates at DFW airport (terminal A). See Appendix for Location Map

The proposed DART Light Rail Transit System – Line Section I-3 will cross Hackberry Creek Tributary 3 at the eastern boundary of the DFW Airport, southwest from the intersection of Cabell Drive and North Belt Line Road, approximately ¾ of a mile south of SH 114 and ½ a mile west of North Belt Line Road.

Proposed Structure

The proposed structure will be an 2-8’ by 6’ multiple box culvert, with a total span width and the length of 17.32’ and 73’, respectively. The plan sheet with the culvert layout is shown in Exhibit EX1-1-3.

FEMA

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the proposed project site is located outside of the regulated FEMA floodplain (Dallas County, Texas and Incorporated Areas, Map Number 48113C0165J dated August 23, 2001).

HYDROLOGY

Drainage Area

This portion of the Hackberry Creek Tributary 3 watershed entails the region located just east of the DFW Airport. The drainage area includes industrial/commercial as well as open grass area, with an approximate size of 64.14 acres. See Exhibit EX1-1-1.

Design Discharge

The discharge (Q) for the 100 year frequency for this segment of Hackberry Creek Tributary 3 was calculated based on the Rational Method since the drainage area is less than 200 acres. The time of concentration used in the Rational Method was calculated based on existing conditions, and DFW Airport future land use. The land use consist of mostly aviation related uses with some industrial, local retail, garden office, and restaurant. The calculated time of concentration exceeded the “maximum inlet time” from DART design Standards, therefore the maximum time of concentration of 20 minutes will be used. The 10% Preliminary Design study

was provided from CP&Y Engineering, this study includes the existing storm drain system and have a slightly higher discharge. Therefore, CP&Y calculated discharge value will be used in this HEC-RAS model. See Table 1.

Table 1: Hackberry Creek Tributary Discharge

Return Period (Year)	Rational Method (cfs)	*Supplied from CP&Y (cfs)
Q_{100}	266	271

HYDRAULICS

Model Development

Survey information was provided by Kiewit Construction Inc, and was used to prepare cross sections extending 150 feet upstream and downstream of proposed crossing along Hackberry Creek. Additional cross section points were taken every 100' for an additional 300'. The updated survey information was then executed using the U.S. Army Corps of Engineers (USACOE) River Analysis System program, version HEC-RAS 4.0. The downstream boundary condition used to develop the water surface profile came from the model obtained from DART 10% Design; which used a water surface elevation of 484.10 (see CP&Y report). The schematic for the cross-section layout for this segment of Hackberry Creek Tributary 3 is shown in Exhibit EX1-1-2.

Existing Condition

Recently obtained survey data of the existing floodway conditions depicts a V-shaped channel with approximately 4:1 side slopes. The existing floodplain is a fairly well defined with grassy overgrown vegetation in the overbank region. Therefore, the Manning's value used in this

analysis was 0.030 and 0.040, respectively. The existing water surface elevations, representative of the headwater and tailwater locations without the proposed culvert, are shown in Table 2.

Proposed Condition

The existing HEC-RAS model was modified to show the proposed DART I-3 track and proposed culvert crossing at Hackberry Creek. A proposed 2 – 8' by 6' box culvert was used to satisfy DART design requirements based on the 100 year design criteria. The DART requirements were met by not raising the water surface elevation upstream of the crossing by more than 0.31' comparing the existing and proposed HEC-RAS models. Rip rap protection was used to an elevation above the 100 year water surface elevation to prevent encroachment into the subballast material of the proposed track. The water surface elevations are recorded in Table 2 for comparison for the tailwater and headwater of the proposed culvert. The existing and proposed water surface elevations of the modeled reach are displayed in Exhibit EX1-1-4.

Table 2. Comparison Water Surface Elevation at the Proposed Project Site on Hackberry Creek Tributary 3 at the DART I-3 Crossing

Channel Station	Existing Condition 100 Year WSE (ft)	Proposed Condition 100 Year WSE (ft)	Difference (ft)
US Face (HW) – 1051.902	489.72	490.03	+0.31
DS Face (TW) – 978.397	488.78	489.09	+0.31

Design Velocity

Table 3 below shows the comparison of the outfall velocities for existing versus proposed condition. There is a slight decrease in the channel velocities.

Table 3. Flow Velocity Comparison for the 100 Year Flood Frequency

Location	Existing Condition Velocity (ft/s)	Proposed Condition Velocity (ft/s)
US Face (HW) – 1051.902	3.84	4.91
DS Face (TW)– 978.397	6.54	5.25

PROPOSED STRUCTURE

Impact of Proposed Structure

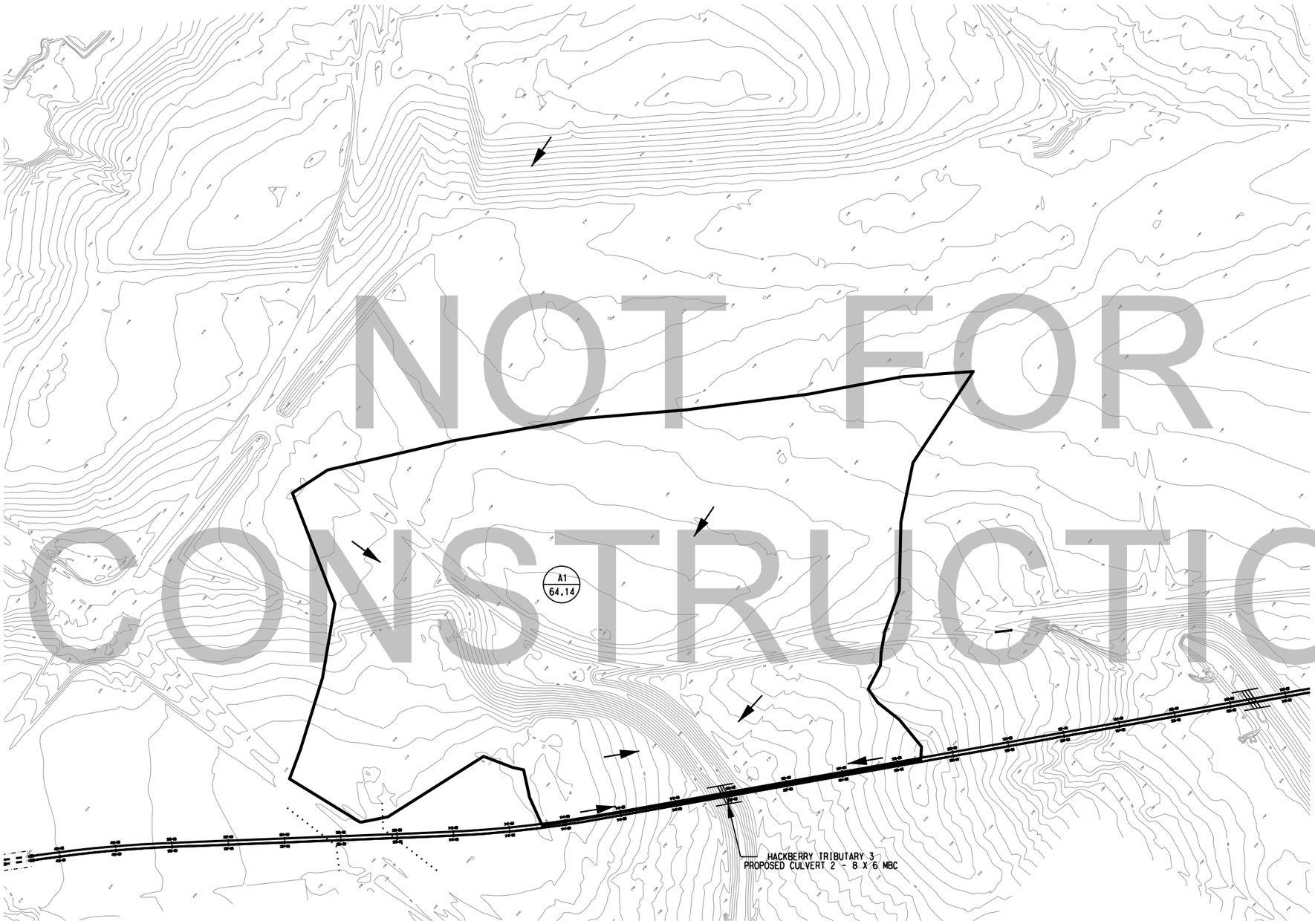
The HEC-RAS analysis of the proposed bridge class box culvert will provide a sufficient hydraulic opening for the conveyance of the stream flow with respect to the 100 year frequency discharge. Although the proposed DART I-3 crossing will slightly impact the water surface elevation, the conditions stipulated by FEMA are still maintained and the proposed construction will have only a negligible effect on the delineation of the 100 year floodplain area as shown in Exhibit EX1-1-3. Under these circumstances, no formal coordination with FEMA is normally required. However, the local floodplain administrator will be sent a copy of this report as well as other supporting documentation relevant to the approval process prior to project construction.

CONCLUSION

The proposed crossing on the DART I-3 at Hackberry Creek adequately Tributary 3 conveys the 100 year design discharge and does not significantly increase the base flood elevation. Therefore the construction of the proposed structure will have no adverse effects on the people and properties in the surrounding area.

Exhibits

DWG No.



SCALE (IN FEET)
0 100 200 400

LEGEND

- PROPOSED CASING
- CENTERLINE OF DITCH
- X-X / X.XX — DRAINAGE AREA NUMBER / DRAINAGE AREA ACRES
- MAJOR DRAINAGE AREA BOUNDARY
- MINOR DRAINAGE AREA BOUNDARY
- DRAINAGE FLOW
- PROPOSED STORM DRAINAGE
- 100 YR FLOOD LIMITS
- ROCK RIPRAP

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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CONSULTING ENGINEERS
DALLAS ◉AUSTIN
REGISTRATION NO. 264

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE
DRAWN
DESIGNED
CHECKED
IN CHARGE
DATE

CAES

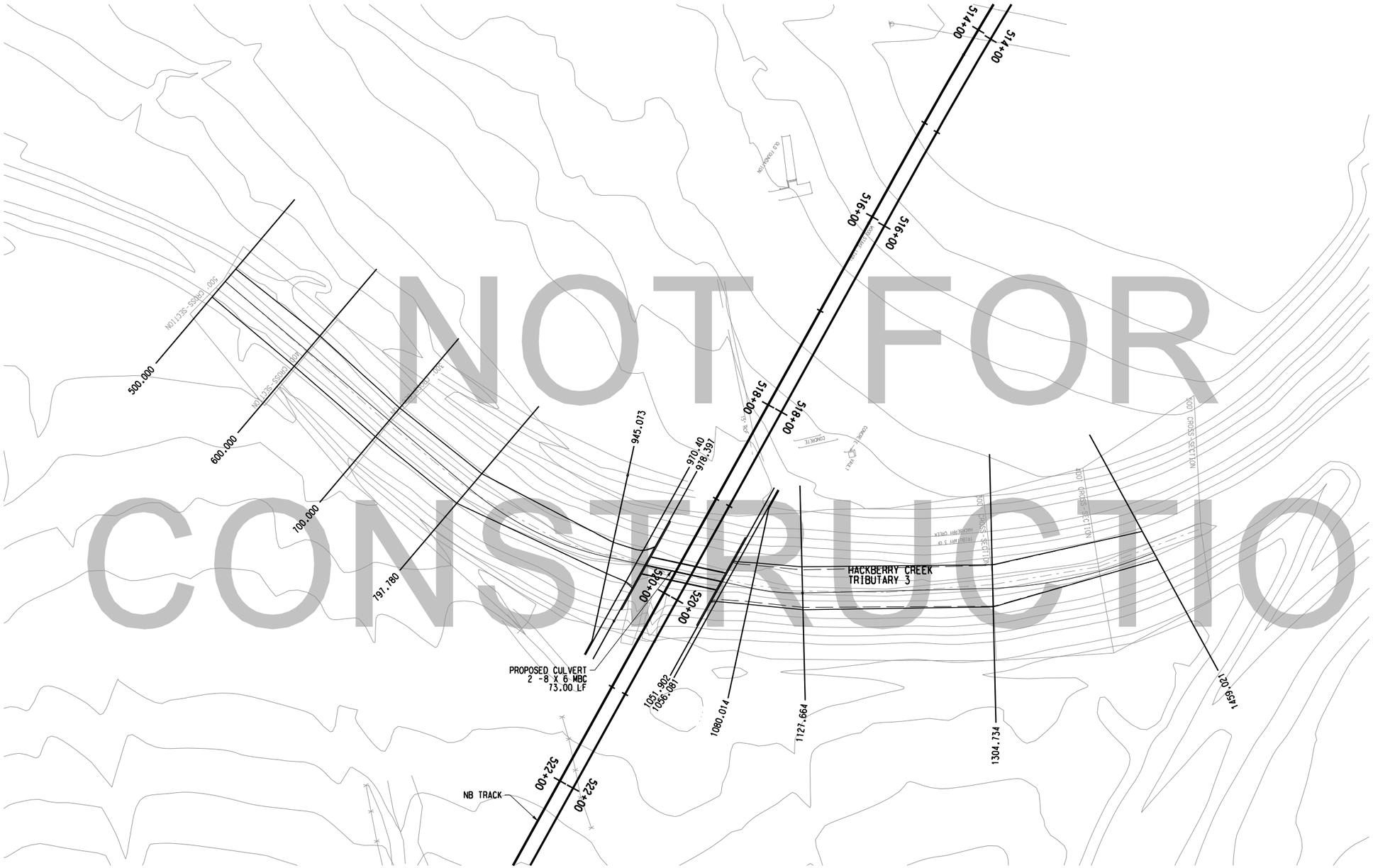
CONTRACT SHEET No. OF

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

DRAINAGE AREA
HACKBERRY TRIBUTARY 3

CONTRACT C-1018691-01 | DWG No. EX1-1-1 | REV B

DWG No.



REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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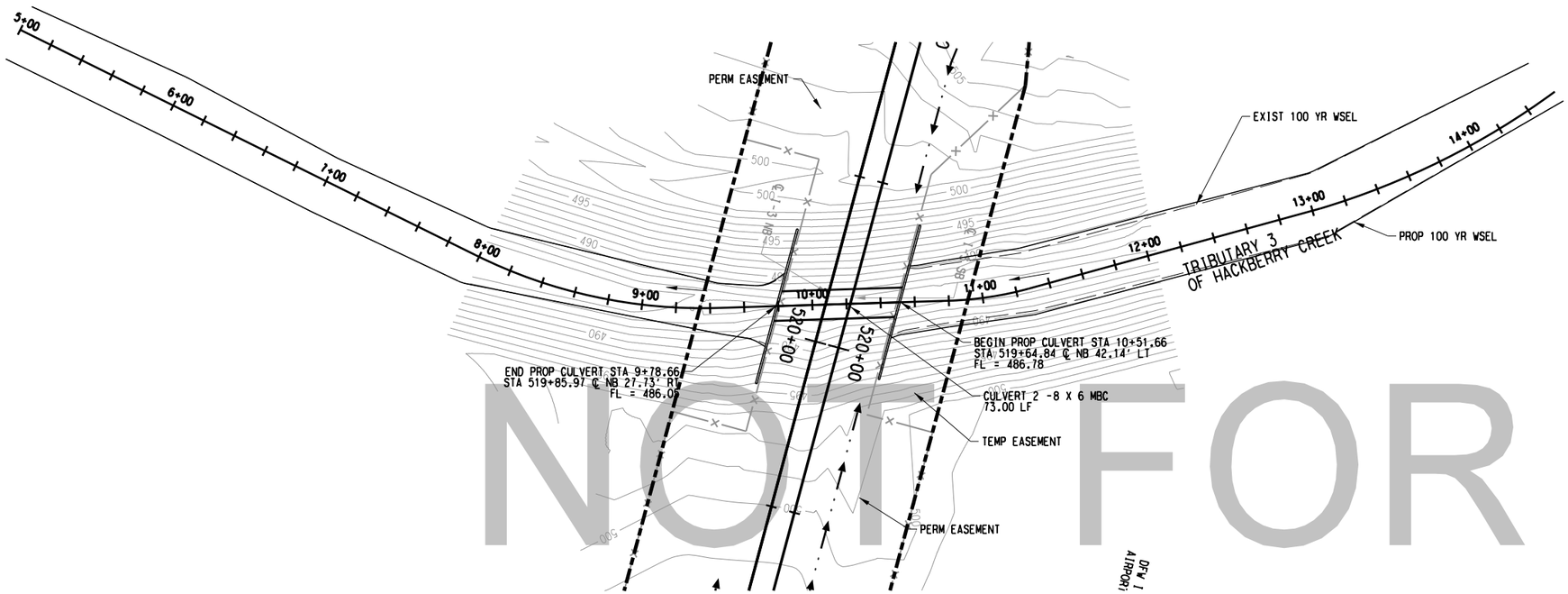
CONTRACT SHEET No. OF

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

CULVERT 520+00 EXHIBIT
HACKBERRY
TRIBUTARY 3

CONTRACT C-1018691-01
DWG No. EX1-1-2
REV

DWG No. EX1-1-3

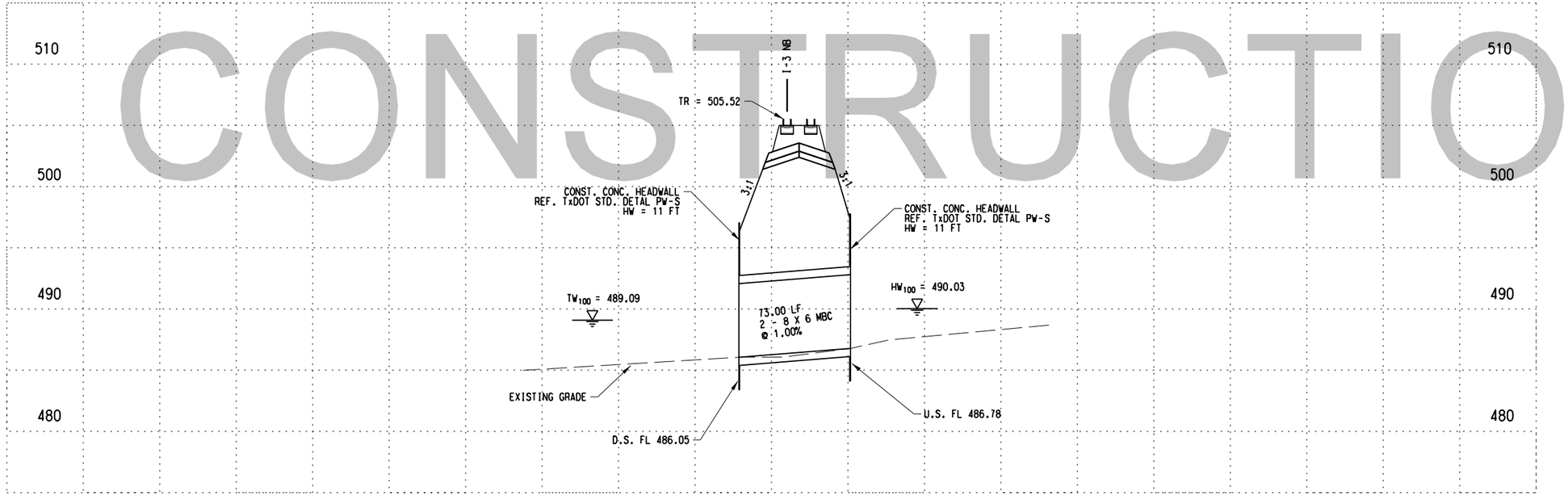


SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

LEGEND

- PROPOSED CASING
- CENTERLINE OF DITCH
- PROPOSED 100 YR WSEL
- EXIST 100 YR WSEL

HYDRAULIC DATA			
EXISTING		PROPOSED	
100 YR		100 YR	
Q (CFS)	271	Q (CFS)	271
V (FPS)	6.54	V (FPS)	5.25
HW ELEV.	489.72	HW ELEV.	490.03
TW ELEV.	488.78	TW ELEV.	489.09



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KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE
DRAWN
DESIGNED
CHECKED
IN CHARGE
DATE

CAES

PARENT PERMIT No.#####
CHILD PERMIT No.#####

CONTRACT SHEET No. OF

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

CULVERT STA 520+00
PLAN AND PROFILE

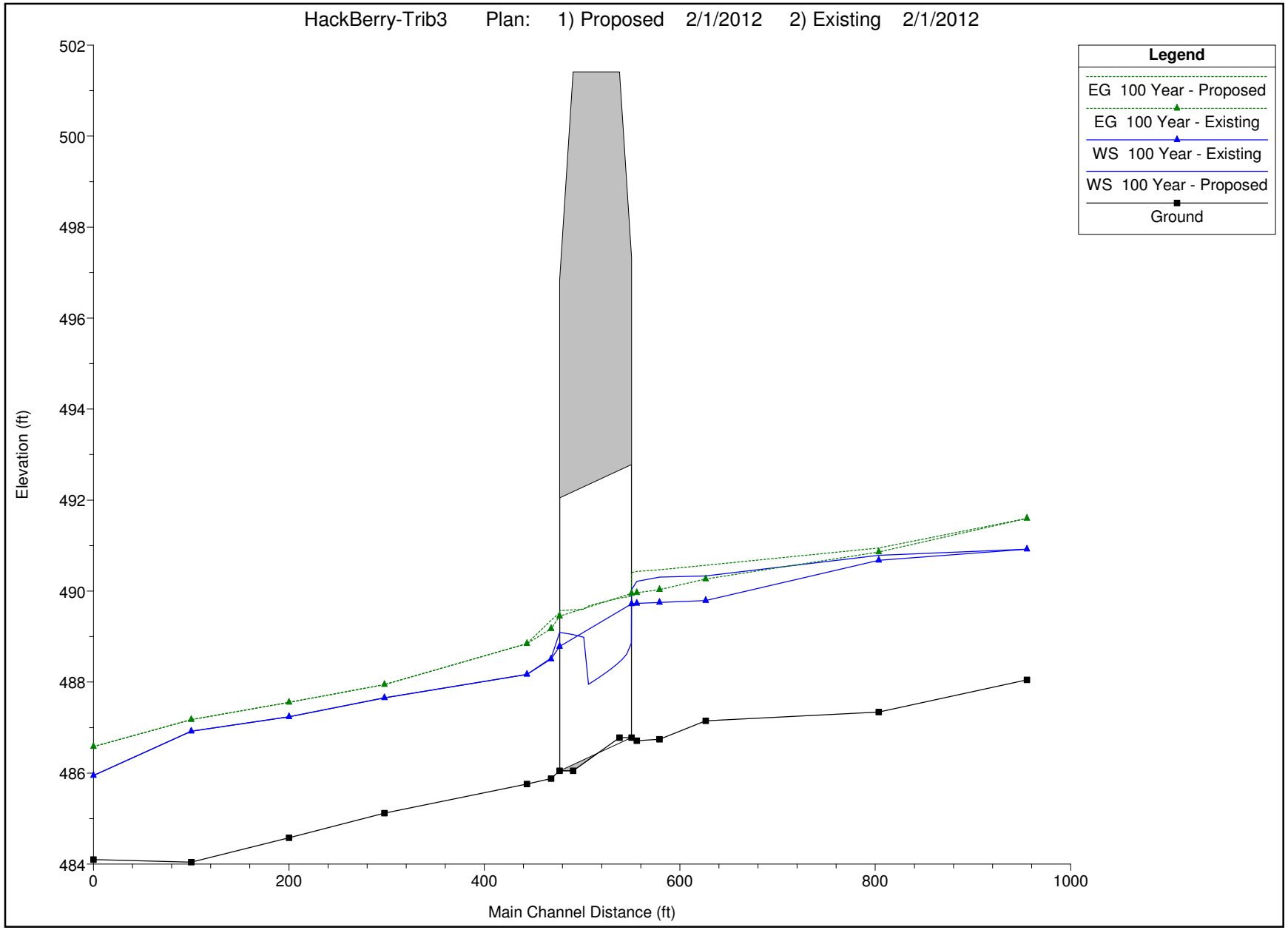
CONTRACT	DWG No.	REV
C-1018691-01	EX1-1-3	

HEC-RAS River: 153 Reach: CUL520 Profile: 100 Year

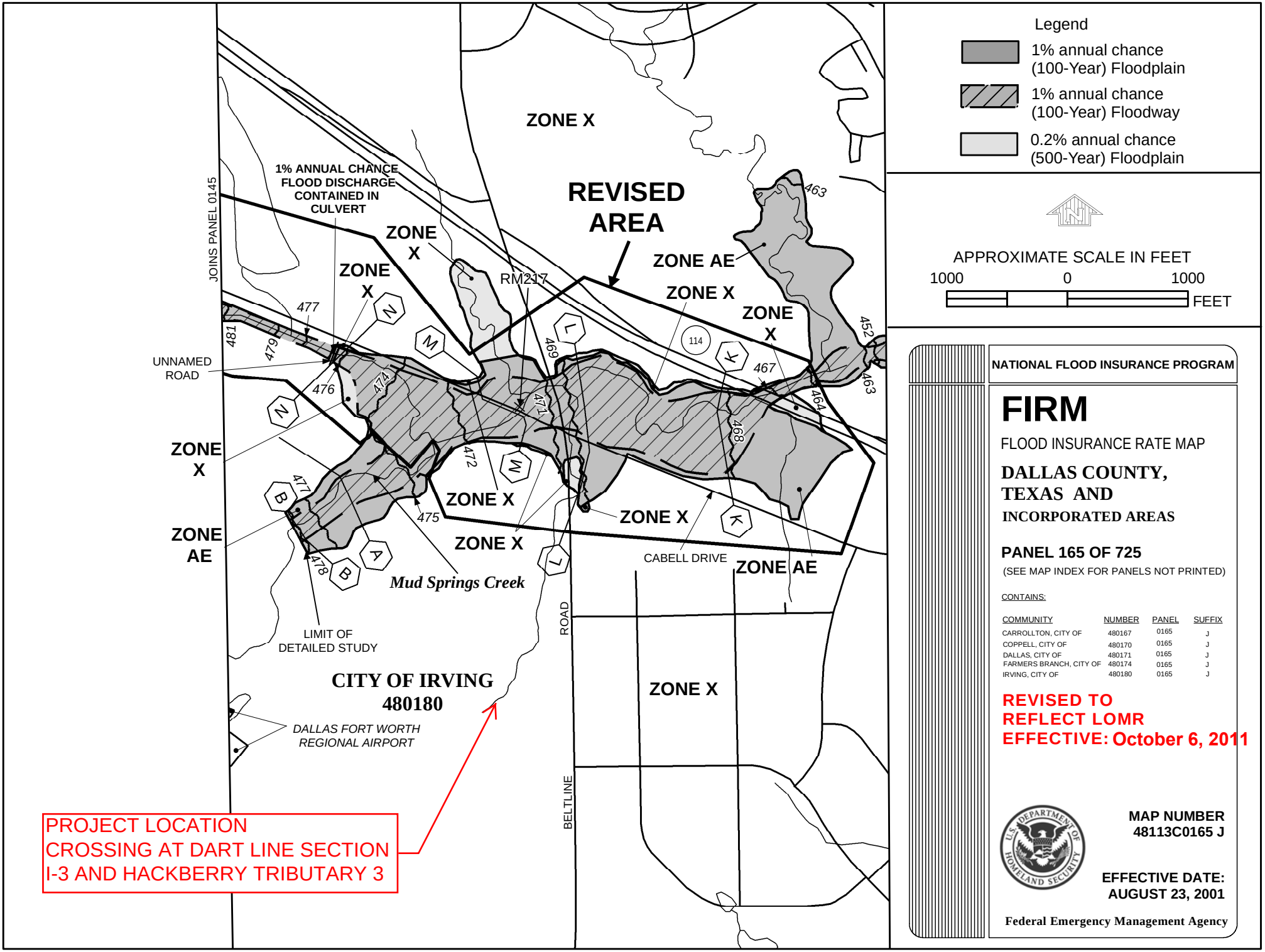
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
CUL520	1459.021	100 Year	Proposed	271.00	488.05	490.92	490.92	491.60	0.012128	6.61	40.98	30.02	1.00
CUL520	1459.021	100 Year	Existing	271.00	488.05	490.92	490.92	491.60	0.012128	6.61	40.98	30.02	1.00
CUL520	1304.734	100 Year	Proposed	271.00	487.34	490.79		490.95	0.001593	3.24	83.68	39.11	0.39
CUL520	1304.734	100 Year	Existing	271.00	487.34	490.68		490.86	0.001832	3.41	79.46	38.18	0.42
CUL520	1127.664	100 Year	Proposed	271.00	487.15	490.33		490.57	0.003051	3.90	69.42	40.02	0.52
CUL520	1127.664	100 Year	Existing	271.00	487.15	489.79		490.26	0.007989	5.50	49.25	34.95	0.82
CUL520	1080.014	100 Year	Proposed	271.00	486.74	490.31		490.47	0.001563	3.22	84.27	39.26	0.39
CUL520	1080.014	100 Year	Existing	271.00	486.74	489.75		490.03	0.003320	4.25	63.78	34.46	0.55
CUL520	1056.081	100 Year	Proposed	271.00	486.71	490.21		490.43	0.001435	3.77	71.79	42.25	0.39
CUL520	1056.081	100 Year	Existing	271.00	486.71	489.73		489.96	0.002704	3.86	70.28	37.75	0.50
CUL520	1051.902	100 Year	Proposed	271.00	486.78	490.03	488.78	490.41	0.002041	4.91	55.17	43.61	0.48
CUL520	1051.902	100 Year	Existing	271.00	486.70	489.72		489.95	0.002668	3.84	70.65	37.88	0.49
CUL520	1000			Culvert									
CUL520	978.397	100 Year	Proposed	271.00	486.05	489.09	488.05	489.52	0.002554	5.25	51.57	44.27	0.53
CUL520	978.397	100 Year	Existing	271.00	486.05	488.78	488.78	489.45	0.012552	6.54	41.46	31.90	1.01
CUL520	970.040	100 Year	Proposed	271.00	485.88	488.53	488.53	489.36	0.011412	7.31	37.09	31.98	1.00
CUL520	970.040	100 Year	Existing	271.00	485.88	488.51	488.51	489.17	0.012562	6.55	41.38	31.76	1.01
CUL520	945.073	100 Year	Proposed	271.00	485.76	488.17	488.15	488.84	0.011681	6.59	41.15	29.63	0.98
CUL520	945.073	100 Year	Existing	271.00	485.76	488.17	488.15	488.84	0.011681	6.59	41.15	29.63	0.98
CUL520	797.780	100 Year	Proposed	271.00	485.12	487.65		487.95	0.003791	4.35	62.28	35.99	0.58
CUL520	797.780	100 Year	Existing	271.00	485.12	487.65		487.95	0.003791	4.35	62.28	35.99	0.58
CUL520	700.000	100 Year	Proposed	271.00	484.58	487.23		487.56	0.004202	4.55	59.62	34.83	0.61
CUL520	700.000	100 Year	Existing	271.00	484.58	487.23		487.56	0.004202	4.55	59.62	34.83	0.61
CUL520	600.000	100 Year	Proposed	271.00	484.04	486.92	486.14	487.18	0.003138	4.07	66.65	37.01	0.53
CUL520	600.000	100 Year	Existing	271.00	484.04	486.92	486.14	487.18	0.003138	4.07	66.65	37.01	0.53
CUL520	500.000	100 Year	Proposed	271.00	484.10	485.95	485.95	486.58	0.012602	6.38	42.50	34.26	1.01
CUL520	500.000	100 Year	Existing	271.00	484.10	485.95	485.95	486.58	0.012602	6.38	42.50	34.26	1.01

EX1-1-4:Hackberry Creek Tributary 3

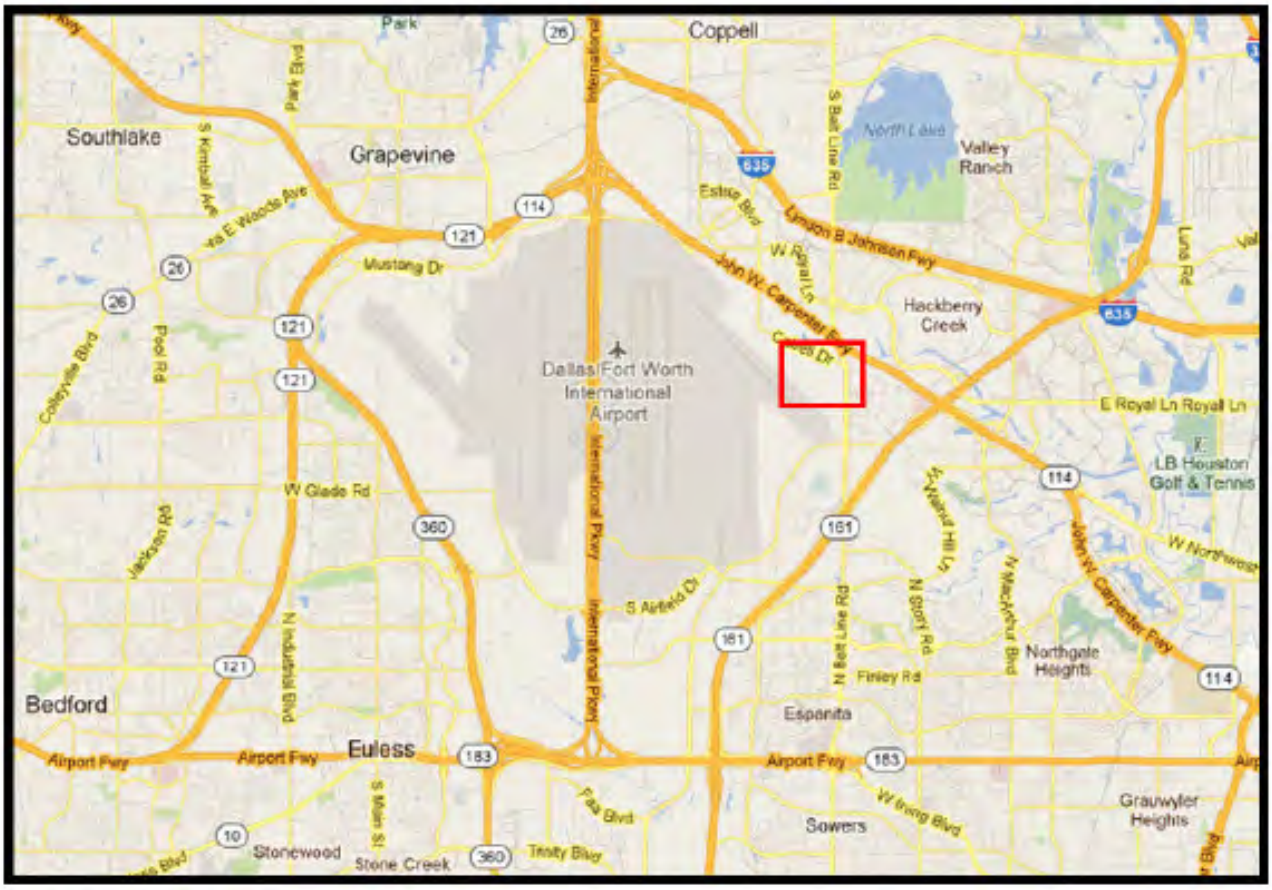
HEC-RAS Output Summary



EX1-1-5:Hackberry Creek Tributary 3
HEC-RAS Profile


ZONE X
1% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
REVISED AREA
ZONE AE
ZONE X
ZONE X
ZONE X
ZONE X
JOINS PANEL 0145
RM217
UNNAMED ROAD
ZONE X
ZONE AE
ZONE X
ZONE X
ZONE X
ZONE X
ZONE AE
CABELL DRIVE
Mud Springs Creek
LIMIT OF DETAILED STUDY
CITY OF IRVING
480180
DALLAS FORT WORTH REGIONAL AIRPORT
ROAD
BELTLINE
ZONE X
PROJECT LOCATION
CROSSING AT DART LINE SECTION
I-3 AND HACKBERRY TRIBUTARY 3
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
1000 0 1000
FEET
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
DALLAS COUNTY, TEXAS AND
INCORPORATED AREAS
PANEL 165 OF 725
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
CARROLLTON, CITY OF 480167 0165 J
COPPELL, CITY OF 480170 0165 J
DALLAS, CITY OF 480171 0165 J
FARMERS BRANCH, CITY OF 480174 0165 J
IRVING, CITY OF 480180 0165 J
REVISED TO REFLECT LOMR EFFECTIVE: October 6, 2011
MAP NUMBER 48113C0165 J
EFFECTIVE DATE: AUGUST 23, 2001
Federal Emergency Management Agency

Appendix



Location Map: Hackberry Creek Tributary 3

Hackberry Trib 3

Sheet flow

	Segment ID	AB
1. Surface description		short grass
2. Manning's roughness coefficient, n		0.450
3. Flow length, L	ft	200
4. Two-year 24-hour rainfall, P_2	in	4.0
5. Land slope, s	ft/ft	0.010
6. $T_t = 0.007\ (n\ L)^{0.8} / P_2^{0.5}\ s^{0.4}$	hr	0.81

Shallow concentrated flow

	Segment ID	BC
7. Surface description (paved or unpaved)		unpaved
8. Flow length, L	ft	1350
9. Watercourse slope, s	ft/ft	0.015
10. Average velocity, V	ft/s	2.0
11. $T_t = L / 3600\ V$	hr	0.19

Channel flow

	Segment ID	DE
12. Cross sectional flow area, a	ft^2	30
13. Wetted perimeter, pw	ft	40.0
14. Hydraulic radius, r = a / pw	ft	0.750
15. Channel slope, s	ft/ft	0.010
16. Manning's roughness coefficient, n		0.030
17. $V = 1.49\ r^{2/3}\ s^{1/2} / n$	ft/s	4.10
18. Flow length, L	ft	600
19. $T_t = L / 3600\ V$	hr	0.04

20. Time of concentration (Tc)	hr	1.039

The maximum time of concentration of 20 mins will be used.

Discharge		Q = CiA	
	C =	0.60	
	i =	6.9	in/hr
	A =	64.14	ac
Therefore the Discharge (Q) =		266	cfs

Inputs										
Return Period (yr)	Intensity (in/hr)					Factored Intensity (in/hr)				
	5	10	15	30	60					
2	6.00	5.04	4.30	3.02	1.95	72.00	30.24	17.20	6.04	1.95
5	6.96	5.88	5.00	3.64	2.42	83.52	35.28	20.00	7.28	2.42
10	7.68	6.48	5.52	4.10	2.75	92.16	38.88	22.08	8.20	2.75
25	8.88	7.44	6.32	4.76	3.22	106.56	44.64	25.28	9.52	3.22
50	9.72	8.16	6.96	5.28	3.59	116.64	48.96	27.84	10.56	3.59
100	10.56	8.88	7.56	5.80	3.96	126.72	53.28	30.24	11.60	3.96

INTERMIDIATE DURATION AND RETURN PERIODS

10 & 30 Minute Relations

10 min value = 0.59(15-min value) + 0.41(5-min value)

30 min value = 0.49(15-min value) + 0.51(5-min value)

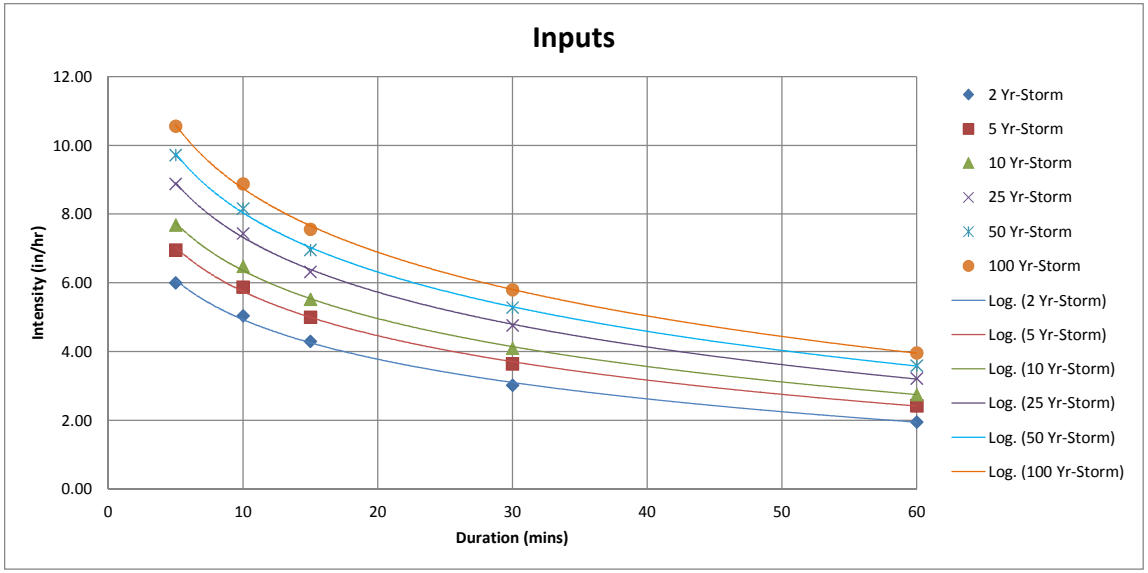
Intermediate Return Periods

5-yr = 0.278(100-yr) + 0.674 (2-year)

10-yr = 0.449(100-yr) + 0.496 (2-year)

25-yr = 0.669(100-yr) + 0.293 (2-year)

50-yr = 0.835(100-yr) + 0.146 (2-year)



DART

IRVING/DFW CORRIDOR

LINE SECTION I-3

HYDRAULIC REPORT

MUD SPRINGS CREEK

Prepared for:

Dallas Area Rapid Transit

DALLAS, TEXAS

DRAFT

February 2012

Prepared by:

BRIDGEFARMER & ASSOCIATES, INC.

Registration No. 264

TABLE OF CONTENTS

INTRODUCTION

The purpose of this study is to determine the length, location and elevation of the proposed Phase 1 DART Light Rail Transit – Line Section I-3, bridge class culvert at the crossing of Mud Springs Creek that is required to pass the discharge of a storm event with a probability of exceedance of 1% in any given year (100 year storm) without excessive velocity or harmful backwater effects.

For this particular location, it is proposed to have two (10' by 10') box culverts, along with some grading needed to level the bottom of the channel. This culvert will meet current DART design standards and will help to optimize the operational efficiency of the facility. The culvert headwalls will be extended to an elevation that will allow for 3:1 side slopes from the ballasts.

The structure will be analyzed to pass the 100 year storm event, to ensure that there will be no adverse effects to adjacent property, cause any rise in floodplain elevation, reduce any capacity or impede the movement of floodwater within the stream due to its placement.

Project Location

Phase 1 of the DART Light Rail Transit System crosses Belt Line Road from the east and enters the north end of the DFW Airport continuing south where it terminates at DFW airport (terminal A). See Appendix for Location Map

The proposed DART Light Rail Transit System – Line Section I-3 will cross Mud Springs Creek at the eastern boundary of the DFW Airport, southeast from the intersection of North Airfield Drive and Emergency Road, approximately ¾ of a mile south of SH 114 and 200 feet north of Emergency Road.

Proposed Structure

The proposed structure will be an 2-10’ by 10’ bridge class multiple box culvert. The total span width and the length of 22.75’ and 78’ respectively. The plan sheet with the culvert layout is shown in Exhibit EX1-2-3.

FEMA

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the proposed project site is located outside the regulated FEMA floodplain (Dallas County, Texas and Incorporated Areas, Map Number 48113C0165J dated August 23, 2001).

HYDROLOGY

Drainage Area

This portion of the Mud Springs Creek watershed entails the region located just east of the DFW Airport. The drainage area includes industrial/commercial as well as open grass area, with an approximate size of 198.09 acres. Exhibit EX1-2-1.

Design Discharge

The discharge (Q) for the 100 year frequency for this segment of Mud Springs Creek was calculated based on the Rational Method since the drainage area is less than 200 acres. The time of concentration used in the Rational Method was calculated based on existing conditions, and DFW Airport future land use. The land use consist of mostly aviation related uses with some industrial, local retail, garden office, and restaurant. The calculated time of concentration exceeded the “maximum inlet time” from DART design Standards, therefore the maximum time of concentration of 20 minutes will be used. The 10% Preliminary Design study was provided from CP&Y Engineering, this study includes the existing storm drain system and have a slightly

higher discharge. Therefore, CP&Y calculated discharge value will be used in this HEC-RAS model. See Table 1.

Table 1: Mud Springs Creek Discharge

Return Period (Year)	Rational Method (cfs)	*Supplied from CP&Y (cfs)
Q_{100}	820	937

HYDRAULICS

Model Development

Survey information was provided by Kiewit Construction Inc, and was used to prepare cross sections extending 300' upstream and 500' downstream of the creek. The updated survey information was then executed using the U.S. Army Corps of Engineers (USACOE) River Analysis System program, version HEC-RAS 4.0. The downstream boundary condition used to start the water surface profile came from the model obtained from DART 10% Design; which used a water surface elevation of 474.12 (see CP&Y report). The schematic for the cross-section layout for this segment of Mud Springs Creek is shown in Exhibit EX1-2-2.

Existing Condition

Recently obtained survey data of the existing floodway conditions depicts a channel with approximately 4:1 side slopes. The existing floodplain is a fairly well defined with grassy overgrown vegetation in the overbank region. Therefore, the Manning's value used in this analysis was 0.030 and 0.040, respectively. The existing water surface elevations, representative of the headwater and tailwater locations without the proposed culvert, are shown in Table 2.

Proposed Condition

The existing HEC-RAS model was modified to show the proposed DART I-3 track and proposed culvert crossing at Mud Springs Creek. A proposed 2 – 10' by 10' bridge class box culvert was used to satisfy DART design requirement based on the 100 year design criteria. The DART requirements were met by not raising water surface elevation upstream of the crossing by more than 0.07' comparing the existing and proposed HEC-RAS models. The water surface elevations are recorded in Table 2 for comparison for the tailwater and headwater of the proposed culvert. The existing and proposed water surface elevations of the modeled reach are displayed in Exhibit EX1-2-4.

Table 2. Comparison Water Surface Elevation at the Proposed Project Site on Mud Springs Creek at the DART I-3 Crossing

Channel Station	Existing Condition 100 Year WSE (ft)	Proposed Condition 100 Year WSE (ft)	Difference (ft)
US Face (HW) - 1379.125	474.15	474.22	+0.07
DS Face (TW) - 1300.572	474.14	473.98	-0.16

Design Velocity

Table 3 below shows the comparison of the outfall velocities for existing versus proposed condition. There is a slight increase in the channel velocities.

Table 3. Flow Velocity Comparison for the 100 Year Flood Frequency

Location	Existing Condition Velocity (ft/s)	Proposed Condition Velocity (ft/s)
US Face (HW) - 1379.125	1.22	4.40
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DART

IRVING/DFW CORRIDOR

LINE SECTION I-3

HYDRAULIC REPORT

MUD SPRINGS CREEK

Prepared for:

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HYDRAULICS

Model Development

Survey information was provided by Kiewit Construction Inc, and was used to prepare cross sections extending 300' upstream and 500' downstream of the creek. The updated survey information was then executed using the U.S. Army Corps of Engineers (USACOE) River Analysis System program, version HEC-RAS 4.0. The downstream boundary condition used to start the water surface profile came from the model obtained from DART 10% Design; which used a water surface elevation of 474.12 (see CP&Y report). The schematic for the cross-section layout for this segment of Mud Springs Creek is shown in Exhibit EX1-2-2.

Existing Condition

Recently obtained survey data of the existing floodway conditions depicts a channel with approximately 4:1 side slopes. The existing floodplain is a fairly well defined with grassy overgrown vegetation in the overbank region. Therefore, the Manning's value used in this analysis was 0.030 and 0.040, respectively. The existing water surface elevations, representative of the headwater and tailwater locations without the proposed culvert, are shown in Table 2.

Proposed Condition

The existing HEC-RAS model was modified to show the proposed DART I-3 track and proposed culvert crossing at Mud Springs Creek. A proposed 2 – 10' by 10' bridge class box culvert was used to satisfy DART design requirement based on the 100 year design criteria. The DART requirements were met by not raising water surface elevation upstream of the crossing by more than 0.07' comparing the existing and proposed HEC-RAS models. The water surface elevations are recorded in Table 2 for comparison for the tailwater and headwater of the proposed culvert. The existing and proposed water surface elevations of the modeled reach are displayed in Exhibit EX1-2-4.

Table 2. Comparison Water Surface Elevation at the Proposed Project Site on Mud Springs Creek at the DART I-3 Crossing

Channel Station	Existing Condition 100 Year WSE (ft)	Proposed Condition 100 Year WSE (ft)	Difference (ft)
US Face (HW) - 1379.125	474.15	474.22	+0.07
DS Face (TW) - 1300.572	474.14	473.98	-0.16

Design Velocity

Table 3 below shows the comparison of the outfall velocities for existing versus proposed condition. There is a slight increase in the channel velocities.

Table 3. Flow Velocity Comparison for the 100 Year Flood Frequency

Location	Existing Condition Velocity (ft/s)	Proposed Condition Velocity (ft/s)
US Face (HW) - 1379.125	1.22	4.40
DS Face (TW) - 1300.572	1.26	4.42

PROPOSED STRUCTURE

Impact of Proposed Structure

The HEC-RAS analysis of the proposed bridge class box culvert will provide a sufficient hydraulic opening for the conveyance of the stream flow with respect to the 100 year frequency discharge. Although the proposed DART I-3 crossing will slightly impact the water surface elevation, the proposed construction will have only a negligible effect on the delineation of the 100 year floodplain area as shown in Exhibit EX1-2-3. Under these circumstances, no formal coordination with FEMA is normally required. However, the local floodplain administrator will be sent a copy of this report as well as other supporting documentation relevant to the approval process prior to project construction.

CONCLUSION

The proposed crossing on the DART I-3 at Mud Springs Creek adequately conveys the 100 year design discharge and does not significantly increase the base flood elevation. Therefore the construction of the proposed structure will have no adverse effects on the people and properties in the surrounding area.

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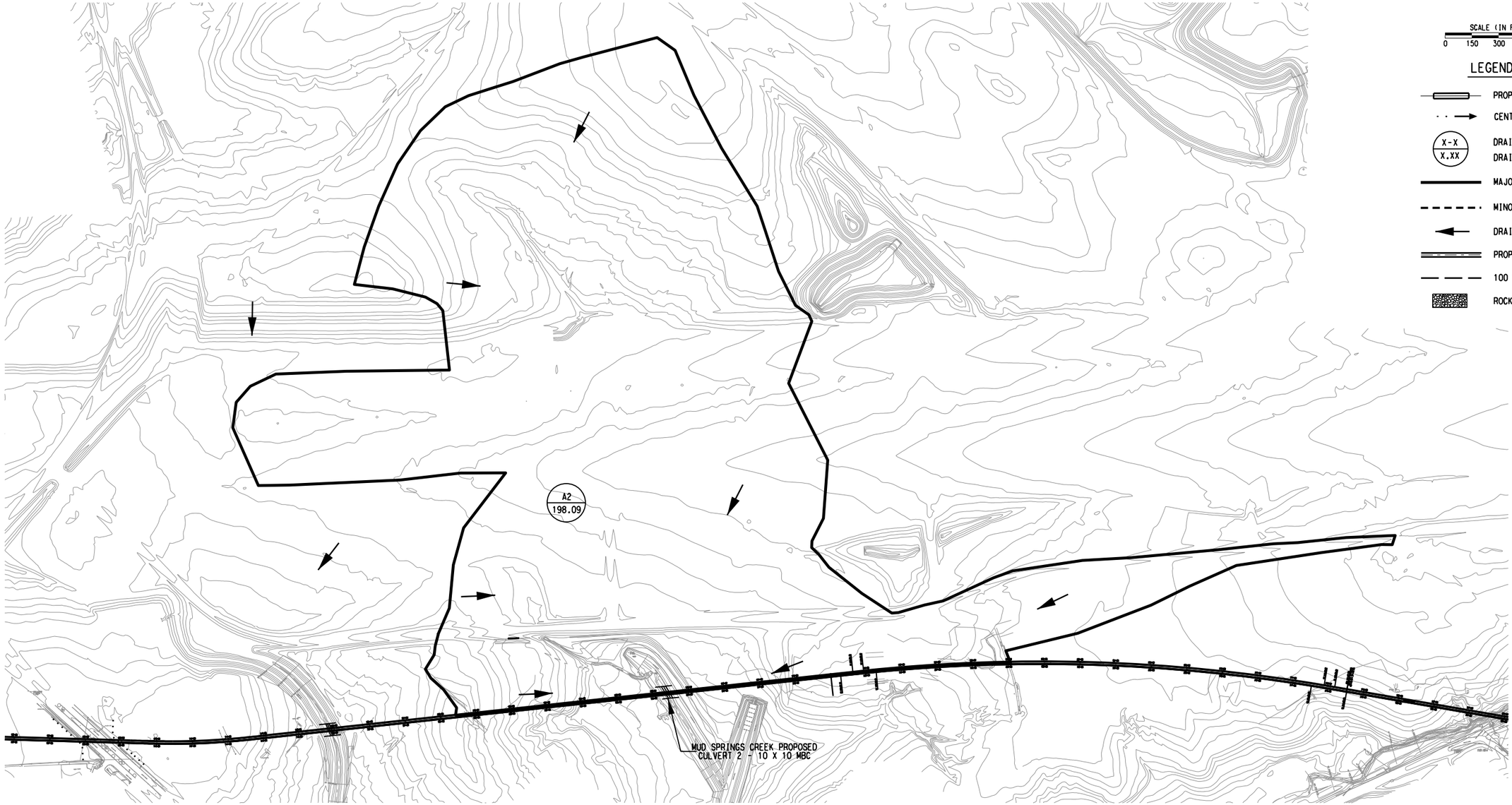
The proposed crossing on the DART I-3 at Mud Springs Creek adequately conveys the 100 year design discharge and does not significantly increase the base flood elevation. Therefore the construction of the proposed structure will have no adverse effects on the people and properties in the surrounding area.

Exhibits

DWG No.



SCALE (IN FEET)
0 150 300 600

LEGEND

- PROPOSED CASING
- CENTERLINE OF DITCH
- X-X / X.XX — DRAINAGE AREA NUMBER / DRAINAGE AREA ACRES
- MAJOR DRAINAGE AREA BOUNDARY
- MINOR DRAINAGE AREA BOUNDARY
- DRAINAGE FLOW
- PROPOSED STORM DRAINAGE
- 100 YR FLOOD LIMITS
- ROCK RIPRAP

CONTRACT SHEET No. OF

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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CONSULTING ENGINEERS
DALLAS ● AUSTIN
REGISTRATION NO. 264

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	
DRAWN	
DESIGNED	
CHECKED	
IN CHARGE	
DATE	

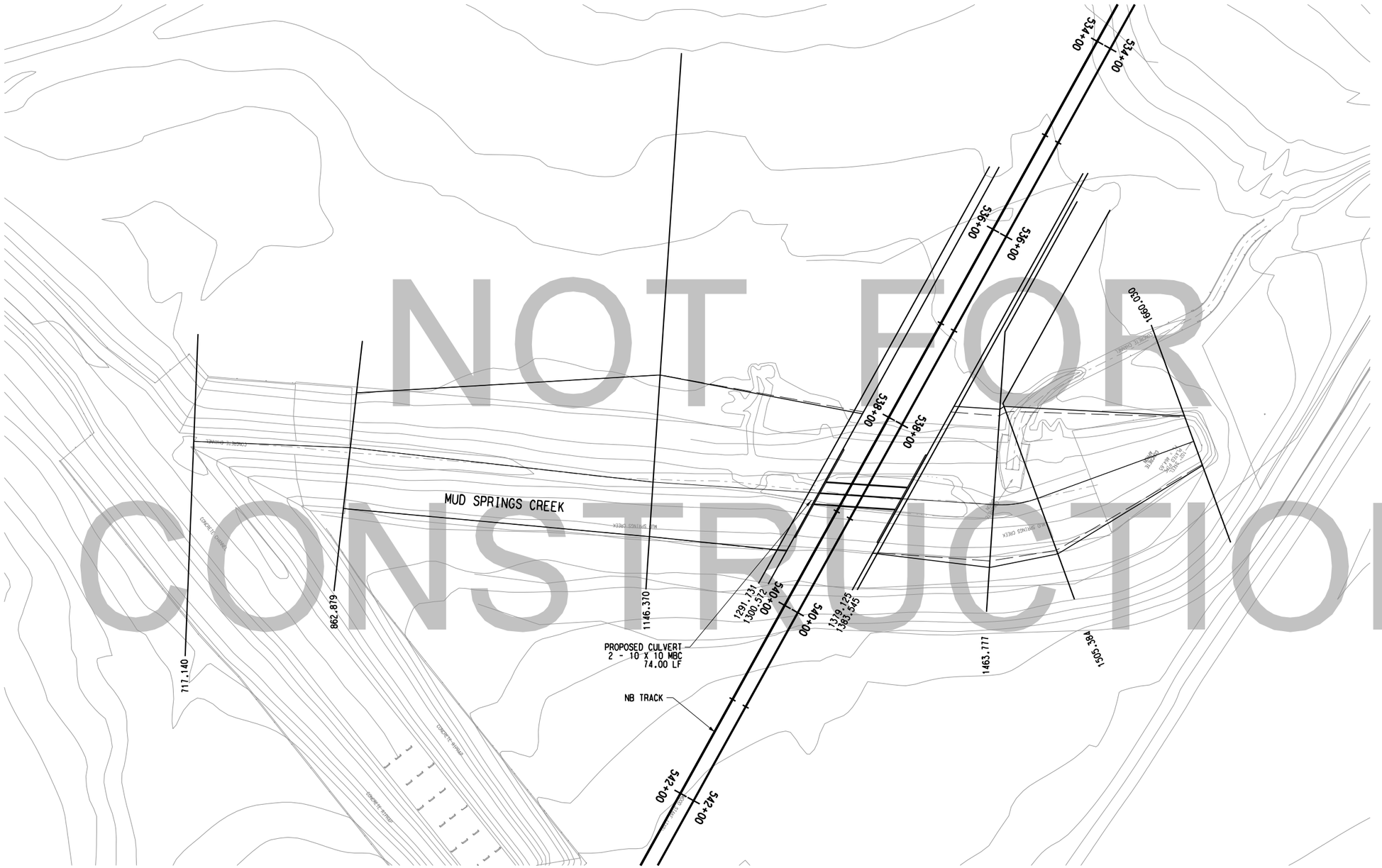
CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

DRAINAGE AREA
MUD SPRINGS CREEK

CONTRACT	DWG No.	REV
C-1018691-01	EX1-2-1	

DWG No.



REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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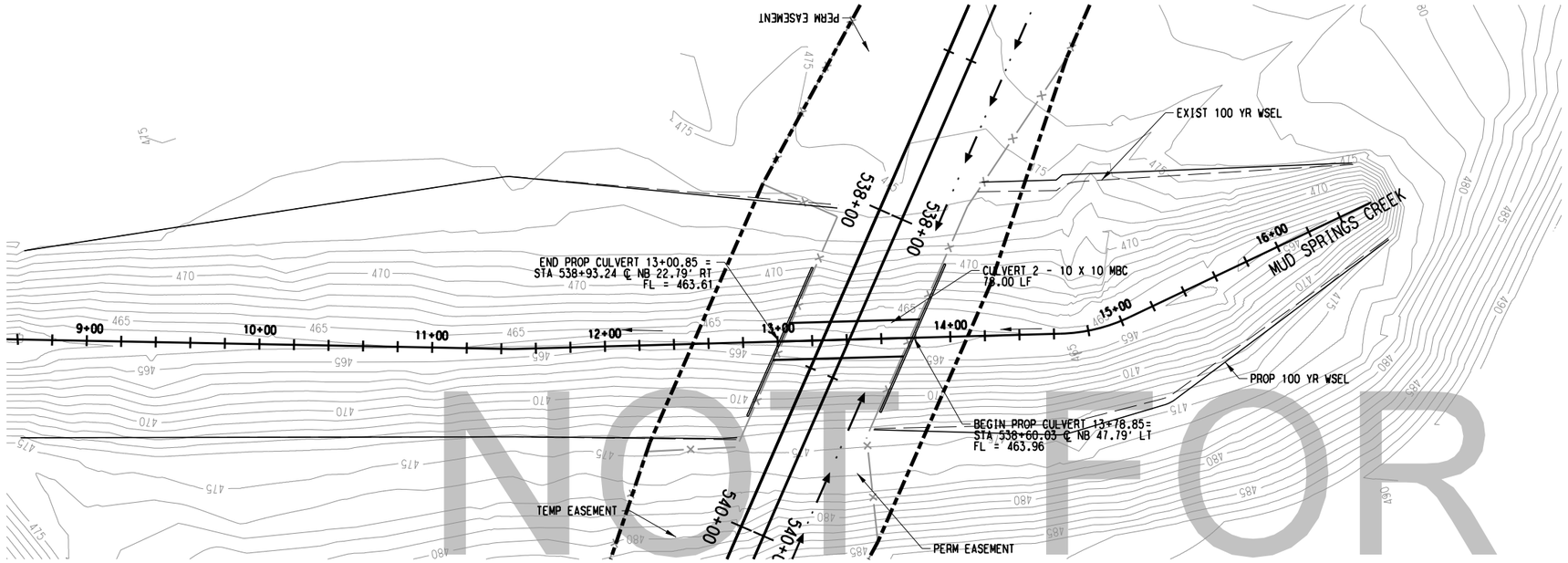
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

CULVERT 540+00 EXHIBIT
MUD SPRINGS CREEK

CONTRACT	DWG No.	REV
C-1018691-01	EX1-2-2	B

DWG No.

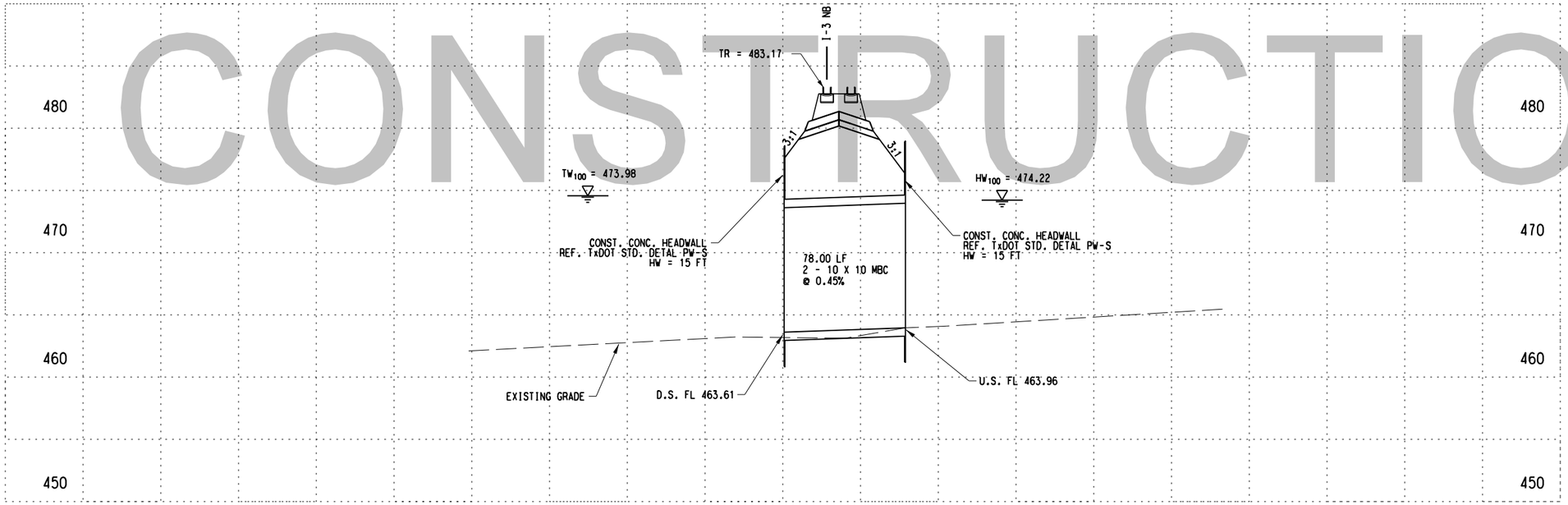


LEGEND

PROPOSED CASING

CENTERLINE OF DITCH

HYDRAULIC DATA			
EXISTING		PROPOSED	
100 YR		100 YR	
Q (CFS)	937	Q (CFS)	937
V (FPS)	1.26	V (FPS)	4.43
HW ELEV.	474.15	HW ELEV.	474.22
TW ELEV.	474.14	TW ELEV.	473.98



REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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IN CHARGE
DATE

CAES

PARENT PERMIT No.#####
CHILD PERMIT No.#####

CONTRACT SHEET No. OF

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

CULVERT STA 540+00
PLAN AND PROFILE

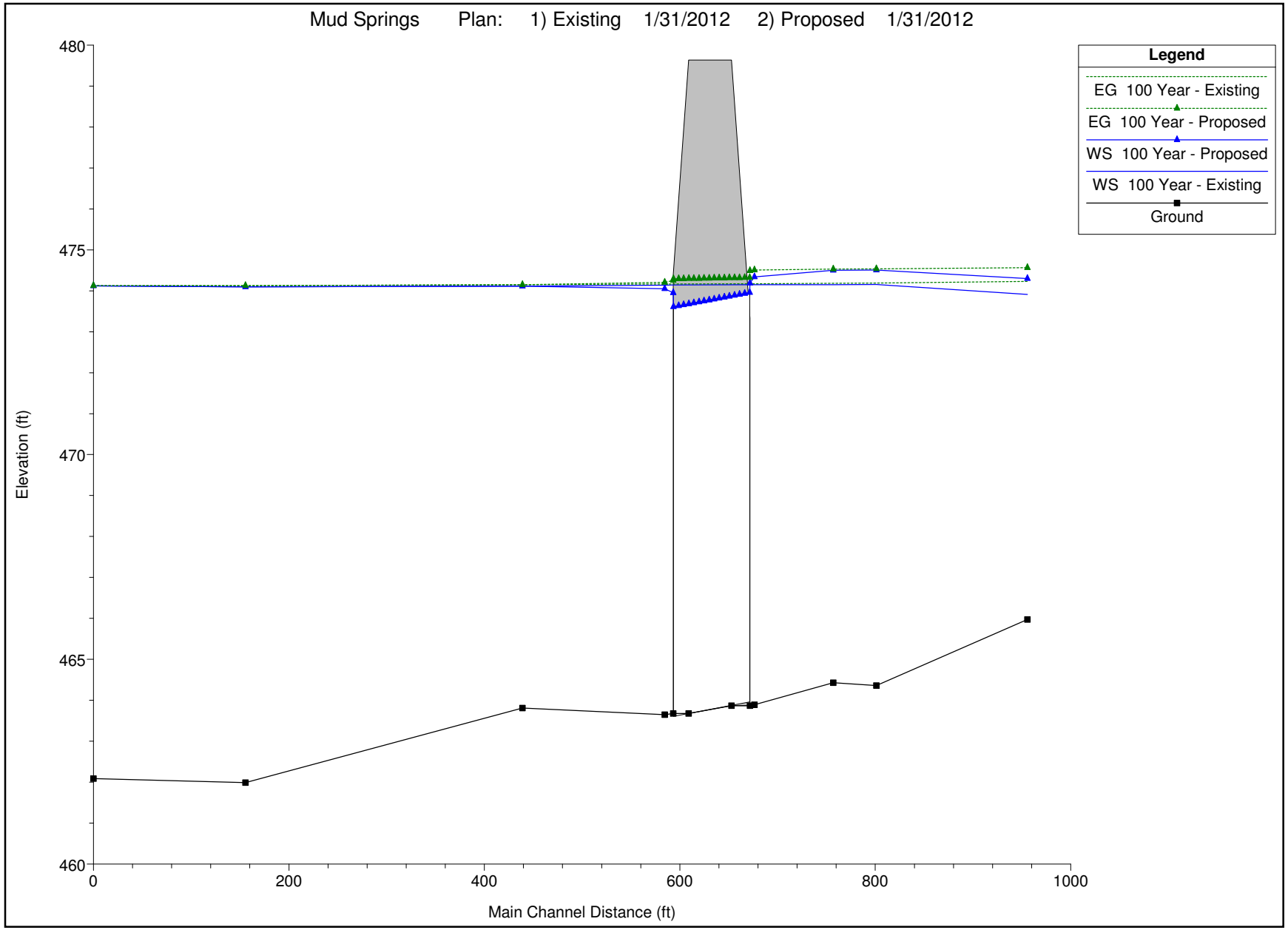
CONTRACT	DWG No.	REV
C-1018691-01	EX1-2-3	

HEC-RAS River: 153 Reach: CUL539 Profile: 100 Year

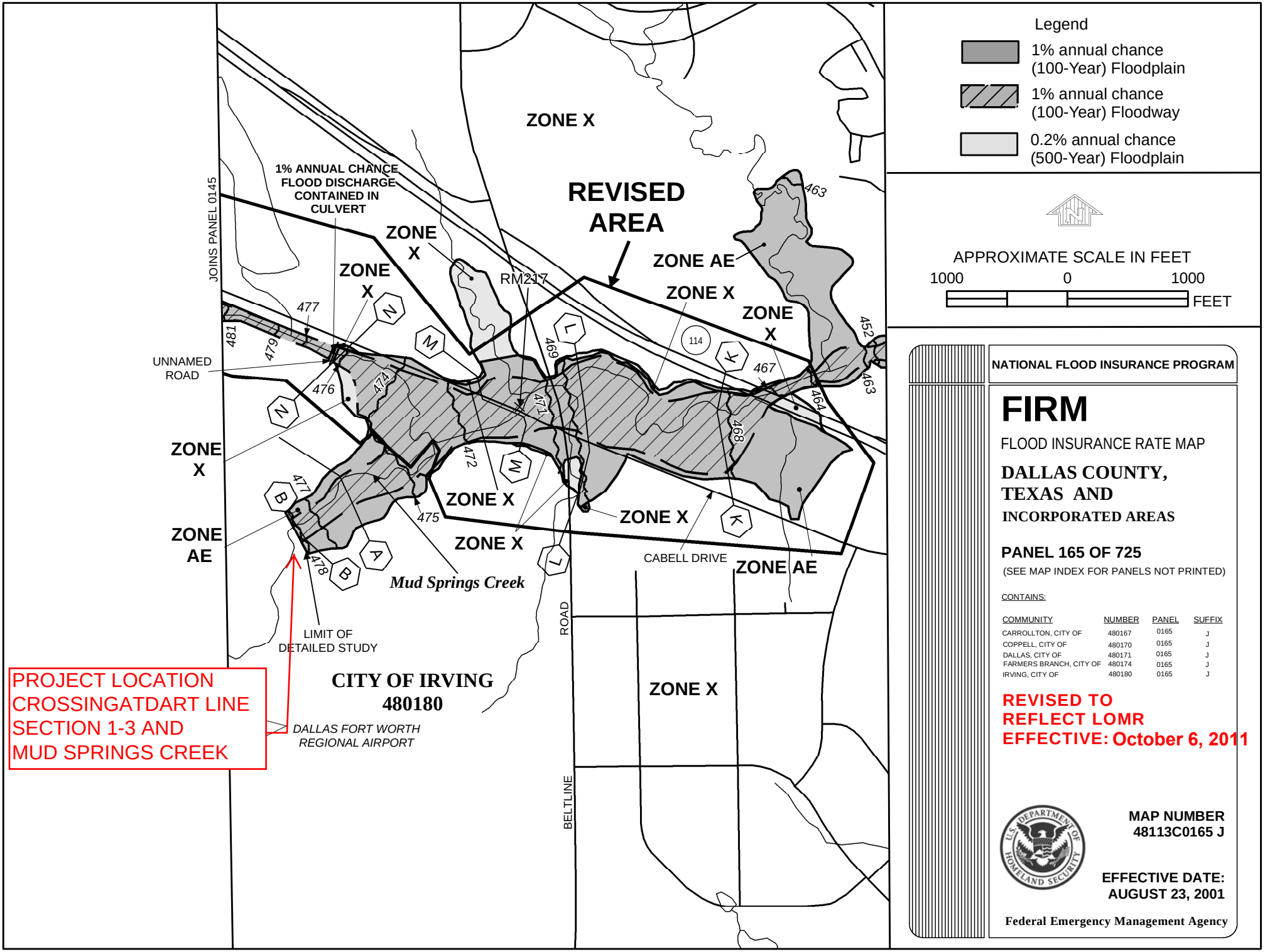
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
CUL539	1660.030	100 Year	Existing	937.00	465.97	473.91		474.23	0.001231	4.50	208.16	47.13	0.38
CUL539	1660.030	100 Year	Proposed	937.00	465.97	474.33		474.60	0.000959	4.10	228.50	49.31	0.34
CUL539	1505.384	100 Year	Existing	937.00	464.36	474.15		474.19	0.000109	1.44	650.78	137.71	0.12
CUL539	1505.384	100 Year	Proposed	937.00	464.36	474.54		474.56	0.000091	1.33	704.90	146.79	0.11
CUL539	1463.777	100 Year	Existing	937.00	464.43	474.15		474.18	0.000116	1.48	633.14	135.03	0.12
CUL539	1463.777	100 Year	Proposed	937.00	464.43	474.53		474.56	0.000098	1.36	687.37	148.45	0.11
CUL539	1383.545	100 Year	Existing	937.00	463.36	474.15		474.17	0.000067	1.22	766.25	149.51	0.09
CUL539	1383.545	100 Year	Proposed	937.00	463.89	474.37		474.53	0.000194	3.23	290.30	157.67	0.18
CUL539	1379.125	100 Year	Existing	937.00	463.35	474.15		474.17	0.000062	1.22	767.46	151.54	0.09
CUL539	1379.125	100 Year	Proposed	937.00	463.87	474.22	467.87	474.52	0.000350	4.40	213.08	155.25	0.24
CUL539	1300.572	100 Year	Existing	937.00	463.25	474.14		474.17	0.000076	1.26	741.38	146.27	0.10
CUL539	1300.572	100 Year	Proposed	937.00	463.68	473.98		474.28	0.000355	4.42	212.07	142.06	0.24
CUL539	1291.731	100 Year	Existing	937.00	463.26	474.14		474.16	0.000081	1.28	732.22	148.87	0.10
CUL539	1291.731	100 Year	Proposed	937.00	463.65	474.05		474.21	0.000211	3.22	291.04	146.46	0.18
CUL539	1146.370	100 Year	Existing	937.00	463.81	474.11		474.15	0.000114	1.53	622.29	150.76	0.12
CUL539	1146.370	100 Year	Proposed	937.00	463.81	474.11		474.15	0.000114	1.53	622.29	150.76	0.12
CUL539	862.879	100 Year	Existing	937.00	461.99	474.10		474.13	0.000061	1.33	707.06	108.23	0.09
CUL539	862.879	100 Year	Proposed	937.00	461.99	474.10		474.13	0.000061	1.33	707.06	108.23	0.09
CUL539	717.140	100 Year	Existing	937.00	462.09	474.12	463.83	474.12	0.000007	0.52	1795.29	225.55	0.03
CUL539	717.140	100 Year	Proposed	937.00	462.09	474.12	463.83	474.12	0.000007	0.52	1795.29	225.55	0.03

EX1-2-4:Mud Springs Creek

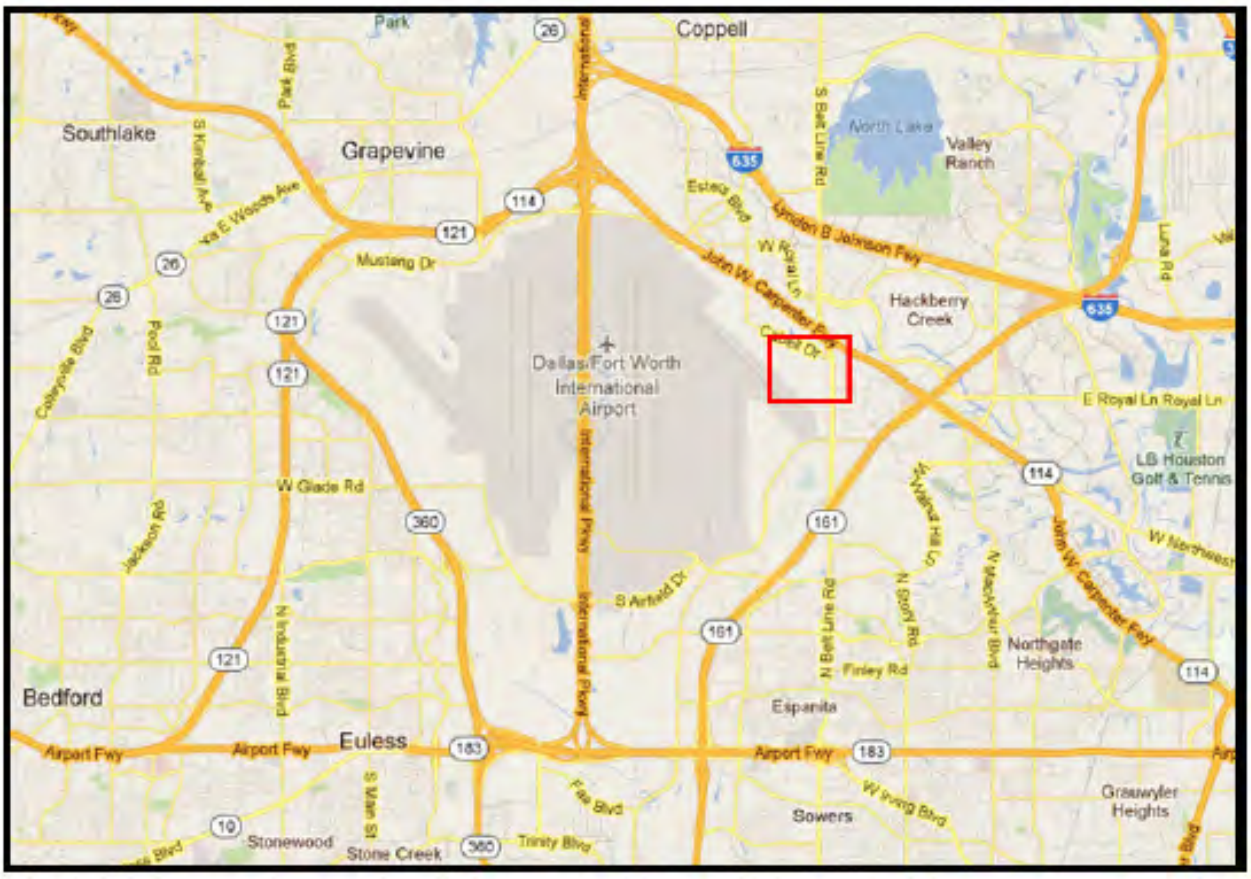
HEC-RAS Output Summary



EX1-2-5:Mud Springs Creek
HEC-RAS Profile


ZONE X
REVISED AREA
1% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
ZONE X
ZONE X
RM217
ZONE AE
ZONE X
ZONE X
JOINS PANEL 0145
UNNAMED ROAD
ZONE X
ZONE AE
ZONE X
ZONE X
ZONE X
ZONE X
ZONE AE
Mud Springs Creek
CABELL DRIVE
LIMIT OF DETAILED STUDY
CITY OF IRVING
480180
DALLAS FORT WORTH REGIONAL AIRPORT
ZONE X
BELTLINE ROAD
PROJECT LOCATION
CROSSINGATDART LINE
SECTION 1-3 AND
MUD SPRINGS CREEK
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
1000 0 1000
FEET
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
DALLAS COUNTY, TEXAS AND
INCORPORATED AREAS
PANEL 165 OF 725
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
CARROLLTON, CITY OF 480167 0165 J
COPPELL, CITY OF 480170 0165 J
DALLAS, CITY OF 480171 0165 J
FARMERS BRANCH, CITY OF 480174 0165 J
IRVING, CITY OF 480180 0165 J
REVISED TO REFLECT LOMR EFFECTIVE: October 6, 2011
MAP NUMBER 48113C0165 J
EFFECTIVE DATE: AUGUST 23, 2001
Federal Emergency Management Agency

Appendix



Location Map: Mud Springs Creek

Mud Springs Creek

Sheet flow

	Segment ID	AB
1. Surface description		short grass
2. Manning's roughness coefficient, n		0.600
3. Flow length, L	ft	200
4. Two-year 24-hour rainfall, P_2	in	4.0
5. Land slope, s	ft/ft	0.010
6. $T_t = 0.007\ (n\ L)^{0.8} / P_2^{0.5}\ s^{0.4}$	hr	1.02

Shallow concentrated flow

	Segment ID	BC
7. Surface description (paved or unpaved)		paved
8. Flow length, L	ft	3350
9. Watercourse slope, s	ft/ft	0.015
10. Average velocity, V	ft/s	2.5
11. $T_t = L / 3600\ V$	hr	0.37

Channel flow

	Segment ID	DE
12. Cross sectional flow area, a	ft^2	235
13. Wetted perimeter, pw	ft	100.0
14. Hydraulic radius, r = a / pw	ft	2.350
15. Channel slope, s	ft/ft	0.010
16. Manning's roughness coefficient, n		0.030
17. $V = 1.49\ r^{2/3}\ s^{1/2} / n$	ft/s	8.78
18. Flow length, L	ft	178
19. $T_t = L / 3600\ V$	hr	0.01

20. Time of concentration (Tc)	hr	1.391

The maximum time of concentration of 20 mins will be used.

Discharge		Q = CiA	
	C =	0.60	
	i =	6.9	in/hr
	A =	198.09	ac
Therefore the Discharge (Q) =		820	cfs

Inputs										
Return Period (yr)	Intensity (in/hr)					Factored Intensity (in/hr)				
	5	10	15	30	60					
2	6.00	5.04	4.30	3.02	1.95	72.00	30.24	17.20	6.04	1.95
5	6.96	5.88	5.00	3.64	2.42	83.52	35.28	20.00	7.28	2.42
10	7.68	6.48	5.52	4.10	2.75	92.16	38.88	22.08	8.20	2.75
25	8.88	7.44	6.32	4.76	3.22	106.56	44.64	25.28	9.52	3.22
50	9.72	8.16	6.96	5.28	3.59	116.64	48.96	27.84	10.56	3.59
100	10.56	8.88	7.56	5.80	3.96	126.72	53.28	30.24	11.60	3.96

INTERMIDIATE DURATION AND RETURN PERIODS

10 & 30 Minute Relations

10 min value = 0.59(15-min value) + 0.41(5-min value)

30 min value = 0.49(15-min value) + 0.51(5-min value)

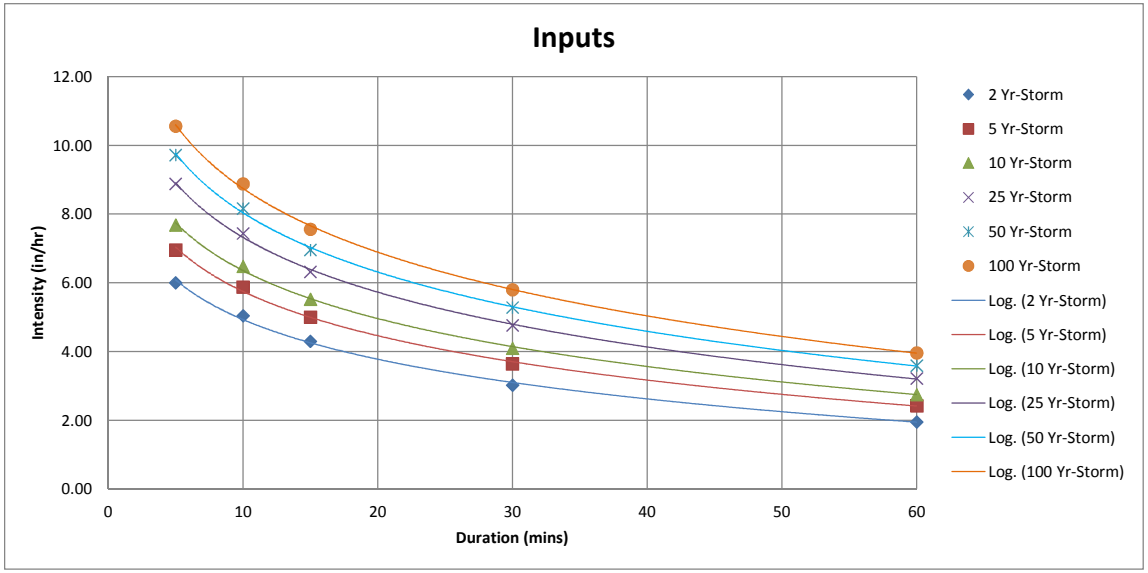
Intermediate Return Periods

5-yr = 0.278(100-yr) + 0.674 (2-year)

10-yr = 0.449(100-yr) + 0.496 (2-year)

25-yr = 0.669(100-yr) + 0.293 (2-year)

50-yr = 0.835(100-yr) + 0.146 (2-year)



DRAFT

HYDRAULIC STUDY

PHASE I DART SEGEMENT I-3 CROSSING AT GRAPEVINE CREEK

PREPARED FOR:

KSWRP

BY:

LTRA
Lina T. Ramey
& Associates, Inc.
TBPE Firm Registration No. F-782

FEBRUARY 2012

TABLE OF CONTENTS

INTRODUCTION

The purpose of this study is to determine the length, location and elevation of the proposed Phase 1 DART Light Rail Transit System- Line Section I-3, bridge class culvert at the crossing of Grapevine Creek that is required to pass the discharge of a storm event with the probability of exceedance of 1% in any given year (100-yr storm event) without excessive velocity or harmful backwater effects.

Phase 1 of the DART Light Rail Transit System crosses Belt Line Rd. from the east and enters the north end of DFW airport continuing south where it terminates near Terminal A, the most northern of the airport terminals.

For this particular location, it was economically feasible to suggest a multiple barrel box culvert, although some channel grading will be needed to transition the large hydraulic opening of the culvert back to the relatively narrow existing open channel. This culvert will meet current design standards and will help to optimize the operational efficiency of the facility. The proposed typical track section, although subject to change with the introduction of an express trough facility, will total 31.6-ft in width, and will comprise of 36 sq. ft. of ballast material, 24 sq. ft of subballast material, and 26 sq. ft of subgrade. See Figure 1 for the typical section. The structure will not only be designed to pass the 100-year storm event but will also be analyzed to ensure that there will be no adverse effects to property, or the stream and existing floodplain due to its placement.

Project Location

The proposed DART Light Rail Transit System- Line Section I-3 will cross Grapevine Creek approximately 3/10 of a mile south of SH 114 which is at the northern boundary of DFW airport. The project is located in the northern quadrant boundaries of both Dallas and Tarrant County (USGS Grapevine 7.5 minute quadrangle) (See Figure 2 for the project location map).

Proposed Structure

The proposed structure will be an 11-10 ft x 10 ft bridge-class multiple box culvert. The total span width and the length of the culvert will be 118-ft. and 37-ft. respectively. The plan sheet for the culvert layout is displayed in Appendix D.

FEMA

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the proposed project site is located just upstream of a detailed studied area or recorded Zone AE which designates a mapped FEMA 100-year floodway (Dallas County, Texas, and Incorporated Areas, Map Number 48113C0145 J dated August 23, 2001). Although the project limits itself is outside of the detailed studied area, the actual electronic files representing the current effective model will be used and amended to perform the hydraulic output for this report. Dallas County and the incorporated areas therein are participants in the National Flood insurance Program (NFIP).

HYDROLOGY

Drainage Area

This portion of the Grapevine Creek watershed entails the region located at the north central end of DFW airport. The drainage area can be considered ultimately fully developed with an approximate size of 1504 acres (2.4 square miles). Figure 3 illustrates the limits and topography of the project's drainage area.

Design Discharge

The discharge (Q) for the 100-year frequency for this segment of Grapevine Creek was determined in accordance with the TxDOT Hydraulic Manual. The discharge was calculated using the Natural Resource Conservation Service (NRCS) Runoff Curve Number method and the Rational Method. The values were then compared with the supplied Q from CP&Y, Inc., (DART 10% design) which, by all accounts, entailed proportioning drainage areas with the Q's provided from the FEMA effective model. After comparing the values, the value supplied within the context of the DART 10% design seemed the reasonable choice as it approximated an average or median of the other two methods. (The hydrological calculations are provided in Appendix B).

Table 1. Comparison of Discharges

Return Period (Year)	**Rational Method (C=0.75) (cfs)**	**NRCS Runoff Curve Number Method (RCN=85) (cfs)**	***Supplied from CP&Y (cfs)**
Q_{100}	4,784	6,525	**5,617**

* Used in design.

HYDRAULICS

Model Development

Data was obtained in HEC-RAS format which represented the corrected effective model for this segment of Grapevine Creek. Because the location was outside the limits of the detailed study (FIS), CP&Y, Inc. modified the original HEC-2 model to include cross-sections in the vicinity of the proposed project location. Additional survey information was then provided by the joint venture of Kiewit, Stacy and Witbeck, Reyes, Parsons (KSWRP) and used to extend the

upstream reach to an appropriate distance. The "updated" model was then executed using the U.S. Army Corps of Engineers (USACOE) River Analysis System program, version HEC-RAS 4.0. All data contained cross-section geometry based off of horizontal datum NAD 83 and vertical datum NAVD 88. The downstream boundary condition used to start the water surface profile calculations was established from the provided corrected effective model which used a "known WSE" (water surface elevation) of 544.42. The schematic for the cross-section layout for this segment of Grapevine Creek is displayed in Appendix D.

Existing Condition

Recently obtained survey data of the existing channel depicts a straight cut open section roughly 60 ft wide with approximately 3:1 side slopes. As previously explained, this data was imported into the corrected effective model obtained from the DART 10% design to establish a reasonable representation of the upstream reach in the vicinity of the proposed project location. From recent site visits (See Appendix A for included site photographs), the floodplain exhibited a section close to a uniform earth channel with overgrown grassy vegetative growth, lining the channel and overbank regions. Therefore, the Manning's values used in this analysis were between 0.045 and 0.060. The stream, in its present condition, exhibits no signs of meandering or instability. Water surface elevations representative of the headwater and tailwater locations from the resulting existing model are shown below in Table 2.

Proposed Condition

Once the existing conditions were evaluated, the proposed DART I-3 track location, profile, and proposed culvert were incorporated into the existing HEC-RAS model to create a proposed or "post construction" model. As it turned out, the most feasible design would involve

an 11 barrel, 10 ft x 10 ft bridge-class box culvert arrangement. This satisfies the 100-yr design criteria or the storm event with the exceedance probability of 1% in any given year. The design criteria established that the flood water from this flood will not create a headwater WSE that will encroach into the subballast material of the proposed bridged track. The WSE's are recorded in Table 2 for comparison purposes at RS 49925 and RS 49866 which represent the stations directly upstream (HW) and downstream (TW) respectively of the proposed culvert location. The calculated headwater is 553.36. The controlling profile grade of the DART I-3 track is 557.24 and the bottom of the subballast as depicted in the typical section was evaluated at an elevation of 554.08 which will provide 0.72 ft of freeboard. To check the backwater effect from placing this culvert, the water surface elevations of the modeled reach are displayed in Table 3 and all HEC-RAS supporting tables are provided in Appendix C.

Table 2. Comparison Water Surface Elevations at the Proposed Project Site on Grapevine Creek at the DART I-3 Crossing

Channel Station	Existing Conditions 100-yr WSE (ft)	Proposed Conditions 100-yr WSE (ft)	Difference (ft)
49925 (US Face-HW)	552.76	553.36	+0.60
49866 (DS Face-TW)	552.75	552.75	0.00

The proposed culvert structure will adequately span the width of the existing Grapevine Creek channel, which has a top of bank to top of bank of approximately 60-ft in width. Based on the parameters presented, the proposed culvert will have the following configuration (The proposed culvert layout is displayed in Appendix D):

- The proposed crossing will be 27-ft wide consisting of two 8' 3" tracks, ballast, subballast and subgrade.

- Culvert configuration: consists of a multiple box culvert that will have a total span width of approximately 118 ft and total length of approximately 37 ft.
- The amount of fill deposited in Waters of the United States will be less than 0.1 acre.
- The span will utilize 11- 10’ x 10’ Box Culverts with a slope of 0.53%.
- The proposed structure will intersect Grapevine Creek with a skew angle of 10 degrees.

Design Velocity

The following is a comparison tabulation of the average approach velocities and outfall velocities that corresponds to the discharge evaluated in the study. There are no negative impacts to the channel velocities. Concrete riprap will still be used at the culvert outfall in order to alleviate anticipated erosion for higher frequency storm events.

Table 4. Flow Velocity Comparison for the 100-YR flood frequency

Location	Existing Flow Velocity (ft/s)	Proposed Flow Velocity (ft/s)
49925 (U.S. Face)	1.62	1.38
Culvert Inlet	-	5.11
Culvert Discharge	-	5.11
49866 (D.S. Face)	1.72	1.69

PROPOSED STRUCTURE

The design criteria of the proposed bridge are controlled by:

- The proposed culvert will adequately pass the 100-year flood by the established design criteria.
- Passage of 100-year flood without endangering roadway or property.
- Design velocity through the culvert as stated by Bridge Division Hydraulic Manual.

Impact of Proposed Structure

The analysis of the proposed structure indicates that the proposed bridge-class box culvert will provide a sufficient hydraulic opening for the conveyance of the stream flow in respect to the 100-yr frequency discharge. Although the proposed DART I-3 crossing will slightly impact the upstream WSE as illustrated in Table 3 below, the conditions stipulated by FEMA are still maintained and the proposed construction will have only a negligible effect on the delineated 100-yr floodplain areas. Under these circumstances, no formal coordination with FEMA is normally required**;** however, the local floodplain administrator will be sent a copy of this report as well as other supporting documentation relevant to the approval process prior to project construction.

Table 3. 100-YR Water Surface Elevation Comparison at the Proposed Project Site on Grapevine Creek at the DART I-3 Crossing

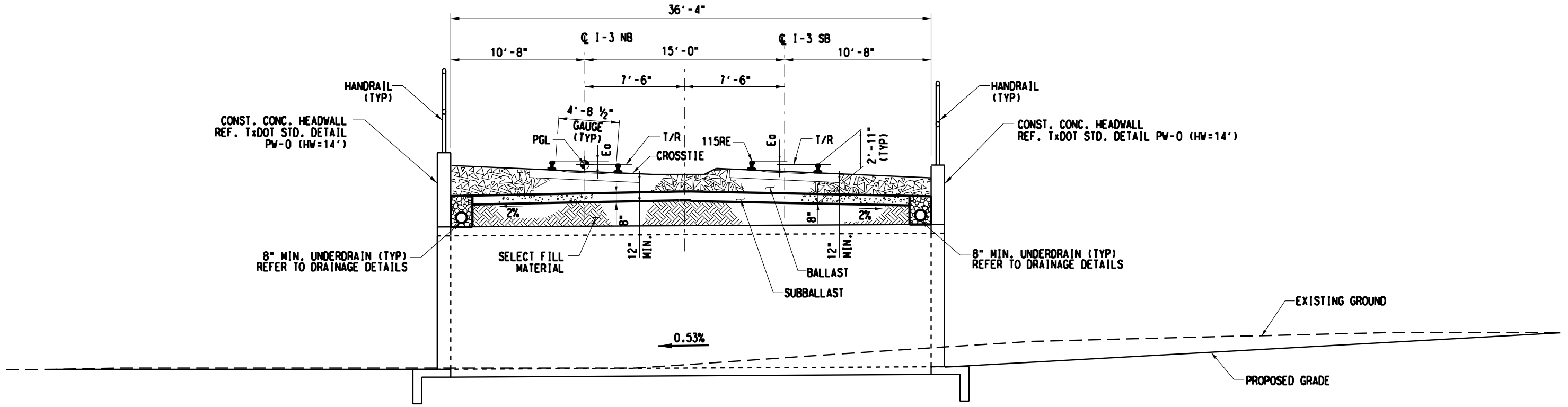
Channel Station	Existing Water Surface Elevation (ft)	Proposed Water Surface Elevation (ft)	Change in 100 YR Water Surface Elevation (ft)
50850	552.93	553.48	+0.55
50550	552.87	553.44	+0.57
50450	552.85	553.42	+0.57
50350	552.81	553.39	+0.58
50150	552.80	553.39	+0.59
49950	552.77	553.37	+0.60
49925 (U.S. Face)	552.76	553.36	+0.60
(Culvert)			
49866 (D.S. Face)	552.75	552.75	0.00
49778	552.74	552.74	0.00
*49700	552.71	552.71	0.00

*U.S. face of culvert at Airfield Drive

CONCLUSION

The proposed crossing on the DART I-3 at Grapevine Creek adequately conveys the 100-year design discharge and does not significantly increase the base flood elevations or negatively affect the velocity. The proposed bridge-class culvert group will provide adequate hydraulic conveyance to channel the design discharge through the proposed embankment and therefore the construction of the proposed structure will have no adverse effects on the people and property in the surrounding areas.

DWG No.



*TYPICAL SECTION
@ GRAPEVINE CREEK CULVERT

NOT TO SCALE

FIGURE 1

* THE PROPOSED TYPICAL TRACK SECTION IS SUBJECT TO CHANGE IF EXPRESS TROUGH IS ADDED.

IN-PROGRESS 60% DESIGN

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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JAMES A. LANG, P.E. NO. 83953

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LINA T. RAMEY & ASSOCIATES, INC.
1349 Empire Central, Suite 900
Dallas, Texas 75247
T(214)979-1144 - F(214)979-2480
TBPE FIRM #782

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

PARENT PERMIT No.00000
CHILD PERMIT No.00000

CONTRACT SHEET No. OF

SCALE: AS SHOWN
DRAWN: L.RAY (LTR)
DESIGNED: S. SHARMA
CHECKED: J. LANG
IN CHARGE: L. CAREY
DATE: 10 DEC 11

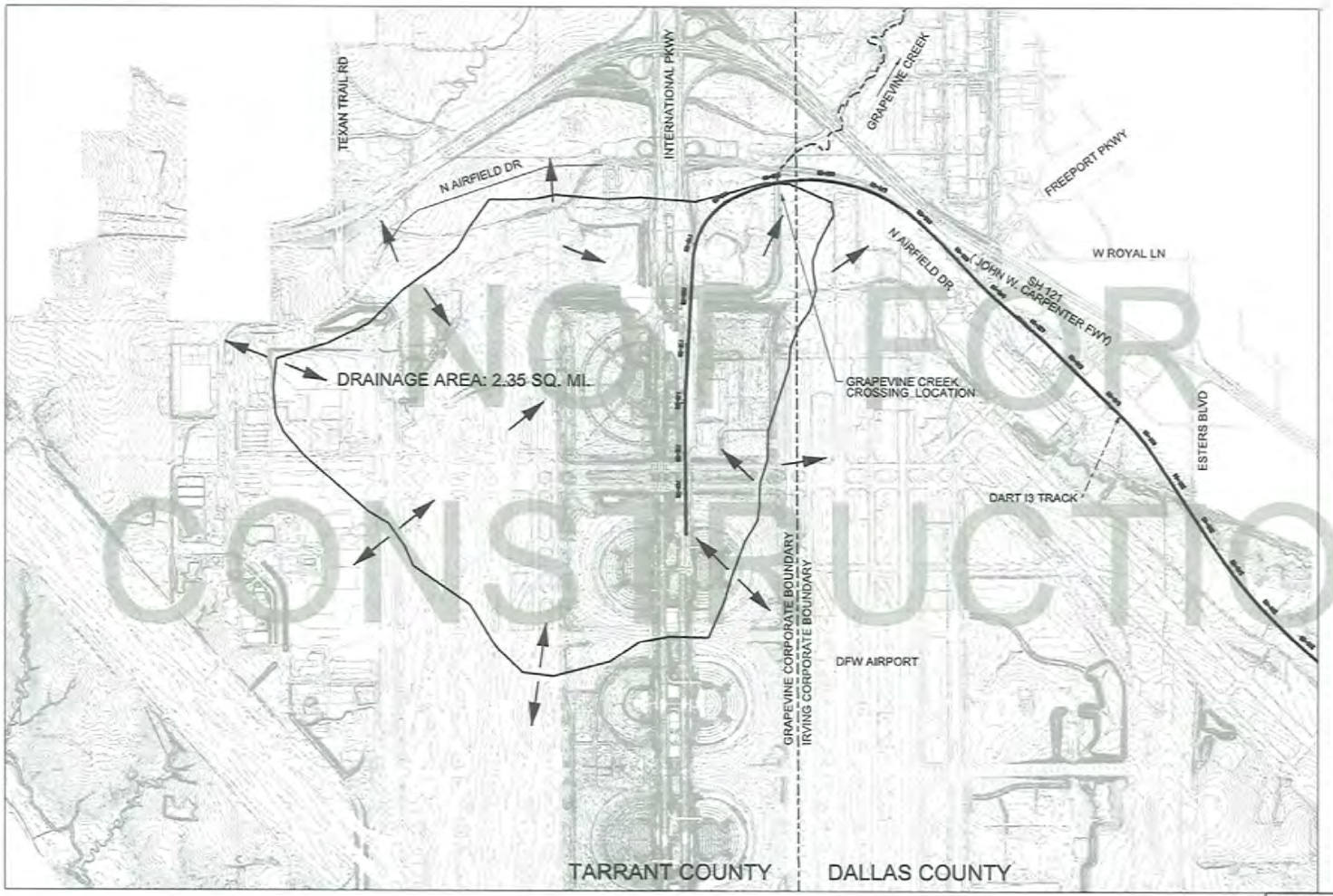
CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3
GRAPEVINE CREEK CULVERT TYPICAL SECTION

CONTRACT C-1018691-01 | DWG No. | REV

FIGURE 2

PROJECT LOCATION: DART I-3 CROSSING AT GRAPEVINE CREEK



0 1000 2000
SCALE IN FEET

DRAINAGE AREA: 1504 ACRES
Q_{100}= *5617 CFS

NOTE: THIS VALUE HAS BEEN PROVIDED/INCLUDED IN THE HEC-RAS MODEL SUPPLIED BY CP&Y ENGINEERING INC. AN ANALYSIS OF THIS VALUE WAS PERFORMED AND DOCUMENTED IN A SUPPLEMENTAL REPORT.

PROJECT LOCATION:
CROSSING AT GRAPEVINE CREEK AND THE DART TRACK

DWG No. CC6-8350

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DART PROJECT

CAES

CONTRACT SHEET No. OF

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

OFFSITE DRAINAGE AREA MAP
GRAPEVINE CREEK CULVERT

CONTRACT C-1018691-01

DWG No. CC6-8350

REV B

FIGURE 3

APPENDIX A
SITE PHOTOGRAPHS

Figure 1. Looking South towards the Existing channel of Grapevine Ck.

Figure 2. Looking South from the culvert at Airfield Drive.

Figure 3. Looking South from Airfield Drive illustrating the floodplain topography.

Figure 4. Illustrating the debris collecting at the downstream end of the culvert at Airfield Drive.

APPENDIX B

HYDROLOGICAL CALCULATIONS

Dallas County

NRCS Runoff Curve Number Methods

				1yr	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
("P24LKUP.XLS")	Total Design Rainfall	P	(in)	**3.2**	**4.00**	**5.40**	**6.50**	**7.60**	**8.60**	**9.60**
S Solis Maps or Reports)	Soils Group			ENTER SG	ENTER SG	ENTER SG	ENTER SG	ENTER SG	ENTER SG	ENTER SG
	Weighted Runoff Curve Number	RCN II		**85**	**85**	**85**	**85**	**85**	**85**	**85**
igure 5-10, pg 5-39)	Rainfall Distribution Types	II		II	II	II	II	II	II	II
	Area	A	(mi^2)	2.35	2.35	2.35	2.35	2.35	2.35	2.35
	Time of Concentration		(hr)	**1.00**	1.00	1.00	1.00	1.00	1.00	1.00
quation 5-9, pg 5-38)	Potential Maximum Retention	$S = 10*((100/RCN)-1))$	(in)	1.76	1.76	1.76	1.76	1.76	1.76	1.76
quation 5-10, pg 5-38)	Initial Retention	$I_A = 0.2*S$	(in)	0.35	0.35	0.35	0.35	0.35	0.35	0.35
tion 5-8,10 & 11, pg 5-38)	NRCS Rainfall-Runoff Equation	$R= (P-I_A)^2 / ((P-I_A)+S)$	(in)	1.76	2.46	3.74	4.78	5.83	6.79	7.77
		I_A/P		0.11	0.09	0.07	0.05	0.05	0.04	0.04
		C_0		2.5532	2.5532	2.5532	2.5532	2.5532	2.5532	2.5532
		C_1		-0.6151	-0.6151	-0.6151	-0.6151	-0.6151	-0.6151	-0.6151
		C_2		-0.1640	-0.1640	-0.1640	-0.1640	-0.1640	-0.1640	-0.1640
	Revised - TxDOT, 02/00	$q_U = 10^(C_0+C_1 \log T_C+C_2[\log T_C]^2)$	($cfs/mi^2/in$)	357.44	357.44	357.44	357.44	357.44	357.44	357.44
		$Q = q_U*A*R*F$	(cfs)	**1,477**	**2,065**	**3,142**	**4,013**	**4,897**	**5,708**	**6,525**
		F= 1								

Equation 5-12 (pg 5-41)	RCN (I)	70
	RCN (II)	85
Equation 5-13 (pg 5-41)	RCN (III)	93

Rainfall Distribution Types	I_A/P	C_0	C_1	C_2
II	0.10	2.5532	-0.6151	-0.1640
	0.30	2.4653	-0.6226	-0.1166
	0.35	2.4190	-0.6159	-0.0882
	0.40	2.3641	-0.5986	-0.0562
	0.45	2.2924	-0.5701	-0.0228
	0.50	2.2028	-0.5160	-0.0126
III	0.10	2.4732	-0.5185	-0.1708
	0.30	2.3963	-0.5120	-0.1325
	0.35	2.3548	-0.4974	-0.1199
	0.40	2.3073	-0.4654	-0.1109
	0.45	2.2488	-0.4131	-0.1151
	0.50	2.1777	-0.3680	-0.0953

% Ponded / swamp area	Factor (F)
0	1
0.2	0.97
1	0.87
3	0.75
5	0.72

* All figure and table references are made to TxDOT Hydraulic Design Manual, Oct. 2011.

PARAMETERS ***(FILL IN YELLOW BOXES THAT APPLY)***

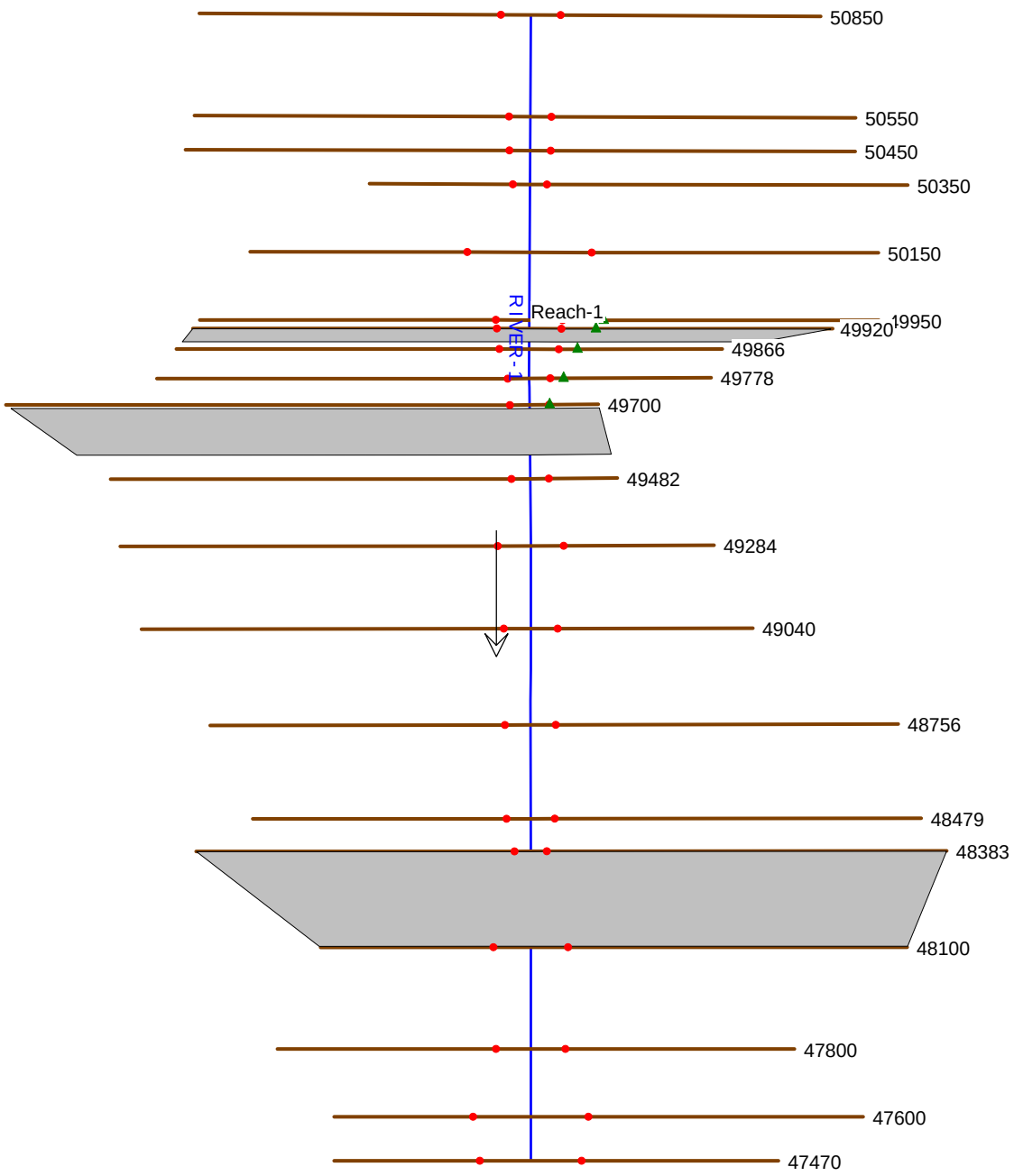
RATIONAL METHOD (for areas up to 200 acres):

RUNOFF COEFFICIENT ("C")=	**0.75**		
TIME OF CONCENTRATION (T_C)=	**60**	**minutes**	(minimum= 10 minutes)
DRAINAGE AREA =	**1504**	**acres**	

STORM FREQUENCY (year)	RATIONAL METHOD "C"	RATIONAL METHOD $I=b/(t_c+d)^e$ *intensity* (in/hr)	RATIONAL METHOD $Q=CIA$ *flow* (CFS)		OMEGA EM REG. EQ. (CFS)	NRCS (TR-55) (CFS)
2	0.75	**1.91**	**2,156**		**473**	**2,065**
5	0.75	**2.49**	**2,807**		**962**	**3,142**
10	0.75	**2.92**	**3,289**		**1,320**	**4,013**
25	0.75	**3.41**	**3,844**		**1,870**	**4,897**
50	0.75	**3.87**	**4,369**		**2,336**	**5,708**
100	0.75	**4.24**	**4,784**		**2,878**	**6,525**

APPENDIX C

HEC-RAS SUPPORTING DOCUMENTATION



None of the XS's are Geo-Referenced (· Geo-Ref user entered XS · Geo-Ref interpolated XS · Non Geo-Ref user entered XS · Non Geo-Ref interpolated XS)

Plan: Exist New RIVER-1 Reach-1 RS: 50350 Profile: 100-YR (Continued)

Max Chl Dpth (ft)	10.81	Hydr. Depth (ft)	2.82	9.65	1.15
Conv. Total (cfs)	306896.4	Conv. (cfs)	151901.1	143361.9	11633.5
Length Wtd. (ft)	199.05	Wetted Per. (ft)	982.96	102.73	337.50
Min Ch El (ft)	542.00	Shear (lb/sq ft)	0.06	0.19	0.02
Alpha	2.12	Stream Power (lb/ft s)	0.06	0.51	0.01
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	35.59	29.95	28.48
C & E Loss (ft)	0.01	Cum SA (acres)	33.12	12.38	38.46

Plan: Exist New RIVER-1 Reach-1 RS: 50150 Profile: 100-YR

E.G. Elev (ft)	552.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.060	0.045	0.050
W.S. Elev (ft)	552.80	Reach Len. (ft)	199.80	200.00	199.30
Crit W.S. (ft)		Flow Area (sq ft)	2799.75	2546.98	1020.51
E.G. Slope (ft/ft)	0.000105	Area (sq ft)	2799.75	2546.98	1020.51
Q Total (cfs)	5535.00	Flow (cfs)	1864.02	3126.58	544.40
Top Width (ft)	1634.26	Top Width (ft)	751.74	366.80	515.72
Vel Total (ft/s)	0.87	Avg. Vel. (ft/s)	0.67	1.23	0.53
Max Chl Dpth (ft)	11.20	Hydr. Depth (ft)	3.72	6.94	1.98
Conv. Total (cfs)	540089.3	Conv. (cfs)	181885.9	305082.4	53120.9
Length Wtd. (ft)	199.76	Wetted Per. (ft)	751.87	368.65	516.04
Min Ch El (ft)	541.60	Shear (lb/sq ft)	0.02	0.05	0.01
Alpha	1.36	Stream Power (lb/ft s)	0.02	0.06	0.01
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	22.99	21.88	25.20
C & E Loss (ft)	0.00	Cum SA (acres)	29.19	11.31	36.47

Plan: Exist New RIVER-1 Reach-1 RS: 49950 Profile: 100-YR

E.G. Elev (ft)	552.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.045	0.045
W.S. Elev (ft)	552.77	Reach Len. (ft)	26.01	25.30	25.06
Crit W.S. (ft)		Flow Area (sq ft)	536.97	1592.76	2702.21
E.G. Slope (ft/ft)	0.000139	Area (sq ft)	3722.35	1592.76	2702.21
Q Total (cfs)	5535.00	Flow (cfs)	507.01	2485.40	2542.59
Top Width (ft)	1861.37	Top Width (ft)	863.26	196.60	801.52
Vel Total (ft/s)	1.15	Avg. Vel. (ft/s)	0.94	1.56	0.94
Max Chl Dpth (ft)	11.47	Hydr. Depth (ft)	4.43	8.10	3.37
Conv. Total (cfs)	469931.5	Conv. (cfs)	43046.4	211014.6	215870.5
Length Wtd. (ft)	25.25	Wetted Per. (ft)	121.20	198.19	801.54
Min Ch El (ft)	541.30	Shear (lb/sq ft)	0.04	0.07	0.03
Alpha	1.21	Stream Power (lb/ft s)	0.04	0.11	0.03
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	8.03	12.37	16.68
C & E Loss (ft)	0.00	Cum SA (acres)	25.49	10.02	33.46

Plan: Exist New RIVER-1 Reach-1 RS: 49925 Profile: 100-YR

E.G. Elev (ft)	552.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.050	0.045	0.045
W.S. Elev (ft)	552.76	Reach Len. (ft)	62.09	60.40	59.84
Crit W.S. (ft)	547.25	Flow Area (sq ft)	448.66	1572.66	2754.41
E.G. Slope (ft/ft)	0.000146	Area (sq ft)	2694.85	1572.66	2754.41
Q Total (cfs)	5617.00	Flow (cfs)	434.11	2553.08	2629.82
Top Width (ft)	1748.18	Top Width (ft)	727.45	190.40	830.33
Vel Total (ft/s)	1.18	Avg. Vel. (ft/s)	0.97	1.62	0.95
Max Chl Dpth (ft)	11.55	Hydr. Depth (ft)	4.41	8.26	3.32
Conv. Total (cfs)	464486.1	Conv. (cfs)	35897.5	211121.4	217467.3
Length Wtd. (ft)	60.23	Wetted Per. (ft)	101.66	191.85	830.35
Min Ch El (ft)	541.21	Shear (lb/sq ft)	0.04	0.07	0.03
Alpha	1.23	Stream Power (lb/ft s)	0.04	0.12	0.03
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	6.12	11.45	15.11
C & E Loss (ft)	0.00	Cum SA (acres)	25.01	9.91	32.99

Plan: Exist New RIVER-1 Reach-1 RS: 49866 Profile: 100-YR

E.G. Elev (ft)	552.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.050	0.045	0.045
W.S. Elev (ft)	552.75	Reach Len. (ft)	90.60	86.60	81.80
Crit W.S. (ft)		Flow Area (sq ft)	241.50	1513.96	2885.00
E.G. Slope (ft/ft)	0.000157	Area (sq ft)	927.80	1513.96	2885.00
Q Total (cfs)	5617.00	Flow (cfs)	241.64	2624.15	2751.21
Top Width (ft)	1464.63	Top Width (ft)	394.04	175.60	894.99
Vel Total (ft/s)	1.21	Avg. Vel. (ft/s)	1.00	1.73	0.95
Max Chl Dpth (ft)	11.75	Hydr. Depth (ft)	4.39	8.62	3.22
Conv. Total (cfs)	447666.0	Conv. (cfs)	19258.1	209140.6	219267.3
Length Wtd. (ft)	84.37	Wetted Per. (ft)	55.00	176.93	895.01
Min Ch El (ft)	541.00	Shear (lb/sq ft)	0.04	0.08	0.03
Alpha	1.29	Stream Power (lb/ft s)	0.04	0.15	0.03
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	3.53	9.31	11.24
C & E Loss (ft)	0.00	Cum SA (acres)	24.21	9.65	31.80

Plan: Exist New RIVER-1 Reach-1 RS: 49778 Profile: 100-YR

E.G. Elev (ft)	552.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.050	0.045	0.045
W.S. Elev (ft)	552.74	Reach Len. (ft)	78.70	78.00	77.40
Crit W.S. (ft)		Flow Area (sq ft)	249.14	1304.90	3182.02
E.G. Slope (ft/ft)	0.000139	Area (sq ft)	1102.30	1304.90	3182.02
Q Total (cfs)	5617.00	Flow (cfs)	299.13	2398.03	2919.84
Top Width (ft)	1466.03	Top Width (ft)	383.50	125.60	956.93
Vel Total (ft/s)	1.19	Avg. Vel. (ft/s)	1.20	1.84	0.92
Max Chl Dpth (ft)	13.24	Hydr. Depth (ft)	6.34	10.39	3.33
Conv. Total (cfs)	476160.4	Conv. (cfs)	25357.9	203283.8	247518.7
Length Wtd. (ft)	77.69	Wetted Per. (ft)	39.31	127.34	956.95
Min Ch El (ft)	539.50	Shear (lb/sq ft)	0.06	0.09	0.03
Alpha	1.39	Stream Power (lb/ft s)	0.07	0.16	0.03
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.42	6.51	5.54
C & E Loss (ft)	0.00	Cum SA (acres)	23.41	9.35	30.06

Plan: Exist New RIVER-1 Reach-1 RS: 49700 Profile: 100-YR

E.G. Elev (ft)	552.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.035	0.045	0.035
W.S. Elev (ft)	552.71	Reach Len. (ft)	235.40	218.00	225.50
Crit W.S. (ft)	547.20	Flow Area (sq ft)	7.05	1097.42	3055.31
E.G. Slope (ft/ft)	0.000211	Area (sq ft)	473.61	1097.42	3055.31
Q Total (cfs)	5617.00	Flow (cfs)	12.20	2335.76	3269.03
Top Width (ft)	1710.42	Top Width (ft)	142.42	115.70	1452.30
Vel Total (ft/s)	1.35	Avg. Vel. (ft/s)	1.73	2.13	1.07
Max Chl Dpth (ft)	12.31	Hydr. Depth (ft)	4.70	9.49	2.10
Conv. Total (cfs)	386371.2	Conv. (cfs)	839.3	160668.0	224863.9
Length Wtd. (ft)	218.00	Wetted Per. (ft)	1.50	117.55	1452.38
Min Ch El (ft)	540.40	Shear (lb/sq ft)	0.06	0.12	0.03
Alpha	1.40	Stream Power (lb/ft s)	0.11	0.26	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)		4.36	
C & E Loss (ft)		Cum SA (acres)	22.93	9.14	27.92

Plan: Prop Cul New RIVER-1 Reach-1 RS: 50350 Profile: 100-YR (Continued)

Max Chl Dpth (ft)	11.39	Hydr. Depth (ft)	3.28	10.24	1.58
Conv. Total (cfs)	381882.4	Conv. (cfs)	201764.9	158239.8	21877.7
Length Wtd. (ft)	199.05	Wetted Per. (ft)	1022.76	102.73	379.93
Min Ch El (ft)	542.00	Shear (lb/sq ft)	0.04	0.13	0.02
Alpha	2.00	Stream Power (lb/ft s)	0.04	0.29	0.01
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	34.39	20.27	16.76
C & E Loss (ft)	0.01	Cum SA (acres)	33.54	12.38	38.96

Plan: Prop Cul New RIVER-1 Reach-1 RS: 50150 Profile: 100-YR

E.G. Elev (ft)	553.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.060	0.045	0.050
W.S. Elev (ft)	553.39	Reach Len. (ft)	199.80	200.00	199.30
Crit W.S. (ft)		Flow Area (sq ft)	3255.93	2762.97	1342.31
E.G. Slope (ft/ft)	0.000071	Area (sq ft)	3255.93	2762.97	1342.31
Q Total (cfs)	5535.00	Flow (cfs)	1918.82	2952.95	663.23
Top Width (ft)	1741.64	Top Width (ft)	797.61	366.80	577.23
Vel Total (ft/s)	0.75	Avg. Vel. (ft/s)	0.59	1.07	0.49
Max Chl Dpth (ft)	11.79	Hydr. Depth (ft)	4.08	7.53	2.33
Conv. Total (cfs)	654934.1	Conv. (cfs)	227045.6	349411.0	78477.4
Length Wtd. (ft)	199.74	Wetted Per. (ft)	797.75	368.65	577.55
Min Ch El (ft)	541.60	Shear (lb/sq ft)	0.02	0.03	0.01
Alpha	1.34	Stream Power (lb/ft s)	0.01	0.04	0.01
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	19.42	11.56	12.23
C & E Loss (ft)	0.00	Cum SA (acres)	29.42	11.31	36.73

Plan: Prop Cul New RIVER-1 Reach-1 RS: 49950 Profile: 100-YR

E.G. Elev (ft)	553.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.045	0.045
W.S. Elev (ft)	553.37	Reach Len. (ft)	26.01	25.30	25.06
Crit W.S. (ft)		Flow Area (sq ft)	609.53	1710.46	3192.53
E.G. Slope (ft/ft)	0.000095	Area (sq ft)	4249.29	1710.46	3192.53
Q Total (cfs)	5535.00	Flow (cfs)	517.73	2313.87	2703.41
Top Width (ft)	1930.10	Top Width (ft)	897.05	196.60	836.45
Vel Total (ft/s)	1.00	Avg. Vel. (ft/s)	0.85	1.35	0.85
Max Chl Dpth (ft)	12.07	Hydr. Depth (ft)	5.03	8.70	3.82
Conv. Total (cfs)	568456.6	Conv. (cfs)	53171.7	237639.3	277645.7
Length Wtd. (ft)	25.24	Wetted Per. (ft)	121.20	198.19	836.48
Min Ch El (ft)	541.30	Shear (lb/sq ft)	0.03	0.05	0.02
Alpha	1.17	Stream Power (lb/ft s)	0.03	0.07	0.02
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	2.21	1.30	1.86
C & E Loss (ft)	0.00	Cum SA (acres)	25.53	10.02	33.50

Plan: Prop Cul New RIVER-1 Reach-1 RS: 49925 Profile: 100-YR

E.G. Elev (ft)	553.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.050	0.045	0.045
W.S. Elev (ft)	553.36	Reach Len. (ft)	62.09	60.40	59.84
Crit W.S. (ft)	546.15	Flow Area (sq ft)	509.75	1793.19	3263.08
E.G. Slope (ft/ft)	0.000093	Area (sq ft)	3142.54	1793.19	3263.08
Q Total (cfs)	5617.00	Flow (cfs)	428.01	2478.28	2710.71
Top Width (ft)	1815.44	Top Width (ft)	762.49	190.40	862.55
Vel Total (ft/s)	1.01	Avg. Vel. (ft/s)	0.84	1.38	0.83
Max Chl Dpth (ft)	11.36	Hydr. Depth (ft)	5.01	9.42	3.78
Conv. Total (cfs)	582710.7	Conv. (cfs)	44402.1	257098.1	281210.5
Length Wtd. (ft)	60.40	Wetted Per. (ft)	101.66	198.19	862.58
Min Ch El (ft)	542.00	Shear (lb/sq ft)	0.03	0.05	0.02
Alpha	1.21	Stream Power (lb/ft s)	0.02	0.07	0.02
Frctn Loss (ft)		Cum Volume (acre-ft)		0.28	
C & E Loss (ft)		Cum SA (acres)	25.04	9.91	33.01

Plan: Prop Cul New RIVER-1 Reach-1 RS: 49866 Profile: 100-YR

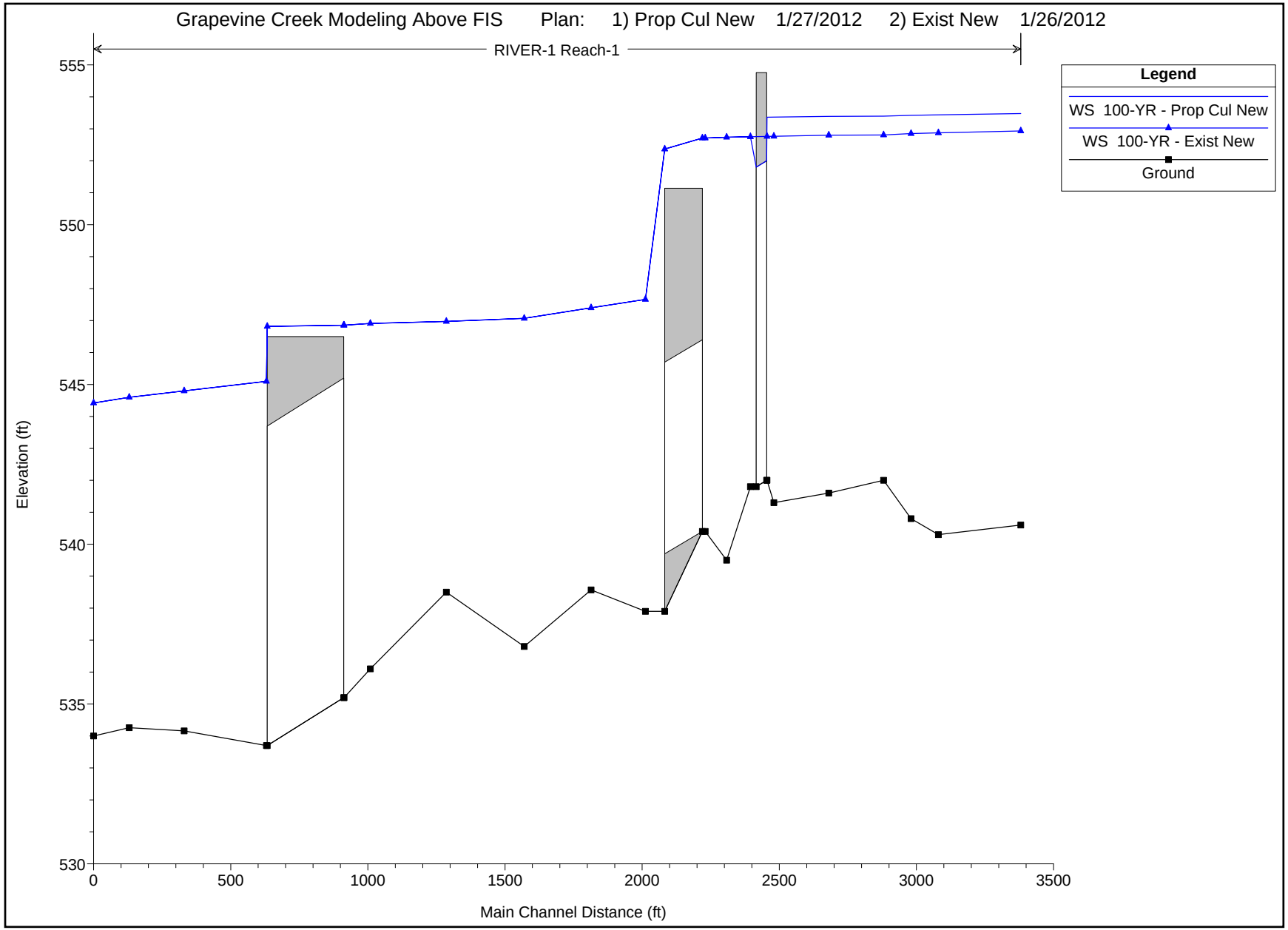
E.G. Elev (ft)	552.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.050	0.045	0.045
W.S. Elev (ft)	552.75	Reach Len. (ft)	90.60	86.60	81.80
Crit W.S. (ft)		Flow Area (sq ft)	241.56	1609.81	2885.93
E.G. Slope (ft/ft)	0.000147	Area (sq ft)	928.21	1609.81	2885.93
Q Total (cfs)	5617.00	Flow (cfs)	233.31	2727.04	2656.66
Top Width (ft)	1464.75	Top Width (ft)	394.11	175.60	895.04
Vel Total (ft/s)	1.19	Avg. Vel. (ft/s)	0.97	1.69	0.92
Max Chl Dpth (ft)	10.95	Hydr. Depth (ft)	4.39	9.17	3.22
Conv. Total (cfs)	463831.7	Conv. (cfs)	19265.6	225189.0	219377.1
Length Wtd. (ft)	84.41	Wetted Per. (ft)	55.00	184.62	895.06
Min Ch El (ft)	541.80	Shear (lb/sq ft)	0.04	0.08	0.03
Alpha	1.30	Stream Power (lb/ft s)	0.04	0.14	0.03
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	3.54	9.41	11.24
C & E Loss (ft)	0.00	Cum SA (acres)	24.21	9.65	31.80

Plan: Prop Cul New RIVER-1 Reach-1 RS: 49778 Profile: 100-YR

E.G. Elev (ft)	552.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.050	0.045	0.045
W.S. Elev (ft)	552.74	Reach Len. (ft)	78.70	78.00	77.40
Crit W.S. (ft)		Flow Area (sq ft)	249.14	1304.90	3182.02
E.G. Slope (ft/ft)	0.000139	Area (sq ft)	1102.30	1304.90	3182.02
Q Total (cfs)	5617.00	Flow (cfs)	299.13	2398.03	2919.84
Top Width (ft)	1466.03	Top Width (ft)	383.50	125.60	956.93
Vel Total (ft/s)	1.19	Avg. Vel. (ft/s)	1.20	1.84	0.92
Max Chl Dpth (ft)	13.24	Hydr. Depth (ft)	6.34	10.39	3.33
Conv. Total (cfs)	476160.4	Conv. (cfs)	25357.9	203283.8	247518.7
Length Wtd. (ft)	77.69	Wetted Per. (ft)	39.31	127.34	956.95
Min Ch El (ft)	539.50	Shear (lb/sq ft)	0.06	0.09	0.03
Alpha	1.39	Stream Power (lb/ft s)	0.07	0.16	0.03
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.42	6.51	5.54
C & E Loss (ft)	0.00	Cum SA (acres)	23.41	9.35	30.06

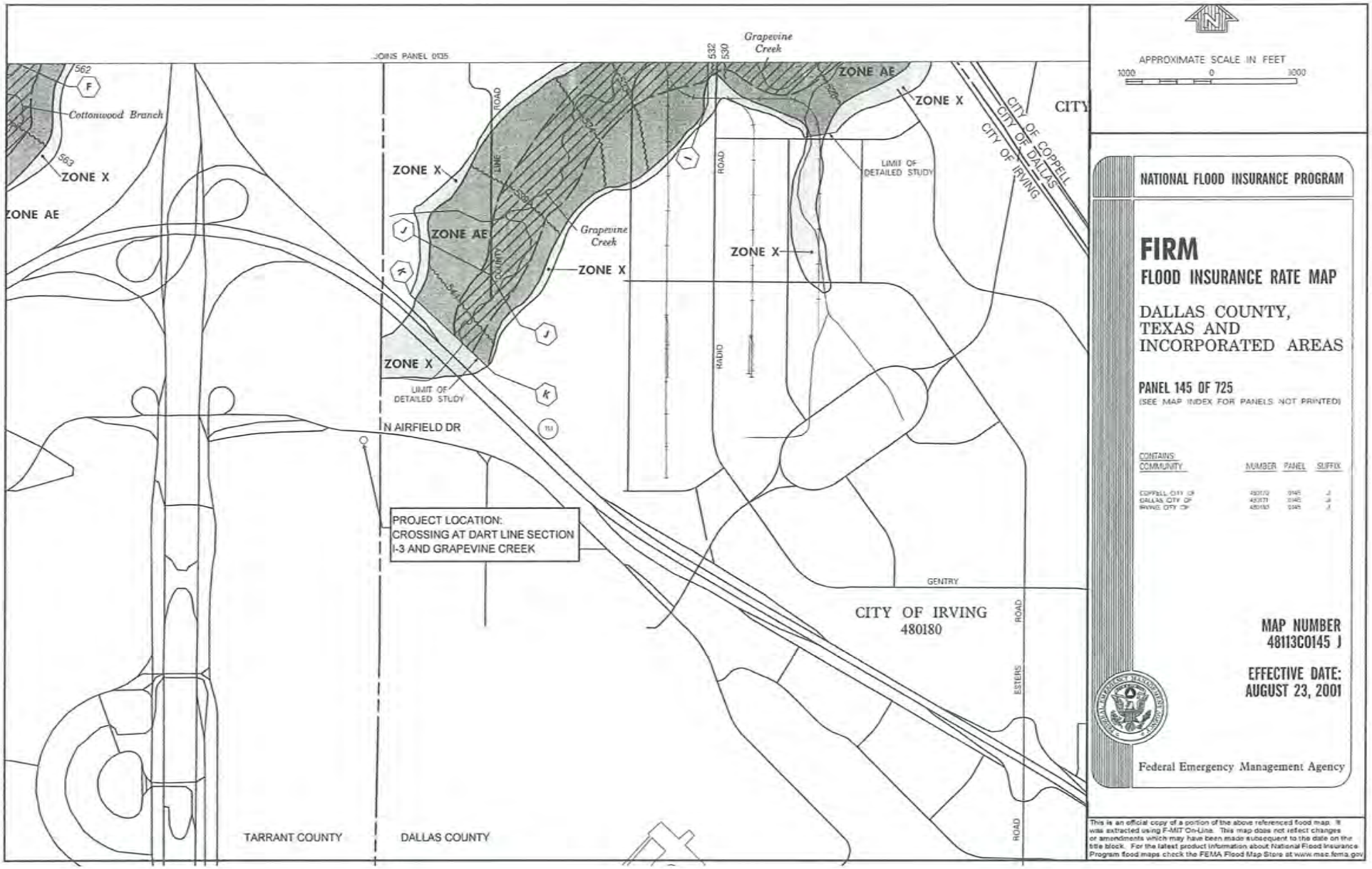
Plan: Prop Cul New RIVER-1 Reach-1 RS: 49700 Profile: 100-YR

E.G. Elev (ft)	552.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.035	0.045	0.035
W.S. Elev (ft)	552.71	Reach Len. (ft)	235.40	218.00	225.50
Crit W.S. (ft)	547.20	Flow Area (sq ft)	7.05	1097.42	3055.31
E.G. Slope (ft/ft)	0.000211	Area (sq ft)	473.61	1097.42	3055.31
Q Total (cfs)	5617.00	Flow (cfs)	12.20	2335.76	3269.03
Top Width (ft)	1710.42	Top Width (ft)	142.42	115.70	1452.30
Vel Total (ft/s)	1.35	Avg. Vel. (ft/s)	1.73	2.13	1.07
Max Chl Dpth (ft)	12.31	Hydr. Depth (ft)	4.70	9.49	2.10
Conv. Total (cfs)	386371.2	Conv. (cfs)	839.3	160668.0	224863.9
Length Wtd. (ft)	218.00	Wetted Per. (ft)	1.50	117.55	1452.38
Min Ch El (ft)	540.40	Shear (lb/sq ft)	0.06	0.12	0.03
Alpha	1.40	Stream Power (lb/ft s)	0.11	0.26	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)		4.36	
C & E Loss (ft)		Cum SA (acres)	22.93	9.14	27.92


Grapevine Creek Modeling Above FIS Plan: 1) Prop Cul New 1/27/2012 2) Exist New 1/26/2012
RIVER-1 Reach-1
Legend
WS 100-YR - Prop Cul New
WS 100-YR - Exist New
Ground
Elevation (ft)
555
550
545
540
535
530
0
500
1000
1500
2000
2500
3000
3500
Main Channel Distance (ft)

HEC-RAS River: RIVER-1 Reach: Reach-1 Profile: 100-YR

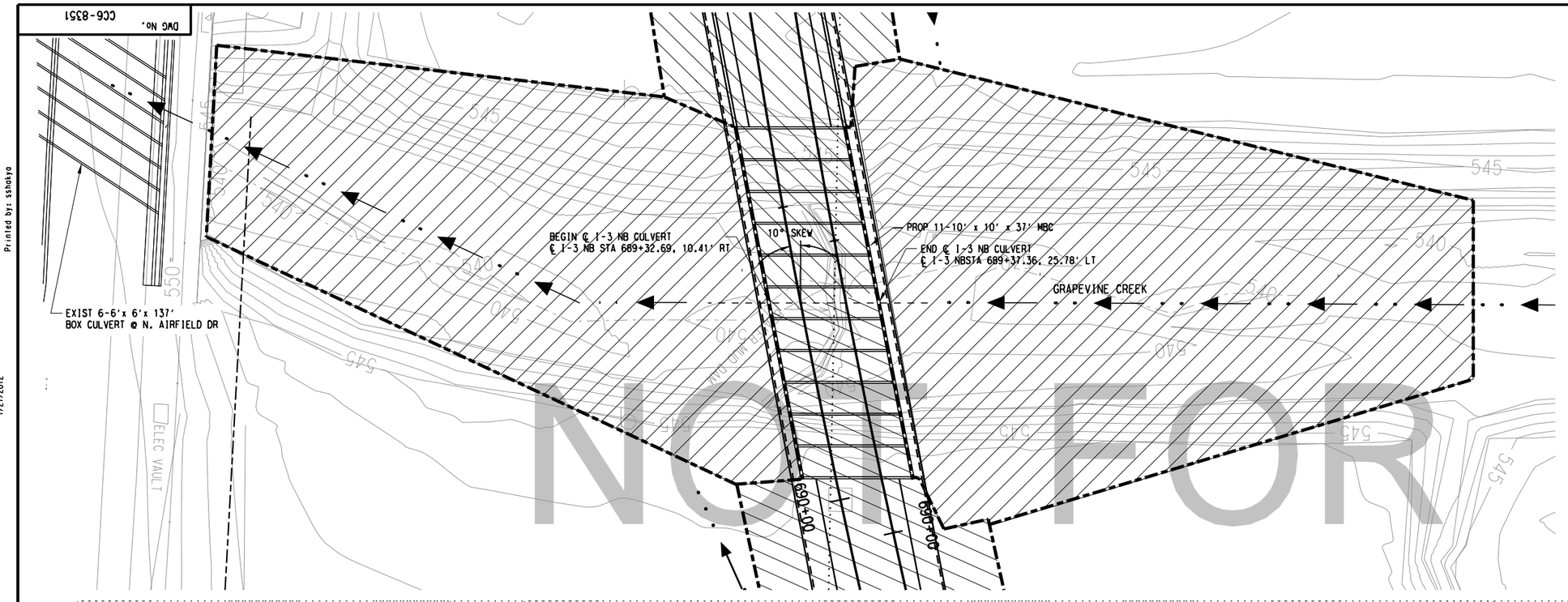
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	50850	100-YR	Prop Cul New	5535.00	540.60	553.48		553.57	0.000494	2.85	2805.39	791.54	0.18
Reach-1	50850	100-YR	Exist New	5535.00	540.60	552.93		553.06	0.000707	3.25	2385.39	732.65	0.21
Reach-1	50550	100-YR	Prop Cul New	5535.00	540.30	553.44		553.47	0.000179	1.97	4853.46	1198.49	0.11
Reach-1	50550	100-YR	Exist New	5535.00	540.30	552.87		552.92	0.000255	2.28	4197.39	1140.37	0.13
Reach-1	50450	100-YR	Prop Cul New	5535.00	540.80	553.42		553.45	0.000151	1.86	5463.25	1590.85	0.10
Reach-1	50450	100-YR	Exist New	5535.00	540.80	552.85		552.89	0.000220	2.16	4600.76	1477.19	0.12
Reach-1	50350	100-YR	Prop Cul New	5535.00	542.00	553.39		553.43	0.000210	2.23	4986.97	1502.80	0.12
Reach-1	50350	100-YR	Exist New	5535.00	542.00	552.81		552.86	0.000325	2.66	4125.79	1420.58	0.15
Reach-1	50150	100-YR	Prop Cul New	5535.00	541.60	553.39		553.40	0.000071	1.07	7361.21	1741.64	0.07
Reach-1	50150	100-YR	Exist New	5535.00	541.60	552.80		552.82	0.000105	1.23	6367.23	1634.26	0.08
Reach-1	49950	100-YR	Prop Cul New	5535.00	541.30	553.37		553.39	0.000095	1.35	5512.52	1930.10	0.08
Reach-1	49950	100-YR	Exist New	5535.00	541.30	552.77		552.79	0.000139	1.56	4831.94	1861.37	0.10
Reach-1	49925	100-YR	Prop Cul New	5617.00	542.00	553.36	546.15	553.38	0.000093	1.38	5566.02	1815.44	0.08
Reach-1	49925	100-YR	Exist New	5617.00	541.21	552.76	547.25	552.79	0.000146	1.62	4775.72	1748.18	0.10
Reach-1	49920			Culvert									
Reach-1	49866	100-YR	Prop Cul New	5617.00	541.80	552.75		552.78	0.000147	1.69	4737.30	1464.75	0.10
Reach-1	49866	100-YR	Exist New	5617.00	541.00	552.75		552.78	0.000157	1.73	4640.46	1464.63	0.10
Reach-1	49778	100-YR	Prop Cul New	5617.00	539.50	552.74		552.77	0.000139	1.84	4736.06	1466.03	0.10
Reach-1	49778	100-YR	Exist New	5617.00	539.50	552.74		552.77	0.000139	1.84	4736.06	1466.03	0.10
Reach-1	49700	100-YR	Prop Cul New	5617.00	540.40	552.71	547.20	552.75	0.000211	2.13	4159.78	1710.42	0.12
Reach-1	49700	100-YR	Exist New	5617.00	540.40	552.71	547.20	552.75	0.000211	2.13	4159.78	1710.42	0.12
Reach-1	49598			Culvert									
Reach-1	49482	100-YR	Prop Cul New	5617.00	537.90	547.66		547.96	0.001851	5.10	1768.26	949.86	0.34
Reach-1	49482	100-YR	Exist New	5617.00	537.90	547.66		547.96	0.001851	5.10	1768.26	949.86	0.34
Reach-1	49284	100-YR	Prop Cul New	5617.00	538.57	547.40		547.57	0.001532	3.87	2109.62	1095.52	0.30
Reach-1	49284	100-YR	Exist New	5617.00	538.57	547.40		547.57	0.001532	3.87	2109.62	1095.52	0.30
Reach-1	49040	100-YR	Prop Cul New	5617.00	536.80	547.07		547.24	0.001228	3.89	2015.54	793.08	0.27
Reach-1	49040	100-YR	Exist New	5617.00	536.80	547.07		547.24	0.001228	3.89	2015.54	793.08	0.27
Reach-1	48756	100-YR	Prop Cul New	7040.00	538.50	546.97		547.02	0.000436	2.31	4520.11	1605.44	0.16
Reach-1	48756	100-YR	Exist New	7040.00	538.50	546.97		547.02	0.000436	2.31	4520.11	1605.44	0.16
Reach-1	48479	100-YR	Prop Cul New	7040.00	536.10	546.91		546.94	0.000186	1.91	5593.41	1581.82	0.11
Reach-1	48479	100-YR	Exist New	7040.00	536.10	546.91		546.94	0.000186	1.91	5593.41	1581.82	0.11
Reach-1	48383	100-YR	Prop Cul New	7040.00	535.20	546.85	540.76	546.91	0.000297	2.70	4999.93	1773.38	0.14
Reach-1	48383	100-YR	Exist New	7040.00	535.20	546.85	540.76	546.91	0.000297	2.70	4999.93	1773.38	0.14
Reach-1	48241			Culvert									
Reach-1	48100	100-YR	Prop Cul New	7040.00	533.70	545.10		545.24	0.000674	3.29	2929.93	1156.21	0.21
Reach-1	48100	100-YR	Exist New	7040.00	533.70	545.10		545.24	0.000674	3.29	2929.93	1156.21	0.21
Reach-1	47800	100-YR	Prop Cul New	7040.00	534.16	544.80		544.98	0.001039	3.82	2708.99	847.01	0.26
Reach-1	47800	100-YR	Exist New	7040.00	534.16	544.80		544.98	0.001039	3.82	2708.99	847.01	0.26
Reach-1	47600	100-YR	Prop Cul New	7040.00	534.26	544.60		544.75	0.001178	3.37	2629.41	798.49	0.26
Reach-1	47600	100-YR	Exist New	7040.00	534.26	544.60		544.75	0.001178	3.37	2629.41	798.49	0.26
Reach-1	47470	100-YR	Prop Cul New	7040.00	534.00	544.42	540.44	544.60	0.001002	3.50	2362.93	618.87	0.25
Reach-1	47470	100-YR	Exist New	7040.00	534.00	544.42	540.44	544.60	0.001002	3.50	2362.93	618.87	0.25

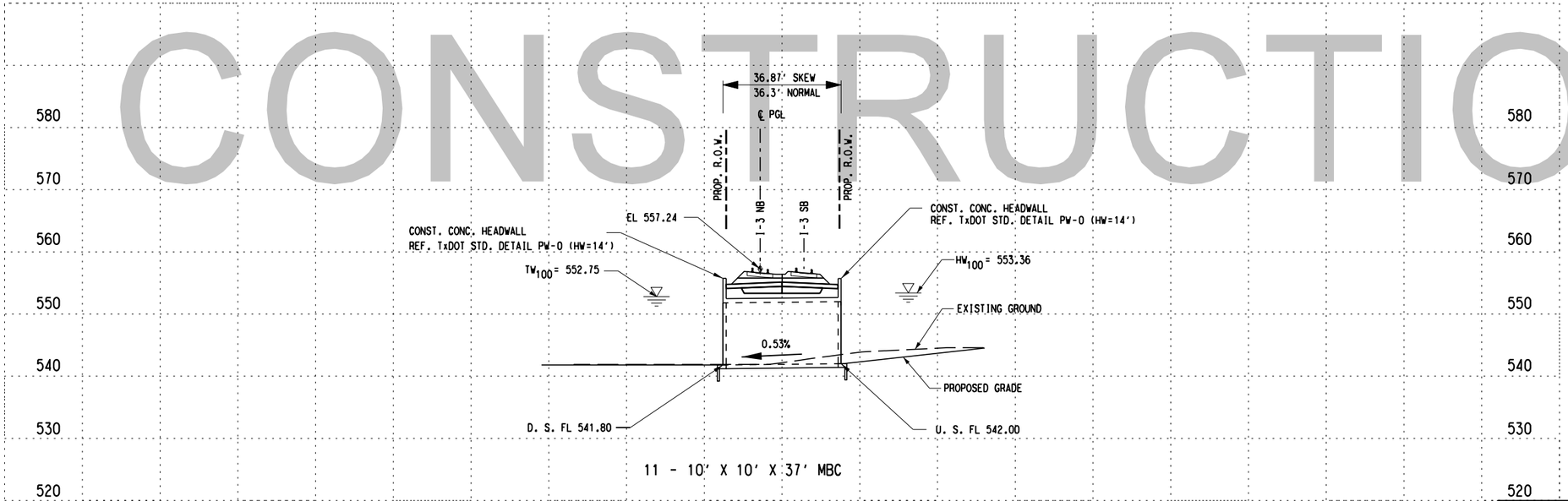

JOINS PANEL 0135
562
F
Cottonwood Branch
563
ZONE X
ZONE AE
ZONE X
ZONE AE
Grapevine Creek
532
530
ZONE AE
ZONE X
CITY
CITY OF COPPELL
CITY OF DALLAS
CITY OF IRVING
ROAD
LIMIT OF DETAILED STUDY
ZONE X
ZONE X
Grapevine Creek
ZONE X
LIMIT OF DETAILED STUDY
RADIO
N AIRFIELD DR
PROJECT LOCATION:
CROSSING AT DART LINE SECTION
I-3 AND GRAPEVINE CREEK
GENTRY
CITY OF IRVING
480180
ESTERS ROAD
ROAD
TARRANT COUNTY
DALLAS COUNTY
APPROXIMATE SCALE IN FEET
1000 0 1000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
DALLAS COUNTY, TEXAS AND INCORPORATED AREAS
PANEL 145 OF 725
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COPPELL, CITY OF 480170 0145 J
DALLAS, CITY OF 480171 0145 J
IRVING, CITY OF 480180 0145 J
MAP NUMBER
48113C0145 J
EFFECTIVE DATE:
AUGUST 23, 2001
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

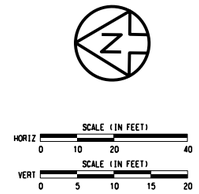
APPENDIX D

PROPOSED CULVERT LAYOUT
CROSS SECTION LAYOUT MAP

DWG No. CC6-8351







NOTE:

1. SPAN LENGTH STATIONING AND VERTICAL PROFILE ARE SHOWN ALONG THE CENTERLINE OF THE I-3 NORTHBOUND TRACK.
2. FOR ALIGNMENT CURVE DATA, SEE GUIDEWAY PLAN AND PROFILE DRAWINGS.
3. FOR ALL EXISTING AND PROPOSED UTILITY INFORMATION SEE UTILITY MODIFICATION COMPOSITE DRAWINGS.

HYDRAULIC DATA			
EXISTING		PROPOSED	
100 YR		100 YR	
Q (CFS)	5617	Q (CFS)	5617
V (FPS)	1.68	V (FPS)	1.38
HW ELEV.	552.76	HW ELEV.	553.36
TW ELEV.	552.75	TW ELEV.	552.75

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW UNDER THE AUTHORITY OF:

JAMES A. LANG, P.E. NO. 83953

IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.

LINA T. RAMEY & ASSOCIATES, INC.
1349 Empire Central, Suite 900
Dallas, Texas 75247
T(214)979-1144 - F(214)979-2480
TBPE FIRM #782

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

PRE-FINAL 95% DESIGN

PARENT PERMIT No.#####
CHILD PERMIT No.#####

CONTRACT SHEET No. OF

SCALE: AS SHOWN
DRAWN: LTRA CAD
DESIGNED: S. SHAKYA
CHECKED: J. LANG
IN CHARGE: L. RAMEY
DATE: 19 DEC 11

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

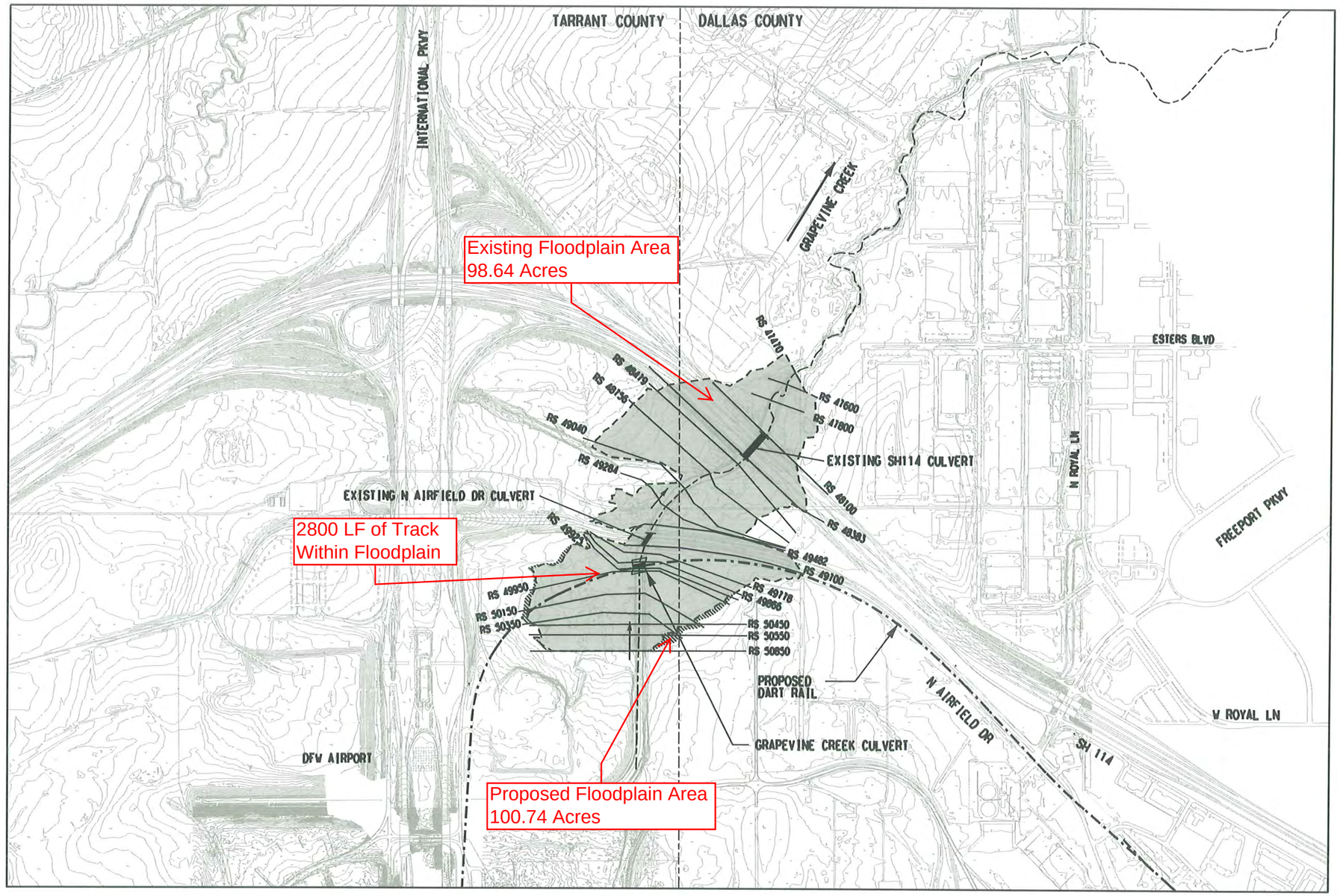
GRAPEVINE CREEK CULVERT
PLAN AND PROFILE

CAES

CONTRACT C-1018691-01

DWG No. CC6-8351

REV B



N

0 500 1000
SCALE IN FEET

DIRECTION OF FLOW
RS XXXXX HEC RAS CROSS SECTION LOCATION
100-YEAR EXISTING FLOODPLAIN
100-YEAR PROPOSED FLOODPLAIN

2.13% increase in floodplain area within the limits for this study

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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LTRA
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KSWBP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

PRE-FINAL 95% DESIGN

PARENT PERMIT No.00000 CHILD PERMIT No.00000	CONTRACT SHEET No. OF
SCALE	LIGHT RAIL TRANSIT SYSTEM LINE SECTION I-3
DRAWN	
DESIGNED	GRAPEVINE CREEK CULVERT CROSS SECTION LOCATION MAP
CHECKED	
IN CHARGE	
DATE	
CAES	CONTRACT C-1018691-01 / DWG No. / REV

APPENDIX D – AIR QUALITY

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[5]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
>0 to 11		2-Stroke Gas	Tampers/Rammers											
	all models			4	0.55		0.29	0.00	0	0	444.95	2.158	0	0
		4-Stroke Gas	Plate Compactors											
	all models			5	0.55		1.92	0.01	0	0	23.92	0.145	0	0
		4-Stroke Gas	Cement & Mortar Mixers											
	all models			7	0.59		1.92	0.02	0	0	23.61	0.215	0	0
		4-Stroke Gas	Paving Equipment											
	all models			7	0.59		1.92	0.02	0	0	23.79	0.217	0	0
		4-Stroke Gas	Pumps											
	all models			7	0.69		0.81	0.01	0	0	31.67	0.337	0	0
		4-Stroke Gas	Air Compressors											
	all models			9	0.56		0.81	0.01	0	0	29.67	0.330	0	0
		4-Stroke Gas	Dumpers/Tenders											
	all models			9	0.41		1.92	0.02	0	0	26.51	0.216	0	0
		4-Stroke Gas	Generator											
	all models			11	0.68		0.01	0.00	0	0	29.58	0.488	0	0
		4-Stroke Gas	(Enter Other Gas Equipment Here)[8]											
	all models[11]				1.00		5.42	0.00	0	0	242.00	0.000	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88				1.00		10.00	0.00	0	0	1.50	0.000	0	0
	88-99				1.00		10.00	0.00	0	0	1.50	0.000	0	0
	00-04		Dual Rail Vibrator	7	1.00	152.1	5.90	0.09	13.84892	0.0069245	1.60	0.025	3.755638	0.001877819
	05-				1.00		5.00	0.00	0	0	0.60	0.000	0	0
>11 to 16		4-Stroke Gas	Concrete/Industrial Saw											
	all models			13	0.78		1.92	0.04	0	0	22.64	0.506	0	0
		4-Stroke Gas	(Enter Other Gas Equipment Here)[8]											
	all models[11]				1.00		5.42	0.00	0	0	242.00	0.000	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88				1.00		10.00	0.00	0	0	1.50	0.000	0	0
	88-99				1.00		10.00	0.00	0	0	1.50	0.000	0	0
	00-04				1.00		5.20	0.00	0	0	0.70	0.000	0	0
	05-		Light Plant	13	1.00	42285.1	5.00	0.14	6059.506	3.0297532	0.60	0.017	727.1408	0.363570383
>16 to 25		Diesel	Grout Mixer[4]											
	pre-88			18	0.56		6.90	0.15	0	0	1.80	0.040	0	0
	88-99			18	0.56		6.90	0.15	0	0	1.80	0.040	0	0
	00-04			18	0.56		5.20	0.12	0	0	0.70	0.016	0	0
	05-			18	0.56		5.00	0.11	0	0	0.60	0.013	0	0
		4-Stroke Gas	Welders											
	pre-88			19	0.51		0.81	0.02	0	0	34.56	0.738	0	0
	88-99			19	0.51		0.81	0.02	0	0	34.56	0.738	0	0
	00-04			19	0.51		0.81	0.02	0	0	34.56	0.738	0	0
	05-			19	0.51		0.81	0.02	0	0	34.56	0.738	0	0
		Diesel	Pressure Washer											
	pre-88			21	0.30		6.90	0.10	0	0	1.80	0.025	0	0
	88-99			21	0.30		6.90	0.10	0	0	1.80	0.025	0	0
	00-04			21	0.30		5.20	0.07	0	0	0.70	0.010	0	0
	05-			21	0.30		5.00	0.07	0	0	0.60	0.008	0	0
		Diesel	Generator											
	pre-88			22	0.74		6.90	0.25	0	0	1.80	0.065	0	0
	88-99			22	0.74		6.90	0.25	0	0	1.80	0.065	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	00-04			22	0.74	336	5.20	0.19	62.70953	0.0313548	0.70	0.025	8.441668	0.004220834
	05-			22	0.74		5.00	0.18	0	0	0.60	0.022	0	0
		Diesel	Pumps											
	pre-88			23	0.74		6.90	0.26	0	0	1.80	0.068	0	0
	88-99			23	0.74		6.90	0.26	0	0	1.80	0.068	0	0
	00-04			23	0.74		5.20	0.20	0	0	0.70	0.026	0	0
	05-			23	0.74		5.00	0.19	0	0	0.60	0.023	0	0
		4-Stroke Gas	(Enter Other Gas Equipment Here)[8]											
	all models[11]				1.00		5.42	0.00	0	0	242.00	0.000	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88				1.00		6.90	0.00	0	0	1.80	0.000	0	0
	88-99				1.00		6.90	0.00	0	0	1.80	0.000	0	0
	00-04				1.00		5.20	0.00	0	0	0.70	0.000	0	0
	05-				1.00		5.00	0.00	0	0	0.60	0.000	0	0
>25 to 50		Diesel	Scissor Lift[4]											
	pre-88			30	0.46		6.90	0.21	0	0	1.80	0.055	0	0
	88-98			30	0.46		6.90	0.21	0	0	1.80	0.055	0	0
	99-03			30	0.46		5.50	0.17	0	0	0.80	0.024	0	0
	04-			30	0.46		5.00	0.15	0	0	0.60	0.018	0	0
		Diesel	Welder											
	pre-88			35	0.45		6.90	0.24	0	0	1.80	0.063	0	0
	88-98			35	0.45		6.90	0.24	0	0	1.80	0.063	0	0
	99-03			35	0.45		5.50	0.19	0	0	0.80	0.028	0	0
	04-			35	0.45		5.00	0.17	0	0	0.60	0.021	0	0
		Diesel	Skid Steer Loaders											
	pre-88			42	0.55		6.90	0.35	0	0	1.80	0.092	0	0
	88-98			42	0.55		6.90	0.35	0	0	1.80	0.092	0	0
	99-03			42	0.55		5.50	0.28	0	0	0.80	0.041	0	0
	04-			42	0.55		5.00	0.25	0	0	0.60	0.031	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88				1.00		6.90	0.00	0	0	1.80	0.000	0	0
	88-98				1.00		6.90	0.00	0	0	1.80	0.000	0	0
	99-03				1.00		5.50	0.00	0	0	0.80	0.000	0	0
	04-				1.00		5.00	0.00	0	0	0.60	0.000	0	0
>50 to 100		Diesel	Aerial Lifts[4]											
	pre-88[1]			56	0.46		8.30	0.47	0	0	0.99	0.056	0	0
	88-97			56	0.46		8.30	0.47	0	0	0.99	0.056	0	0
	98-03			56	0.46		6.90	0.39	0	0	0.70	0.040	0	0
	04-07			56	0.46		5.20	0.30	0	0	0.40	0.023	0	0
	08-		Man Lift 60'	56	0.46	1498.6	3.30	0.19	280.8549	0.1404275	0.20	0.011	17.02151	0.008510756
		Diesel	Concrete Saw											
	pre-88[2]			56	0.73		10.43	0.94	0	0	1.05	0.095	0	0
	88-97			56	0.73		8.30	0.75	0	0	0.99	0.089	0	0
	98-03			56	0.73		6.90	0.62	0	0	0.70	0.063	0	0
	04-07			56	0.73		5.20	0.47	0	0	0.40	0.036	0	0
	08-			56	0.73		3.30	0.30	0	0	0.20	0.018	0	0
		Diesel	Skid Steer Loaders[4]											
	pre-88[2]			60	0.55		10.59	0.77	0	0	3.44	0.250	0	0
	88-97			60	0.55		8.30	0.60	0	0	0.99	0.072	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[4]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	98-03			60	0.55		6.90	0.50	0	0	0.70	0.051	0	0
	04-07			60	0.55		5.20	0.38	0	0	0.40	0.029	0	0
	08-			60	0.55		3.30	0.24	0	0	0.20	0.015	0	0
		Diesel	Trenchers											
	pre-88[2]			60	0.75		9.49	0.94	0	0	3.44	0.341	0	0
	88-97			60	0.75		8.30	0.82	0	0	0.99	0.098	0	0
	98-03			60	0.75		6.90	0.68	0	0	0.70	0.069	0	0
	04-07			60	0.75		5.20	0.52	0	0	0.40	0.040	0	0
	08-			60	0.75		3.30	0.33	0	0	0.20	0.020	0	0
		Diesel	Tractor/Loader (Backhoe)											
	pre-88[2]			71	0.55		11.14	0.96	0	0	2.29	0.197	0	0
	88-97			71	0.55		8.30	0.71	0	0	0.99	0.085	0	0
	98-03			71	0.55		6.90	0.59	0	0	0.70	0.060	0	0
	04-07			71	0.55		5.20	0.45	0	0	0.40	0.034	0	0
	08-			71	0.55		3.30	0.28	0	0	0.20	0.017	0	0
		Diesel	Air Compressors[4]											
	pre-88[3]			75	0.48		11.30	0.90	0	0	3.44	0.273	0	0
	88-97			75	0.48		8.30	0.66	0	0	0.99	0.079	0	0
	98-03		CMPRSR	75	0.48	3975.8	6.90	0.55	2177.272	1.0886359	0.70	0.056	220.8826	0.110441324
	04-07			75	0.48		5.20	0.41	0	0	0.40	0.032	0	0
	08-			75	0.48		3.30	0.26	0	0	0.20	0.016	0	0
		Diesel	Sandblaster[4]											
	pre-88[3]			75	0.30		11.30	0.56	0	0	3.44	0.171	0	0
	88-97			75	0.30		8.30	0.41	0	0	0.99	0.049	0	0
	98-03			75	0.30		6.90	0.34	0	0	0.70	0.035	0	0
	04-07			75	0.30		5.20	0.26	0	0	0.40	0.020	0	0
	08-			75	0.30		3.30	0.16	0	0	0.20	0.010	0	0
		Diesel	Sweepers[4]											
	pre-88[3]			75	0.68		11.30	1.27	0	0	3.44	0.387	0	0
	88-97			75	0.68		8.30	0.93	0	0	0.99	0.111	0	0
	98-03			75	0.68		6.90	0.78	0	0	0.70	0.079	0	0
	04-07			75	0.68		5.20	0.58	0	0	0.40	0.045	0	0
	08-			75	0.68		3.30	0.37	0	0	0.20	0.022	0	0
		Diesel	Asphalt Paver											
	pre-88[2]			77	0.62		9.63	1.01	0	0	0.99	0.104	0	0
	88-97			77	0.62		8.30	0.87	0	0	0.99	0.104	0	0
	98-03			77	0.62		6.90	0.73	0	0	0.70	0.074	0	0
	04-07			77	0.62		5.20	0.55	0	0	0.40	0.042	0	0
	08-			77	0.62		3.30	0.35	0	0	0.20	0.021	0	0
		Diesel	Tractor/Loader (Backhoe)											
	pre-88[2]			77	0.55		11.14	1.04	0	0	2.29	0.214	0	0
	88-97			77	0.55		8.30	0.77	0	0	0.99	0.092	0	0
	98-03			77	0.55		6.90	0.64	0	0	0.70	0.065	0	0
	04-07			77	0.55		5.20	0.49	0	0	0.40	0.037	0	0
	08-			77	0.55		3.30	0.31	0	0	0.20	0.019	0	0
		Diesel	Fork Lifts											
	pre-88[3]			83	0.59		11.30	1.22	0	0	3.44	0.371	0	0
	88-97			83	0.59		8.30	0.90	0	0	0.99	0.107	0	0
	98-03			83	0.59		6.90	0.74	0	0	0.70	0.076	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	04-07			83	0.59		5.20	0.56	0	0	0.40	0.043	0	0
	08-			83	0.59		3.30	0.36	0	0	0.20	0.022	0	0
		Diesel	Asphalt Paver											
	pre-88[2]			91	0.62		9.63	1.20	0	0	0.99	0.123	0	0
	88-97			91	0.62		8.30	1.03	0	0	0.99	0.123	0	0
	98-03			91	0.62		6.90	0.86	0	0	0.70	0.087	0	0
	04-07			91	0.62		5.20	0.65	0	0	0.40	0.050	0	0
	08-			91	0.62		3.30	0.41	0	0	0.20	0.025	0	0
		Diesel	Paint Sprayers[5]											
	pre-88[3]			92	0.58		11.30	1.33	0	0	3.44	0.405	0	0
	88-97			92	0.58		8.30	0.98	0	0	0.99	0.116	0	0
	98-03			92	0.58		6.90	0.81	0	0	0.70	0.082	0	0
	04-07			92	0.58		5.20	0.61	0	0	0.40	0.047	0	0
	08-			92	0.58		3.30	0.39	0	0	0.20	0.024	0	0
		Diesel	Rough Terrain Forklift											
	pre-88[1]			93	0.60		8.30	1.02	0	0	0.99	0.122	0	0
	88-97			93	0.60		8.30	1.02	0	0	0.99	0.122	0	0
	98-03			93	0.60		6.90	0.85	0	0	0.70	0.086	0	0
	04-07			93	0.60		5.20	0.64	0	0	0.40	0.049	0	0
	08-			93	0.60		3.30	0.41	0	0	0.20	0.025	0	0
		Diesel	Sweepers											
	pre-88[3]			97	0.68		11.30	1.64	0	0	3.44	0.500	0	0
	88-97			97	0.68		8.30	1.21	0	0	0.99	0.144	0	0
	98-03			97	0.68		6.90	1.00	0	0	0.70	0.102	0	0
	04-07			97	0.68		5.20	0.76	0	0	0.40	0.058	0	0
	08-			97	0.68		3.30	0.48	0	0	0.20	0.029	0	0
		Diesel	Paving Equipment											
	pre-88[2]			99	0.53		10.43	1.21	0	0	1.06	0.123	0	0
	88-97			99	0.53		8.30	0.96	0	0	0.99	0.115	0	0
	98-03			99	0.53		6.90	0.80	0	0	0.70	0.081	0	0
	04-07			99	0.53		5.20	0.60	0	0	0.40	0.046	0	0
	08-			99	0.53		3.30	0.38	0	0	0.20	0.023	0	0
		Diesel	Rollers (Compactor Roller incl.)											
	pre-88[2]			99	0.56		8.81	1.08	0	0	0.99	0.121	0	0
	88-97			99	0.56		8.30	1.01	0	0	0.99	0.121	0	0
	98-03			99	0.56		6.90	0.84	0	0	0.70	0.086	0	0
	04-07			99	0.56	1747.3	5.20	0.64	1110.531	0.5552654	0.40	0.049	85.42544	0.042712719
	08-			99	0.56		3.30	0.40	0	0	0.20	0.024	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-97				1.00		8.30	0.00	0	0	0.99	0.000	0	0
	98-03		Bridge Deck Finisher	56	1.00	135	6.90	0.85	115.0025	0.0575013	0.70	0.086	11.66692	0.005833462
	04-07		Backhoe 310/426	91	1.00	834.1	5.20	1.04	870.1605	0.4350803	0.40	0.080	66.93543	0.033467713
	04-07		Backhoe 410/446	98	1.00	51.8	5.20	1.12	58.19634	0.0290982	0.40	0.086	4.476642	0.002238321
	08-		Skid Steer Loaders[4]	90	1.00	4639.4	3.30	0.65	3037.769	1.5188847	0.20	0.040	184.1072	0.092053617
>100 to 175		Diesel	Crushing/Proc. Equipment											
	pre-88[2]			127	0.78		11.01	2.40	0	0	1.01	0.221	0	0
	88-96			127	0.78		8.38	1.83	0	0	0.68	0.149	0	0
	97-02			127	0.78		6.90	1.51	0	0	0.40	0.087	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[5]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	03-06			127	0.78		4.50	0.98	0	0	0.40	0.087	0	0
	07-			127	0.78		2.80	0.61	0	0	0.20	0.044	0	0
		Diesel	Concrete Pavers											
	pre-88[2]			130	0.68		9.63	1.88	0	0	0.99	0.193	0	0
	88-96			130	0.68		8.38	1.63	0	0	0.68	0.133	0	0
	97-02			130	0.68		6.90	1.34	0	0	0.40	0.078	0	0
	03-06			130	0.68		4.50	0.88	0	0	0.40	0.078	0	0
	07-			130	0.68		2.80	0.55	0	0	0.20	0.039	0	0
		Diesel	Crawler Loader/Dozer[5]											
	pre-88[2]			134	0.64		9.76	1.85	0	0	0.94	0.178	0	0
	88-96			134	0.64		8.38	1.58	0	0	0.68	0.129	0	0
	97-02			134	0.64		6.90	1.30	0	0	0.40	0.076	0	0
	03-06			134	0.64	1819.9	4.50	0.85	1548.394	0.7741968	0.40	0.076	137.635	0.068817489
	07-			134	0.64		2.80	0.53	0	0	0.20	0.038	0	0
		Diesel	Excavators											
	pre-88[2]			143	0.57		10.19	1.83	0	0	0.68	0.122	0	0
	88-96			143	0.57		8.38	1.51	0	0	0.68	0.122	0	0
	97-02			143	0.57		6.90	1.24	0	0	0.40	0.072	0	0
	03-06			143	0.57	2516.1	4.50	0.81	2034.641	1.0173206	0.40	0.072	180.857	0.090428498
	07-			143	0.57		2.80	0.50	0	0	0.20	0.036	0	0
		Diesel	Hoe Ram[4]											
	pre-88[2]			143	0.43		11.01	1.49	0	0	1.01	0.137	0	0
	88-96			143	0.43		8.38	1.14	0	0	0.68	0.092	0	0
	97-02			143	0.43		6.90	0.94	0	0	0.40	0.054	0	0
	03-06			143	0.43		4.50	0.61	0	0	0.40	0.054	0	0
	07-			143	0.43		2.80	0.38	0	0	0.20	0.027	0	0
		Diesel	Graders											
	pre-88[2]			147	0.61		9.10	1.80	0	0	1.15	0.227	0	0
	88-96			147	0.61		8.38	1.66	0	0	0.68	0.134	0	0
	97-02			147	0.61		6.90	1.36	0	0	0.40	0.079	0	0
	03-06			147	0.61		4.50	0.89	0	0	0.40	0.079	0	0
	07-			147	0.61		2.80	0.55	0	0	0.20	0.040	0	0
		Diesel	Crawler Tractors											
	pre-88[3]			157	0.58		11.30	2.27	0	0	3.44	0.691	0	0
	88-96			157	0.58		8.38	1.68	0	0	0.68	0.137	0	0
	97-02			157	0.58		6.90	1.39	0	0	0.40	0.080	0	0
	03-06			157	0.58		4.50	0.90	0	0	0.40	0.080	0	0
	07-			157	0.58		2.80	0.56	0	0	0.20	0.040	0	0
		Diesel	Other Construction Equipment											
	pre-88[2]			161	0.62		10.43	2.30	0	0	1.05	0.231	0	0
	88-96			161	0.62		8.38	1.84	0	0	0.68	0.150	0	0
	97-02			161	0.62		6.90	1.52	0	0	0.40	0.088	0	0
	03-06			161	0.62		4.50	0.99	0	0	0.40	0.088	0	0
	07-			161	0.62		2.80	0.62	0	0	0.20	0.044	0	0
		Diesel	Graders											
	pre-88[2]			172	0.61		9.10	2.10	0	0	1.15	0.266	0	0
	88-96			172	0.61		8.38	1.94	0	0	0.68	0.157	0	0
	97-02			172	0.61		6.90	1.60	0	0	0.40	0.093	0	0
	03-06			172	0.61		4.50	1.04	0	0	0.40	0.093	0	0
	07-			172	0.61		2.80	0.65	0	0	0.20	0.046	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[9]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-96		Backhoe 710	126	1.00	29	8.38	2.33	67.50704	0.0337535	0.68	0.189	5.477899	0.002738949
	97-02				1.00		6.90	0.00	0	0	0.40	0.000	0	0
	03-06				1.00		4.50	0.00	0	0	0.40	0.000	0	0
	07-				1.00		2.80	0.00	0	0	0.20	0.000	0	0
>175 to 300		Diesel	Rubber Tire Loader											
	pre-88[2]			158	0.54		9.76	1.84	0	0	0.68	0.128	0	0
	88-95			158	0.54		8.38	1.58	0	0	0.68	0.128	0	0
	96-02			158	0.54		6.90	1.30	0	0	0.40	0.075	0	0
	03-05			158	0.54		4.50	0.85	0	0	0.40	0.075	0	0
	06-			158	0.54		2.80	0.53	0	0	0.20	0.038	0	0
		Diesel	Drill Rigs[4]											
	pre-88[2]			177	0.75		11.01	3.22	0	0	1.01	0.296	0	0
	88-95			177	0.75		8.38	2.45	0	0	0.68	0.199	0	0
	96-02			177	0.75		6.90	2.02	0	0	0.40	0.117	0	0
	03-05			177	0.75		4.50	1.32	0	0	0.40	0.117	0	0
	06-			177	0.75		2.80	0.82	0	0	0.20	0.059	0	0
		Diesel	Cranes											
	pre-88[2]			194	0.43		10.30	1.89	0	0	0.90	0.166	0	0
	88-95			194	0.43		8.38	1.54	0	0	0.68	0.125	0	0
	96-02			194	0.43		6.90	1.27	0	0	0.40	0.074	0	0
	03-05			194	0.43	2412.3	4.50	0.83	1996.414	0.9982069	0.40	0.074	177.459	0.088729498
	06-			194	0.43		2.80	0.51	0	0	0.20	0.037	0	0
		Diesel	Concrete Pump[4]											
	pre-88[3]			200	0.74		11.30	3.69	0	0	3.44	1.122	0	0
	88-95			200	0.74		8.38	2.73	0	0	0.68	0.222	0	0
	96-02			200	0.74		6.90	2.25	0	0	0.40	0.131	0	0
	03-05			200	0.74		4.50	1.47	0	0	0.40	0.131	0	0
	06-			200	0.74		2.80	0.91	0	0	0.20	0.065	0	0
		Diesel	Bore Drill Rigs											
	pre-88[2]			209	0.75		11.01	3.80	0	0	1.01	0.349	0	0
	88-95			209	0.75		8.38	2.90	0	0	0.68	0.235	0	0
	96-02			209	0.75		6.90	2.38	0	0	0.40	0.138	0	0
	03-05			209	0.75		4.50	1.56	0	0	0.40	0.138	0	0
	06-			209	0.75		2.80	0.97	0	0	0.20	0.069	0	0
		Diesel	Off Highway Tractors											
	pre-88[2]			214	0.65		11.28	3.46	0	0	1.84	0.564	0	0
	88-95			214	0.65		8.38	2.57	0	0	0.68	0.209	0	0
	96-02			214	0.65		6.90	2.12	0	0	0.40	0.123	0	0
	03-05			214	0.65		4.50	1.38	0	0	0.40	0.123	0	0
	06-			214	0.65		2.80	0.86	0	0	0.20	0.061	0	0
		Diesel	Cement Mixer[4]											
	pre-88[2]			285	0.56		11.01	3.87	0	0	1.01	0.355	0	0
	88-95			285	0.56		8.38	2.95	0	0	0.68	0.239	0	0
	96-02			285	0.56		6.90	2.43	0	0	0.40	0.141	0	0
	03-05			285	0.56		4.50	1.58	0	0	0.40	0.141	0	0
	06-			285	0.56		2.80	0.99	0	0	0.20	0.070	0	0
		Diesel	Pulvimixer[4]											

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	pre-88[2]			290	0.56		11.01	3.94	0	0	1.01	0.362	0	0
	88-95			290	0.56		8.38	3.00	0	0	0.68	0.243	0	0
	96-02			290	0.56		6.90	2.47	0	0	0.40	0.143	0	0
	03-05			290	0.56		4.50	1.61	0	0	0.40	0.143	0	0
	06-			290	0.56		2.80	1.00	0	0	0.20	0.072	0	0
		Diesel	Scrapers											
	pre-88[1]			290	0.72		8.38	3.86	0	0	0.68	0.313	0	0
	88-95			290	0.72		8.38	3.86	0	0	0.68	0.313	0	0
	96-02			290	0.72		6.90	3.18	0	0	0.40	0.184	0	0
	03-05			290	0.72		4.50	2.07	0	0	0.40	0.184	0	0
	06-			290	0.72		2.80	1.29	0	0	0.20	0.092	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-95				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	96-02		Tamper	200	1.00	965.4	6.90	3.04	2937.128	1.4685641	0.40	0.176	170.2683	0.085134152
	96-02		Fairmont Ballast Regulator	275	1.00	817.3	6.90	4.18	3419.006	1.7095028	0.40	0.243	198.2032	0.099101612
	96-02		Pettibone 360 Speed Swing	175	1.00	2131.1	6.90	2.66	5673.192	2.8365961	0.40	0.154	328.8807	0.164440354
	03-05		Blade 14H dirt	259	1.00	4	4.50	2.57	10.278	0.005139	0.40	0.228	0.9136	0.0004568
	06-				1.00		2.80	0.00	0	0	0.20	0.000	0	0
>300 to 600		Diesel	Off Highway Trucks											
	pre-88[2]			300	0.57		9.10	3.43	0	0	0.63	0.238	0	0
	88-95			300	0.57		8.38	3.16	0	0	0.68	0.256	0	0
	96-00			300	0.57		6.90	2.60	0	0	0.30	0.113	0	0
	01-05			300	0.57		4.50	1.70	0	0	0.30	0.113	0	0
	06-			300	0.57		2.80	1.06	0	0	0.20	0.075	0	0
		Diesel	Scrapers											
	pre-88[1]			311	0.72		8.38	4.14	0	0	0.68	0.336	0	0
	88-95			311	0.72		8.38	4.14	0	0	0.68	0.336	0	0
	96-00			311	0.72		6.90	3.41	0	0	0.30	0.148	0	0
	01-05			311	0.72		4.50	2.22	0	0	0.30	0.148	0	0
	06-			311	0.72		2.80	1.38	0	0	0.20	0.099	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-95				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	96-00				1.00		6.90	0.00	0	0	0.30	0.000	0	0
	01-05		Scrapers	330	1.00	2	4.50	3.27	6.547763	0.0032739	0.30	0.218	0.436518	0.000218259
	06-				1.00		2.80	0.00	0	0	0.20	0.000	0	0
>600 to 750		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-95				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	96-01				1.00		6.90	0.00	0	0	0.30	0.000	0	0
	02-05				1.00		4.50	0.00	0	0	0.30	0.000	0	0
	06-				1.00		2.80	0.00	0	0	0.20	0.000	0	0
>750		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-99				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	06-				1.00		4.50	0.00	0	0	0.30	0.000	0	0
EPA Model 5 and 6 Onroad Model						Miles	g/mile[7]	lbs/mile	Total lbs	Total Tons	g/mile[7]	lbs/mile	Total lbs	Total Tons

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	97-00		Pickups (Light duty trucks)				1.3	0.002866	0.00	0.00000	1.9	0.004189	0.00	0.00000
	97-00		Highway Trucks (Heavy duty trucks)				8.2	0.018078	0.00	0.00000	2.0	0.004409	0.00	0.00000
	01-03		Pickups (Light duty trucks)			149,038	0.5	0.001102	164.29	0.08214	0.6	0.001323	197.14	0.09857
	01-03		Highway Trucks (Heavy duty trucks)			3,781	6.5	0.014330	54.18	0.02709	2.0	0.004409	16.67	0.00834
									TOTAL	12.6714			TOTAL	1.3719004

Signature:				
Submitted By: (typed/printed name &	Melissa Soto	Contact Phone Number:	(972) 374-4800	Submission Date: 12-10-1

Note 1: The estimated emission factors for Pre-88 equipment were lower than the Tier 1 values, therefore, the Tier 1 values were assumed to be conservative.
Note 2: Pre-88 emission factor estimates were taken from US EPA Draft NONROAD model which is based on NEVES.
Note 3: Pre-88 emission factor estimates were not provided in the US EPA Draft NONROAD model so the maximum values are assumed to be conservative.
Note 4: Average Horsepower is calculated from the *Rental Rate Blue Book for Construction Volume 1 copyright 2000.*
Note 5: Load Factors taken from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling," Report No. NR-005A, US EPA, 12/9/97, revised 6/16/98.

Note 6: one pound=453.59 grams
Note 7: The emission factors for Highway Trucks and Pickups are taken from EPA Model 5 and 6.
Note 8: All load factors for the "other equipment" category are assumed to be 1.00 unless information is available to support a lower factor.
Note 9: Load Factors taken from the "Nonroad Engine and Vehicle Emission Study Report, November 1991" (NEVES), table 2-05.
Note 10:Average Horsepower taken from the "Nonroad Engine and Vehicle Emission Study Report, November 1991" (NEVES), table 2-04.
Note 11:All emission factors for "other gas equipment "category are assigned maximum values to be conservative, maximum factors taken from the, "Nonroad Engine and Vehicle Emission Study Report, November 1991" (N

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[5]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
>0 to 11		2-Stroke Gas	Tampers/Rammers											
	all models			4	0.55		0.29	0.00	0	0	444.95	2.158	0	0
		4-Stroke Gas	Plate Compactors											
	all models			5	0.55		1.92	0.01	0	0	23.92	0.145	0	0
		4-Stroke Gas	Cement & Mortar Mixers											
	all models			7	0.59		1.92	0.02	0	0	23.61	0.215	0	0
		4-Stroke Gas	Paving Equipment											
	all models			7	0.59		1.92	0.02	0	0	23.79	0.217	0	0
		4-Stroke Gas	Pumps											
	all models			7	0.69		0.81	0.01	0	0	31.67	0.337	0	0
		4-Stroke Gas	Air Compressors											
	all models			9	0.56		0.81	0.01	0	0	29.67	0.330	0	0
		4-Stroke Gas	Dumpers/Tenders											
	all models			9	0.41		1.92	0.02	0	0	26.51	0.216	0	0
		4-Stroke Gas	Generator											
	all models			11	0.68		0.01	0.00	0	0	29.58	0.488	0	0
		4-Stroke Gas	(Enter Other Gas Equipment Here)[8]											
	all models[11]				1.00		5.42	0.00	0	0	242.00	0.000	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88				1.00		10.00	0.00	0	0	1.50	0.000	0	0
	88-99				1.00		10.00	0.00	0	0	1.50	0.000	0	0
	00-04				1.00		5.90	0.00	0	0	1.60	0.000	0	0
	05-				1.00		5.00	0.00	0	0	0.60	0.000	0	0
>11 to 16		4-Stroke Gas	Concrete/Industrial Saw											
	all models			13	0.78		1.92	0.04	0	0	22.64	0.506	0	0
		4-Stroke Gas	(Enter Other Gas Equipment Here)[8]											
	all models[11]				1.00		5.42	0.00	0	0	242.00	0.000	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88				1.00		10.00	0.00	0	0	1.50	0.000	0	0
	88-99				1.00		10.00	0.00	0	0	1.50	0.000	0	0
	00-04				1.00		5.20	0.00	0	0	0.70	0.000	0	0
	05-			13	1.00		5.00	0.14	0	0	0.60	0.017	0	0
>16 to 25		Diesel	Grout Mixer[4]											
	pre-88			18	0.56		6.90	0.15	0	0	1.80	0.040	0	0
	88-99			18	0.56		6.90	0.15	0	0	1.80	0.040	0	0
	00-04			18	0.56		5.20	0.12	0	0	0.70	0.016	0	0
	05-			18	0.56		5.00	0.11	0	0	0.60	0.013	0	0
		4-Stroke Gas	Welders											
	pre-88			19	0.51		0.81	0.02	0	0	34.56	0.738	0	0
	88-99			19	0.51		0.81	0.02	0	0	34.56	0.738	0	0
	00-04			19	0.51		0.81	0.02	0	0	34.56	0.738	0	0
	05-			19	0.51		0.81	0.02	0	0	34.56	0.738	0	0
		Diesel	Pressure Washer											
	pre-88			21	0.30		6.90	0.10	0	0	1.80	0.025	0	0
	88-99			21	0.30		6.90	0.10	0	0	1.80	0.025	0	0
	00-04			21	0.30		5.20	0.07	0	0	0.70	0.010	0	0
	05-			21	0.30		5.00	0.07	0	0	0.60	0.008	0	0
		Diesel	Generator											
	pre-88			22	0.74		6.90	0.25	0	0	1.80	0.065	0	0
	88-99			22	0.74		6.90	0.25	0	0	1.80	0.065	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	00-04			22	0.74		5.20	0.19	0	0	0.70	0.025	0	0
	05-			22	0.74		5.00	0.18	0	0	0.60	0.022	0	0
		Diesel	Pumps											
	pre-88			23	0.74		6.90	0.26	0	0	1.80	0.068	0	0
	88-99			23	0.74		6.90	0.26	0	0	1.80	0.068	0	0
	00-04			23	0.74		5.20	0.20	0	0	0.70	0.026	0	0
	05-			23	0.74		5.00	0.19	0	0	0.60	0.023	0	0
		4-Stroke Gas	(Enter Other Gas Equipment Here)[8]											
	all models[11]				1.00		5.42	0.00	0	0	242.00	0.000	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88				1.00		6.90	0.00	0	0	1.80	0.000	0	0
	88-99				1.00		6.90	0.00	0	0	1.80	0.000	0	0
	00-04				1.00		5.20	0.00	0	0	0.70	0.000	0	0
	05-				1.00		5.00	0.00	0	0	0.60	0.000	0	0
>25 to 50		Diesel	Scissor Lift[4]											
	pre-88			30	0.46		6.90	0.21	0	0	1.80	0.055	0	0
	88-98			30	0.46		6.90	0.21	0	0	1.80	0.055	0	0
	99-03			30	0.46		5.50	0.17	0	0	0.80	0.024	0	0
	04-			30	0.46		5.00	0.15	0	0	0.60	0.018	0	0
		Diesel	Welder											
	pre-88			35	0.45		6.90	0.24	0	0	1.80	0.063	0	0
	88-98			35	0.45		6.90	0.24	0	0	1.80	0.063	0	0
	99-03			35	0.45		5.50	0.19	0	0	0.80	0.028	0	0
	04-			35	0.45		5.00	0.17	0	0	0.60	0.021	0	0
		Diesel	Skid Steer Loaders											
	pre-88			42	0.55		6.90	0.35	0	0	1.80	0.092	0	0
	88-98			42	0.55		6.90	0.35	0	0	1.80	0.092	0	0
	99-03			42	0.55		5.50	0.28	0	0	0.80	0.041	0	0
	04-			42	0.55		5.00	0.25	0	0	0.60	0.031	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88				1.00		6.90	0.00	0	0	1.80	0.000	0	0
	88-98				1.00		6.90	0.00	0	0	1.80	0.000	0	0
	99-03				1.00		5.50	0.00	0	0	0.80	0.000	0	0
	04-				1.00		5.00	0.00	0	0	0.60	0.000	0	0
>50 to 100		Diesel	Aerial Lifts[4]											
	pre-88[1]			56	0.46		8.30	0.47	0	0	0.99	0.056	0	0
	88-97			56	0.46		8.30	0.47	0	0	0.99	0.056	0	0
	98-03			56	0.46		6.90	0.39	0	0	0.70	0.040	0	0
	04-07			56	0.46		5.20	0.30	0	0	0.40	0.023	0	0
	08-			56	0.46		3.30	0.19	0	0	0.20	0.011	0	0
		Diesel	Concrete Saw											
	pre-88[2]			56	0.73		10.43	0.94	0	0	1.05	0.095	0	0
	88-97			56	0.73		8.30	0.75	0	0	0.99	0.089	0	0
	98-03			56	0.73		6.90	0.62	0	0	0.70	0.063	0	0
	04-07			56	0.73		5.20	0.47	0	0	0.40	0.036	0	0
	08-			56	0.73		3.30	0.30	0	0	0.20	0.018	0	0
		Diesel	Skid Steer Loaders[4]											
	pre-88[2]			60	0.55		10.59	0.77	0	0	3.44	0.250	0	0
	88-97			60	0.55		8.30	0.60	0	0	0.99	0.072	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	98-03			60	0.55		6.90	0.50	0	0	0.70	0.051	0	0
	04-07			60	0.55		5.20	0.38	0	0	0.40	0.029	0	0
	08-			60	0.55		3.30	0.24	0	0	0.20	0.015	0	0
		Diesel	Trenchers											
	pre-88[2]			60	0.75		9.49	0.94	0	0	3.44	0.341	0	0
	88-97			60	0.75		8.30	0.82	0	0	0.99	0.098	0	0
	98-03			60	0.75		6.90	0.68	0	0	0.70	0.069	0	0
	04-07			60	0.75		5.20	0.52	0	0	0.40	0.040	0	0
	08-			60	0.75		3.30	0.33	0	0	0.20	0.020	0	0
		Diesel	Tractor/Loader (Backhoe)											
	pre-88[2]			71	0.55		11.14	0.96	0	0	2.29	0.197	0	0
	88-97			71	0.55		8.30	0.71	0	0	0.99	0.085	0	0
	98-03			71	0.55		6.90	0.59	0	0	0.70	0.060	0	0
	04-07			71	0.55		5.20	0.45	0	0	0.40	0.034	0	0
	08-			71	0.55		3.30	0.28	0	0	0.20	0.017	0	0
		Diesel	Air Compressors[4]											
	pre-88[3]			75	0.48		11.30	0.90	0	0	3.44	0.273	0	0
	88-97			75	0.48		8.30	0.66	0	0	0.99	0.079	0	0
	98-03			75	0.48		6.90	0.55	0	0	0.70	0.056	0	0
	04-07			75	0.48		5.20	0.41	0	0	0.40	0.032	0	0
	08-			75	0.48		3.30	0.26	0	0	0.20	0.016	0	0
		Diesel	Sandblaster[4]											
	pre-88[3]			75	0.30		11.30	0.56	0	0	3.44	0.171	0	0
	88-97			75	0.30		8.30	0.41	0	0	0.99	0.049	0	0
	98-03			75	0.30		6.90	0.34	0	0	0.70	0.035	0	0
	04-07			75	0.30		5.20	0.26	0	0	0.40	0.020	0	0
	08-			75	0.30		3.30	0.16	0	0	0.20	0.010	0	0
		Diesel	Sweepers[4]											
	pre-88[3]			75	0.68		11.30	1.27	0	0	3.44	0.387	0	0
	88-97			75	0.68		8.30	0.93	0	0	0.99	0.111	0	0
	98-03			75	0.68		6.90	0.78	0	0	0.70	0.079	0	0
	04-07			75	0.68		5.20	0.58	0	0	0.40	0.045	0	0
	08-			75	0.68		3.30	0.37	0	0	0.20	0.022	0	0
		Diesel	Asphalt Paver											
	pre-88[2]			77	0.62		9.63	1.01	0	0	0.99	0.104	0	0
	88-97			77	0.62		8.30	0.87	0	0	0.99	0.104	0	0
	98-03			77	0.62		6.90	0.73	0	0	0.70	0.074	0	0
	04-07			77	0.62		5.20	0.55	0	0	0.40	0.042	0	0
	08-			77	0.62		3.30	0.35	0	0	0.20	0.021	0	0
		Diesel	Tractor/Loader (Backhoe)											
	pre-88[2]			77	0.55		11.14	1.04	0	0	2.29	0.214	0	0
	88-97			77	0.55		8.30	0.77	0	0	0.99	0.092	0	0
	98-03			77	0.55		6.90	0.64	0	0	0.70	0.065	0	0
	04-07			77	0.55		5.20	0.49	0	0	0.40	0.037	0	0
	08-			77	0.55		3.30	0.31	0	0	0.20	0.019	0	0
		Diesel	Fork Lifts											
	pre-88[3]			83	0.59		11.30	1.22	0	0	3.44	0.371	0	0
	88-97			83	0.59		8.30	0.90	0	0	0.99	0.107	0	0
	98-03			83	0.59		6.90	0.74	0	0	0.70	0.076	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[5]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	04-07			83	0.59		5.20	0.56	0	0	0.40	0.043	0	0
	08-			83	0.59		3.30	0.36	0	0	0.20	0.022	0	0
		Diesel	Asphalt Paver											
	pre-88[2]			91	0.62		9.63	1.20	0	0	0.99	0.123	0	0
	88-97			91	0.62		8.30	1.03	0	0	0.99	0.123	0	0
	98-03			91	0.62		6.90	0.86	0	0	0.70	0.087	0	0
	04-07			91	0.62		5.20	0.65	0	0	0.40	0.050	0	0
	08-			91	0.62		3.30	0.41	0	0	0.20	0.025	0	0
		Diesel	Paint Sprayers[5]											
	pre-88[3]			92	0.58		11.30	1.33	0	0	3.44	0.405	0	0
	88-97			92	0.58		8.30	0.98	0	0	0.99	0.116	0	0
	98-03			92	0.58		6.90	0.81	0	0	0.70	0.082	0	0
	04-07			92	0.58		5.20	0.61	0	0	0.40	0.047	0	0
	08-			92	0.58		3.30	0.39	0	0	0.20	0.024	0	0
		Diesel	Rough Terrain Forklift											
	pre-88[1]			93	0.60		8.30	1.02	0	0	0.99	0.122	0	0
	88-97			93	0.60		8.30	1.02	0	0	0.99	0.122	0	0
	98-03			93	0.60		6.90	0.85	0	0	0.70	0.086	0	0
	04-07			93	0.60		5.20	0.64	0	0	0.40	0.049	0	0
	08-			93	0.60		3.30	0.41	0	0	0.20	0.025	0	0
		Diesel	Sweepers											
	pre-88[3]			97	0.68		11.30	1.64	0	0	3.44	0.500	0	0
	88-97			97	0.68		8.30	1.21	0	0	0.99	0.144	0	0
	98-03			97	0.68		6.90	1.00	0	0	0.70	0.102	0	0
	04-07			97	0.68		5.20	0.76	0	0	0.40	0.058	0	0
	08-			97	0.68		3.30	0.48	0	0	0.20	0.029	0	0
		Diesel	Paving Equipment											
	pre-88[2]			99	0.53		10.43	1.21	0	0	1.06	0.123	0	0
	88-97			99	0.53		8.30	0.96	0	0	0.99	0.115	0	0
	98-03			99	0.53		6.90	0.80	0	0	0.70	0.081	0	0
	04-07			99	0.53		5.20	0.60	0	0	0.40	0.046	0	0
	08-			99	0.53		3.30	0.38	0	0	0.20	0.023	0	0
		Diesel	Rollers (Compactor Roller incl.)											
	pre-88[2]			99	0.56		8.81	1.08	0	0	0.99	0.121	0	0
	88-97			99	0.56		8.30	1.01	0	0	0.99	0.121	0	0
	98-03			99	0.56		6.90	0.84	0	0	0.70	0.086	0	0
	04-07			99	0.56		5.20	0.64	0	0	0.40	0.049	0	0
	08-			99	0.56		3.30	0.40	0	0	0.20	0.024	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-97				1.00		8.30	0.00	0	0	0.99	0.000	0	0
	98-03				1.00		6.90	0.00	0	0	0.70	0.000	0	0
	04-07				1.00		5.20	0.00	0	0	0.40	0.000	0	0
	04-07				1.00		5.20	0.00	0	0	0.40	0.000	0	0
	08-				1.00		3.30	0.00	0	0	0.20	0.000	0	0
>100 to 175		Diesel	Crushing/Proc. Equipment											
	pre-88[2]			127	0.78		11.01	2.40	0	0	1.01	0.221	0	0
	88-96			127	0.78		8.38	1.83	0	0	0.68	0.149	0	0
	97-02			127	0.78		6.90	1.51	0	0	0.40	0.087	0	0
	03-06			127	0.78		4.50	0.98	0	0	0.40	0.087	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[3]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	07-			127	0.78		2.80	0.61	0	0	0.20	0.044	0	0
		Diesel	Concrete Pavers											
	pre-88[2]			130	0.68		9.63	1.88	0	0	0.99	0.193	0	0
	88-96			130	0.68		8.38	1.63	0	0	0.68	0.133	0	0
	97-02			130	0.68		6.90	1.34	0	0	0.40	0.078	0	0
	03-06			130	0.68		4.50	0.88	0	0	0.40	0.078	0	0
	07-			130	0.68		2.80	0.55	0	0	0.20	0.039	0	0
		Diesel	Crawler Loader/Dozer[5]											
	pre-88[2]			134	0.64		9.76	1.85	0	0	0.94	0.178	0	0
	88-96			134	0.64		8.38	1.58	0	0	0.68	0.129	0	0
	97-02			134	0.64		6.90	1.30	0	0	0.40	0.076	0	0
	03-06			134	0.64		4.50	0.85	0	0	0.40	0.076	0	0
	07-			134	0.64		2.80	0.53	0	0	0.20	0.038	0	0
		Diesel	Excavators											
	pre-88[2]			143	0.57		10.19	1.83	0	0	0.68	0.122	0	0
	88-96			143	0.57		8.38	1.51	0	0	0.68	0.122	0	0
	97-02			143	0.57		6.90	1.24	0	0	0.40	0.072	0	0
	03-06			143	0.57		4.50	0.81	0	0	0.40	0.072	0	0
	07-			143	0.57		2.80	0.50	0	0	0.20	0.036	0	0
		Diesel	Hoe Ram[4]											
	pre-88[2]			143	0.43		11.01	1.49	0	0	1.01	0.137	0	0
	88-96			143	0.43		8.38	1.14	0	0	0.68	0.092	0	0
	97-02			143	0.43		6.90	0.94	0	0	0.40	0.054	0	0
	03-06			143	0.43		4.50	0.61	0	0	0.40	0.054	0	0
	07-			143	0.43		2.80	0.38	0	0	0.20	0.027	0	0
		Diesel	Graders											
	pre-88[2]			147	0.61		9.10	1.80	0	0	1.15	0.227	0	0
	88-96			147	0.61		8.38	1.66	0	0	0.68	0.134	0	0
	97-02			147	0.61		6.90	1.36	0	0	0.40	0.079	0	0
	03-06			147	0.61		4.50	0.89	0	0	0.40	0.079	0	0
	07-			147	0.61		2.80	0.55	0	0	0.20	0.040	0	0
		Diesel	Crawler Tractors											
	pre-88[3]			157	0.58		11.30	2.27	0	0	3.44	0.691	0	0
	88-96			157	0.58		8.38	1.68	0	0	0.68	0.137	0	0
	97-02			157	0.58		6.90	1.39	0	0	0.40	0.080	0	0
	03-06			157	0.58		4.50	0.90	0	0	0.40	0.080	0	0
	07-			157	0.58		2.80	0.56	0	0	0.20	0.040	0	0
		Diesel	Other Construction Equipment											
	pre-88[2]			161	0.62		10.43	2.30	0	0	1.05	0.231	0	0
	88-96			161	0.62		8.38	1.84	0	0	0.68	0.150	0	0
	97-02			161	0.62		6.90	1.52	0	0	0.40	0.088	0	0
	03-06			161	0.62		4.50	0.99	0	0	0.40	0.088	0	0
	07-			161	0.62		2.80	0.62	0	0	0.20	0.044	0	0
		Diesel	Graders											
	pre-88[2]			172	0.61		9.10	2.10	0	0	1.15	0.266	0	0
	88-96			172	0.61		8.38	1.94	0	0	0.68	0.157	0	0
	97-02			172	0.61		6.90	1.60	0	0	0.40	0.093	0	0
	03-06			172	0.61		4.50	1.04	0	0	0.40	0.093	0	0
	07-			172	0.61		2.80	0.65	0	0	0.20	0.046	0	0

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
		Diesel	(Enter Other Diesel Equipment Here)[9]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-96				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	97-02				1.00		6.90	0.00	0	0	0.40	0.000	0	0
	03-06				1.00		4.50	0.00	0	0	0.40	0.000	0	0
	07-				1.00		2.80	0.00	0	0	0.20	0.000	0	0
>175 to 300		Diesel	Rubber Tire Loader											
	pre-88[2]			158	0.54		9.76	1.84	0	0	0.68	0.128	0	0
	88-95			158	0.54		8.38	1.58	0	0	0.68	0.128	0	0
	96-02			158	0.54		6.90	1.30	0	0	0.40	0.075	0	0
	03-05			158	0.54		4.50	0.85	0	0	0.40	0.075	0	0
	06-			158	0.54		2.80	0.53	0	0	0.20	0.038	0	0
		Diesel	Drill Rigs[4]											
	pre-88[2]			177	0.75		11.01	3.22	0	0	1.01	0.296	0	0
	88-95			177	0.75		8.38	2.45	0	0	0.68	0.199	0	0
	96-02		Truck Mounted	177	0.75	320	6.90	2.02	646.2047	0.3231024	0.40	0.117	37.46114	0.018730572
	03-05			177	0.75		4.50	1.32	0	0	0.40	0.117	0	0
	06-			177	0.75		2.80	0.82	0	0	0.20	0.059	0	0
		Diesel	Cranes											
	pre-88[2]			194	0.43		10.30	1.89	0	0	0.90	0.166	0	0
	88-95			194	0.43		8.38	1.54	0	0	0.68	0.125	0	0
	96-02			194	0.43		6.90	1.27	0	0	0.40	0.074	0	0
	03-05			194	0.43		4.50	0.83	0	0	0.40	0.074	0	0
	06-			194	0.43		2.80	0.51	0	0	0.20	0.037	0	0
		Diesel	Concrete Pump[4]											
	pre-88[3]			200	0.74		11.30	3.69	0	0	3.44	1.122	0	0
	88-95			200	0.74		8.38	2.73	0	0	0.68	0.222	0	0
	96-02			200	0.74		6.90	2.25	0	0	0.40	0.131	0	0
	03-05			200	0.74		4.50	1.47	0	0	0.40	0.131	0	0
	06-			200	0.74		2.80	0.91	0	0	0.20	0.065	0	0
		Diesel	Bore Drill Rigs											
	pre-88[2]			209	0.75		11.01	3.80	0	0	1.01	0.349	0	0
	88-95			209	0.75		8.38	2.90	0	0	0.68	0.235	0	0
	96-02			209	0.75		6.90	2.38	0	0	0.40	0.138	0	0
	03-05			209	0.75		4.50	1.56	0	0	0.40	0.138	0	0
	06-			209	0.75		2.80	0.97	0	0	0.20	0.069	0	0
		Diesel	Off Highway Tractors											
	pre-88[2]			214	0.65		11.28	3.46	0	0	1.84	0.564	0	0
	88-95			214	0.65		8.38	2.57	0	0	0.68	0.209	0	0
	96-02			214	0.65		6.90	2.12	0	0	0.40	0.123	0	0
	03-05			214	0.65		4.50	1.38	0	0	0.40	0.123	0	0
	06-			214	0.65		2.80	0.86	0	0	0.20	0.061	0	0
		Diesel	Cement Mixer[4]											
	pre-88[2]			285	0.56		11.01	3.87	0	0	1.01	0.355	0	0
	88-95			285	0.56		8.38	2.95	0	0	0.68	0.239	0	0
	96-02			285	0.56		6.90	2.43	0	0	0.40	0.141	0	0
	03-05			285	0.56		4.50	1.58	0	0	0.40	0.141	0	0
	06-			285	0.56		2.80	0.99	0	0	0.20	0.070	0	0
		Diesel	Pulvimixer[4]											

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	pre-88[2]			290	0.56		11.01	3.94	0	0	1.01	0.362	0	0
	88-95			290	0.56		8.38	3.00	0	0	0.68	0.243	0	0
	96-02			290	0.56		6.90	2.47	0	0	0.40	0.143	0	0
	03-05			290	0.56		4.50	1.61	0	0	0.40	0.143	0	0
	06-			290	0.56		2.80	1.00	0	0	0.20	0.072	0	0
		Diesel	Scrapers											
	pre-88[1]			290	0.72		8.38	3.86	0	0	0.68	0.313	0	0
	88-95			290	0.72		8.38	3.86	0	0	0.68	0.313	0	0
	96-02			290	0.72		6.90	3.18	0	0	0.40	0.184	0	0
	03-05			290	0.72		4.50	2.07	0	0	0.40	0.184	0	0
	06-			290	0.72		2.80	1.29	0	0	0.20	0.092	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-95				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	96-02				1.00		6.90	0.00	0	0	0.40	0.000	0	0
	96-02				1.00		6.90	0.00	0	0	0.40	0.000	0	0
	96-02				1.00		6.90	0.00	0	0	0.40	0.000	0	0
	03-05				1.00		4.50	0.00	0	0	0.40	0.000	0	0
	06-				1.00		2.80	0.00	0	0	0.20	0.000	0	0
>300 to 600		Diesel	Off Highway Trucks											
	pre-88[2]			300	0.57		9.10	3.43	0	0	0.63	0.238	0	0
	88-95			300	0.57		8.38	3.16	0	0	0.68	0.256	0	0
	96-00			300	0.57		6.90	2.60	0	0	0.30	0.113	0	0
	01-05			300	0.57		4.50	1.70	0	0	0.30	0.113	0	0
	06-			300	0.57		2.80	1.06	0	0	0.20	0.075	0	0
		Diesel	Scrapers											
	pre-88[1]			311	0.72		8.38	4.14	0	0	0.68	0.336	0	0
	88-95			311	0.72		8.38	4.14	0	0	0.68	0.336	0	0
	96-00			311	0.72		6.90	3.41	0	0	0.30	0.148	0	0
	01-05			311	0.72		4.50	2.22	0	0	0.30	0.148	0	0
	06-			311	0.72		2.80	1.38	0	0	0.20	0.099	0	0
		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-95				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	96-00				1.00		6.90	0.00	0	0	0.30	0.000	0	0
	01-05				1.00		4.50	0.00	0	0	0.30	0.000	0	0
	06-				1.00		2.80	0.00	0	0	0.20	0.000	0	0
>600 to 750		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-95				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	96-01				1.00		6.90	0.00	0	0	0.30	0.000	0	0
	02-05				1.00		4.50	0.00	0	0	0.30	0.000	0	0
	06-				1.00		2.80	0.00	0	0	0.20	0.000	0	0
>750		Diesel	(Enter Other Diesel Equipment Here)[8]											
	pre-88[3]				1.00		11.30	0.00	0	0	3.44	0.000	0	0
	88-99				1.00		8.38	0.00	0	0	0.68	0.000	0	0
	06-				1.00		4.50	0.00	0	0	0.30	0.000	0	0
EPA Model 5 and 6 Onroad Model						Miles	g/mile[7]	lbs/mile	Total lbs	Total Tons	g/mile[7]	lbs/mile	Total lbs	Total Tons

Revised: 7/3/2003

File Name:DFW Aerospace-Emissions for Geotech Activities

AIRPORT CONSTRUCTION EMISSION QUANTIFICATION WORKSHEET

Airport Name:	Dallas/ Fort Worth Airport	Project Name:	DART Orange Line, Segment I-3
Airspace Number:		Project Number:	

NON-ROAD EQUIPMENT				PROJECT DATA			NOx Unit Rates		Total NOx Emissions		HC Unit Rates		Total HC Emissions	
HP Range	Model Year	Typical Fuel and Engine	Equipment	HP	Load Factor[9]	Hours	g/hp-hr	lbs/hr[6]	lbs	Tons	g/hp-hr	lbs/hr	lbs	Tons
	97-00		Pickups (Light duty trucks)				1.3	0.002866	0.00	0.00000	1.9	0.004189	0.00	0.00000
	97-00		Highway Trucks (Heavy duty trucks)				8.2	0.018078	0.00	0.00000	2.0	0.004409	0.00	0.00000
	01-03		Pickups (Light duty trucks)			320	0.5	0.001102	0.35	0.00018	0.6	0.001323	0.42	0.00021
	01-03		Highway Trucks (Heavy duty trucks)				6.5	0.014330	0.00	0.00000	2.0	0.004409	0.00	0.00000
									TOTAL	0.3231			TOTAL	0.01894222

Signature:					
Submitted By: (typed/printed name &	CLAY PARRY	Contact Phone Number:	972-374-4800	Submission Date:	1/12/12

Note 1: The estimated emission factors for Pre-88 equipment were lower than the Tier 1 values, therefore, the Tier 1 values were assumed to be conservative.
Note 2: Pre-88 emission factor estimates were taken from US EPA Draft NONROAD model which is based on NEVES.
Note 3: Pre-88 emission factor estimates were not provided in the US EPA Draft NONROAD model so the maximum values are assumed to be conservative.
Note 4: Average Horsepower is calculated from the *Rental Rate Blue Book for Construction Volume 1 copyright 2000.*
Note 5: Load Factors taken from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling," Report No. NR-005A, US EPA, 12/9/97, revised 6/16/98.

Note 6. one pound=453.59 grams
Note 7: The emission factors for Highway Trucks and Pickups are taken from EPA Model 5 and 6.
Note 8: All load factors for the "other equipment" category are assumed to be 1.00 unless information is available to support a lower factor.
Note 9: Load Factors taken from the "Nonroad Engine and Vehicle Emission Study Report, November 1991" (NEVES), table 2-05.
Note 10:Average Horsepower taken from the "Nonroad Engine and Vehicle Emission Study Report, November 1991" (NEVES), table 2-04.
Note 11:All emission factors for "other gas equipment "category are assigned maximum values to be conservative. maximum factors taken from the, "Nonroad Engine and Vehicle Emission Study Report, November 1991" (N

APPENDIX E – DISTRIBUTION LIST

Distribution List

Dallas/Fort Worth International Airport
Rick Reeter, Director of the Environmental Affairs Department
Sandra Lancaster, Environmental Affairs Department
Ed Simon, Environmental Affairs Department
Adam Parsons, Environmental Affairs Department
Craig Miller, DFW Airport Airspace Administrator ADE Code Compliance
Wade McClaren, DFW Airport Operations
Greg Royster, DFW Airport Planning Department

Texas Historical Commission
Mark Wolfe, Executive Director

Texas Parks & Wildlife Department
Karen Hardin, Wildlife Habitat Assessment Program, Wildlife Division

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List of Preparers

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Master of Environmental Science, Indiana University
Master of Public Administration (MPA), Indiana University

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Master of City and Regional Planning, University of Texas at Arlington

Megan Inman, I-3 Project Coordinator
Bachelor of Arts, Southwestern University

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APPENDIX G – SUPPLEMENTAL FINDINGS FOR AERONAUTIAL ASSESSMENT FOR RAIL ACCESS TO DFW AIRPORT

JACOBS

March 30, 2012

Dallas Area Rapid Transit (DART)
Program Manager
1401 Pacific Avenue
Dallas, Texas 75202

Attn: Mr. John Hoppie

Subject: DART I-3 Light Rail Access Aeronautical Assessment Findings Supplement

Dear Mr. Hoppie:

Jacobs Engineering Group Inc. in June 2010, completed an aeronautical assessment for the potential aeronautical effects of the proposed Dallas Area Rapid Transit, Irving - 3 (DART I-3) Light Rail Transit (LRT) system onto the Dallas Fort Worth International Airport (DFW). The study was based on a 10% design level for the proposed project. The results of that study provided positive results for the project to go forward, as well as technical guidance for the designers, Federal Transit Administration (FTA), Federal Aviation Administration (FAA) and DFW.

Subsequent to the selection of the DART Design Builder (KSWRP), briefings were held with the FTA, FAA, and DFW to provide an overview of the project and their innovative design changes, they incorporated into their 30% design level plan. The changes proposed from an aeronautical and airport operations required additional coordination, assessment & analysis with the key stakeholders. As a result of that briefing, DART and the KSWRP team have held several meetings with the key stakeholders to discuss the comments provided, operational & design requirements toward developing mitigated solutions that meet the federal and operational requirements.

A summary of those comments, findings and their final resolution, may be found in Tables 2-2 and 2-3, in the Supplemental Environmental Assessment, which are summarized below.

Table 2-2, FAA Aeronautical Assessment Areas of Concerns, was developed from the initial briefing comments, subsequent meetings and agreed upon resolution of requirements with DART, the KSWRP team, DFW and the FAA. These items are summarized as follows;

1. **Airspace Feasibility Study -** A preliminary airspace study was completed on the 10% design alignment. The FAA's determination did not object to the proposed 10% design. The assessment and analysis of the revised alignment, as delineated in the 60% design, places the proposed alignment in a location which will yield an acceptable determination from the FAA. The final acceptance of the proposed DART I-3 alignment, will be based on the 90% design level plans.

2. **Runway 17C & 17L Runway Protection Zone (RPZ) –** The DART I-3 10% alignment penetrated the Runway 17C & 17L RPZ. The Runway 17C currently is penetrated by DFW's North Airfield Drive and State Highway 114. The revised alignment, as delineated in the 60% design, now routes the DART I-3 alignment outside of the Runway 17L RPZ. The Runway 17C penetration is considered, compatible, with FAA Airport Design Standards.

The FAA will fully assess and determine any potential impacts during actual design plan airspace reviews.

3. **Terminal Instrument Procedures (TERPS): Localizer Final Trapezoid –** The elevated sections of the EA 10% alignment in the approach area to Runways 17C and 17R would have increased the "Localizer Only" landing minimums. The revised 60% at-grade design, will significantly minimize those potential minimum increases. DART will develop and submit airspace studies for the proposed 60% design modification. As a part of the airspace study process FAA will assess all planned features and temporary construction equipment for their potential impacts to existing FAA instrument procedures, and Federal Aviation Regulations (FAR) Part 77 imaginary, FAA Airport Design Standards and FAA navigational systems & services. FAA Airspace determinations will provide the results of those assessments and document required conditions of the air space studies.

4. **Runway 31R Localizer: Flight Inspection Error Tolerance –** The FAA is replacing the Runway 31R navigation systems (localizer and glide slope) in the summer of 2012 with an upgraded system that will reduce the potential effects of the proposed DART ail infrastructure to an acceptable level. This will mitigate the previously identified airport factors issue.

8. **Relocation of LLWAS NE #4 and ASDE-X Remote Unit #2 -** The proposed 60% alignment moves the alignment approximately 100 feet south of the LLWAS/ASDE-X high-mast pole and will now not impact the operation of the LLWAS NE #4 and ASDE-X Remote Unit #2. The access driveway to the FAA facility will additionally not be impacted for FAA personnel ingress/egress.

9. **Software Adaption –** This action was required for the relocation of the LLWAS NE #4 and ASDE-X RU #2, which is no longer required, this task is now eliminated. During the construction activities near the LLWAS/ASDE-X sensor, DART will coordinate with the FAA SSC to monitor their system for any system anomalies attributed to the DART I-3.

10. **DFW Airport West Airport Surveillance Radar (ASR) –** The FAA identified a potential concern from the EA 10% elevated design bridge structure and alignment near the DFW West ASR, may impact its' operation. The revised 60% design reduced the length and height of the elevated bridge structure. That reduction along with the revised alignment being located outside of the FAA's ASR clearance area of 1,500 feet and approximately 80 feet below the radar antenna will significantly reduce any potential impact. DART will advise the FAA when their construction activities are within 2,500 feet of the ASR, so that they can begin monitoring the system for any potential anomalies that may be attributed to the DART.

11. **DFW Airport East ASDE-X Remote Unit #3 Potential Multi-Path Signal Reflections -** The FAA was initially concerned of potential multi-path signal reflections due to the proposed EA 10% design. The revised 60% design modifications would result in the proposed DART alignment being lower in height than the 10% design in two substantial areas north of Runways 17C and 17R. Additionally, lowering the guideway to an at-grade alignment would further reduce the number of potential multi-path sources and associated operational impacts. Preliminary assessment completed by FAA for the proposed design modifications did not reveal obvious potential impacts to the ASDE-X system. During construction of the LRT alignment FAA will monitor the ASDE-X system to determine if

system anomalies occur. Anomalies attributed to the DART I-3 alignment, must be mitigated by DART as soon as possible through coordination with FAA.

12. **Northeast End Around Taxiway Traffic Control Visibility –** The FAA is concerned what their visual scene may look like when DART LRV and the Perimeter Taxiway become operational. The FAA requested line-of-sight exhibits to provide them what their visual scene will look like when the DART LRV, with the proposed LRT alignment are operating. DART has developed those exhibits for FAA's review.

13. **Chesapeake Pad Site "AC" -** The 10% design DART alignment was elevated in the area where Chesapeake Energy's Pad Site AC monitor and control communication data link path is located and would require elevating the communication tower significantly. The revised 60% design to an at-grade alignment, which will now not penetrate the communication data link path. Chesapeake Energy has accepted the proposed mitigation.

14. **Northeast Perimeter Taxiway, Taxiing Operation Safety, Day Time Visual Screening –** A human factors concern was raised in the EA 10% design for potential daytime distraction for pilots taxiing on the Northeast Perimeter Taxiway, in close proximity with DART's Light Rail Vehicles (LRV). The EA 10% design incorporated at-grade and elevated paths within this confined area. The revised 60% design is now completely at-grade throughout this area, placing the LRV at the same level and position as current vehicular traffic on North Airfield Drive, thereby eliminating any vertical distraction. A visual screen will be incorporated into the DART Right-of-Way fence, in this area, which will provide pilots effective visual cues and enhanced discrimination of the LRV for their own situational awareness.

15. **Northeast Perimeter Taxiway, Taxiing Operation Safety, Night Time Visual Screening -** In addition to the item 14 requirements, listed above, the night time operations will require additional mitigation in the form of red obstruction lights on the tops of each catenary pole within this area. These lights will provide additional visual cues for pilots taxiing on the Northeast Perimeter Taxiway. DART is incorporating the FAA approved red obstruction lights on the tops of the Catenary poles within this area.

16. **FAA Safety Risk Management Decision –** The FAA has been provided 60% design plans for the project. Upon completion of their review, and if necessary, the FAA will host a Safety Risk Management Panel with representatives within the FAA, DFW Airport and DART to identify potential hazards, their risk severity and frequency, and mitigation to an acceptable level of safety for the project and the national airspace system. DART would coordinate with the FAA and DFW Airport in developing and implementing recommended mitigation.

17. F**ormal Airspace Studies –** DFW Airport and the FAA have received 60 % design plans for their review. The DFW and FAA will assess the proposed design and provide comments in the form of an airspace study and followed by an airspace determination. DART would review the FAA determination and coordinate with the FAA and DFW Airport on any mitigation required.

18. **FAA Microwave Path Line-of-Sight from 4E RTR to Center ATCT –** The 60% design alignment will be near the FAA's microwave link communication path, from the 4E Remote Transmitter receiver (RTR) to the Central Airport Traffic Control Tower (C-ATCT). The FAA

is developing a test plan to assess the potential impact to this critical aeronautical communication link. Should mitigation be required, the FAA has indicated that the antenna at the 4E Remote Transmitter Receiver (RTR) may have the antenna raised.

DART provided the FAA and DFW their 60% design documents for review and comment. DART received 12 additional areas of concern for review and mitigation. The FAA and DFW have collaborated with DART on these 12 items and have agreed solutions, as summarized, as follows:

1. **Southeast Temporary Construction Access Road –** DFW was concerned if the proposed temporary construction road would be capable of accommodating their emergency vehicles. DART has provided DFW design information that assures them of that capability. This road is intended to be temporary in nature and the area will be restored to pre-existing conditions upon completion of the project.

2. **FAA DFWB RTR 4E Access Road –** The FAA is concerned about the type of gates and safety of FAA vehicles on the FAA DFWB RTR 4E access road. DART has agreed to provide an additional route to the facility that originates from the existing Runway 17L approach light access road, then under the DART elevated crossing over Hackberry Creek and then continues on the north side of the DART alignment to the FAA facility. This will become the primary access to this facility and will accommodate DFW emergency vehicles. The existing access road will be gated at the DART right-of-way and will be available for use with special advanced coordination with DART.

3. **Planned Temporary Soil Storage Area Near the FAA RTR 4E Facility -** The FAA identified that the proposed Soil Storage Area could impact the operational performance of the FAA microwave link from the FAA RTR 4E to FAA Central ATCT path. DART will work with the FAA to develop a test plan and assess potential impact. Mitigation would be proposed, if required.

4. **DART Rail Welding Process Area -** The FAA and DFW Airport requested confirmation that the LRT rail welding process would not interfere with FAA systems (radio communication equipment). Additionally, the FAA asked if the welding process would generate visual flashes that could affect air traffic controllers and/or pilots. DART would develop information on the welding process and, if necessary, complete a demonstration for FAA personnel. Screening measures will be implemented during construction to shield any visual flashes from the view of air traffic controllers and/or pilots.

5. **DART Alignment and Roadway Design near Esters Boulevard, Cabell Road, future North and East Airfield Drive Extensions -** DART proposed to replace the EA 10% designed aerial structure with an at-grade crossing. DFW Airport expressed a concern that the proposed design could constrain their ability to construct future roadway infrastructure. DART has collaborated with DFW Airport to develop a shortened version of the original aerial structure concept that allows for construction of future roadway infrastructure including the new RTR 4E Access Road

6. **East Temporary Construction Access Road -** The proposed temporary construction road parallel to the proposed 60% alignment from the proposed RTR 4E Access Road, near the Hackberry Creek crossing to North Airfield Drive. This road will be located on the south side

of the alignment. The road will additionally be suitable for DFW Airport Emergency Vehicles. The temporary construction access road would continue to be coordinated with DFW Airport, but is only intended to be temporary in nature. The area would be restored to pre-existing conditions upon completion of the project.

7. **TPSS #8 Near the FAA RTR 2E Communication Facility -** Previous DART studies for potential spectrum interference, due to the DART Rail infrastructure, did not consider the placement of a TPSS facility. DART will confirm with the with the FAA's Spectrum Management organization that there will be no effect .

8. **Noise Screening Wall near the Hawthorn Suites Hotel -** FAA wants to confirm that the track profile and wall, including the noise wall, would not interfere with the FAA airport traffic control tower operations. The proposed sound wall is located on the far north side of the elevated section of the DART alignment. This is outside of the air traffic movement area and will not be an issue.

9. **Emergency Vehicle Access to the Chesapeake Pad Site AC -** DFW Airport requested confirmation that their large ARFF vehicles could access the Chesapeake Pad AC site. DART has coordinated with DFW Airport and Federal Express on the overall design of the access road. The final design will accommodate DFW Airport's large Aircraft Rescue and Fire Fighting (ARFF) vehicles as well as Chesapeake's largest vehicles, and has been accepted by DFW Airport, Federal Express, and Chesapeake.

10. **ONCOR Dual Feed Power Feed to Water Pump Station, Northeast (NE) Tanks** - DFW Airport requested information on how the ONCOR power feed to the airport water pumps near Freeport Parkway would be protected. The loss of one of the sources would critically impact DFW Airport operations. DFW's Water Pump Station-NE Tanks, has two power feeds, one from the east side and the other one from the west side. The feed on the east side would not be disrupted by the project. The existing ONCOR switch gear on the west side would be relocated. It would be accomplished during a one-day event to splice the cable. During the splicing, there would be one power feed available for the water pump. The power to the water pump would not be disrupted by the project and it would remain fully operational during the required work. Coordination with ONCOR and DFW Airport will be ongoing during construction in order to timely schedule this activity

11. **DART LRT Vehicle Visual Screening –** The FAA has requested exhibits on how the DART vehicle will be screened, within the Northeast Perimeter Taxiway area, to minimize the potential distraction of the DART vehicle operations in close proximity to aircraft taxiing on the perimeter taxiway. DART has provided the FAA and exhibits and a simulation package to support effective visual screening.

12. **North Airfield Drive Expansion to Six Lanes -** DFW Airport has requested an exhibit that illustrates how the planned North Airfield Drive expansion to six lanes would be accommodated with the planned LRT alignment. DART has provided an exhibits illustrating how the proposed expansion could be accommodated by DFW Airport in the future. DFW Airport has approved the plan for future six-lane accommodation.

13. **Aircraft Line of Sight to FAA Approach Lighting Systems IAW FAA Standards –** FAA requested a profile exhibit of the FAA Approach Lighting Systems with the proposed DART

LRT alignment to ensure that the Approach Light Plane is not penetrated. DART provided the FAA Approach Lighting system, Line of Sight exhibits for Runways 17L, 17C and 17R.

14. **Proposed Closure of DFW Construction Access Road Planned near Runway 17R & 17C at North Airfield Drive and proposed Gate 210 Temporary Construction Access Road -** DFW Airport and the FAA requested information on the planned closure for the DFW Airport construction access road at North Airfield Drive. DFW Airport and the FAA have approved the closure of the Runway 17R/35L Access Road from North Airfield Drive located near Station 674+00. A temporary construction road would be built off of the access road to the Water Pump Station – NE Tanks. The road would extend along the southern boundary of the DART ROW and North Airfield Drive and connect to the existing construction access road for Gate 210. Upon completion of the project, the road would remain for DFW Airport use during construction of the perimeter taxiway.

15. **Perform Runway 17C & 17L Baseline Modeling and Flight Inspection –** The FAA is concerned about all of the various construction activities at DFW and has requested the development and analysis of an ILS Math Model and flight inspection of Runway 17L Category I ILS and Runway 17C Category I/II/III ILS systems to establish baseline performance conditions of the ILS propagated signals. This task will begin prior to the start of construction of the LRT alignment. DART will develop the ILS Math Modeling analysis package for Runway 17C and 17L, which will be process through FAA Technical Center. Once complete the analysis will be provided to FAA pertinent departments.

If you have any questions or comments, please feel free to call me at 817-395-3823.

Sincerely,

Richard K. Compton

Richard K. Compton
Senior Program Manager for Aviation
Jacobs Engineering Group Inc.

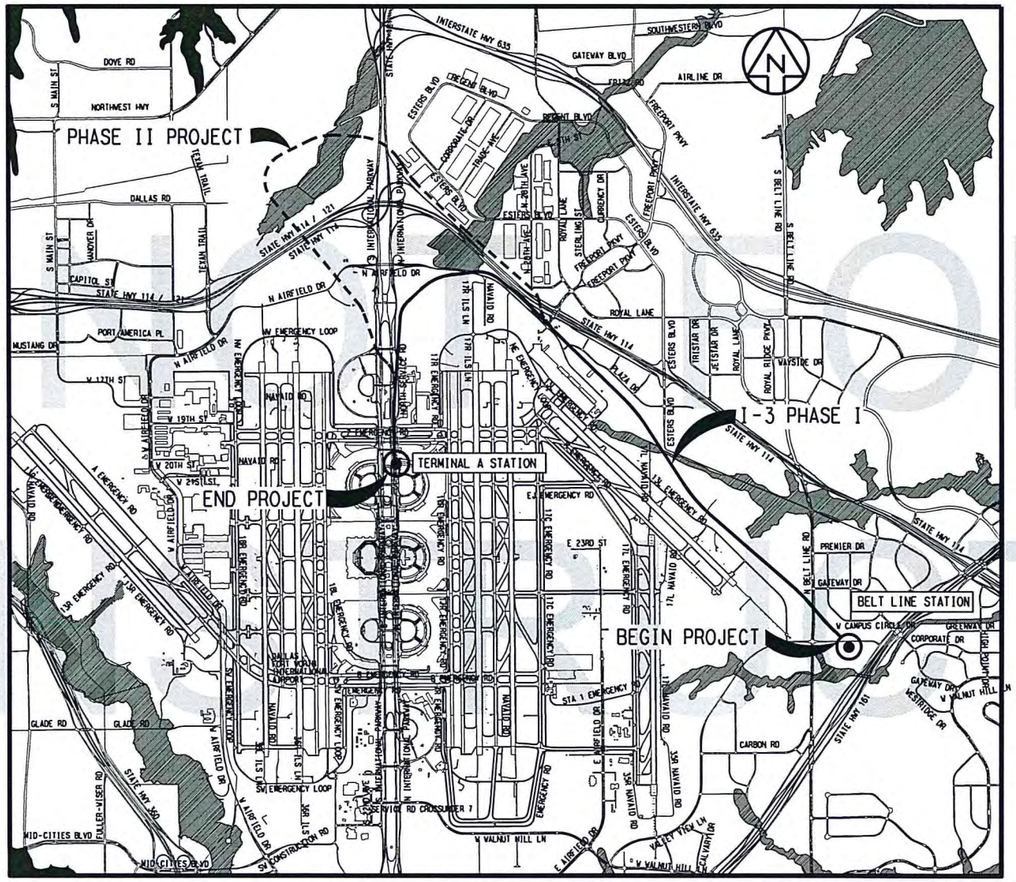
APPENDIX H - 60% DESIGN PLANS (UNDER SEPARATE COVER)

IRVING/DFW CORRIDOR
BELT LINE ROAD TO TERMINAL A STATION
CONTRACT NO. C-1018691-01
LINE SECTION I-3
STA. 495+00 TO STA. 768+95.00
TRACK ALIGNMENT

MARCH 27, 2012

DART®

DWG No. GC1-8001



LOCATION MAP

NO SCALE

PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 2 OF 15

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF REVIEW UNDER THE AUTHORITY OF:

KRIT VEERACHARTKUL, P.E 96648

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PARSONS

PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	NO SCALE
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. VEERACHARTKUL
IN CHARGE	K. VEERACHARTKUL
DATE	02/03/12

CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

LOCATION MAP

CONTRACT	DWG No.	REV
C-1018691-01	GC1-8002	C

DWG No. GC3-8001

SYMBOLS

- PROFILE GRADE LINE / ELEVATION CONTROL POINT
- DIRECTION OF FLOW
- C OR B CENTERLINE OR BASELINE
- FUTURE OR NOT IN CONTRACT
- CENTERLINE
- BASELINE
- PROPERTY LINE
- DIMENSION LINE CONTINUES
- MATCH LINE
- 510 CONTOUR LINE
- TRACK (TRANSIT) CENTER LINE
- EXISTING FENCE LINE
- PROPOSED FENCE LINE
- STRUCTURE OUTLINE
- RAILROAD TRACKS
- CO CLEANOUT
- MH MANHOLE
- SIDEWALK AND MISC. LINES
- DROP INLET, CATCH BASIN OR DRAIN - TO SCALE
- CULVERT HEADWALLS - TO SCALE
- X 543.5 SPOT ELEVATION
- CURB LINE
- EXISTING BARRIER/RETAINING WALL
- PROPOSED RETAINING WALL
- PROPOSED BALLAST WALL
- NOISE IMPACT AREA
- METAL BEAM GUARD FENCE
- HAND RAIL
- UNPAVED ROADS
- CTB — CTB CONCRETE TRAFFIC BARRIER
- VEGETATION LINE
- T TREE
- S SHRUB
- POLE

- TL TRAFFIC POLE
- UTILITY POLE
- SS SANITARY (DIRECTION OF FLOW) , PLUG
- GRID OF THE STATE PLANE COORDINATE SYSTEM
- BILLBOARD
- Δ TOTAL CENTRAL ANGLE OF SPIRAL AND CIRCULAR CURVES
- Δ_{C1} SUFFIX (1) AT THE SYMBOL DENOTES DATA FOR THE FIRST CIRCULAR CURVE OF A COMPOUND CURVE
- Δ_{C2} SUFFIX (2) AT THE SYMBOL DENOTES DATA FOR THE SECOND CIRCULAR CURVE OF A COMPOUND CURVE
- Θ_S CENTRAL ANGLE OF SPIRAL OR SPIRAL ANGLE
- Θ_{SAC} CENTRAL ANGLE OF COMPOUND SPIRAL OR COMPOUND ANGLE (CS1 TO CS2)
- Θ_{SAT} TOTAL CENTRAL ANGLE OF COMPOUND SPIRAL OR TOTAL COMPOUND SPIRAL ANGLE (FROM SPO TO SC2)
- SMH SANITARY OR STORM SEWER MANHOLE
- EMH, TMH, WUMH ELECTRICAL, TELEPHONE, OR WESTERN UNION MANHOLE
- TPMH, CSMH TRACTION POWER AND SIGNAL/COMMUNICATION MANHOLE
- EXISTING REDUCER
- PROPOSED REDUCER
- WM WATER METER
- WMH WATER MANHOLE
- WV WATER VALVE
- FH FIRE HYDRANT
- CAP OR PLUG
- GV GAS VALVE
- GM GAS METER
- PB PULL BOX OR SPLICING CHAMBER
- LIGHT POLE
- FS FIRE SERVICE STAND PIPE
- TRAFFIC SIGN
- POLE GUY AND ANCHOR
- TRANSMISSION LINE TOWER
- TRAFFIC CONTROL GATE
- TEST BORING LOCATION
- (OH) OVERHEAD LINES
- E(OH) OVERHEAD ELECTRIC LINES
- T(UG) UNDERGROUND TELEPHONE LINE
- E(UG) UNDERGROUND ELECTRIC LINE

- EXISTING AERIAL UTILITY
- PROPOSED AERIAL UTILITY
- UTILITY FACILITY LESS THAN 24"
- MAJOR UTILITY FACILITY 24" OR LARGER IN PLAN VIEW
- FACILITY TO BE ABANDONED
- DOUBLE CROSSOVER
- POINT OF SWITCH
- EXISTING DITCH
- PROPOSED DITCH
- DITCH PROPOSED SPECIAL DITCH
- SD STORM DRAIN
- UD UNDERDRAIN
- SS SANITARY SEWER
- W WATER LINE
- G GAS LINE
- TS TRAFFIC SIGNALIZATION LINE
- E ELECTRIC POWER LINE
- ESL ELECTRIC LINE, STREET LIGHTING
- T TELEPHONE LINE
- TG TELEGRAPH LINE
- TV CABLEVISION LINE
- PROPOSED CASING
- PROPOSED STREET CLOSING
- PROPOSED STREET CONSTRUCTION
- EXISTING STREET/RAILROAD RIGHT-OF-WAY LINE
- EXISTING PROPERTY LINE
- ZONING BOUNDARIES
- PROP. RIGHT-OF-WAY OR PUBLIC MASS TRANSPORTATION EASEMENT
- EXISTING EASEMENT LINE
- PROP. DRAINAGE, SLOPE OR UTILITY EASEMENT
- EXIST ○ SET ● COPPER, IRON PIN, PIPE IRON ROD MARKERS OR ANY PROPERTY CORNER
- □ ■ RIGHT-OF-WAY OR CONTROL MONUMENT OR MARKERS
- EXISTING INTERSECTION OF PROPERTY LINES
- INTERSECTION OF PROPOSED DART RIGHT-OF-WAY LINES
- PROPOSED DART RIGHT-OF-WAY MONUMENT

- LEFT HAND TURNOUT
- RIGHT HAND TURNOUT
- DERAIL SWITCH
- PI/PVI/PITO
- NON-INSULATED JOINT
- F SWITCH NUMBERING "F" INDICATES FUTURE
- 136#/115# TRANSITION RAIL
- 11-A CURVE NUMBER
- BLUE FLAG
- BUMPING POST
- EQUILATERAL TURNOUT
- CORROSION CONTROL TEST STATION
- CORROSION CONTROL REFERENCE ELECTRODE
- CTB CONCRETE TRAFFIC BARRIER
- OCS POLE
- OCS POLE W/ DOWN GUY
- GABION BLANKET
- BALLAST
- SUBBALLAST
- SUBGRADE
- FILTER FABRIC
- TxDOT CCTV
- EXISTING STREET LIGHT
- PROPOSED STREET LIGHT
- PROPOSED GROUND BOX
- PROPOSED CONDUIT
- GATE

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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PARSONS

PARSONS TRANSPORTATION GROUP, INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 4 OF 15

SCALE	NO SCALE
DRAWN	L. MATTHEWS
DESIGNED	L. MATTHEWS
CHECKED	W. WANG
IN CHARGE	W. WANG
DATE	03 FEB 12

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

SYMBOLS

CAES

CONTRACT C-1018691-01 | DWG No. GC3-8001 | REV C

DWG No. GC3-8002

A	AREA
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS
ABUT	ABUTMENT
ABV	ABOVE
ABVNT	ABOVE NET
AC	ACRE
ACI	AMERICAN CONCRETE INSTITUTE
ACP	ASBESTOS CEMENT PIPE
AD	AREA DRAIN
ADA	AMERICANS WITH DISABILITIES ACT
ADD	ADDENDUM
ADJ	ADJACENT
A/E	ARCHITECT/ENGINEER
AFF	ABOVE FINISHED FLOOR
A/G	AT GRADE
AGG	AGGREGATE
AHD	AHEAD
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC
AISI	AMERICAN IRON AND STEEL INSTITUTE
AL	ALUMINUM
ALT	ALTERNATE
ANC	ANCHOR
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
APP	APPROACH
APT	AUTOMATED PERSONAL TRANSIT
ARCH.	ARCHITECT, ARCHITECTURE
AREMA	AMERICAN RAILWAY ENGINEERING AND MAINTAINANCE OF WAY ASSOCIATION
ASA	AMERICAN STANDARDS ASSOCIATION
ASPH	ASPHALT
ASSY	ASSEMBLY
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ATR	ABOVE TOP OF RAIL
ATT/D	ATT (TEXAS)
ATT/TCG	ATT (LOCAL SERVICE)
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWG	AMERICAN WIRE GAUGE
AWS	AMERICAN WELDING SOCIETY
BAS	BRIDGE APPROACH SLAB
B/B	BACK TO BACK
B/C	BACK OF CURB
BCCP	BITUMINOUS COATED CORRUGATED PIPE
BD	BOARD, BALLAST DRAIN
BEG.	BEGINNING
BF	BOTH FACES
BH	BORED HOLE
BIT.	BITUMINOUS
BJF	BITUMINOUS JOINT FILLER
BK	BACK
BKF	BACKFILL
BKWL	BACKWALL
B/L	BUILDING LINE
BLDG	BUILDING
BLKG	BLOCKING
BLVD	BOULEVARD
BM	BEAM
B.M.	BENCH MARK
BOT	BOTTOM
BNSF	BURLINGTON NORTHERN SANTA FE RAILWAY
BPA	BRIDGE PROTECTIVE ASSEMBLY
BRG	BEARING
BRKT	BRACKET
BS	BOTH SIDES
B/S	BOTTOM OF SLOPE
BTWN	BETWEEN
BVL	BEVELED
BW	BOTH WAYS, BOTTOM WIDTH
C_X_	AMERICAN STANDARD CHANNEL, _X_= SIZE BY WEIGHT
C	RUNOFF COEFFICIENT
CAB.	CABINET
CANT	CANTILEVER
CAT.	CATENARY
CATF	CATENARY FOUNDATION
CATP	CATENARY POLE
CB	CATCH BASIN
C	RUNOFF COEFFICIENT
CC	CENTER OF CURVE
CCOM	CONSOLIDATED COMMUNICATIONS
C TO C	CENTER TO CENTER
CEM	CEMENT
CF	CUBIC FEET
CFL	COUNTERFLASHING
CFS	CUBIC FEET PER SECOND
CG	CONCRETE GUTTER
C & G	CURB AND GUTTER
C/G	CORNER GUARD
CHAN	CHANFER
CHD	CHORD
CHDPE	CORRUGATED HIGH DENSITY PLOYETHYLENE
CI	CAST IRON, CURB INLET
CIH	CENTRAL INSTRUMENT HOUSE
CIP	CAST-IN-PLACE, CAST IRON PIPE
CJ	CONSTRUCTION JOINT
℄	CENTERLINE
CL	CLASS
C/L	CURB LINE
CLF	CHAIN LINK FENCE
CLR	CLEARANCE, CLEAR
CMB	CHANGEABLE MESSAGE BOARD
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT
COD	CITY OF DALLAS
COI	CITY OF IRVING
COL	COLUMN
COMB	COMBINATION
COMM	COMMUNICATIONS
COMP	COMPRESSED, COMPRESSIVE
CON	CONSTRUCTION LINES
CONC	CONCRETE
CONN	CONNECT, CONNECTOR, CONNECTION
CONST	CONSTRUCTION, CONSTRUCT
CONT	CONTINUATION, CONTINUOUS
CORR	CORRUGATED
CRS	COLD ROLLED STEEL
CS	CURVE TO SPIRAL POINT
CSMH	CONTROL SYSTEMS MANHOLE
CTB	CEMENT TREATED BASE, CONCRETE TRAFFIC BARRIER
CTR	CENTER
CULV	CULVERT
CWR	CONTINUOUS WELDED RAIL
CY	CUBIC YARD
D, DEG	DEGREE OF CURVE
DART	DALLAS AREA RAPID TRANSIT
DBL	DOUBLE
DCURD	DALLAS COUNTY UTILITY & RECLAMATION DISTRICT
DEFL	DEFLECTION
DEG	DEGREE
DEP	DEPRESSED
DET	DETAIL
D/FW	DALLAS/FORT WORTH
DF	DIRECT FIXATION
DG	DOWNGUY
DI	DROP INLET, DUCTILE IRON
DIA	DIAMETER
DIM.	DIMENSION
DIP	DUCTILE IRON PIPE
DIST	DISTANCE
DL	DEAD LOAD
DN	DOWN
DP	DAMPPROOFING
DPL	DALLAS POWER & LIGHT COMPANY
DR	DOOR, DRIVE, DERAILMENT LOAD
DRN	DRAIN, DRAINAGE
DRWY	DRIVEWAY
DS	DOWNSPOUT
D.S.	DRILLED SHAFT
DWG	DRAWING
DWU	DALLAS WATER UTILITY
E	EXPANSION BEAM END, EAST, ELECTRIC
Eo	SUPERELEVATION IN INCHES
EA	EACH
EB	EAST BOUND
EBFR	EAST BOUND FRONTAGE ROAD
EBML	EAST BOUND MAINLINE
EF	EACH FACE
EFC	EXPOSED FINISH CONCRETE
E.G.	FOR EXAMPLE
EL, ELEV	ELEVATION
ELEC	ELECTRIC, ELECTRICAL
EMBED	EMBEDMENT
EMH	ELECTRICAL MANHOLE
ENCSMT	ENCASEMENT
E/P, EOP	EDGE OF PAVEMENTS
E/P	EDGE OF PAVEMENTS
EQ	EQUAL
EQUIV	EQUIVALENT
E/S	EDGE OF SHOULDER
ESMT	EASEMENT
EST	ESTIMATE
Es	EXTERNAL DISTANCE OF SPIRAL CURVE
Eu	SUPERELEVATION UNBALANCED IN INCHES
ETC	ET CETERA
EW	EACH WAY
EWEF	EACH WAY, EACH FACE
Ex, EXIST.	EXISTING
EXP	EXPANSION
EXPJT	EXPANSION JOINT
EXPO	EXPOSED
EXT	EXTERIOR
EXPWY	EXPRESSWAY
F	FIXED BEAM END, FAHRENHEIT
F TO F	FACE TO FACE
FBR OPT	FIBER OPTIC
F/C	FACE OF CURVE
FD	FLOOR DRAIN
FDN	FOUNDATION
FF	FINISH FLOOR, FAR FACE
FFBW	FRONT FACE BACKWALL
FG	FINISH GRADE
FH	FIRE HYDRANT
FIG	FIGURE
FIN.	FINISH
FL	FLOW LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLR	FLOOR
FOF	FACE OF FINISH
FRWY	FREEWAY
FS	FAR SIDE
FT	FOOT OR FEET
FTG	FOOTING
FURN	FURNISH
FUT	FUTURE
FWD	FORWARD
FW	FORT WORTH
G	GAS (NATURAL)
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GB	GROUND BOX
GEC	GENERAL ENGINEERING CONSULTANT
GEN	GENERAL
GI	GALVANIZED IRON, GRATE INLET
G/L	GROUND LINE
GM	GAS METER
GND	GROUND
GP	GAUGE PLATE, GRAND PRAIRIE
GR	GRADE
G/R	GUARD RAIL
GRAN	GRANITE, GRANULAR
G/R PL	GUARD RAIL PLATE
GRTG	GRATING
GV	GAS VALVE
GV	GATE VALVE
GVL	GRAVEL
H	HEIGHT
H.C.	HANDICAP
H/D	HEAVY DUTY
HDWL	HEADWALL
HEX	HEXAGONAL
HH	HAND HOLE
HMAC	HOT MIX ASPHALTIC CONCRETE
HMLP	HIGH MAST LIGHT POLE
HORIZ	HORIZONTAL
HP_X_	BEARING PILE SHAPE, _X_ = SIZE BY WEIGHT
HPT	HIGH POINT
HR	HOUR
HSB	HIGH STRENGTH BOLT
HSS_X_X_	HOLLOW STRUCTURAL SHAPE X_(X_) = _ DIMENSION X DIMENSION X THICKNESS
HSS	HIGH STRENGTH STEEL
HWL	HIGH WATER LINE
HWY	HIGHWAY
I	RAINFALL INTENSITY
ICLRT	INTERMEDIATE CAPACITY LIGHT RAIL TRANSIT
ID	INSIDE DIAMETER
IF.	INSIDE FACE
IH	INTERSTATE HIGHWAY
IJ	INSULATED JOINT
IN.	INCH, INCHES
INC	INCORPORATED
INCL	INCLUDE
INT	INTERIOR
INV	INVERT
IRR.	IRRIGATION
ISF	INSIDE FACE
ITS	INTELLIGENT TRANSPORTATION SYSTEMS
JT	JOINT
K	KIP, RATE OF VERTICAL CURVATURE
KV	KILOVOLT
L	TOTAL CURVE LENGTH, LENGTH, LEFT (DEFLECTION)
LB	POUND
LC	TOTAL LENGTH OF CIRCULAR CURVE
LF	LINEAR FEET
LG	LENGTH, LONG
LH	LEFT HAND
LIN	LINEAR, LINEAL
LL	LIVE LOAD
LN	LANE
LOC	LOCATION
LONG.	LONGITUDINAL
LPT	LOW POINT
LRT	LIGHT RAIL TRANSIT
LTD	LIMITED
Ls	TOTAL LENGTH OF SPIRAL
LSG	LONE STAR GAS
LT	LEFT
LTL	LINTEL
LVC	LENGTH OF VERTICAL CURVE
LVL	LEVEL
LVL 3	LEVEL (3) COMMUNICATION, INC
M_X_	MISCELLANEOUS PILE SHAPE, _X_ = SIZE BY WEIGHT
MATL	MATERIAL
MAX	MAXIMUM
MBGR	METAL BEAM GUARD RAIL
MBR	MEMBER
MC_X_	MISCELLANEOUS CHANNEL, _X_ = SIZE BY WEIGHT
MCI	MCI TELECOMMUNICATIONS
MEAS	MEASURE
MEMB	MEMBRANE
MET.	METAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINUTES, MINIMUM
MISC	MISCELLANEOUS
MKT	MISSOURI-KANSAS-TEXAS RAILROAD COMPANY
ML	MAINLINE
MOD	MODULAR, MODIFIED
MON	MONUMENT
MSE	MECHANICALLY STABILIZED EARTH
MT	MOUNTED
MTG	MOUNTING
MULT	MULTIPLE
N	NORTH
N/A	NOT APPLICABLE
NAT	NATURAL
NB	NORTHBOUND
NBFR	NORTHBOUND FRONTAGE ROAD
NBML	NORTHBOUND MAINLINE
NCTCOG	NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS
NG	NAUTRAL GROUND
NF	NEAR FACE
NIC	NOT IN CONTRACT
No.	NUMBER
Nos	NUMBERS
NOM	NOMINAL
NS	NEAR SIDE
N/S	NORTH/SOUTH
NTNWD	NORTH TEXAS MUNICIPAL WATER DISTRICT
NTS	NOT TO SCALE
NTTA	NORTH TEXAS TOLLWAY AUTHORITY
OC	ON CENTERS
OCEW	ON CENTER EACH WAY
OCS	OVERHEAD CATENARY SYSTEM
OD	OUTSIDE DIAMETER
OF	OUTSIDE FACE
OFF	OFFSET
OH	OVERHEAD
OHE	OVERHEAD ELECTRIC
O TO O	OUT TO OUT
OPNG	OPENING
OPP	OPPOSITE
ORD	ORDINATE
PB	PULLBOX
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE
P/C	PRECAST
PED	PEDESTRIAN
PEJ	PREFORMED EXPANSION JOINT
PERF	PERFORATED
PERM	PERMANENT
PERMISS	PERMISSIBLE
PERP	PERPENDICULAR
PF	POINT OF FROG
PG	PROFILE GRADE, PAGE
PGL	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
PITO	POINT OF INTERSECTION - TURNOUT
PL	PLATE, PROPERTY LINE
PLAT.	PLATFORM
PMDF	PERMANENT METAL DECK FORMS
PNTE	PUBLIC MASS INTERSECTION EASEMENT
P/O	PART OF
POB	POINT OF BEGINNING
POC	POINT OF CURVE
POE	POINT OF ENDING
POLY	POLYETHYLENE
POS	POINT OF SPIRAL
POT	POINT OF TANGENT
PP	POWER POLE
PREM	PREMOLDED
PROJ.	PROJECTION
PROP	PROPOSED
PROT	PROTECTION
PRVT	PRIVATE
P/S	PRE-STRESSED
PS	POINT OF SWITCH
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENT
PTD	PAINTED
PVI	POINT OF VERTICAL INTERSECTION
PVMT	PAVEMENT
PVP	POLYVINYL CHLORIDE PIPE
PVC	POLY VINYL CHLORIDE, POINT OF VERTICAL CURVE
PVRC	POINT OF VERTICAL REVERSE CURVATURE
PVT	POINT OF VERTICAL CURVE
Q	STORM WATER DISCHARGE
QTY	QUANTITY
R	RADIUS
R1	RIGHT (DEFLECTION)
RC	REINFORCED CONCRETE
RCB	REINFORCED CONCRETE BOX CULVERT
RCCP	REINFORCED CONCRETE CYLINDER PIPE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
REFL	REFLECTIVE
REINF	REINFORCE, REINFORCED, REINFORCING, REINFORCEMENT
REQD	REQUIRED
REV	REVISE, REVISION
RH	RIGHT HAND
RO	ROUGH OPENING
ROW	RIGHT OF WAY
RR	RAILROAD
RSC	RAILROAD SIGNAL CABLE
RT	RIGHT
S	SOUTH, SLOPE
S & I	SERVICE & INSPECTION
S_X_	SHAPE, X = SIZE BY WEIGHT
SB	SOUTHBOUND
SBFR	SOUTHBOUND FRONTAGE ROAD
SBML	SOUTHBOUND MAINLINE
SC	SPIRAL TO CURVE
SCHED	SCHEDULE
SCR	SCREW
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SDWK	SIDEWALK
SEJ	SEALED EXPANSION JOINT
SEL	SELECT
SG	SWITCH GEAR
SH	STATE HIGHWAY
S/H	STRUCTURAL HEIGHT
SHLD	SHOULDER
SHT	SHEET
SIG	SIGNAL
SIM	SIMILAR
SL	STREET LIGHT, SLAB
SLV	SLEEVE
SM	SMOOTH
SMH	SEWER MANHOLE
SP	SOUTHERN PACIFIC TRANS. CORP.
SPC	SPACE
SPEC(S)	SPECIFICATION, SPECIFICATIONS
SQ	SQUARE
SQ FT	SQUARE FOOT
SQ IN	SQUARE INCH
SS	SANITARY SEWER
SST	STAINLESS STEEL
ST	STREET, SPIRAL TO TANGENT POINT
STA	STATION, STATIONING
STD	STANDARD
STIFF	STIFFENER
STL	STEEL
STM	STORM
STRGTH	STRENGTH
STRUCT	STRUCTURE, STRUCTURAL
SURF.	SURFACE
SWR	SEWER
SY	SQUARE YARD
SYM	SYMMETRICAL
SYS	SYSTEM
T	LENGTH OF TANGENT, TELEPHONE
Tc	TIME OF CONCENTRATION
T(UG)	TELEPHONE (UNDERGROUND)
T/	TOP OF
T & B	TOP AND BOTTOM
TBM	TEMPORARY BENCH MARK
TBR	TO BE REMOVED
T/C	TOP OF CURB
T/D	TOP OF DITCH
TCO	TERMINAL CLEANOUT
TEM	TEMPORARY
TEMP	TEMPERATURE
TEN	TENSION
TES	TRACTION ELECTRIFICATION SYSTEM
TG	TELEGRAPH, TOP OF GRADE
TGMH	TELEGRAPH MANHOLE
THRU	THROUGH
THK	THICK, THICKNESS
TL	TRAFFIC LIGHT
TMH	TELECOM MANHOLE
TO	TURNOUT
TOC	TOP OF CONCRETE
TOD	TRANSIT ORIENTED DEVELOPMENT
TP	TOP OF PAVEMENT
TPL	TEXAS POWER & LIGHT
TPSS	TRACTION POWER SUBSTATION
T/R	TOP OF RAIL
TRA	TRINITY RIVER AUTHORITY
TRAF SIG	TRAFFIC SIGNAL
TRK	TRACK
TRNSF	TRANSFORMER
TS	TANGENT TO SPIRAL
T/S	TOP OF SLOPE
T/STL	TOP OF STEEL
TUE	TEXAS UTILITIES ELECTRIC COMPANY
T/W	TOP OF WALL
TxDOT	TEXAS DEPARTMENT OF TRANSPORTATION
TXU	TEXAS UTILITY ELECTRIC
TWC	TIME WARNER CABLE
TYP	TYPICAL
TY	TYPE
TWT	TIME WARNER TELECOM
UD	UNDERDRAIN
UG	UNDERGROUND
UGC	UNDERGROUND CABLE
UGE	UNDERGROUND ELECTRIC
UNO	UNLESS NOTED OTHERWISE
UP	UNION PACIFIC RAILWAY
US	UNITED STATES
USC&GS	U.S. COAST & GEODETIC SURVEY
USGS	UNITED STATES GEOLOGICAL SURVEY
UTIL	UTILITY
V	VELOCITY
VAR	VARIABLE, VARIES
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
VLT	VAULT
VOL	VOLUME
VRZ/B	VERIZON BUSINESS
VRZ	VERIZON
W	WEST, WATER
W/	WITH
WB	WESTBOUND
WBFR	WESTBOUND FRONTAGE ROAD
WBML	WESTBOUND MAINLINE
W_X_	WIDE FLANGE SHAPE, _X_ = SIZE BY WEIGHT
WI	WROUGHT IRON
W/O	WITHOUT
WL	WATER LINE
WM	WATER METER
WP	WORK POINT
W/P	WEATHERPROOF
WS	WATER SURFACE
WT	WATERTIGHT, WEIGHT
WTR	WATER
WTRPRF	WATERPROOF
WV	WATER VALVE
WW	WASTEWATER
WWF	WELDED WIRE FABRIC
WSEL	WATER SURFACE ELEVATION
X-ING	CROSSING
X-SECT	CROSS SECTION
XO	XO COMMUNICATIONS
360	360 NETWORKS

PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 5 OF 15

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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PARSONS

PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	NO SCALE
DRAWN	L. MATTHEWS
DESIGNED	L. MATTHEWS
CHECKED	W. WANG
IN CHARGE	W. WANG
DATE	03 FEB 12

CAES

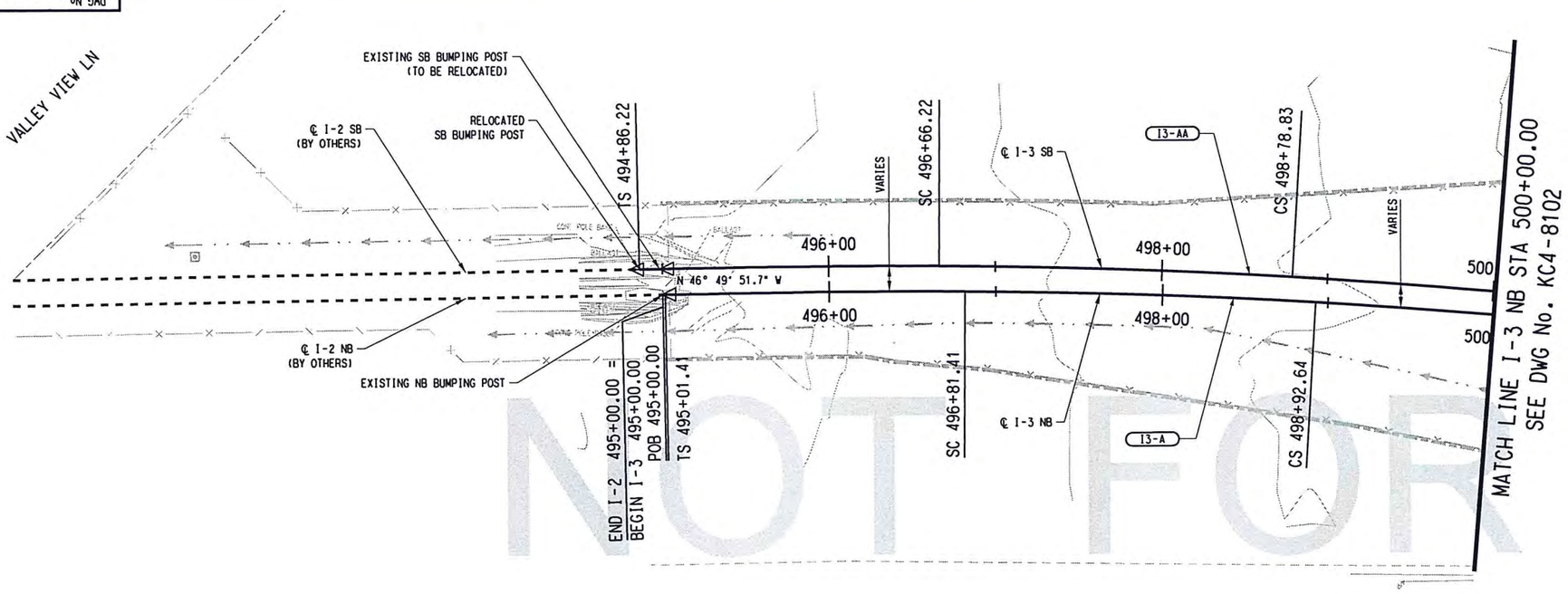
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

ABBREVIATIONS

CONTRACT	DWG No.	REV
C-1018691-01	GC3-8002	C

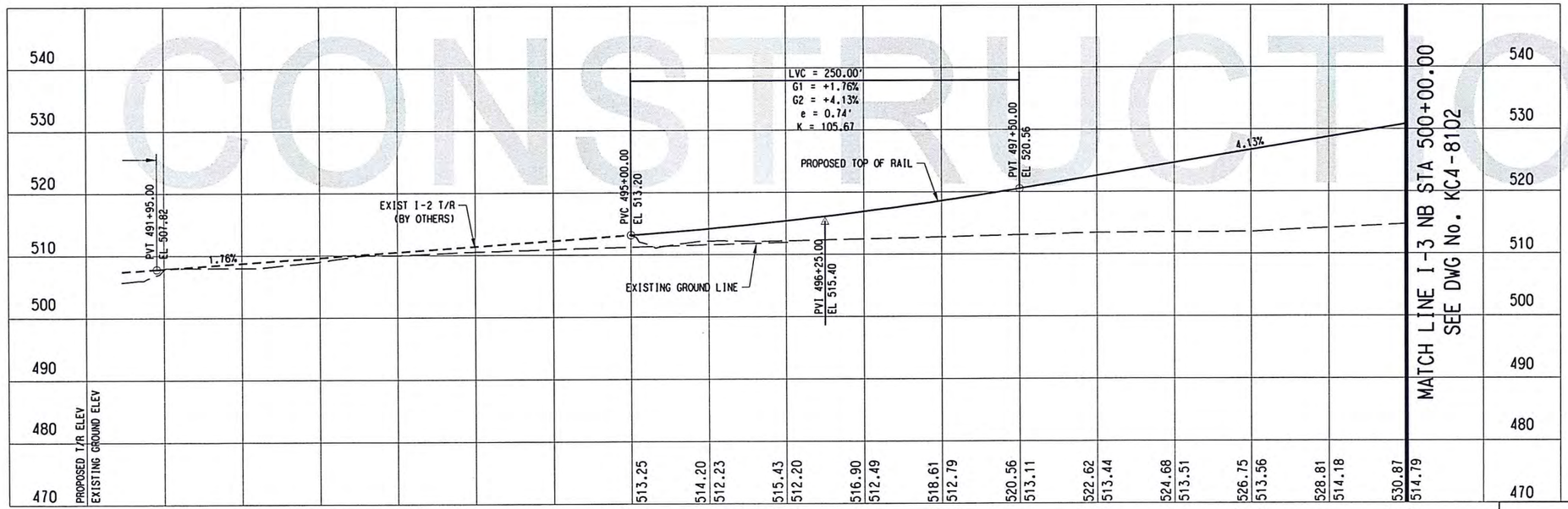
DWG No. KC4-8101

P0001



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-A (NB)		I3-AA (SB)	
Rc=	3975.00'	Rc=	3989.00'
Ls=	180.00'	Ls=	180.00'
Lc=	211.23'	Lc=	212.61'
Eo=	2.75"	Eo=	2.75"
Eu=	1.50"	Eu=	1.49"
V=	65 MPH	V=	65 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 9 OF 15

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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GEAS BULBUL, P.E. 101954

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BRIDGEFARMER & ASSOCIATES, INC.
CONSULTING ENGINEERS
DALLAS ● AUSTIN
REGISTRATION NO. 264

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	J. SLOAT
DESIGNED	G. BULBUL
CHECKED	L. LUAN
IN CHARGE	G. BULBUL
DATE	03 FEB 12

CAES

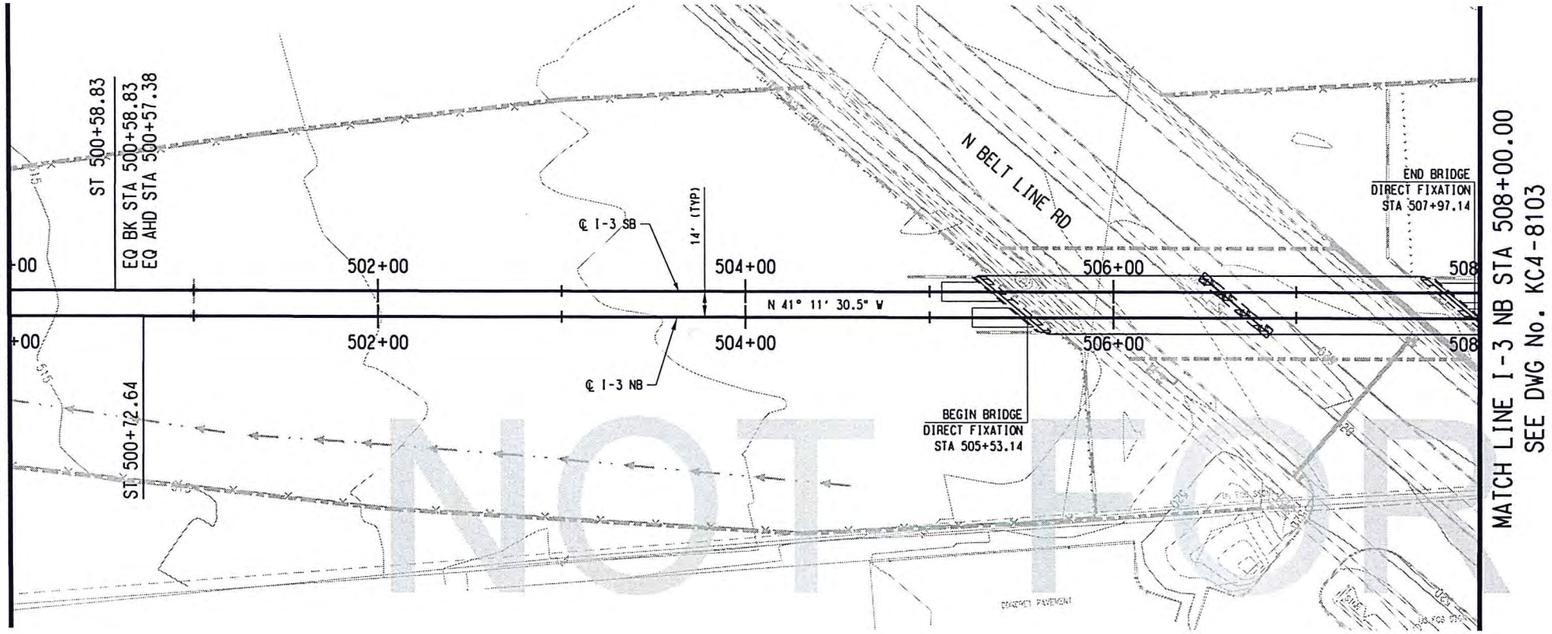
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 495+00.00 TO STA 500+00.00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8101	C

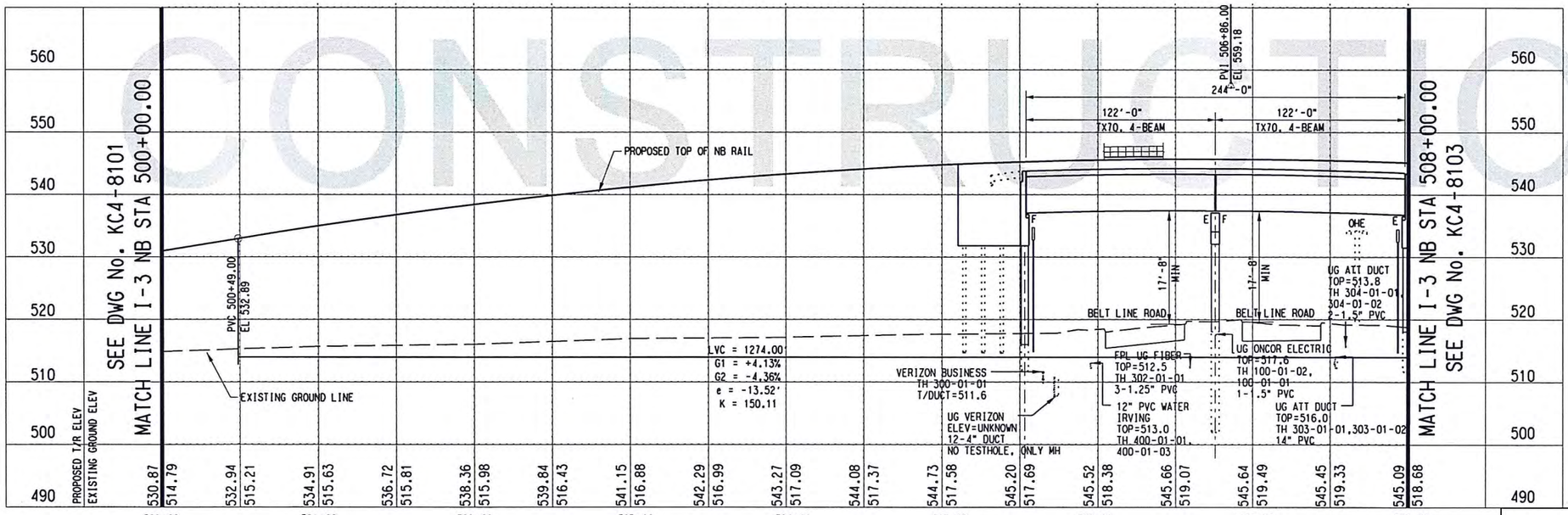
DWG No. KC4-8102

P0002



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-A (NB)		I3-AA (SB)	
Rc=	3975.00'	Rc=	3989.00'
Ls=	180.00'	Ls=	180.00'
Lc=	211.23'	Lc=	212.61'
Ea=	2.75"	Ea=	2.75"
Eu=	1.50"	Eu=	1.49"
V=	65 MPH	V=	65 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 10 OF 15

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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BRIDGEFARMER & ASSOCIATES, INC.
CONSULTING ENGINEERS
DALLAS ● AUSTIN
REGISTRATION NO. 264

KSWRP
KIEWIT. STACY AND WITBECK. REYES. PARSONS. a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	J. SLOAT
DESIGNED	G. BULBUL
CHECKED	L. LUAN
IN CHARGE	G. BULBUL
DATE	03 FEB 12

CAES

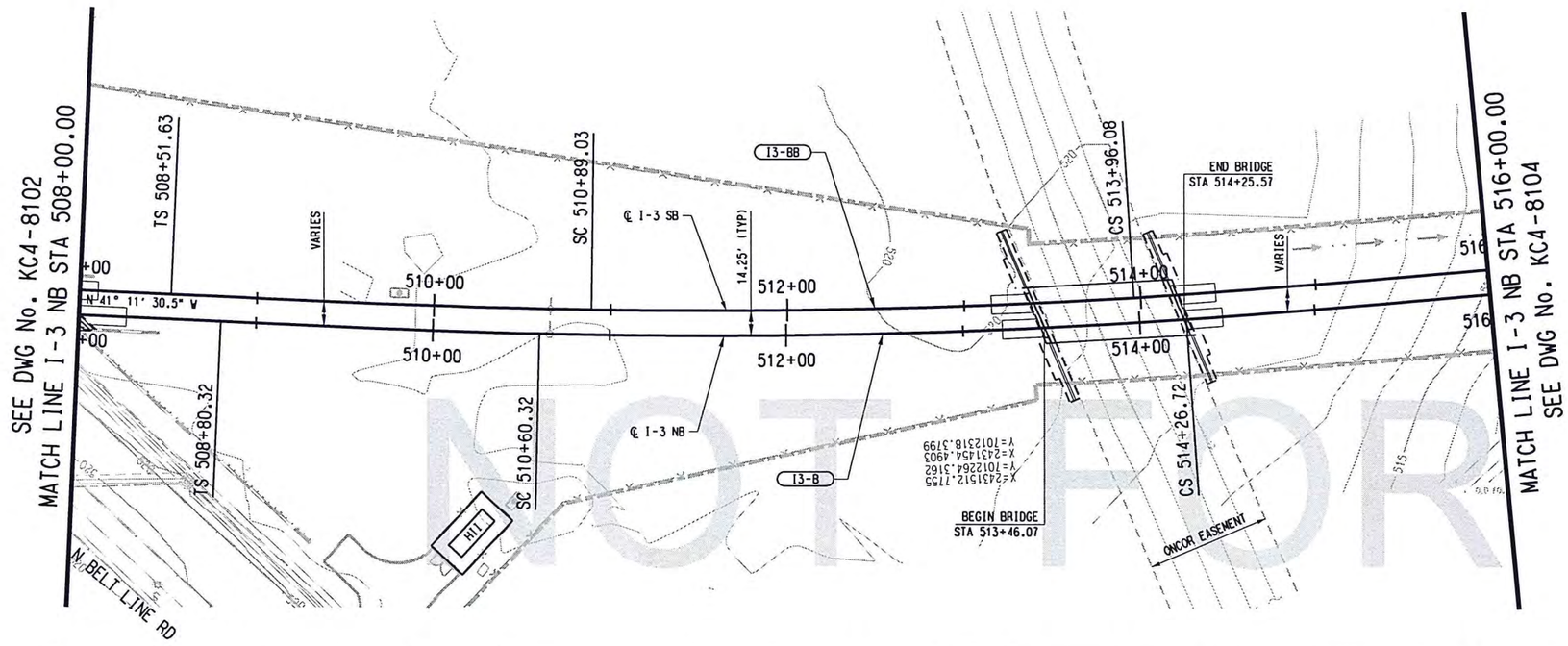
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 500+00.00 TO STA 508+00.00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8102	C

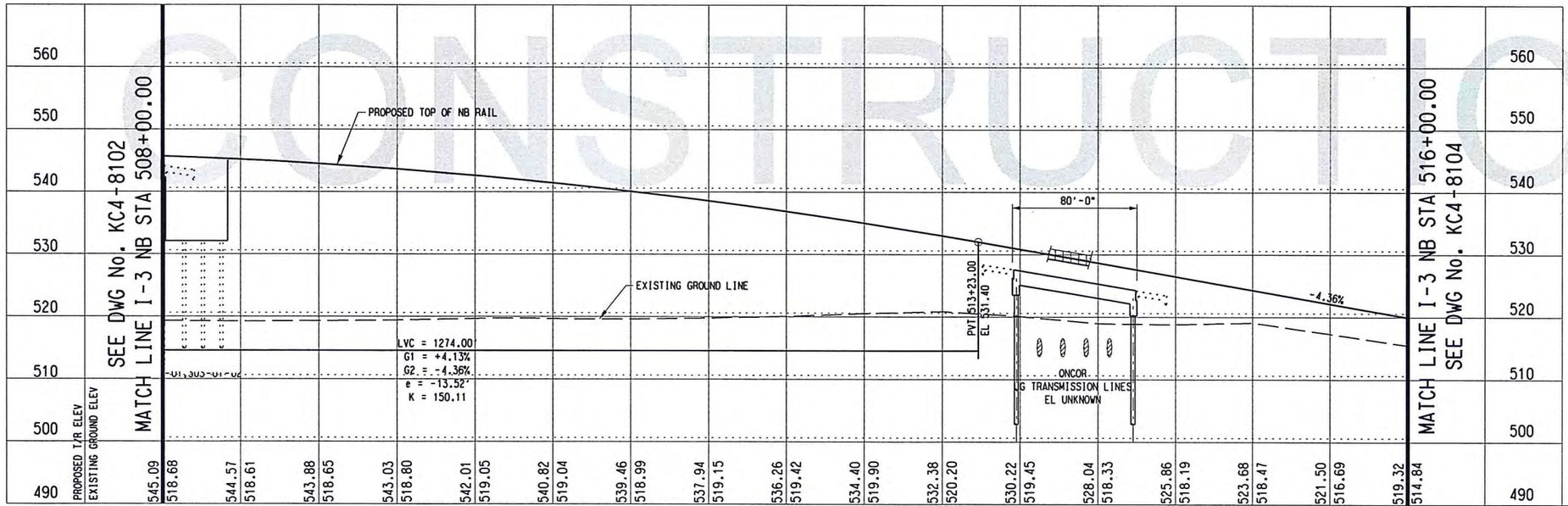
DWG No. KC4-8103

P0003



I3-B	(NB)	I3-BB	(SB)
Rc=	3994.25'	Rc=	3980.00'
Ls=	180.00'	Ls=	237.40'
Lc=	366.40'	Lc=	307.05'
Ea=	2.75"	Ea=	2.75"
Eu=	1.48"	Eu=	1.50"
V=	65 MPH	V=	65 MPH

HORIZ SCALE (IN FEET) 0 20 40 80
VERT SCALE (IN FEET) 0 5 10 15 20



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 11 OF 15

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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REGISTRATION NO. 264

KSWRP
KIEWIT. STACY AND WITBECK. REYES. PARSONS. a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	J. SLOAT
DESIGNED	G. BULBUL
CHECKED	L. LUNN
IN CHARGE	G. BULBUL
DATE	03 FEB 12

CAES

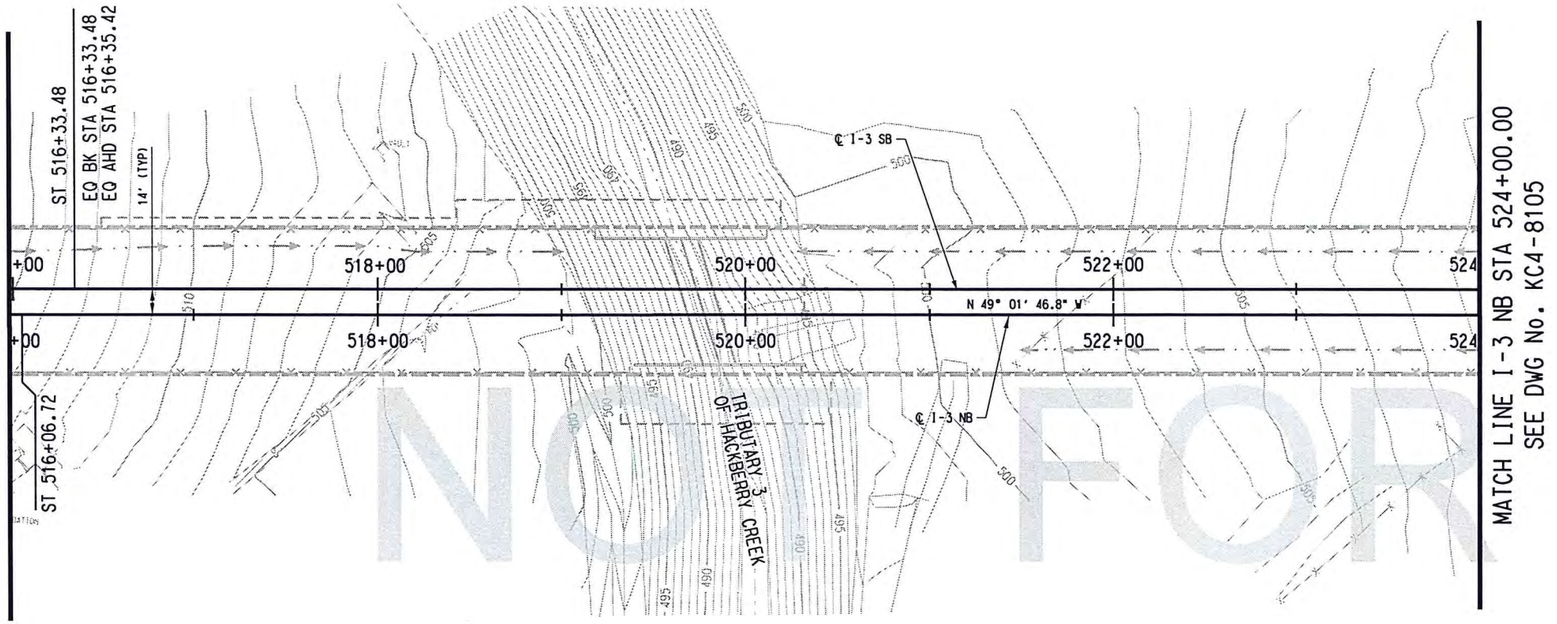
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 508+00.00 TO STA 516+00.00

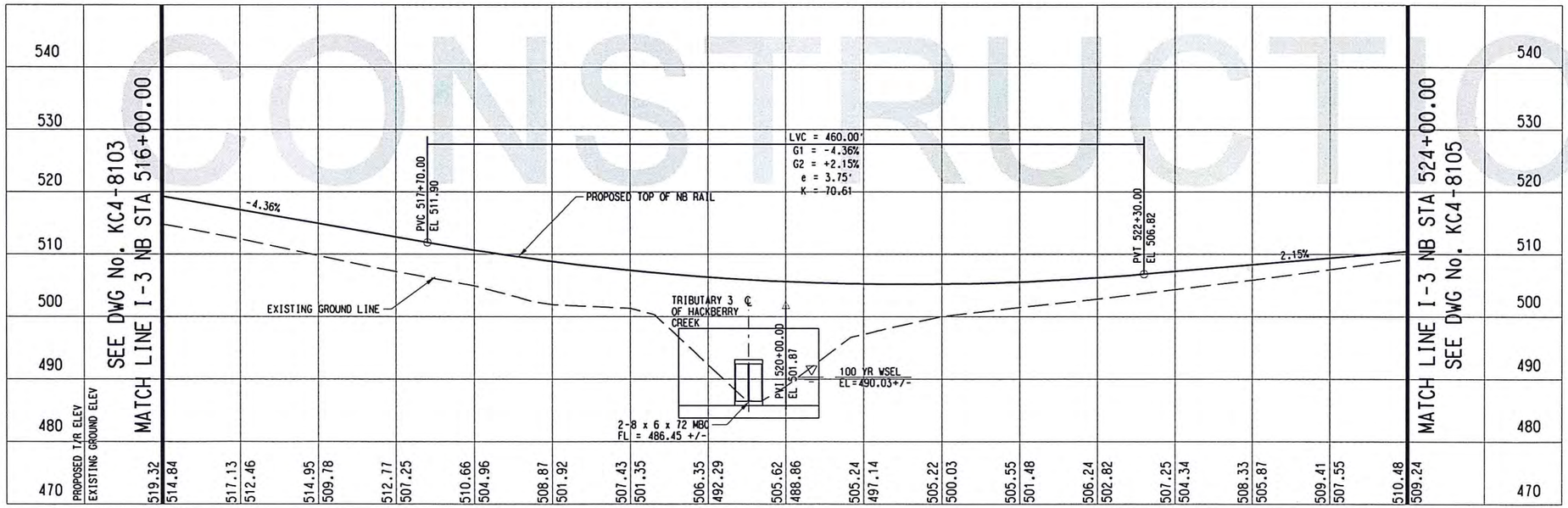
CONTRACT C-1018691-01 | DWG No. KC4-8103 | REV C

DWG No. KC4-8104

P0004



I3-B (NB)		I3-BB (SB)	
Rc=	3994.25'	Rc=	3980.00'
Ls=	180.00'	Ls=	237.40'
Lc=	366.40'	Lc=	307.05'
Eq=	2.75"	Eq=	2.75"
Eu=	1.48"	Eu=	1.50"
V=	65 MPH	V=	65 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 12 OF 15

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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CONSULTING ENGINEERS
DALLAS ◉ AUSTIN
REGISTRATION NO. 264

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	J. SLOAT
DESIGNED	G. BULBUL
CHECKED	L. LUAN
IN CHARGE	G. BULBUL
DATE	03 FEB 12

CAES

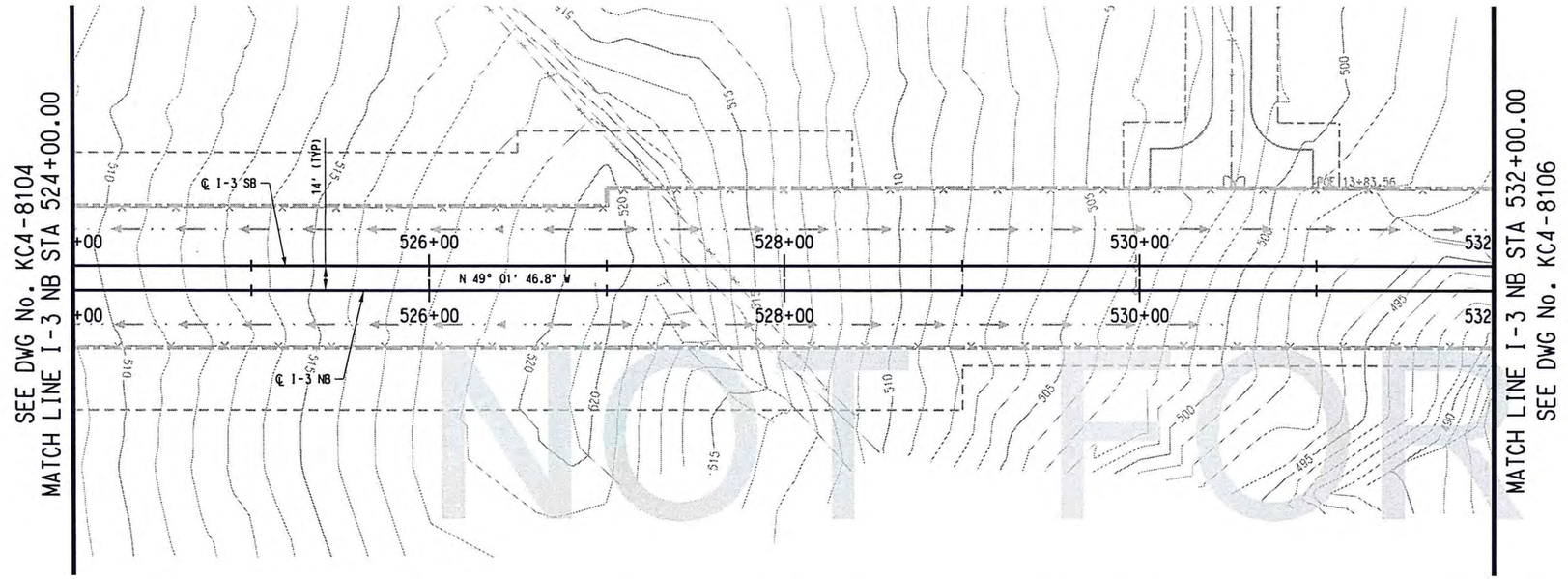
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

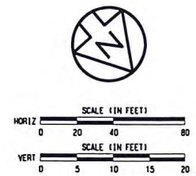
TRACK PLAN AND PROFILE
STA 516+00.00 TO STA 524+00.00

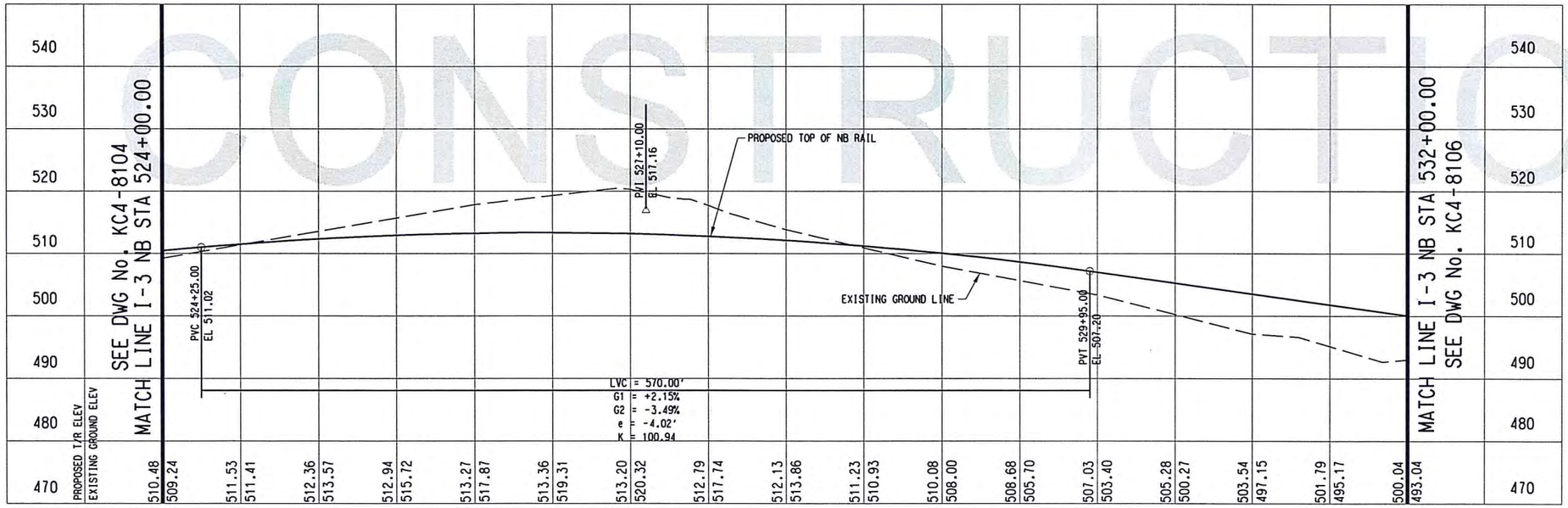
CONTRACT	DWG No.	REV
C-1018691-01	KC4-8104	C

DWG No. KC4-8105

P0005







$$FILE6$$
$$FILE7$$
$$FILE8$$
$$FILE9$$
$$FILE10$$

$$FILE2$$
$$FILE3$$
$$FILE4$$
$$FILE5$$

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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REGISTRATION NO. 264

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	J. SLOAT
DESIGNED	G. BULBUL
CHECKED	L. LUAN
IN CHARGE	G. BULBUL
DATE	03 FEB 12

CAES

PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 13 OF 15

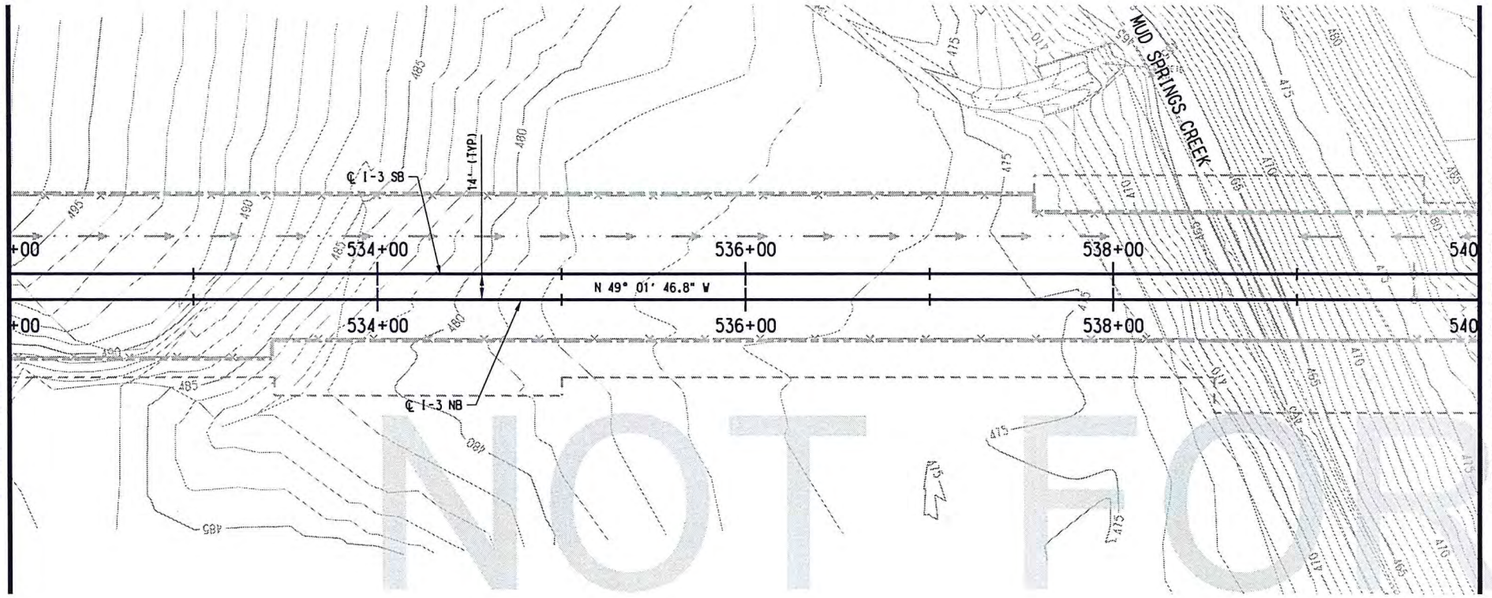
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

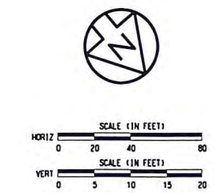
TRACK PLAN AND PROFILE
STA 524+00.00 TO STA 532+00.00

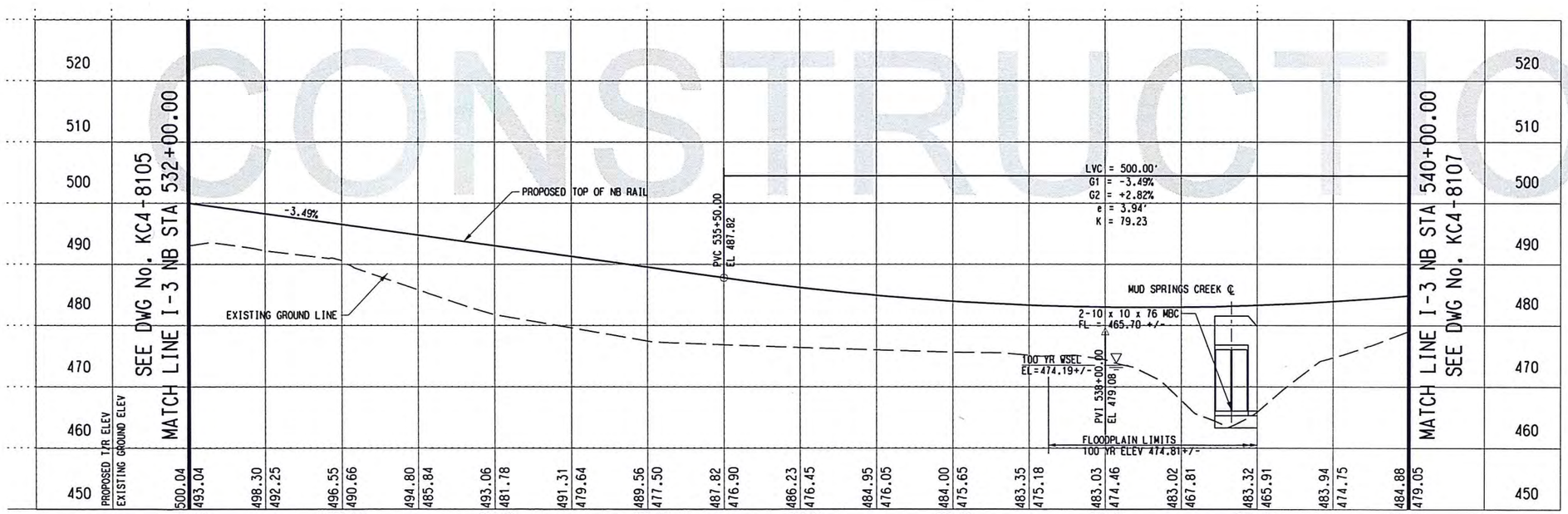
CONTRACT	DWG No.	REV
C-1018691-01	KC4-8105	C

DWG No.

P0006







PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 14 OF 15

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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CONSULTING ENGINEERS
DALLAS ⊛AUSTIN
REGISTRATION NO. 264

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	J. SLOAT
DESIGNED	G. BULBUL
CHECKED	L. LUAN
IN CHARGE	G. BULBUL
DATE	03 FEB 12

CAES

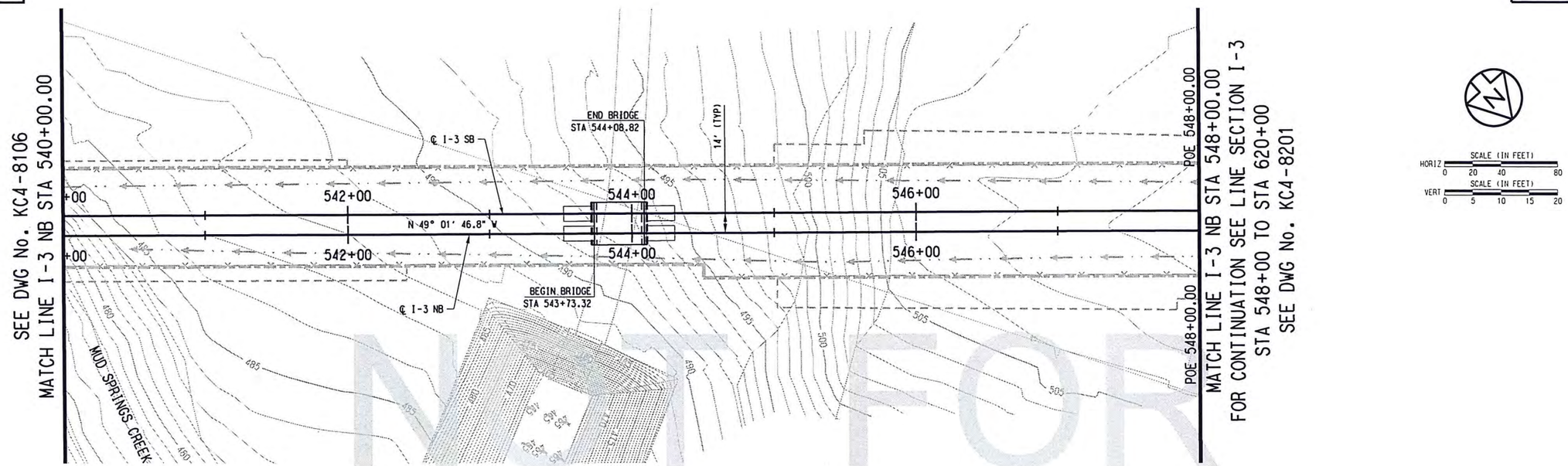
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

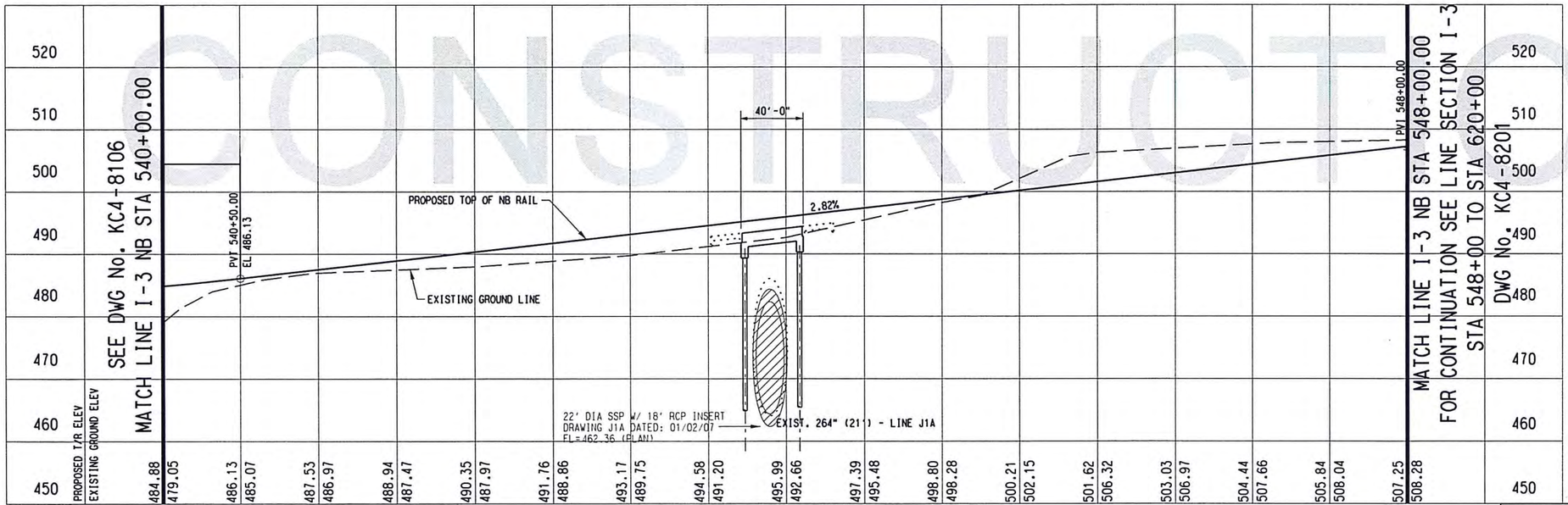
TRACK PLAN AND PROFILE
STA 532+00.00 TO STA 540+00.00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8106	C

DWG No. KC4-8107

P0007





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CONTRACT SHEET No. 15 OF 15

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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CONSULTING ENGINEERS
DALLAS ◉ AUSTIN
REGISTRATION NO. 264

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	J. SLOAT
DESIGNED	G. BULBUL
CHECKED	L. LUAN
IN CHARGE	G. BULBUL
DATE	03 FEB 12

CAES

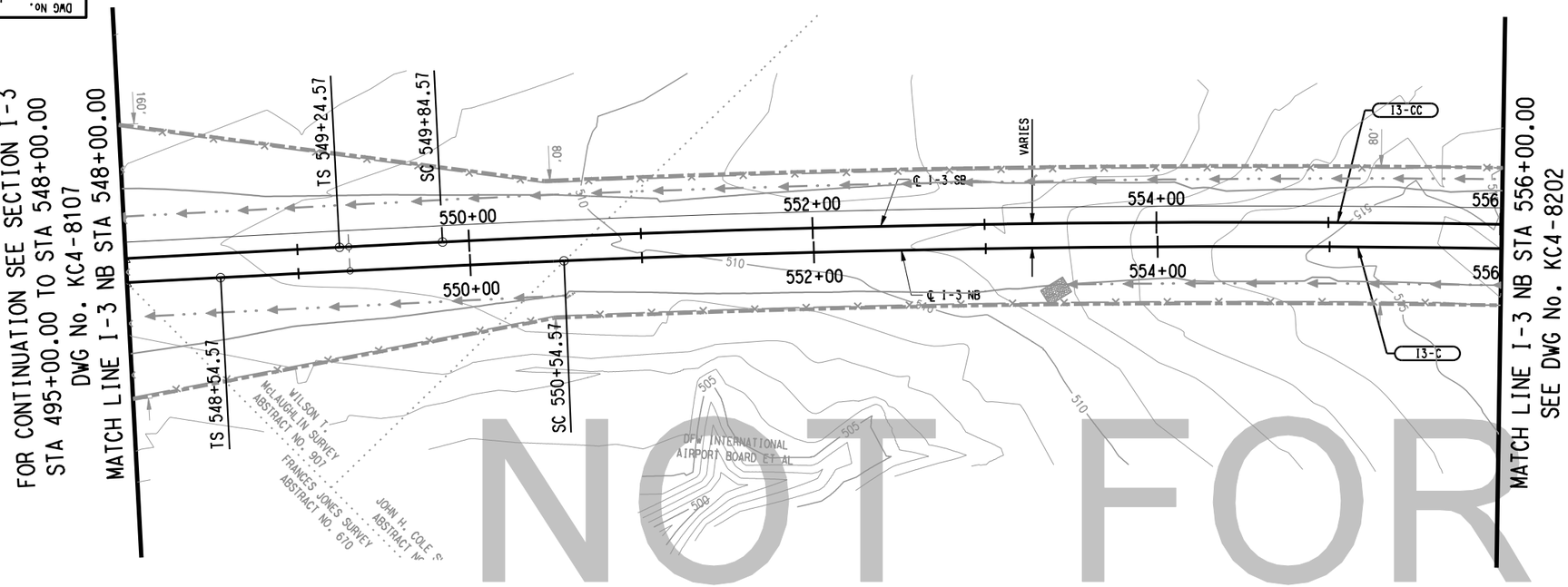
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 540+00.00 TO STA 548+00.00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8107	C

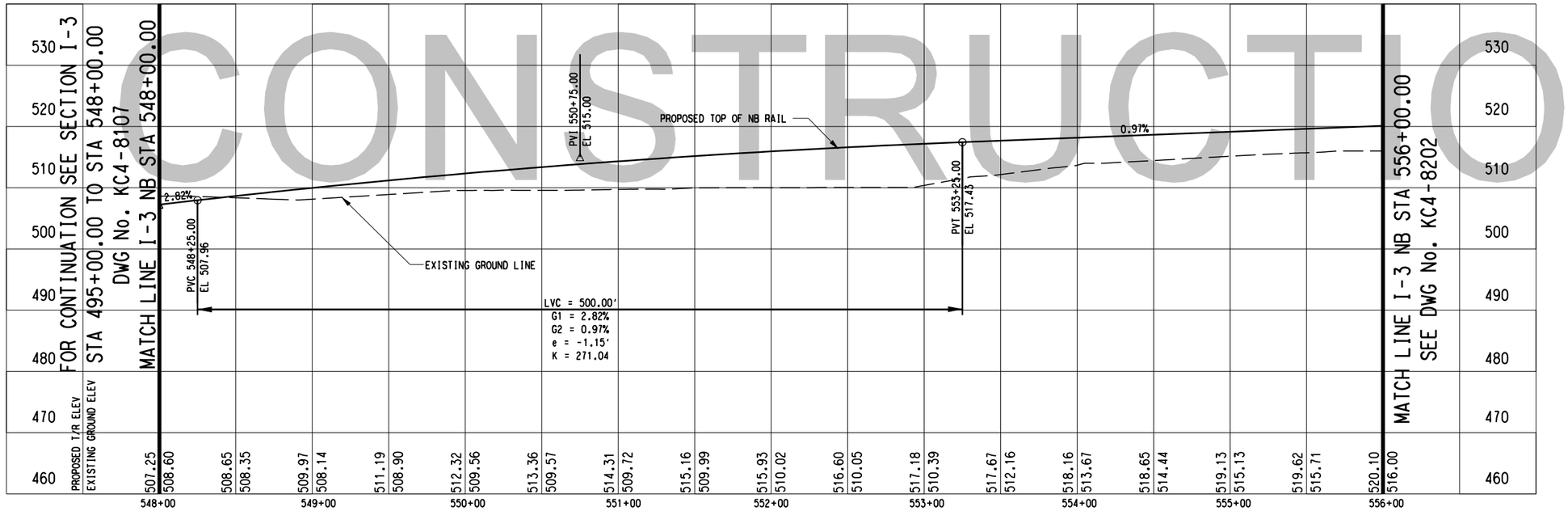
DWG No. KC4-8201

P0008



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-C (NB)		I3-CC (SB)	
Rc=	9500.00'	Rc=	9514.15'
LsIN=	200.00'	LsIN=	60.00'
LsOUT=	200.00'	LsOUT=	60.00'
Lc=	2448.36'	Lc=	2592.30'
Ea=	0.50"	Ea=	0.50"
Eu=	1.28"	Eu=	1.28"
V=	65 MPH	V=	65 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 10 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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KRIT WEERACHARTKUL, P.E 96648

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PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	17 FEB 12

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

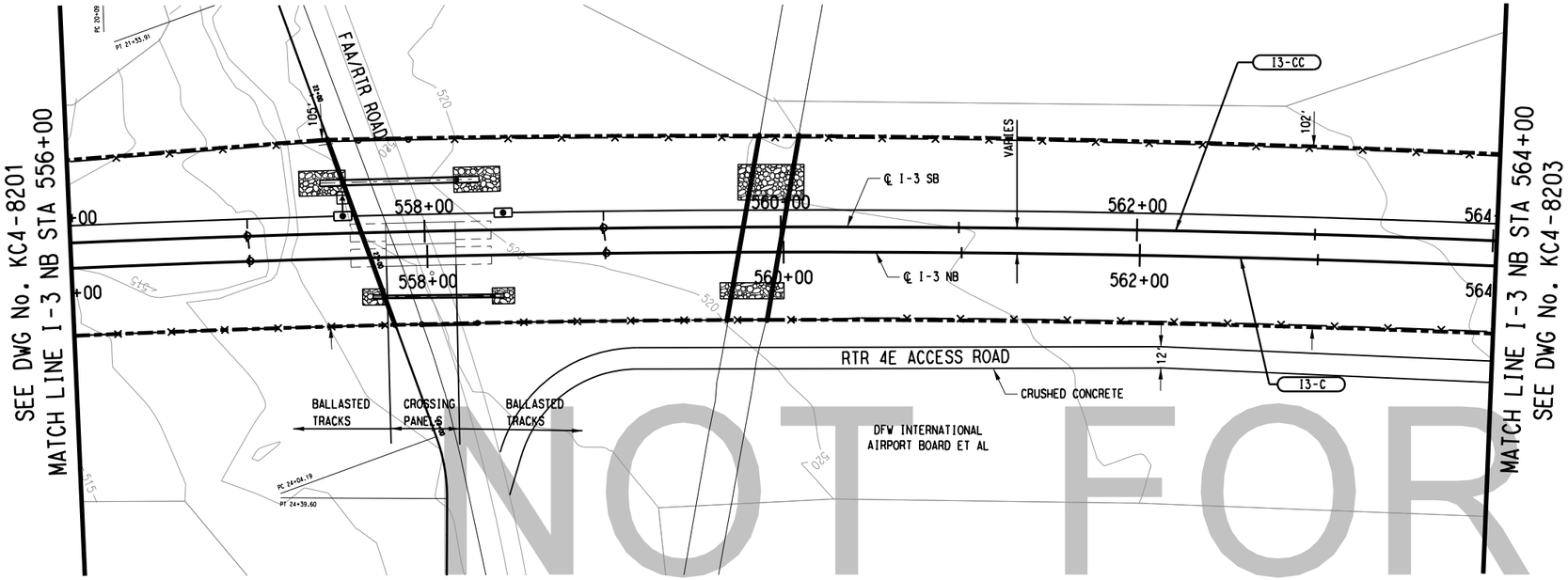
TRACK PLAN AND PROFILE
STA 548+00 TO STA 556+00

CAES

CONTRACT C-1018691-01 | DWG No. KC4-8201 | REV C

DWG No. KC4-8202

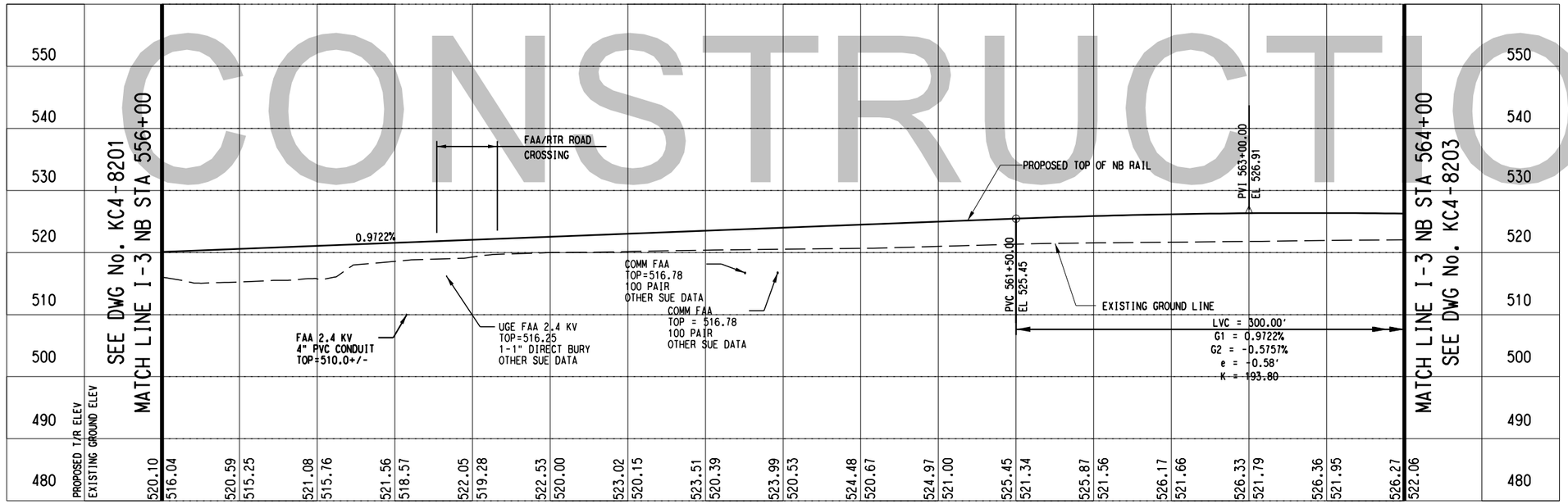
P0009



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-C (NB)	
Rc=	9500.00'
LsIN=	200.00'
LsOUT=	200.00'
Lc=	2448.36'
Eq=	0.50"
Eu=	1.28"
V=	65 MPH

I3-CC (SB)	
Rc=	9514.15'
LsIN=	60.00'
LsOUT=	60.00'
Lc=	2592.30'
Eq=	0.50"
Eu=	1.28"
V=	65 MPH



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CONTRACT SHEET No. 11 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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PARSONS TRANSPORTATION GROUP, INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	04 APR 12

CAES

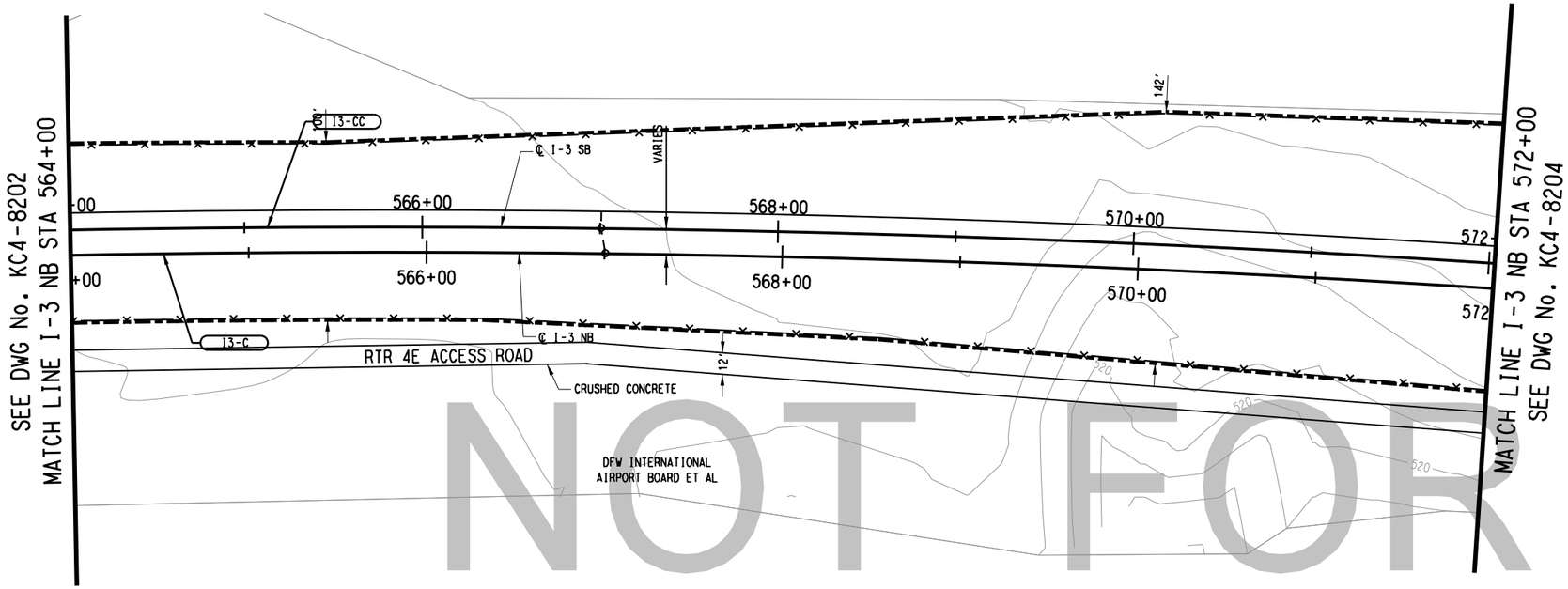
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

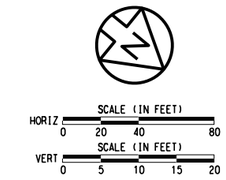
TRACK PLAN AND PROFILE
STA 556+00 TO STA 564+00

CONTRACT C-1018691-01 | DWG No. KC4-8202 | REV D

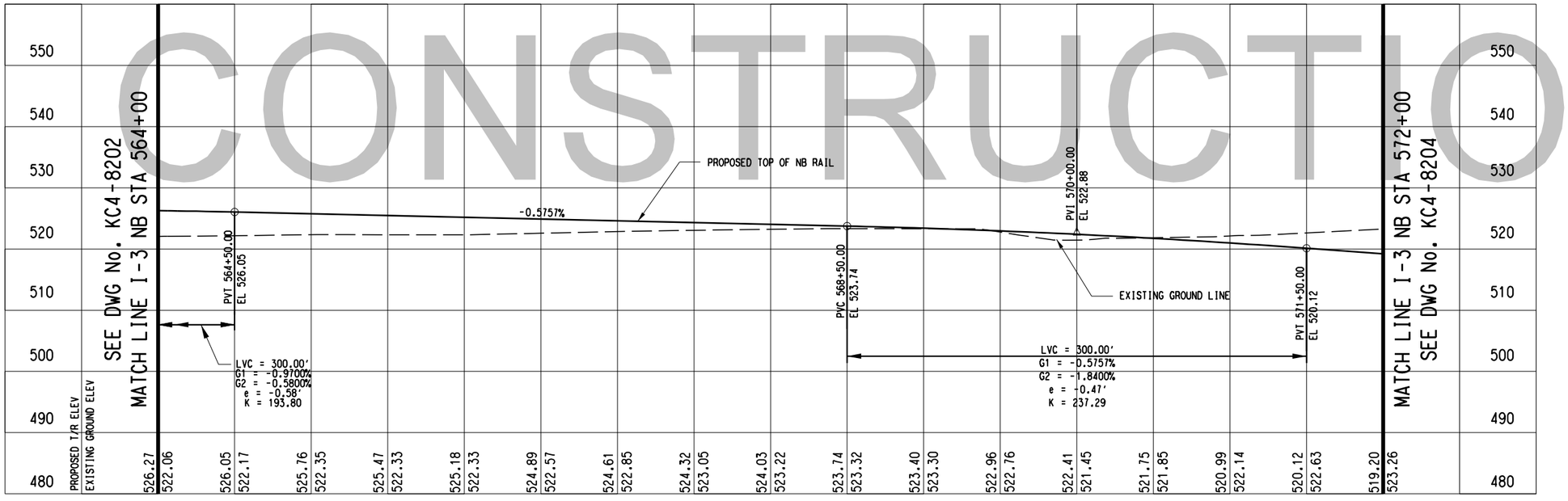
DWG No. KC4-8203

P0010





I3-C (NB)		I3-CC (SB)	
Rc=	9500.00'	Rc=	9514.15'
LsIN=	200.00'	LsIN=	60.00'
LsOUT=	200.00'	LsOUT=	60.00'
Lc=	2448.36'	Lc=	2592.30'
Ea=	0.50"	Ea=	0.50"
Eu=	1.28"	Eu=	1.28"
V=	65 MPH	V=	65 MPH



REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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PARSONS TRANSPORTATION GROUP, INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080
FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	04 APR 12

CAES

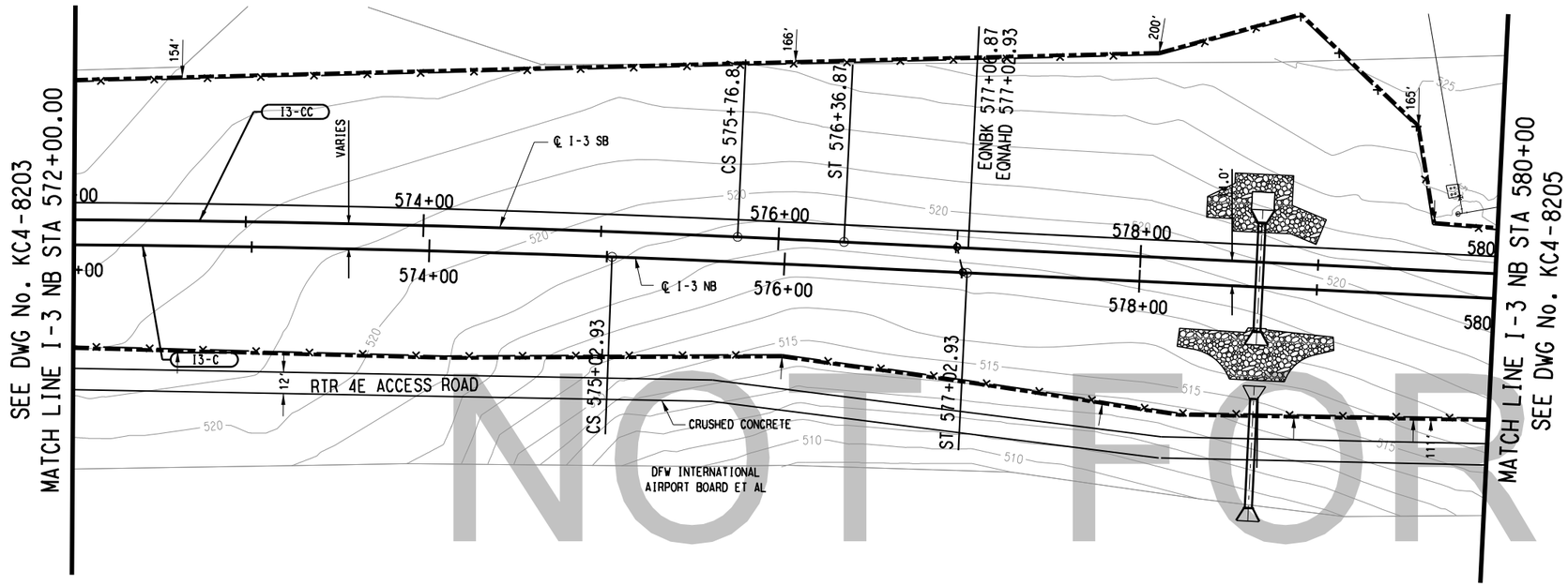
PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 12 OF 18

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

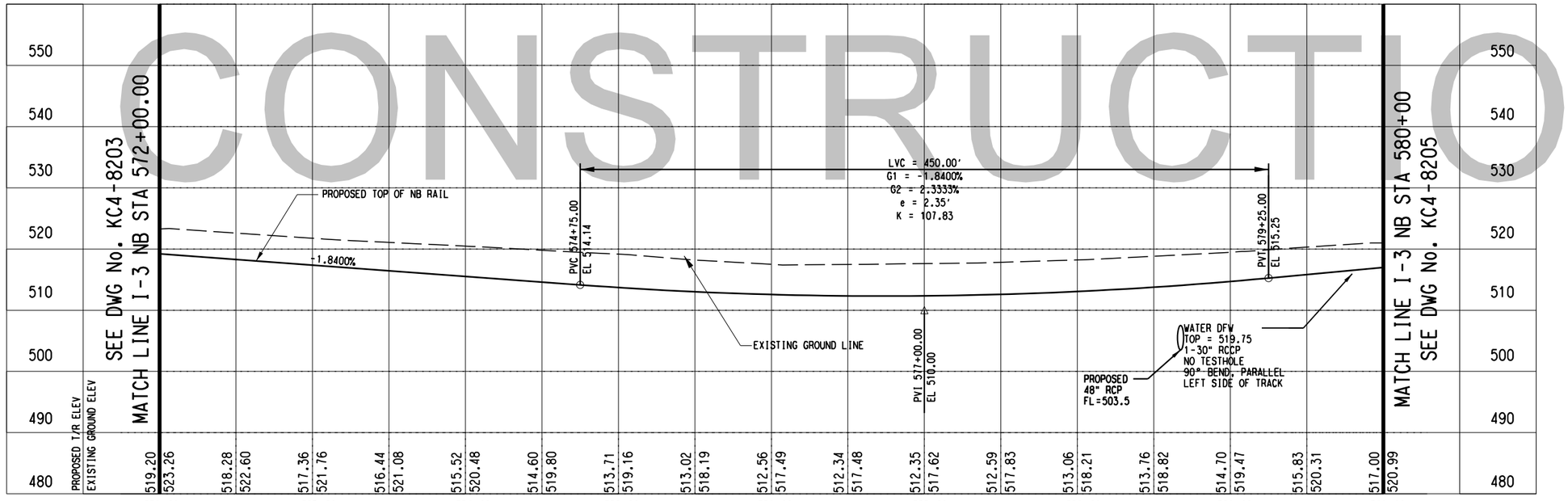
TRACK PLAN AND PROFILE
STA 564+00 TO STA 572+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8203	D



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-C (NB)		I3-CC (SB)	
Rc=	9500.00'	Rc=	9514.15'
LsIN=	200.00'	LsIN=	60.00'
LsOUT=	200.00'	LsOUT=	60.00'
Lc=	2448.36'	Lc=	2592.30'
Ea=	0.50"	Ea=	0.50"
Eu=	1.28"	Eu=	1.28"
V=	65 MPH	V=	65 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 13 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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PARSONS

PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	04 APR 12

CAES

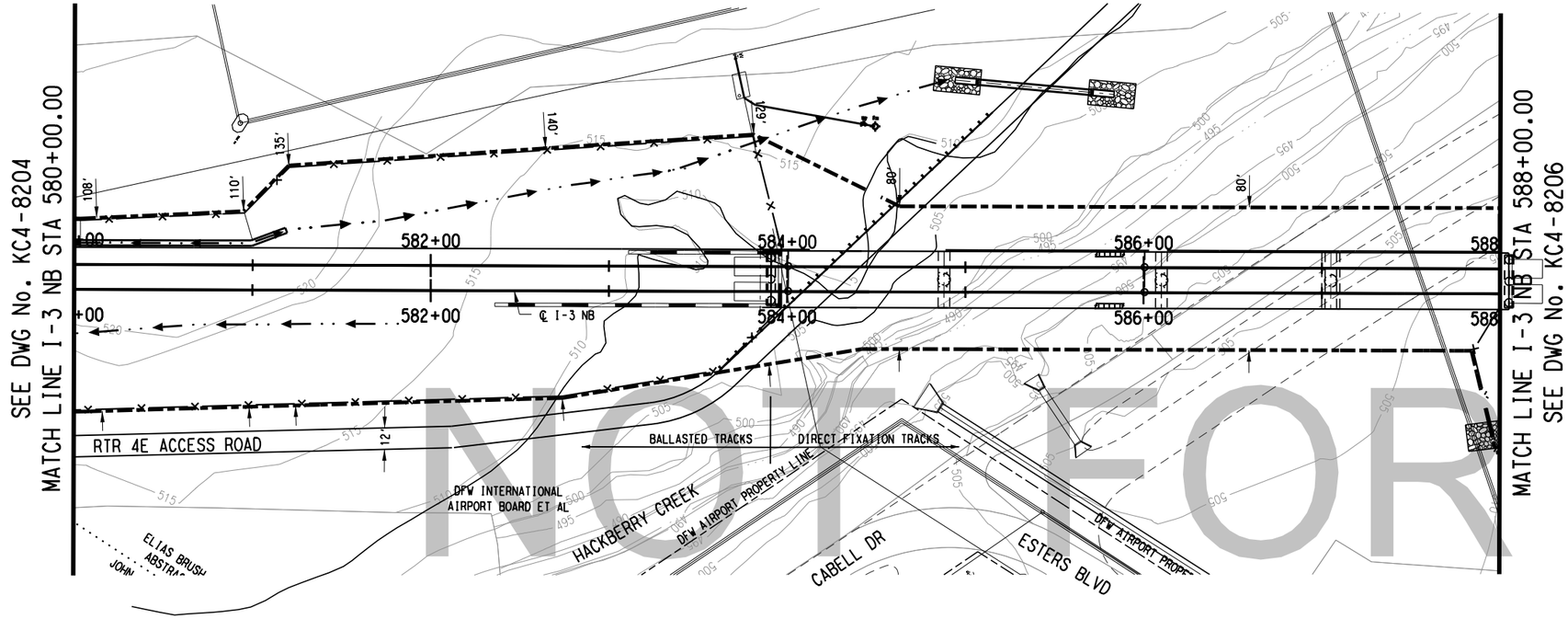
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

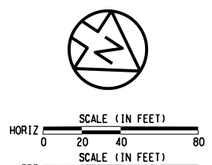
TRACK PLAN AND PROFILE
STA 572+00 TO STA 580+00

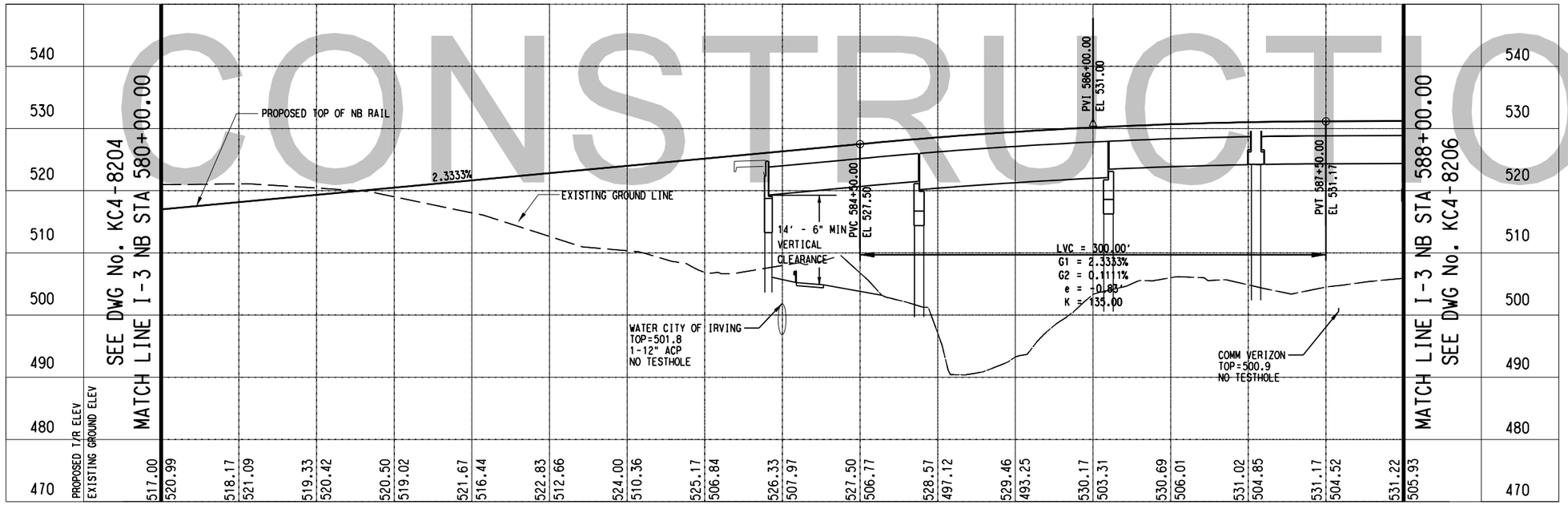
CONTRACT	DWG No.	REV
C-1018691-01	KC4-8204	D

DWG No. KC4-8205

P0012







PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 14 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	04 APR 12

CAES

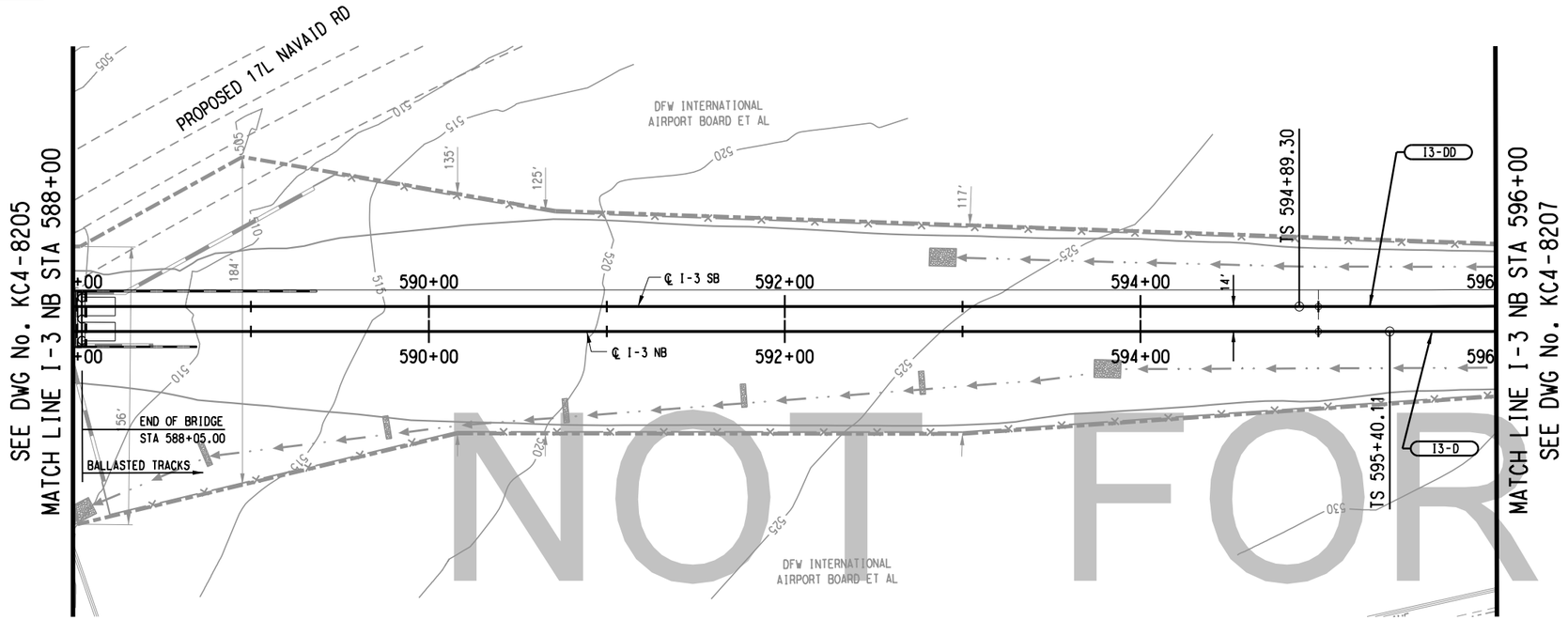
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 580+00 TO STA 588+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8205	D

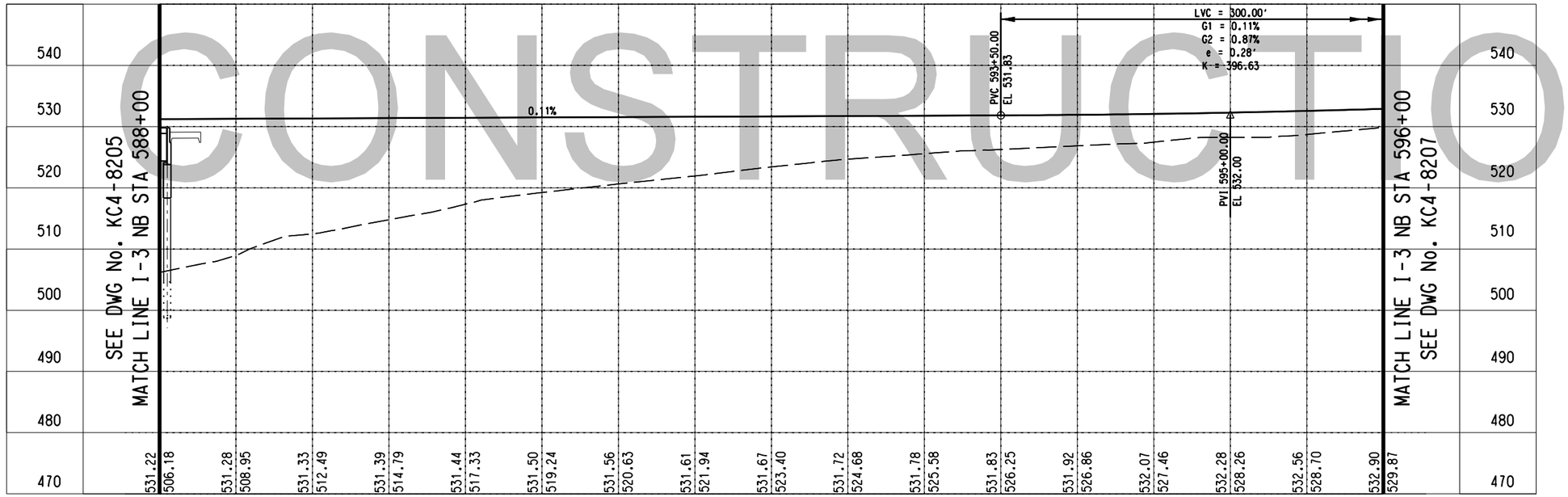
DWG No. KC4-8206

P0013



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-D (NB)		I3-DD (SB)	
Rc=	5214.22'	Rc=	5200.00'
LsIN=	115.00'	LsIN=	202.94'
LsOUT=	115.00'	LsOUT=	202.94'
Lc=	1037.26'	Lc=	946.17'
Eo=	1.75"	Eo=	1.75"
Eu=	1.49"	Eu=	1.50"
V=	65 MPH	V=	65 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 15 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT. STACY AND WITBECK. REYES. PARSONS. a Joint Venture

DART PROJECT

DART®

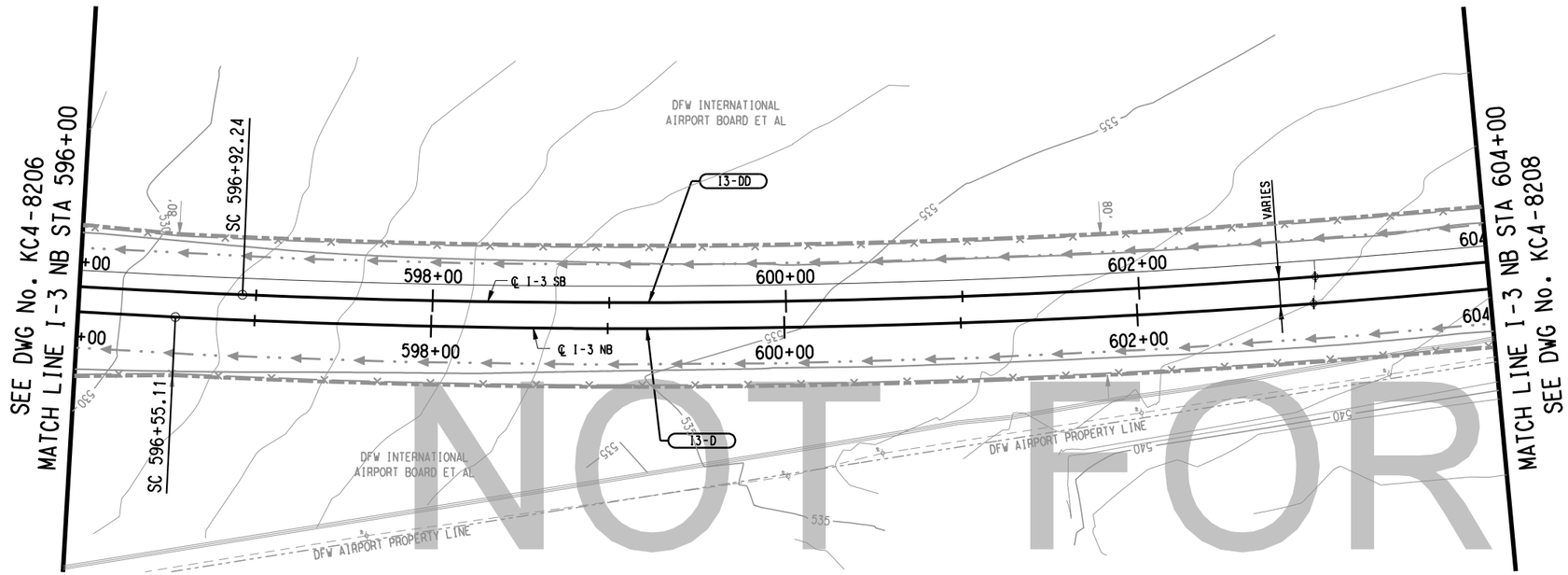
SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	17 FEB 12

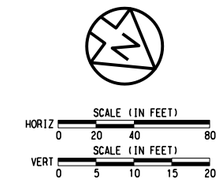
CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

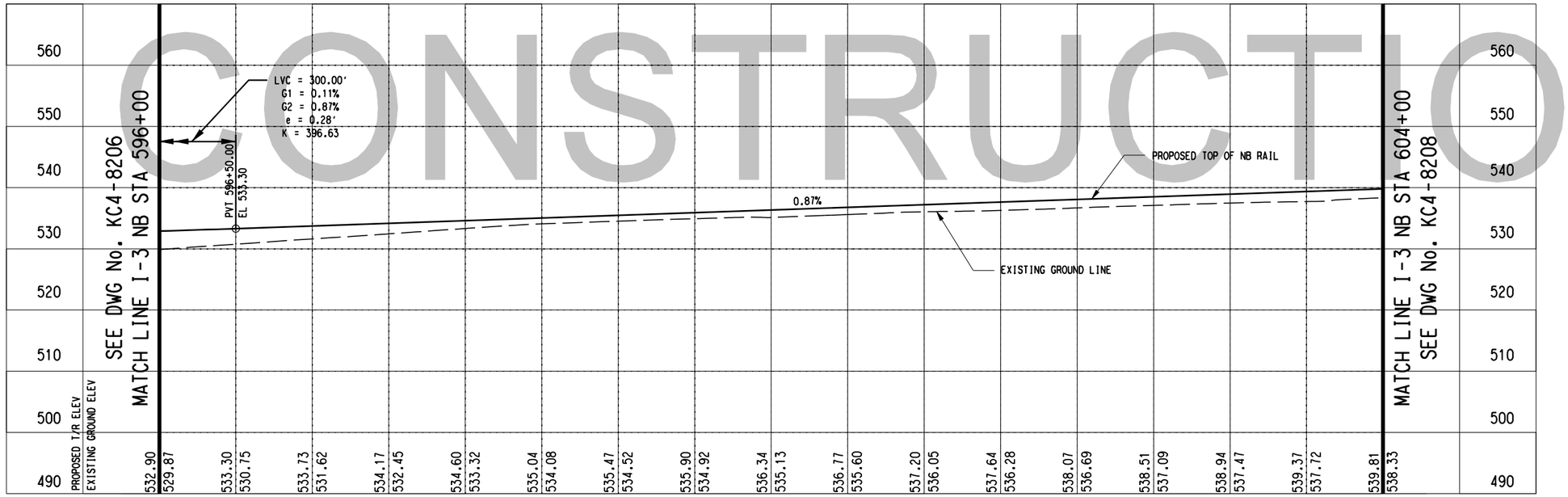
TRACK PLAN AND PROFILE
STA 588+00 TO STA 596+00

CONTRACT C-1018691-01 | DWG No. KC4-8206 | REV C





I3-D (NB)		I3-DD (SB)	
Rc=	5214.22'	Rc=	5200.00'
LsIN=	115.00'	LsIN=	202.94'
LsOUT=	115.00'	LsOUT=	202.94'
Lc=	1037.26'	Lc=	946.17'
Ea=	1.75"	Ea=	1.75"
Eu=	1.49"	Eu=	1.50"
V=	65 MPH	V=	65 MPH



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CONTRACT SHEET No. 16 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	17 FEB 12

CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 596+00 TO STA 604+00

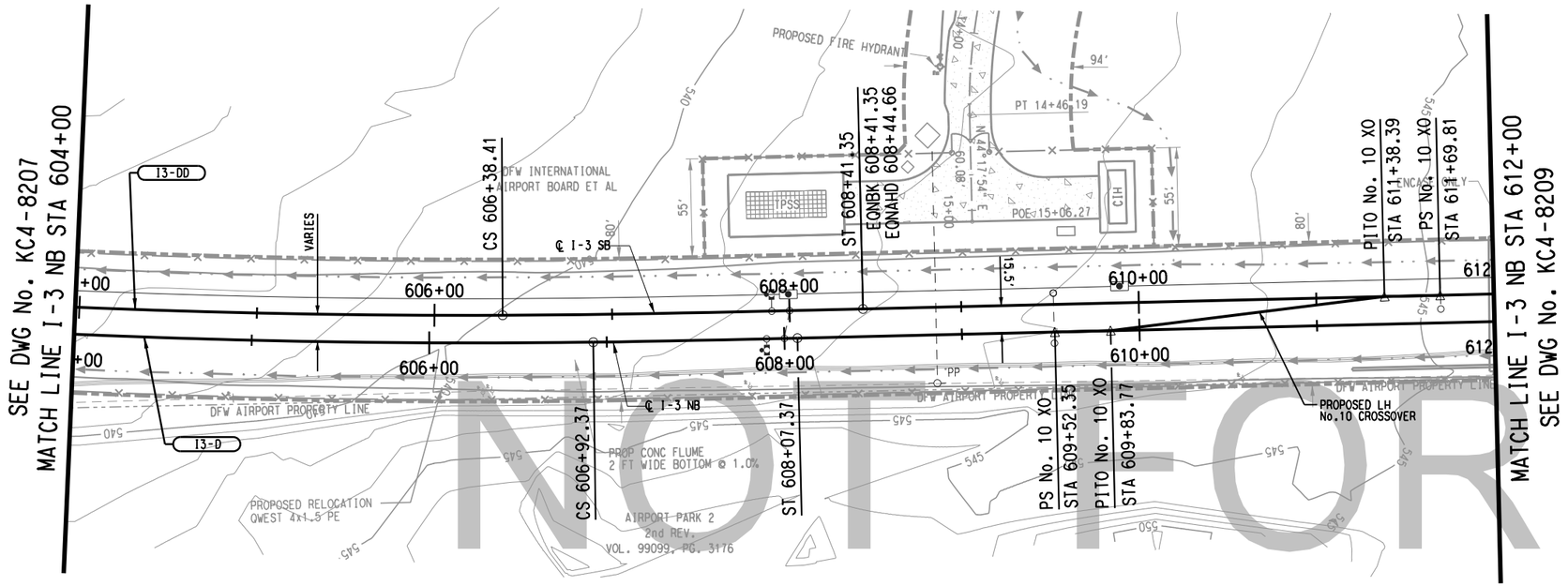
CONTRACT C-1018691-01

DWG No. KC4-8207

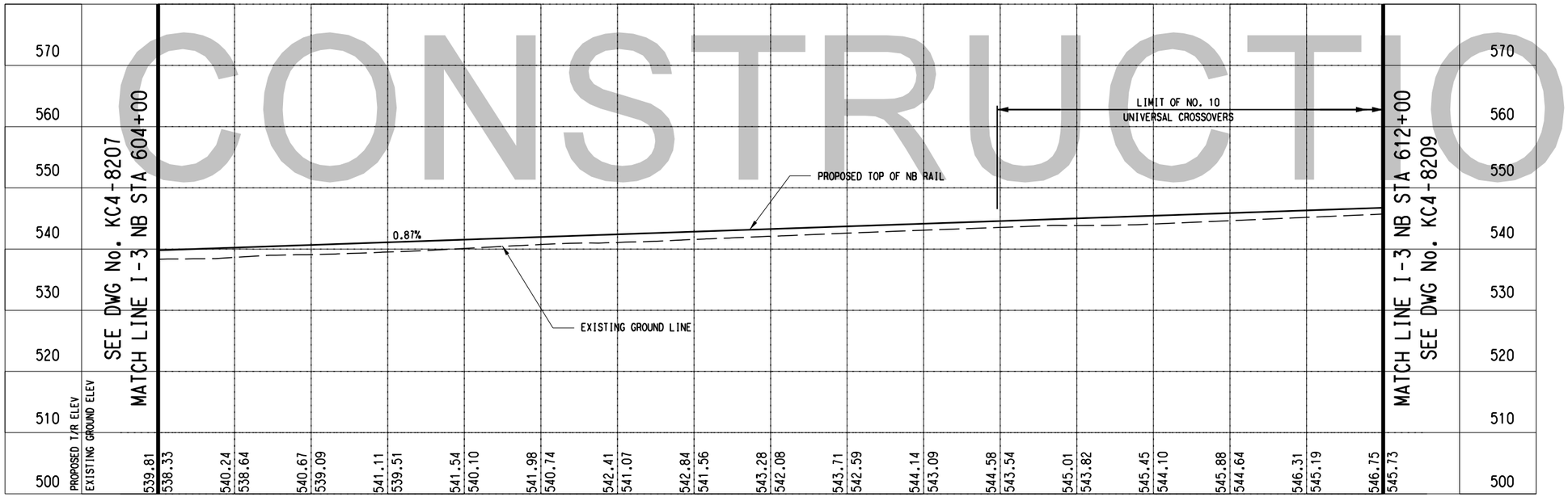
REV C

DWG No. KC4-8208

P0015



I3-D (NB)		I3-DD (SB)	
Rc=	5214.22'	Rc=	5200.00'
LsIN=	115.00'	LsIN=	202.94'
LsOUT=	115.00'	LsOUT=	202.94'
Lc=	1037.26'	Lc=	946.17'
Ea=	1.75"	Ea=	1.75"
Eu=	1.49"	Eu=	1.50"
V=	65 MPH	V=	65 MPH



REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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PARSONS TRANSPORTATION GROUP, INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080
FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	17 FEB 12

CAES

PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 17 OF 18

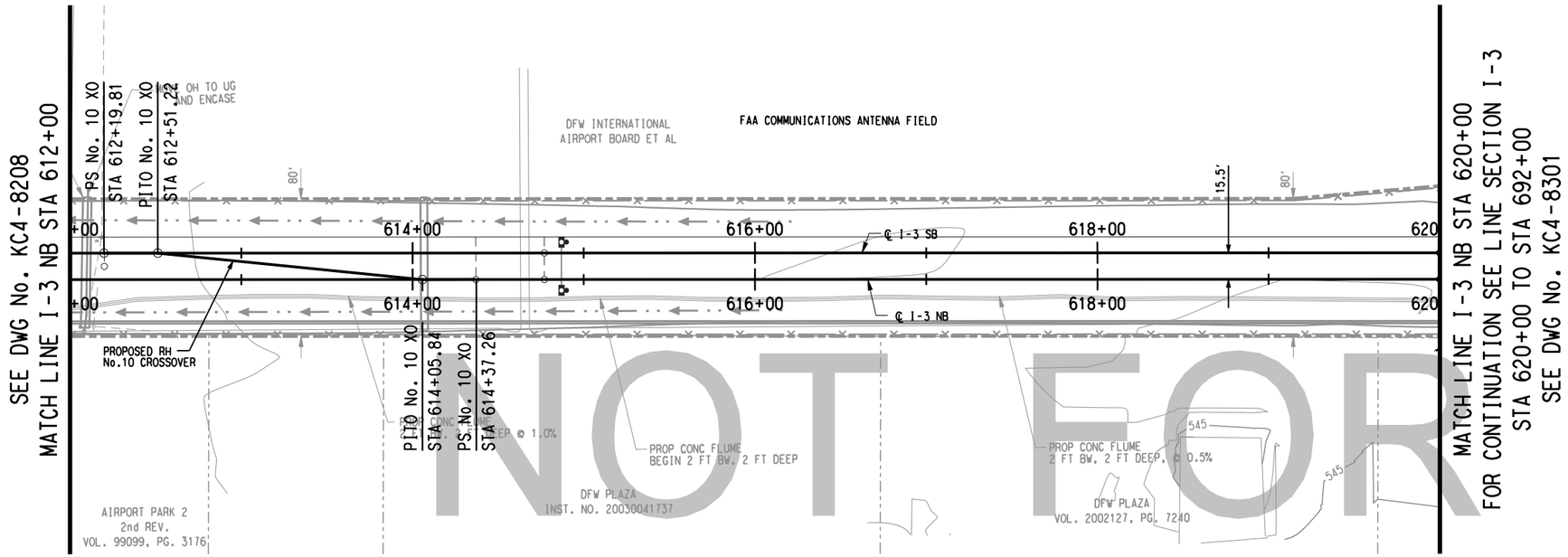
LIGHT RAIL TRANSIT SYSTEM LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 604+00 TO STA 612+00

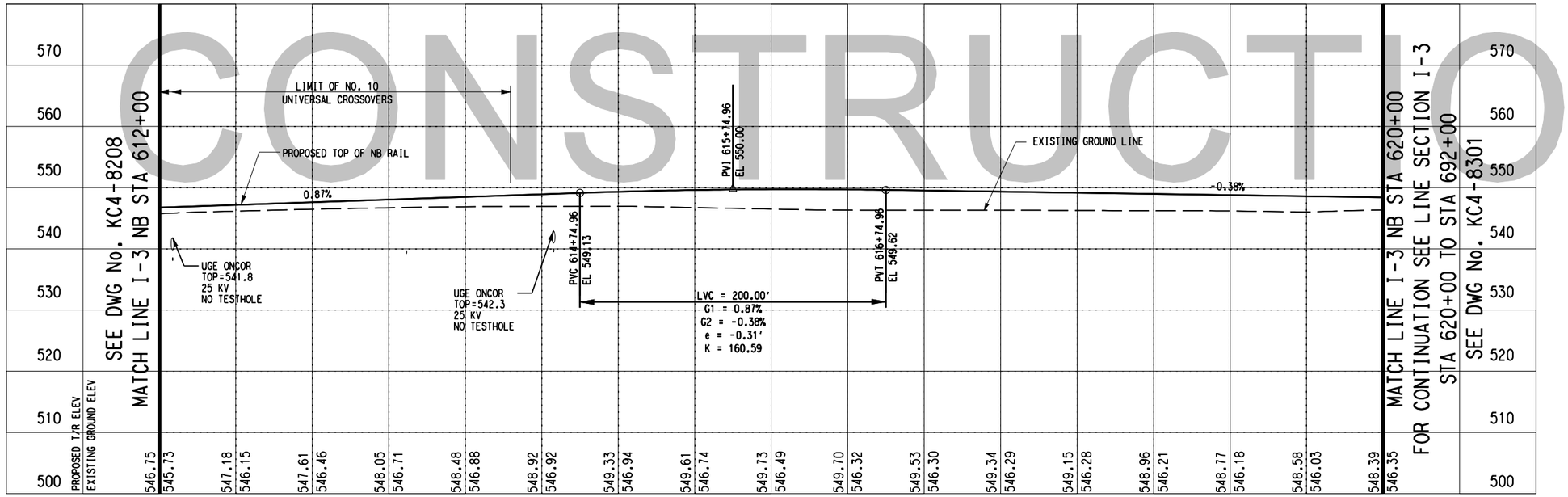
CONTRACT C-1018691-01

DWG No. KC4-8208

REV C



HORIZ SCALE (IN FEET) 0 20 40 80
VERT SCALE (IN FEET) 0 5 10 15 20



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 18 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

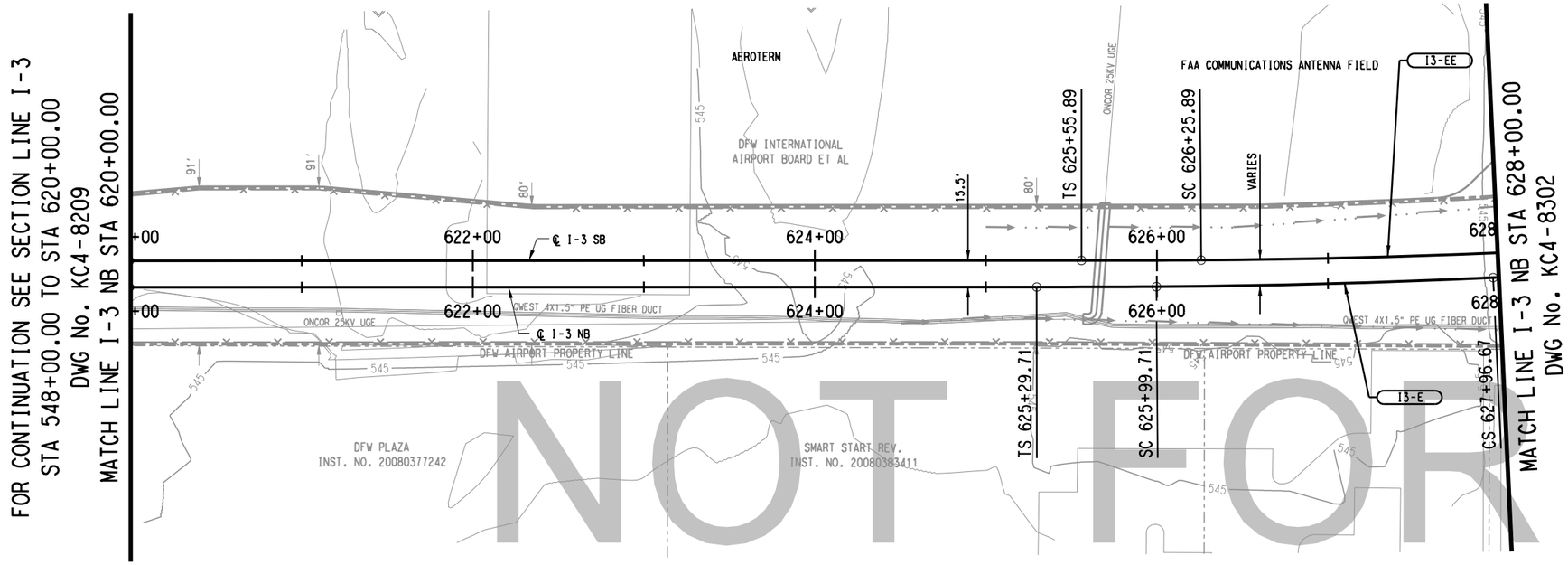
SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	17 FEB 12

CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

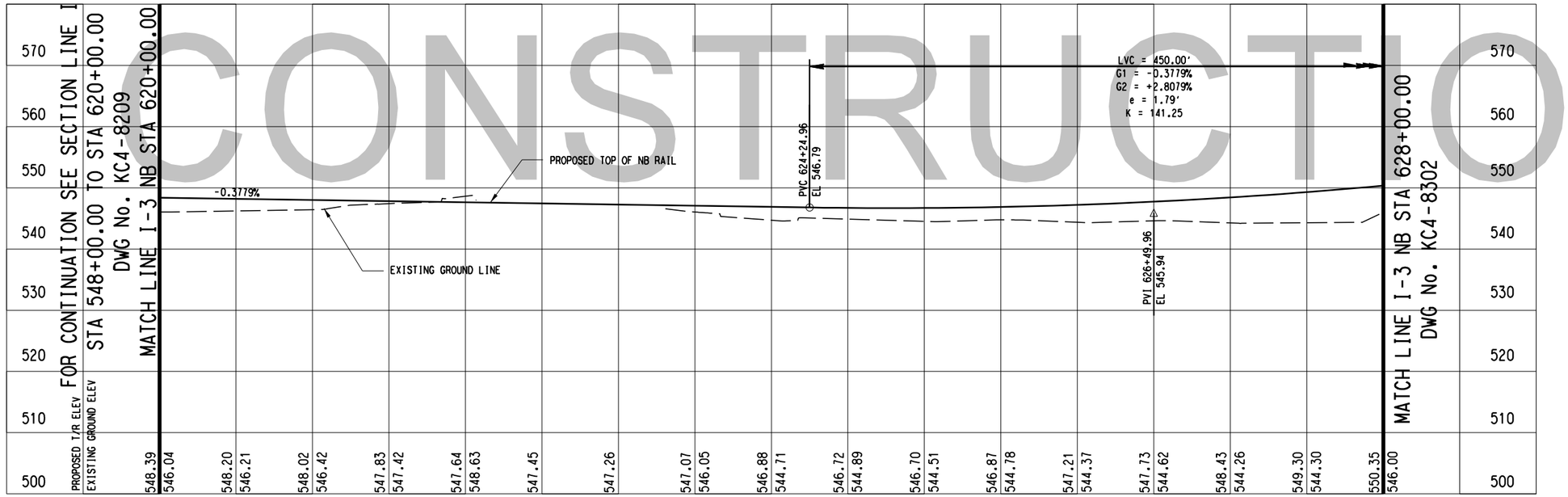
TRACK PLAN AND PROFILE
STA 612+00 TO STA 620+00

CONTRACT C-1018691-01 | DWG No. KC4-8209 | REV C



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-E (NB)		I3-EE (SB)	
Rc=	5014.22'	Rc=	5000.00'
LsIN=	70'	LsIN=	70'
LsOUT=	110'	LsOUT=	110'
Lc=	196.96'	Lc=	196.15'
Eo=	2.00"	Eo=	2.00"
Eu=	1.37"	Eu=	1.38"
V=	65 MPH	V=	65 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 10 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

CAES

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

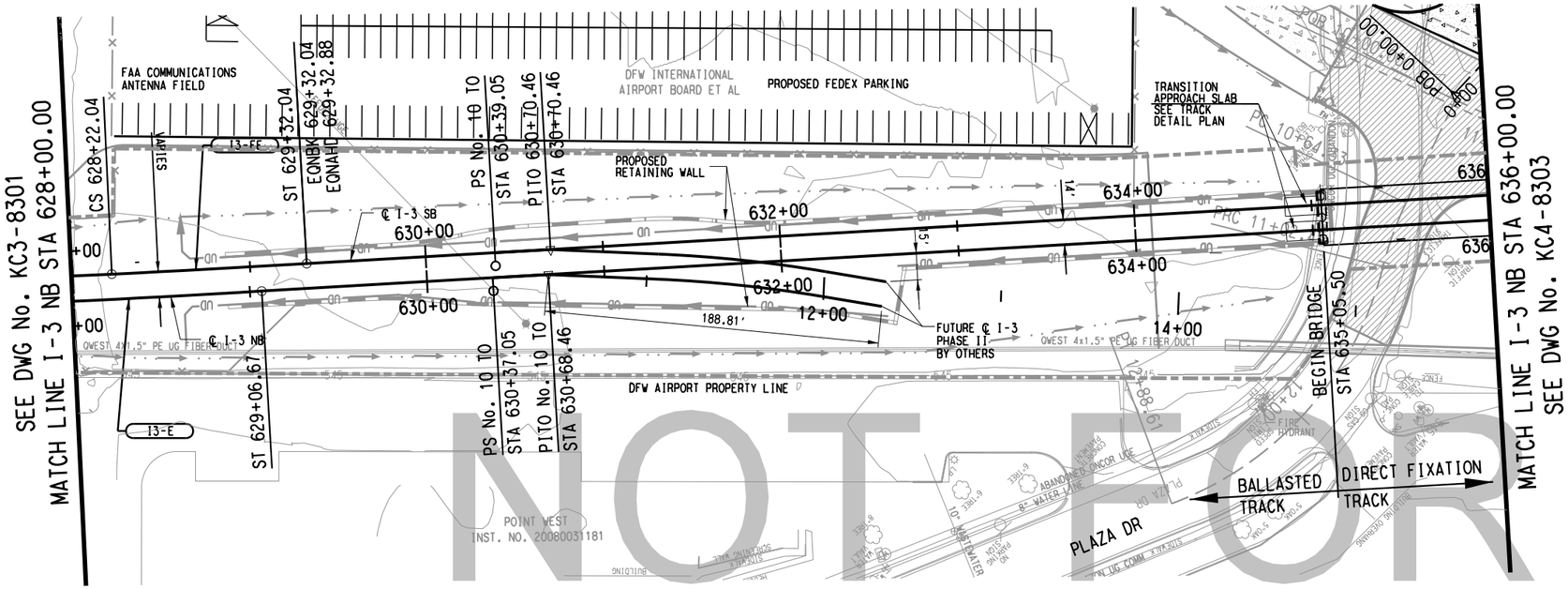
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

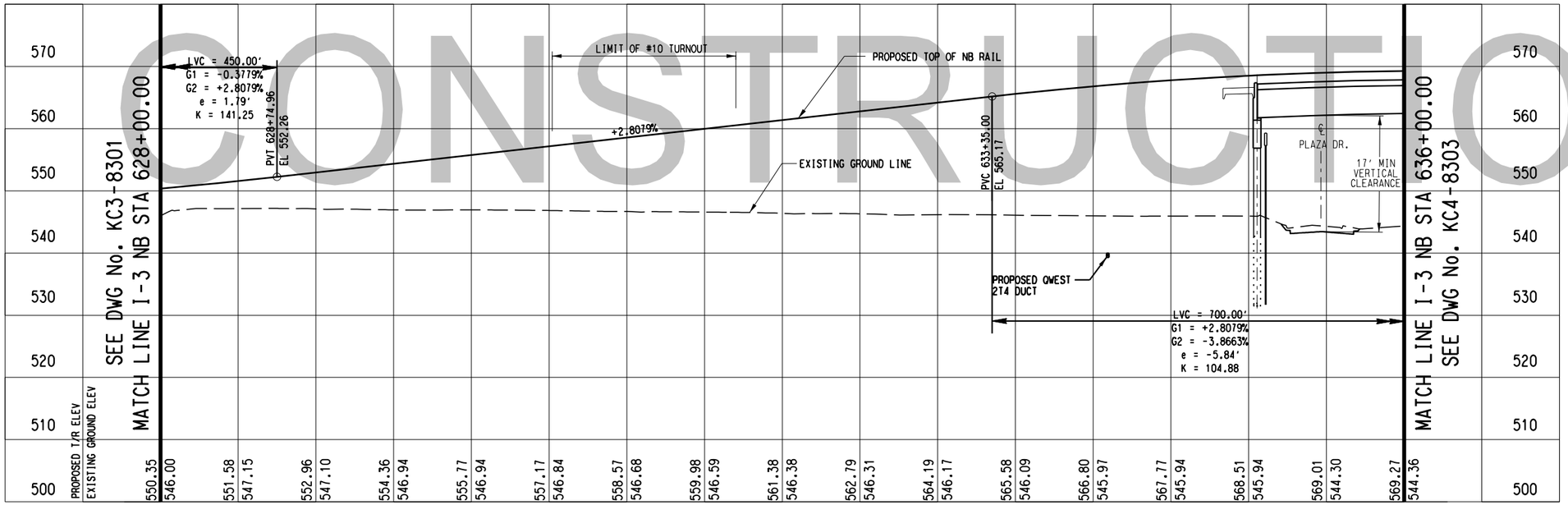
TRACK PLAN AND PROFILE
STA 620+00.00 TO STA 628+00.00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8301	C

DWG No. KC4-8302

P0018





SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-E (NB)		I3-EE (SB)	
Rc=	5014.22'	Rc=	5000.00'
LsIN=	70.00'	LsIN=	70.00'
LcOUT=	110.00'	LcOUT=	110.00'
Lc=	196.96'	Lc=	196.15'
Ea=	2.00"	Ea=	2.00"
Eu=	1.37"	Eu=	1.38"
V=	65 MPH	V=	65 MPH

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

CAES

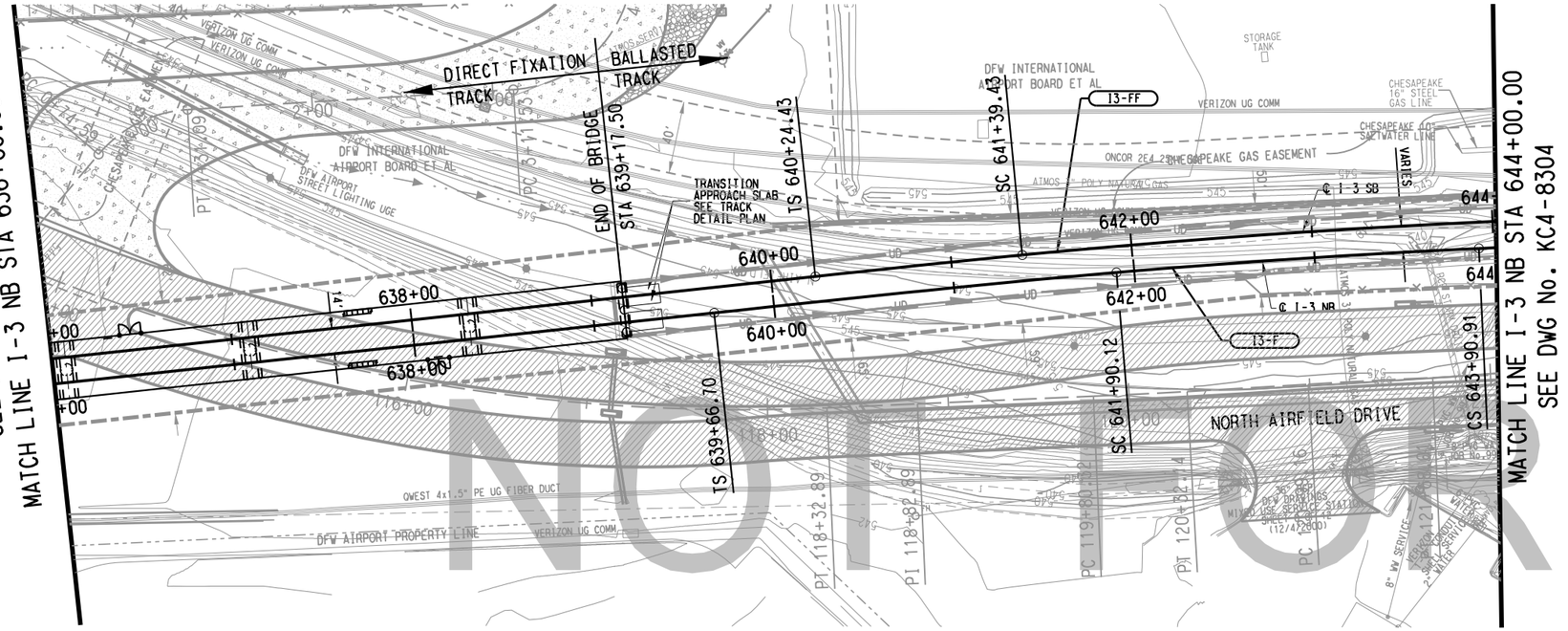
PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 11 OF 18

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

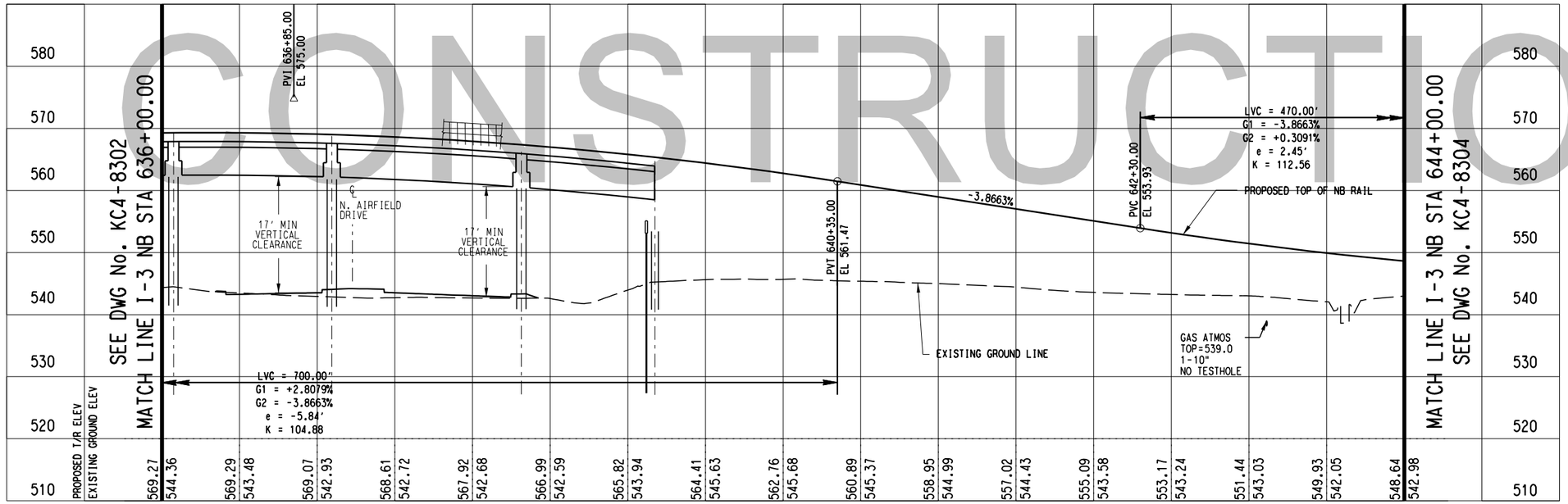
TRACK PLAN AND PROFILE
STA 628+00.00 TO STA 636+00.00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8302	C



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-F (NB)		I3-FF (SB)	
Rc=	5200.00'	Rc=	5214.22'
LsIN=	223.43'	LsIN=	115.00'
LsOUT=	223.43'	LsOUT=	115.00'
Lc=	200.79'	Lc=	310.38'
Ea=	1.75"	Ea=	1.75"
Eu=	1.50"	Eu=	1.49"
V=	65 MPH	V=	65 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 12 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	W. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 636+00 TO STA 644+00

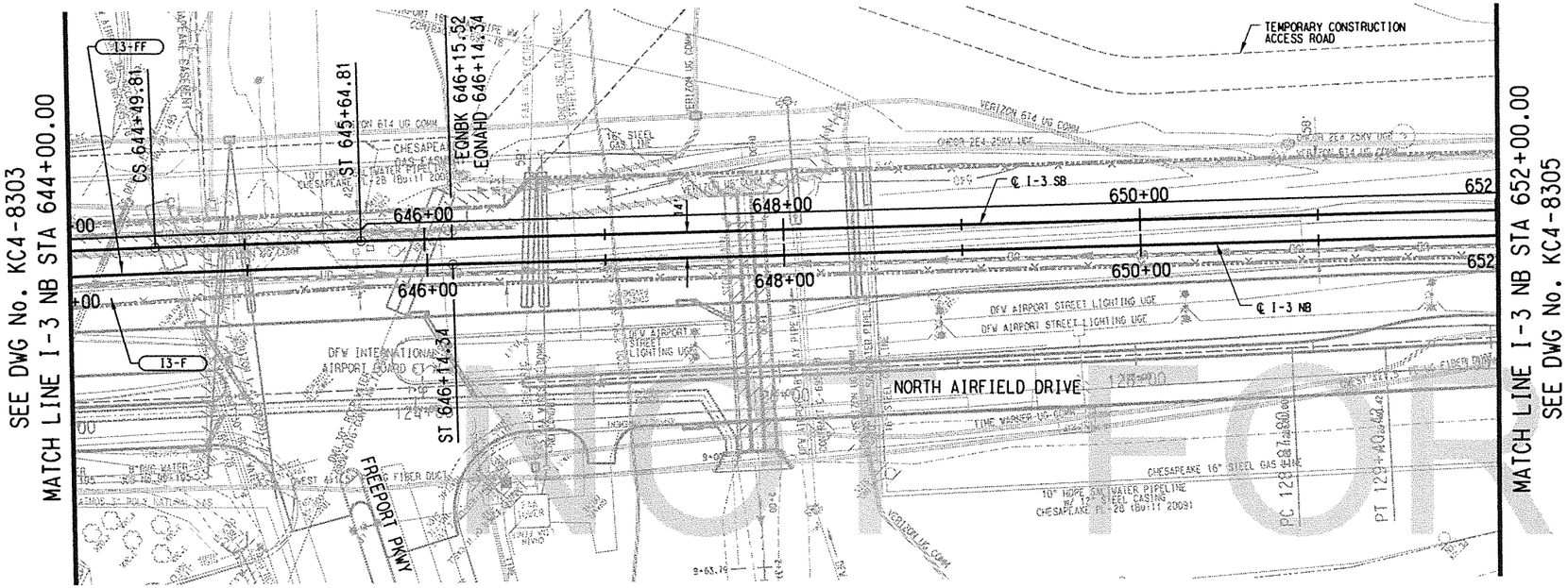
CONTRACT C-1018691-01

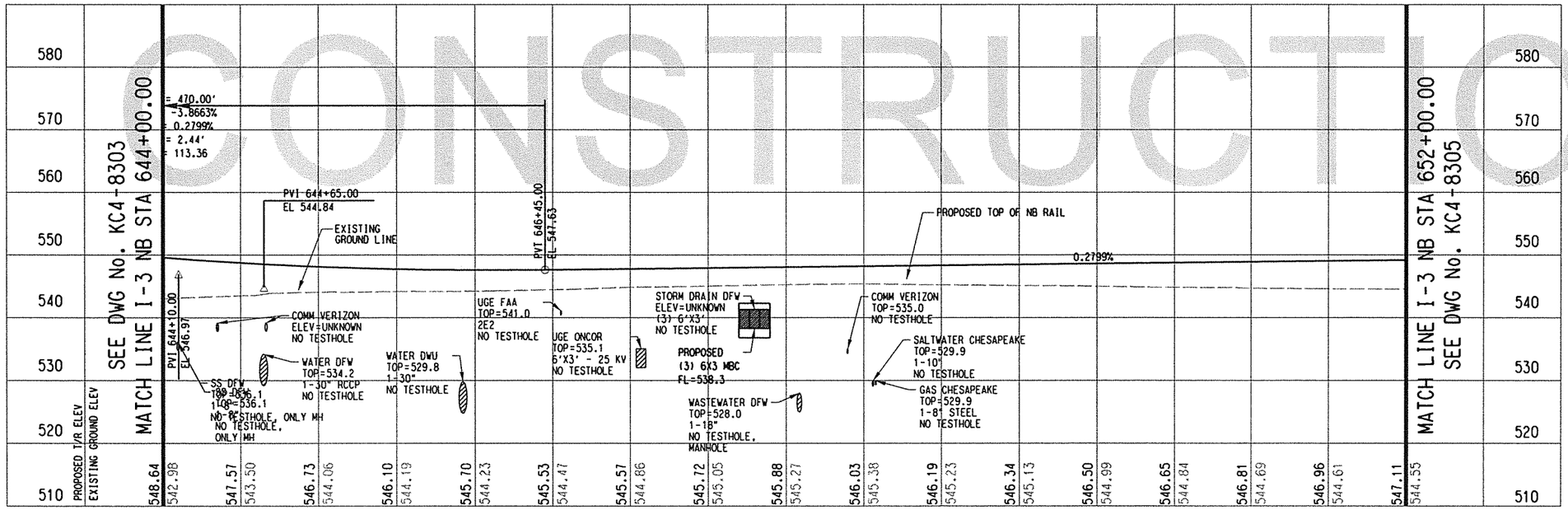
DWG No. KC4-8303

REV C

DWG No. KC4-8304

P0020





PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 13 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	N. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

CAES

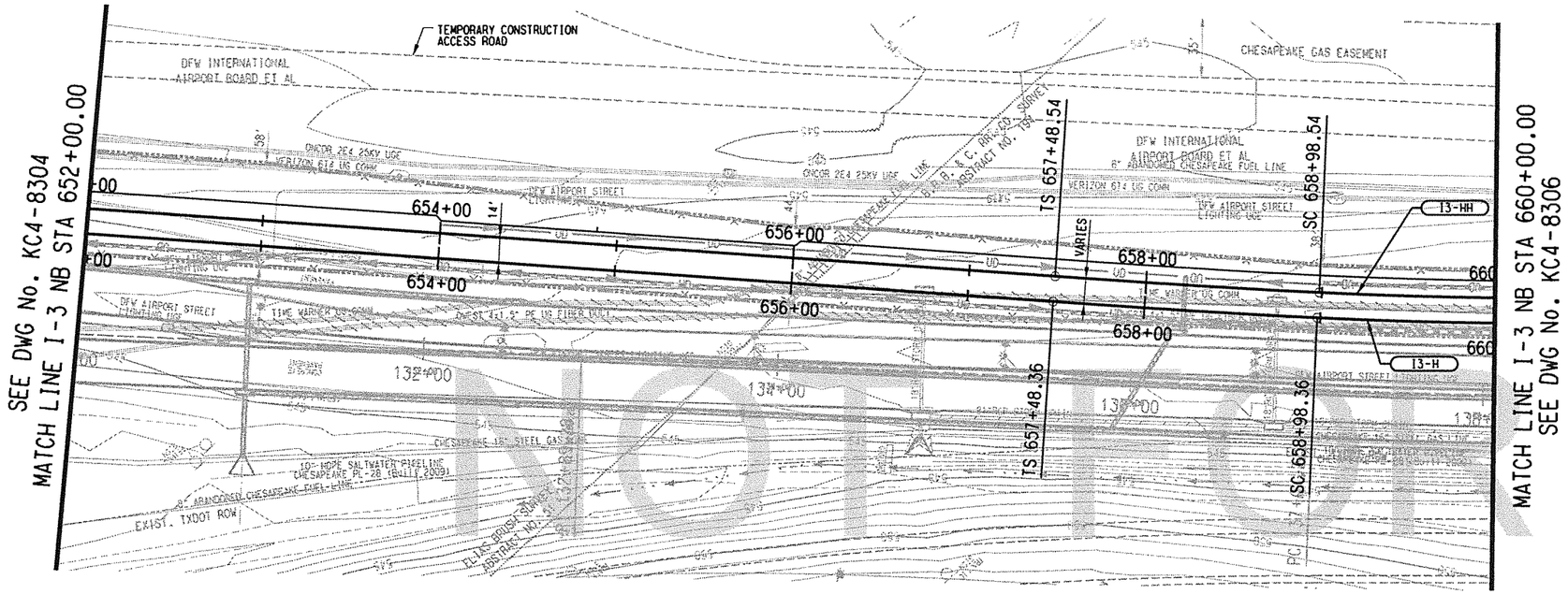
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 644+00.00 TO STA 652+00.00

CONTRACT C-1018691-01 | DWG No. KC4-8304 | REV C

DWG No. KC4-8305

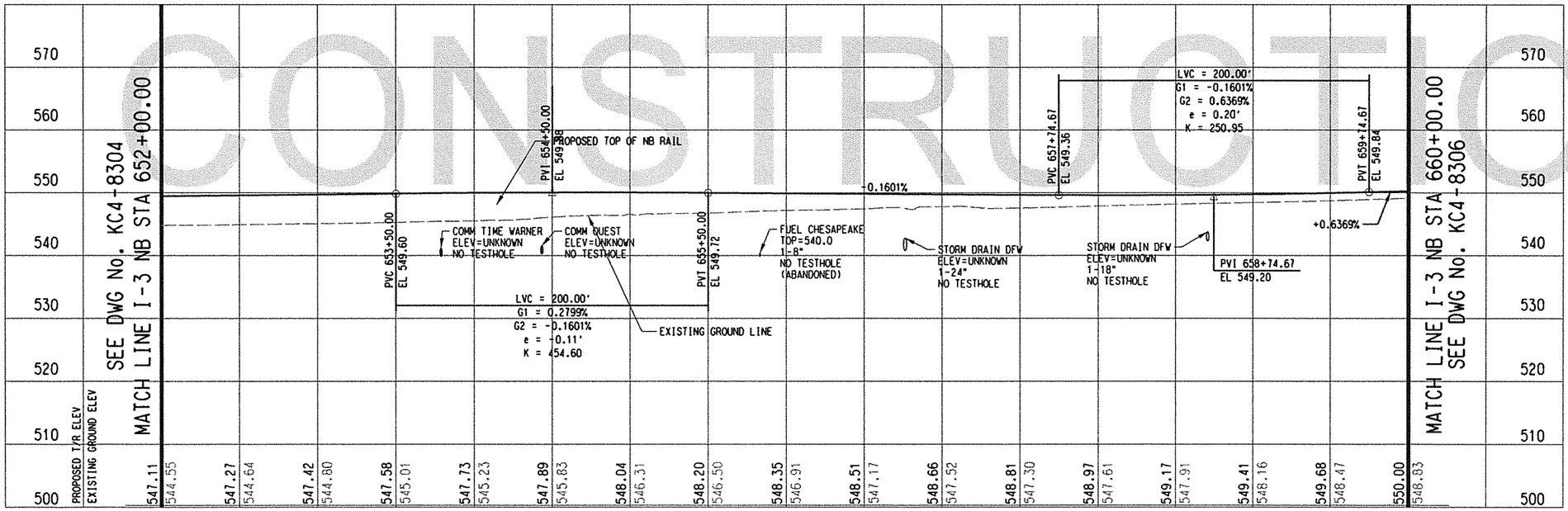
P0021



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-H (NB)	
Rc=	3109.29'
LsIN=	150'
LsOUT=	60'
Lc=	3830.03'
Eq=	2.50"
Eu=	1.39"
V=	55 MPH

I3-HH (SB)	
Rc=	3090.00'
LsIN=	150'
LsOUT=	75'
Lc=	3810.93'
Eq=	2.50"
Eu=	1.42"
V=	55 MPH



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CONTRACT SHEET No. 14 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

CAES

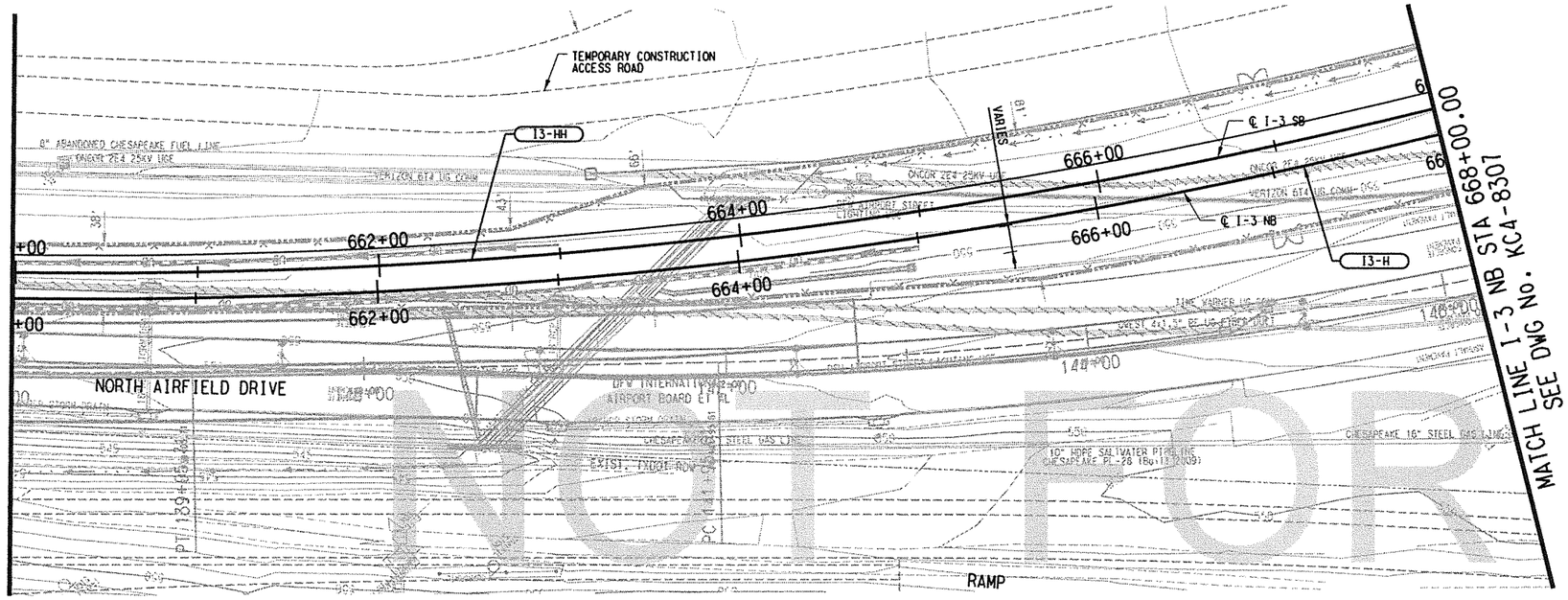
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 652+00 TO STA 660+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8305	C

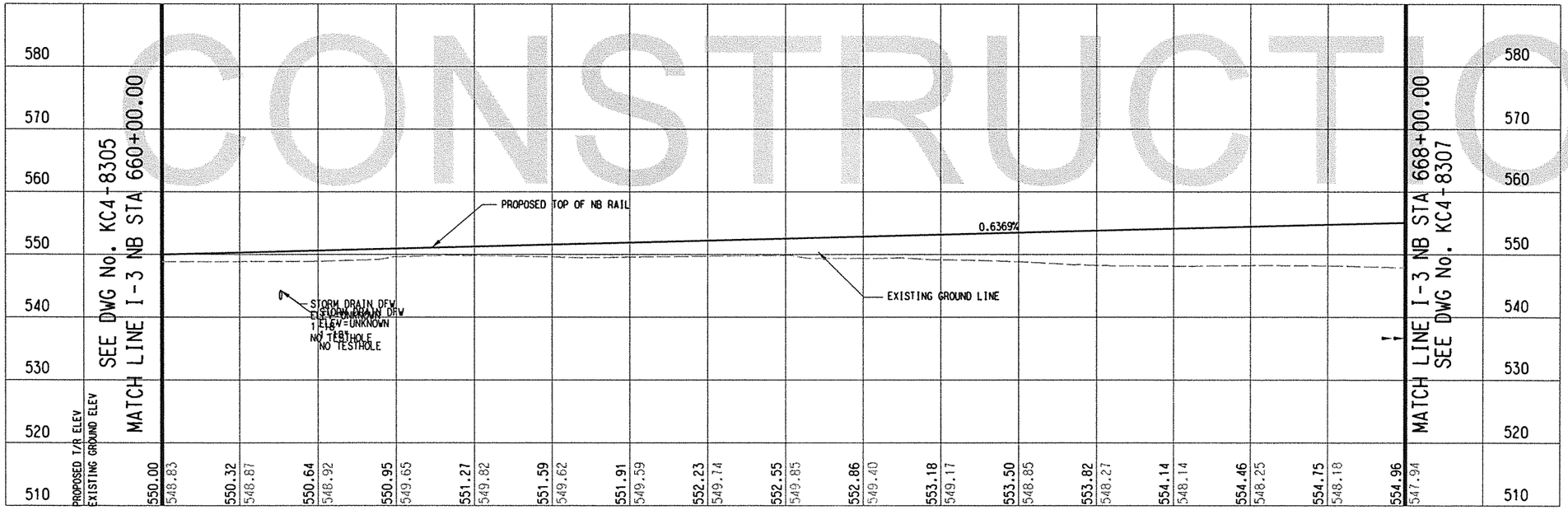
DWG No. KC4-8306

P0022



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-H (NB)		I3-HH (SB)	
Rc=	3109.29'	Rc=	3090.00'
LsIN=	150'	LsIN=	150'
LsOUT=	60'	LsOUT=	75'
Lc=	3830.03'	Lc=	3810.93'
Eo=	2.50"	Eo=	2.50"
Eu=	1.39"	Eu=	1.42"
V=	55 MPH	V=	55 MPH



	660+00	661+00	662+00	663+00	664+00	665+00	666+00	667+00	668+00
PROPOSED T/R ELEV	550.00	550.32	550.64	550.95	551.27	551.59	551.91	552.23	552.55
EXISTING GROUND ELEV	548.83	548.87	548.92	549.65	549.82	549.62	549.59	549.74	549.85

	553.18	553.50	553.82	554.14	554.46	554.75	554.96
	549.17	548.85	548.27	548.14	548.25	548.18	547.94

PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 15 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

CAES

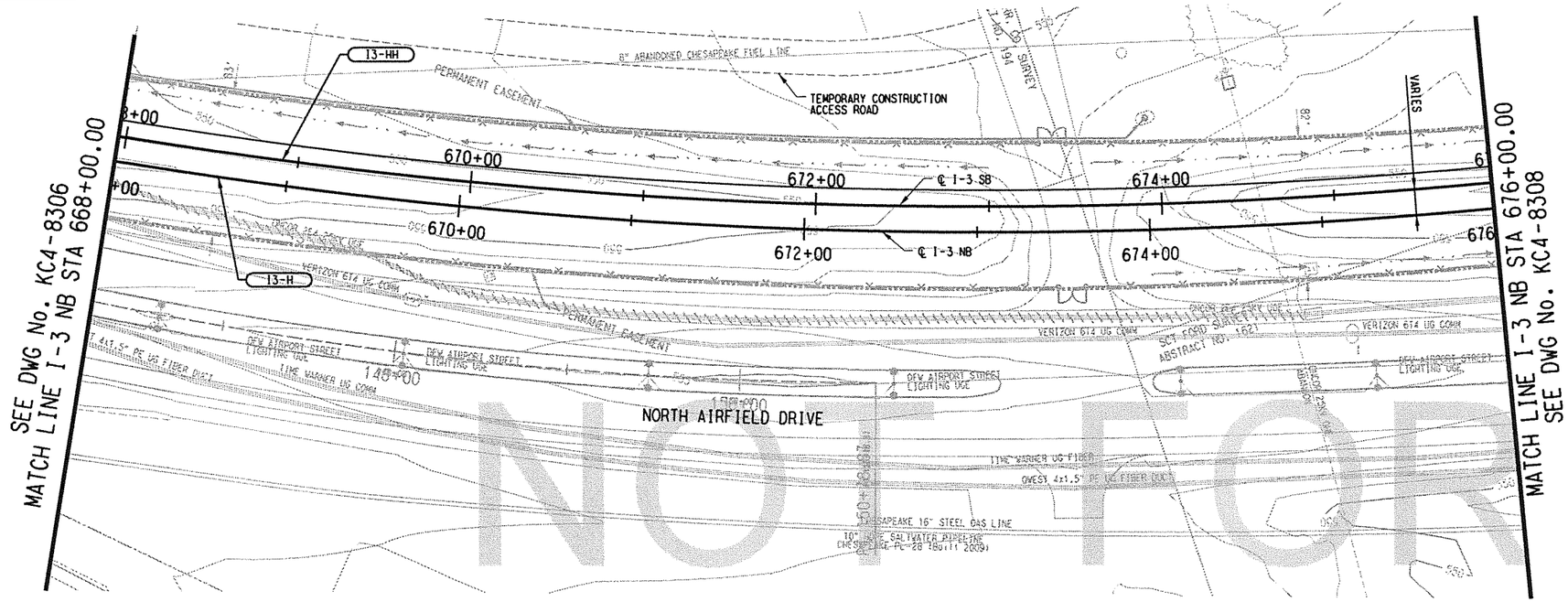
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 660+00 TO STA 668+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8306	C

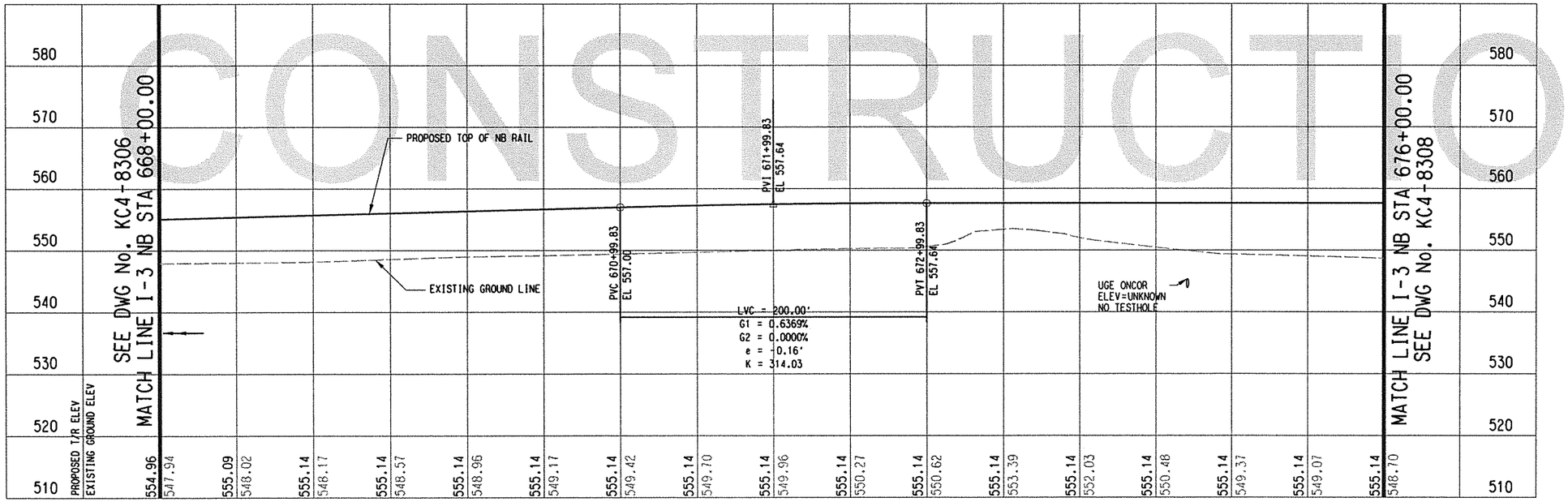
DWG No. KC4-8307

P0023



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-H (NB)		I3-HH (SB)	
Rc=	3109.29'	Rc=	3090.00'
LsIN=	150'	LsIN=	150'
LsOUT=	60'	LsOUT=	75'
Lc=	3830.03'	Lc=	3810.93'
Eo=	2.50"	Eo=	2.50"
Eu=	1.39"	Eu=	1.42"
V=	55 MPH	V=	55 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 16 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	N. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

CAES

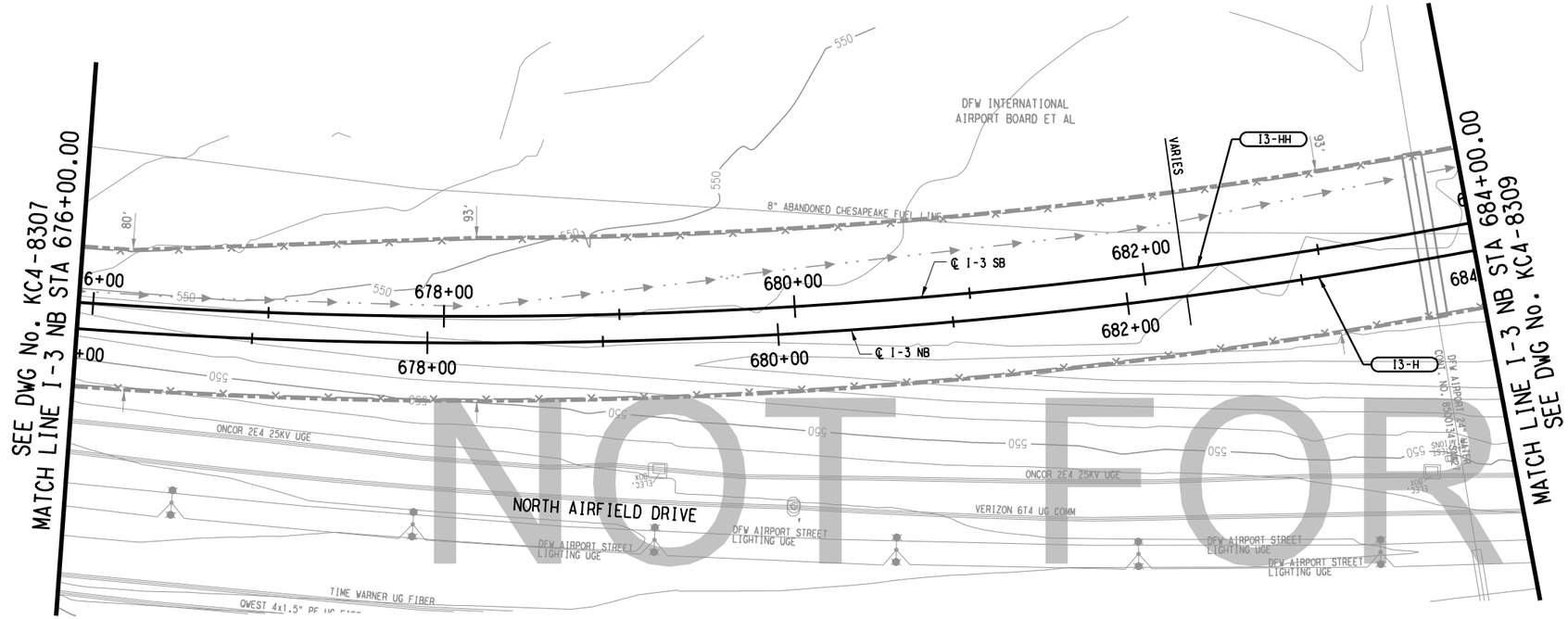
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

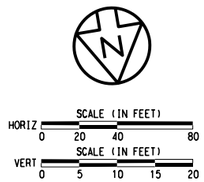
TRACK PLAN AND PROFILE
STA 668+00 TO STA 676+00

CONTRACT C-1018691-01 | DWG No. KC4-8307 | REV C

DWG No. KC4-8308

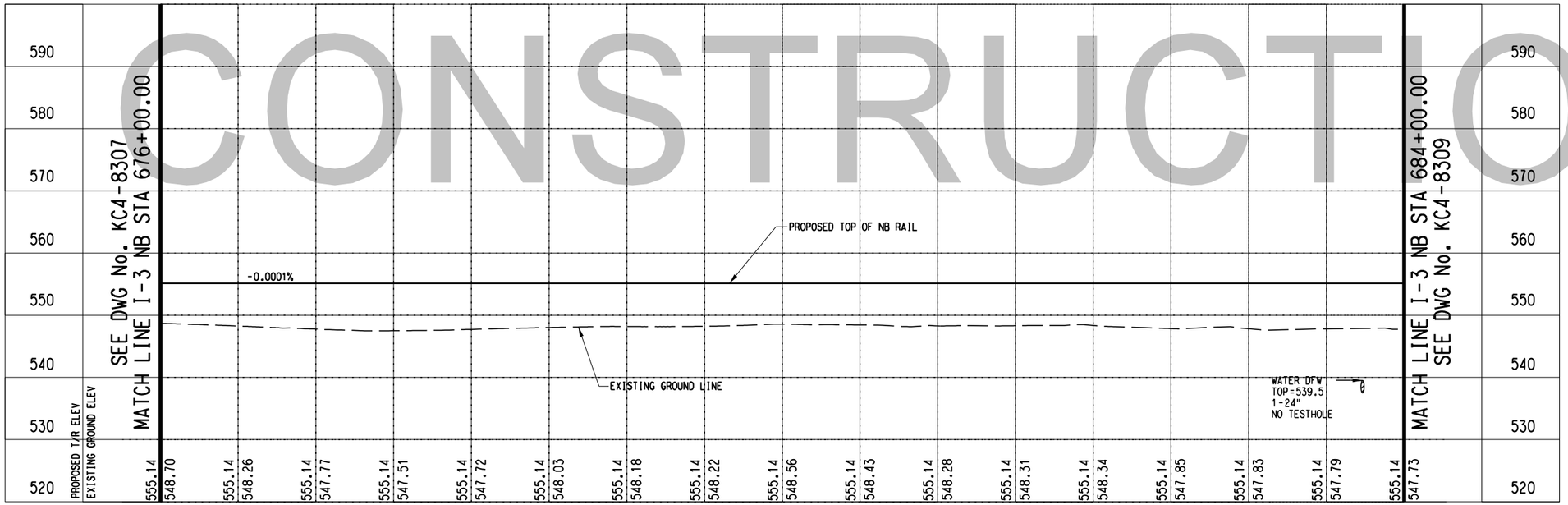
P0024





I3-H (NB)	
Rc=	3109.29'
LsIN=	150'
LsOUT=	60'
Lc=	3830.03'
Ea=	2.50"
Eu=	1.39"
V=	55 MPH

I3-HH (SB)	
Rc=	3090.00'
LsIN=	150'
LsOUT=	75'
Lc=	3810.93'
Ea=	2.50"
Eu=	1.42"
V=	55 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 17 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP
△								

IN-PROGRESS

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

CAES

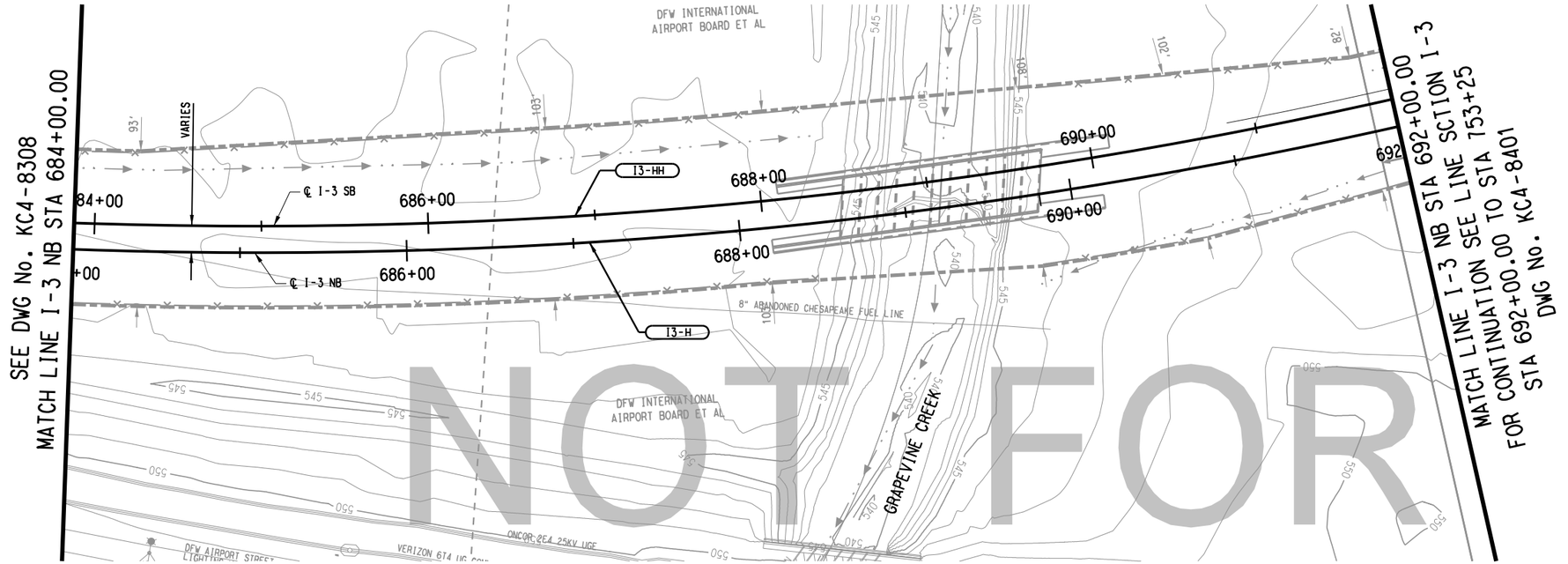
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 676+00.00 TO STA 684+00.00

CONTRACT C-1018691-01 | DWG No. KC4-8308 | REV C

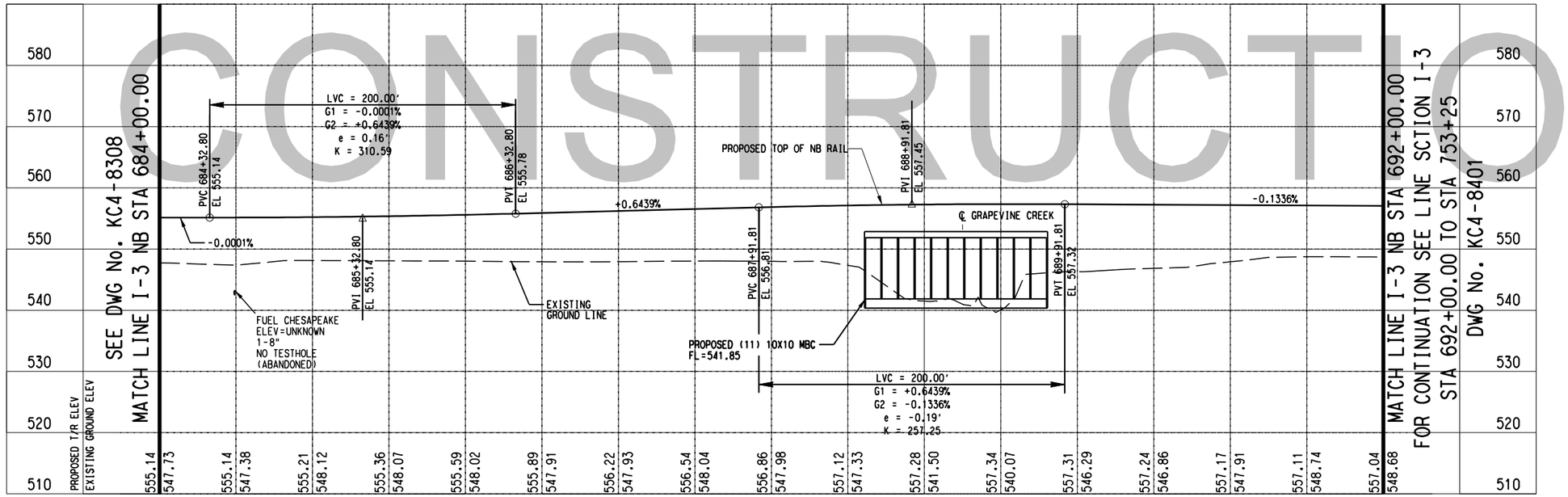
DWG No. KC4-8309

P0025



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-H (NB)		I3-HH (SB)	
Rc=	3109.29'	Rc=	3090.00'
LsIN=	150'	LsIN=	150'
LsOUT=	60'	LsOUT=	75'
Lc=	3830.03'	Lc=	3810.93'
Eq=	2.50"	Eq=	2.50"
Eu=	1.39"	Eu=	1.42"
V=	55 MPH	V=	55 MPH



PRE-FINAL 95% DESIGN

CONTRACT SHEET No. 18 OF 18

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	K. MEDICK
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	24 FEB 12

CAES

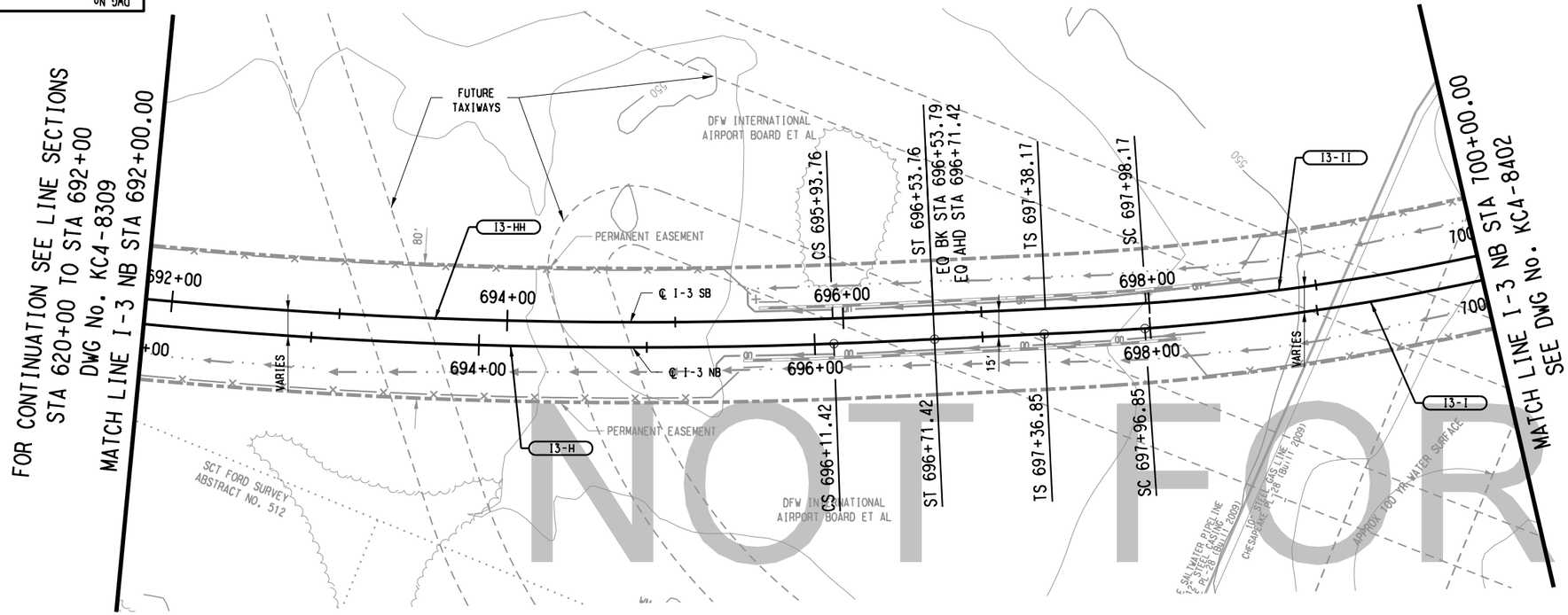
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

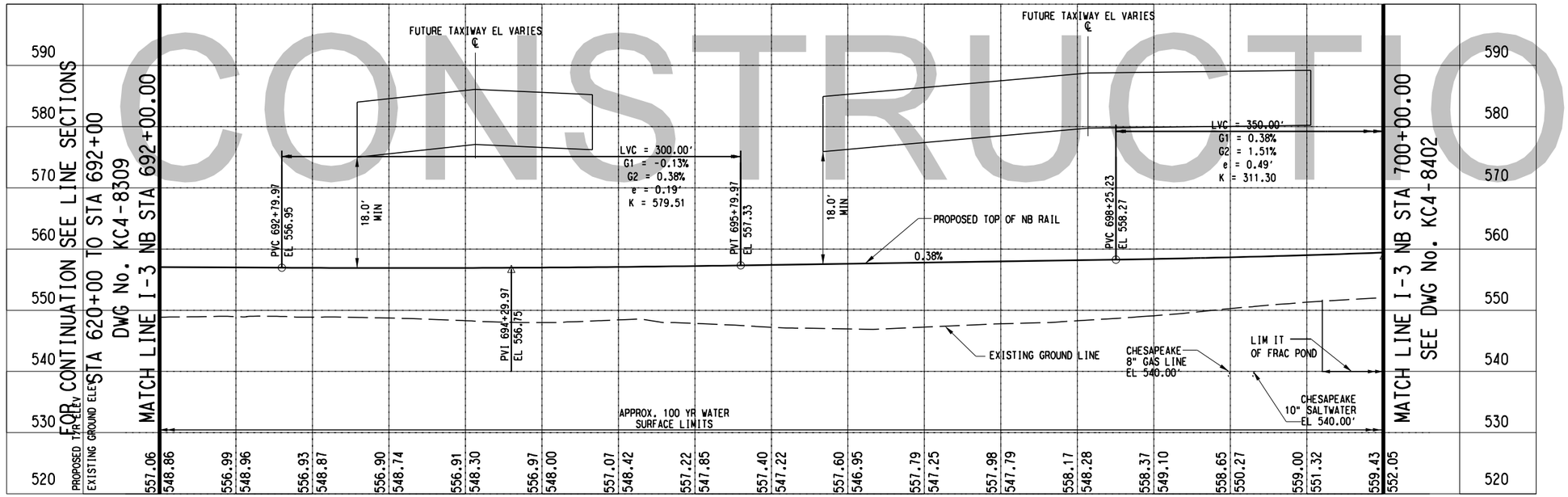
TRACK PLAN AND PROFILE
STA 684+00 TO STA 692+00

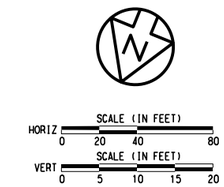
CONTRACT C-1018691-01 | DWG No. KC4-8309 | REV C

DWG No. KC4-8401

P0026







I3-H (NB)		I3-HH (SB)	
Rc=	3109.30'	Rc=	3095.00'
LsIN=	150.00'	LsIN=	249.80'
LsOUT=	60.00'	LsOUT=	60.00'
Lc=	3591.74'	Lc=	3524.84'
Ea=	2.50"	Ea=	2.50'
Eu=	1.39"	Eu=	1.41"
V=	55 MPH	V=	55 MPH

I3-I (NB)		I3-II (SB)	
Rc=	1380.00'	Rc=	1363.00'
LsIN=	60.00'	LsIN=	60.00'
LsOUT=	165.00'	LsOUT=	237.62'
Lc=	1385.93'	Lc=	1331.17'
Ea=	3.25"	Ea=	3.25"
Eu=	1.39"	Eu=	1.45"
V=	40 MPH	V=	40 MPH

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080
FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. MATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/05/12

CAES

IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. OF

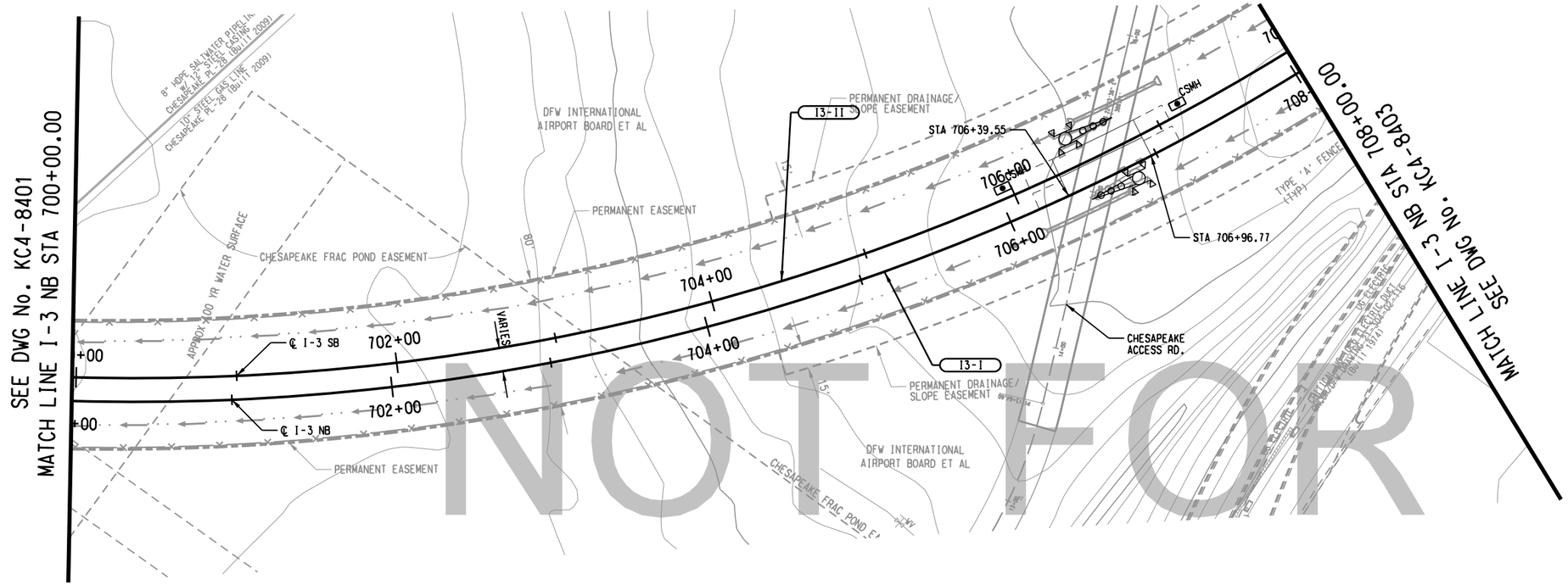
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

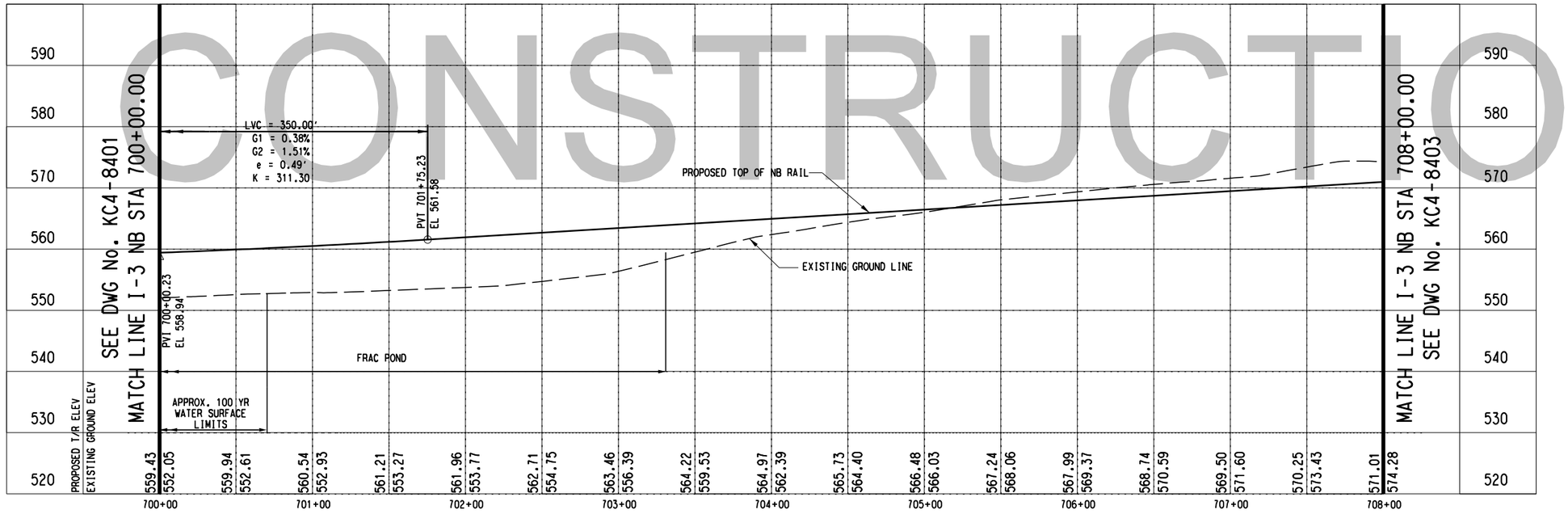
TRACK PLAN AND PROFILE
STA 692+00 TO STA 700+00

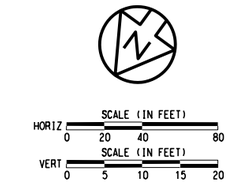
CONTRACT	DWG No.	REV
C-1018691-01	KC4-8401	B

DWG No. KC4-8402

P0027







I3-I (NB)		I3-II (SB)	
Rc=	1380.00'	Rc=	1363.00'
LsIN=	60.00'	LsIN=	60.00'
LsOUT=	165.00'	LsOUT=	237.62'
Lc=	1385.93'	Lc=	1331.17'
Ea=	3.25"	Ea=	3.25"
Eu=	1.39"	Eu=	1.45"
V=	40 MPH	V=	40 MPH

CONTRACT DOCUMENT 100% DESIGN

CONTRACT SHEET No. OF

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080
FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/05/12

CAES

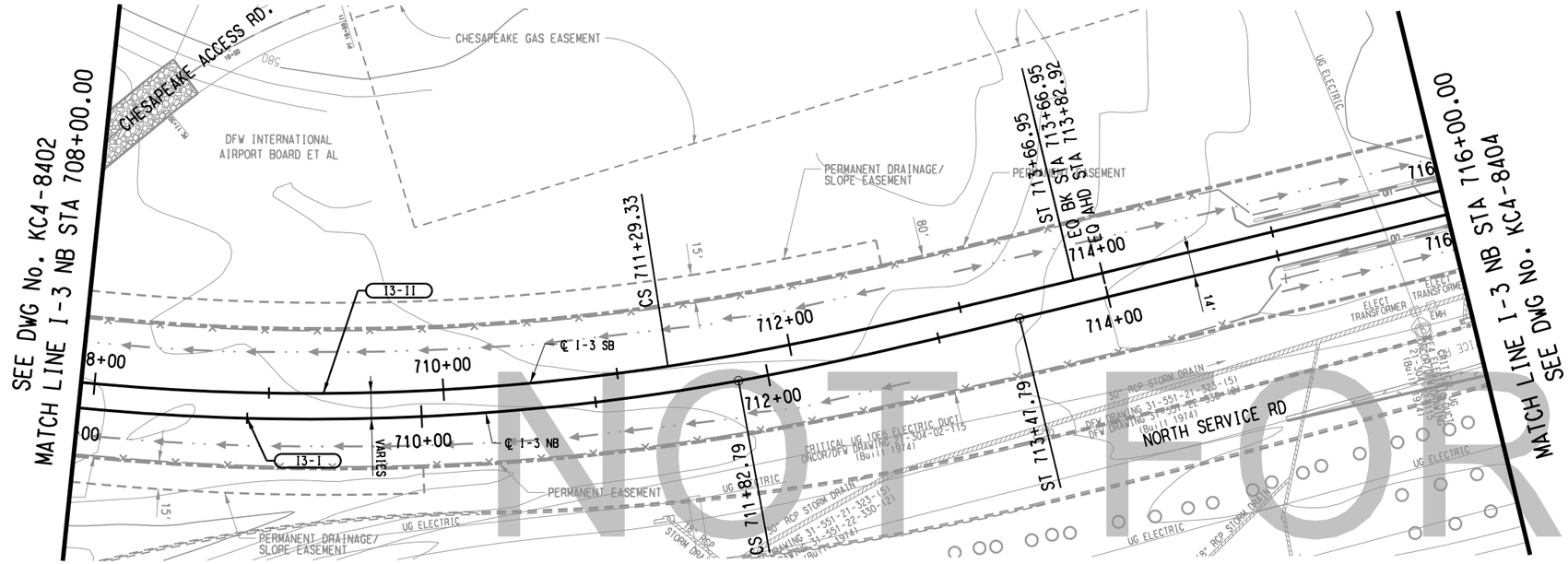
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 700+00 TO 708+00

CONTRACT C-1018691-01 | DWG No. KC4-8402 | REV B

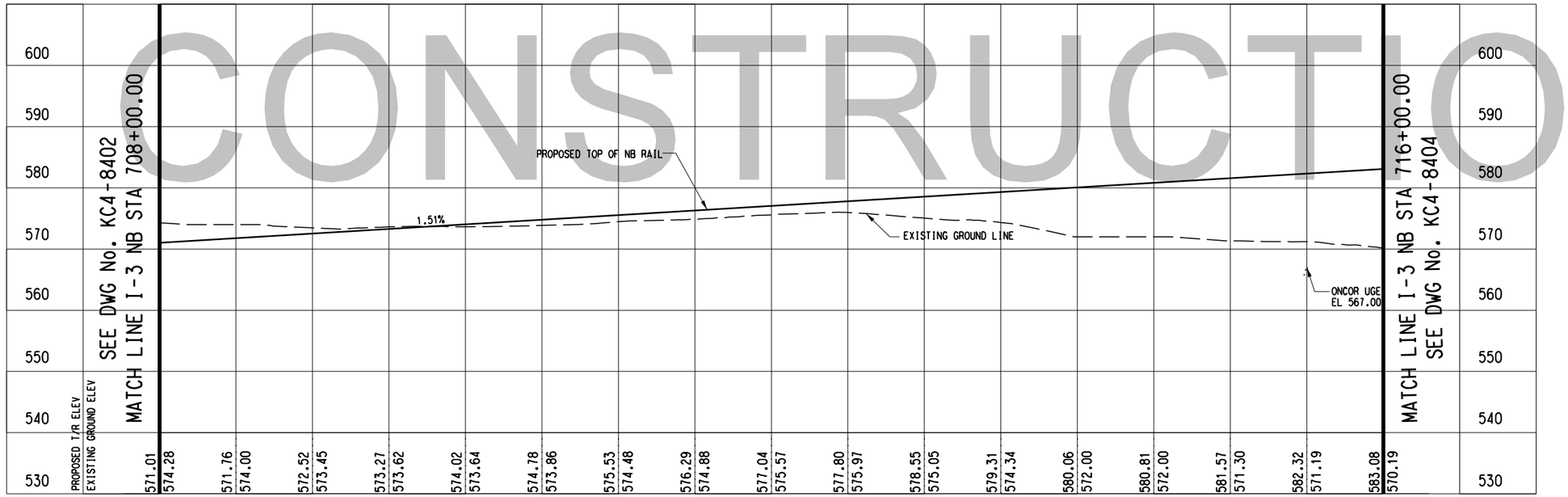
DWG No. KC4-8403

P0028



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

I3-I (NB)		I3-II (SB)	
Rc=	1380.00'	Rc=	1363.00'
LsIN=	60.00'	LsIN=	60.00'
LsOUT=	165.00'	LsOUT=	237.62'
Lc=	1385.93'	Lc=	1331.17'
Eq=	3.25"	Eq=	3.25"
Eu=	1.39"	Eu=	1.45"
V=	40 MPH	V=	40 MPH



IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. OF

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/06/12

CAES

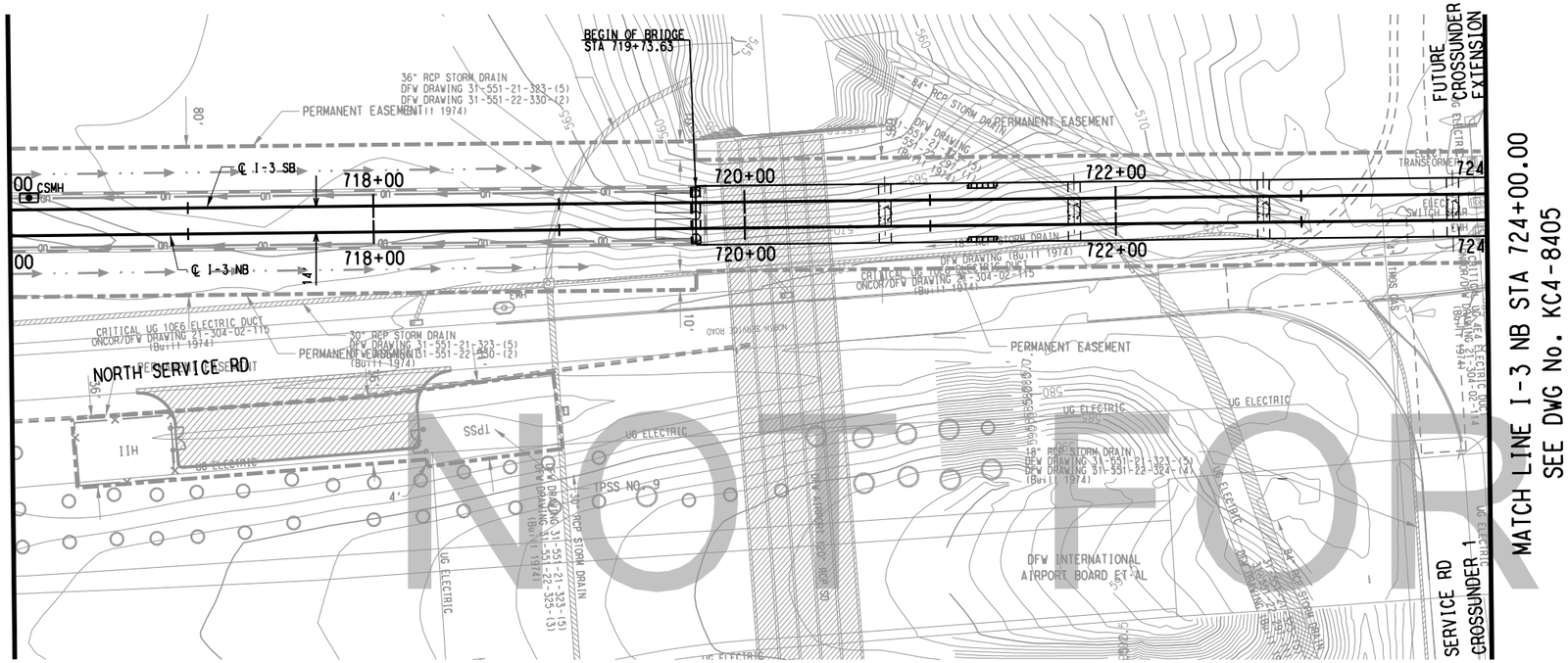
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

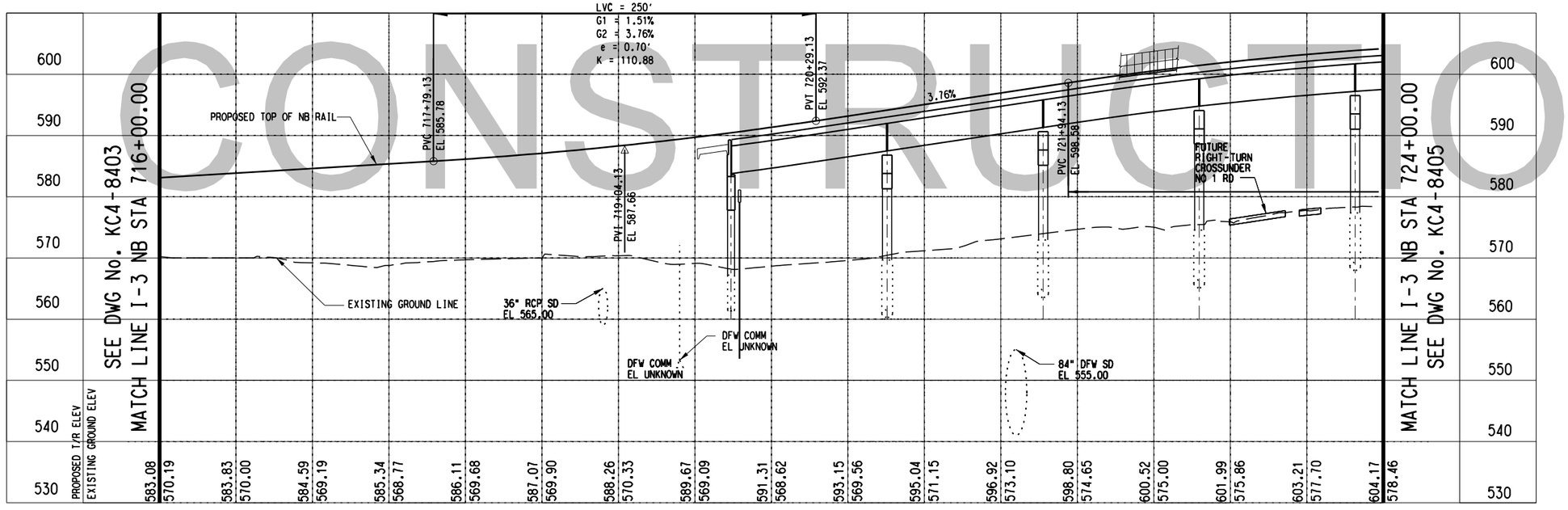
TRACK PLAN AND PROFILE
STA 708+00 TO STA 716+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8403	B

DWG No. KC4-8404

P0029





REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/05/12

CAES

IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. OF

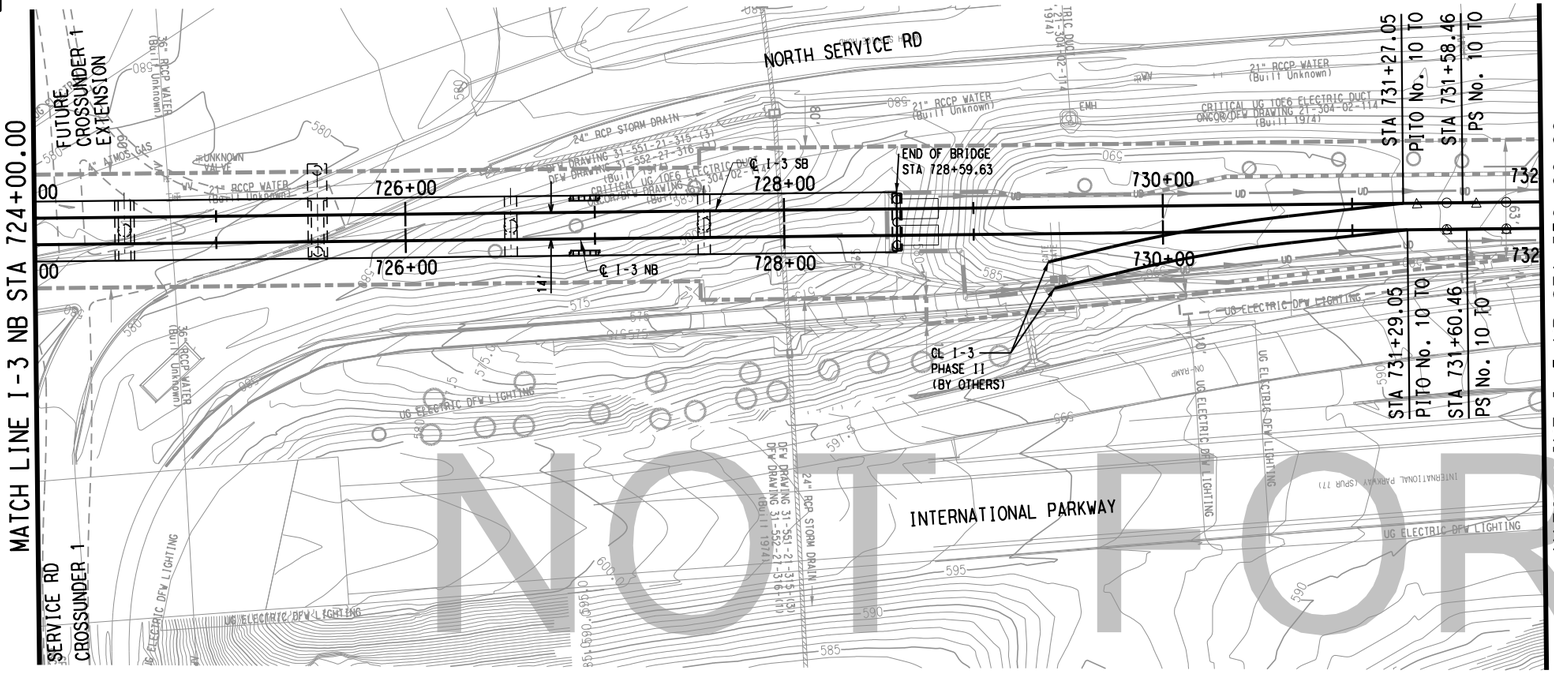
LIGHT RAIL TRANSIT SYSTEM LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 716+00 TO STA 724+00

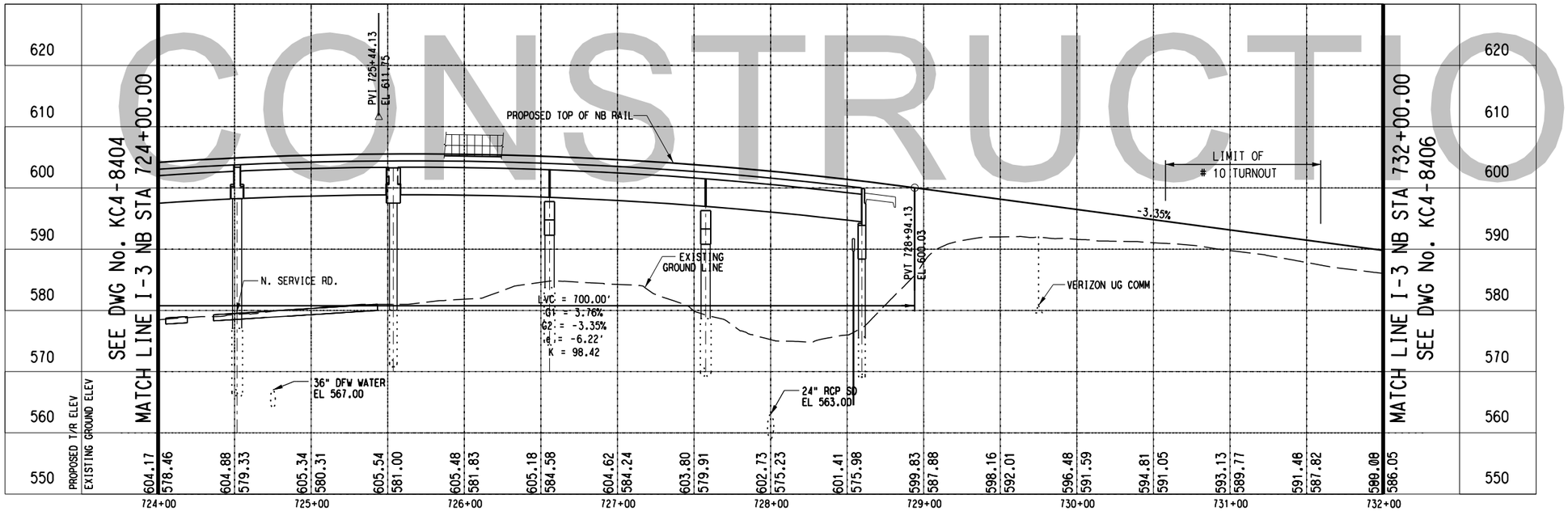
CONTRACT	DWG No.	REV
C-1018691-01	KC4-8404	B

DWG No. KC4-8405

P0030



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20



IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. OF

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080
FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

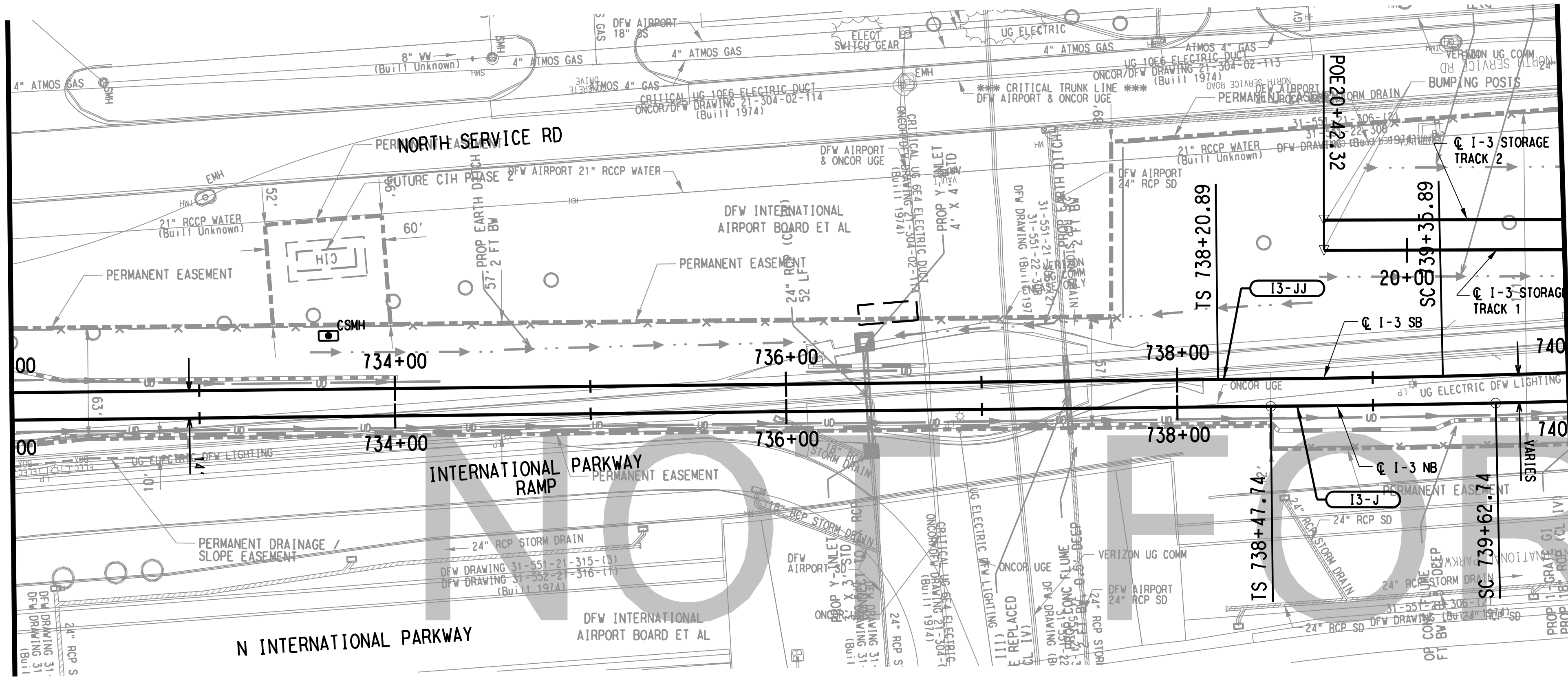
SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/05/12

CAES

LIGHT RAIL TRANSIT SYSTEM LINE SECTION I-3

TRACK PLAN AND PROFILE STA 724+00 TO 732+00

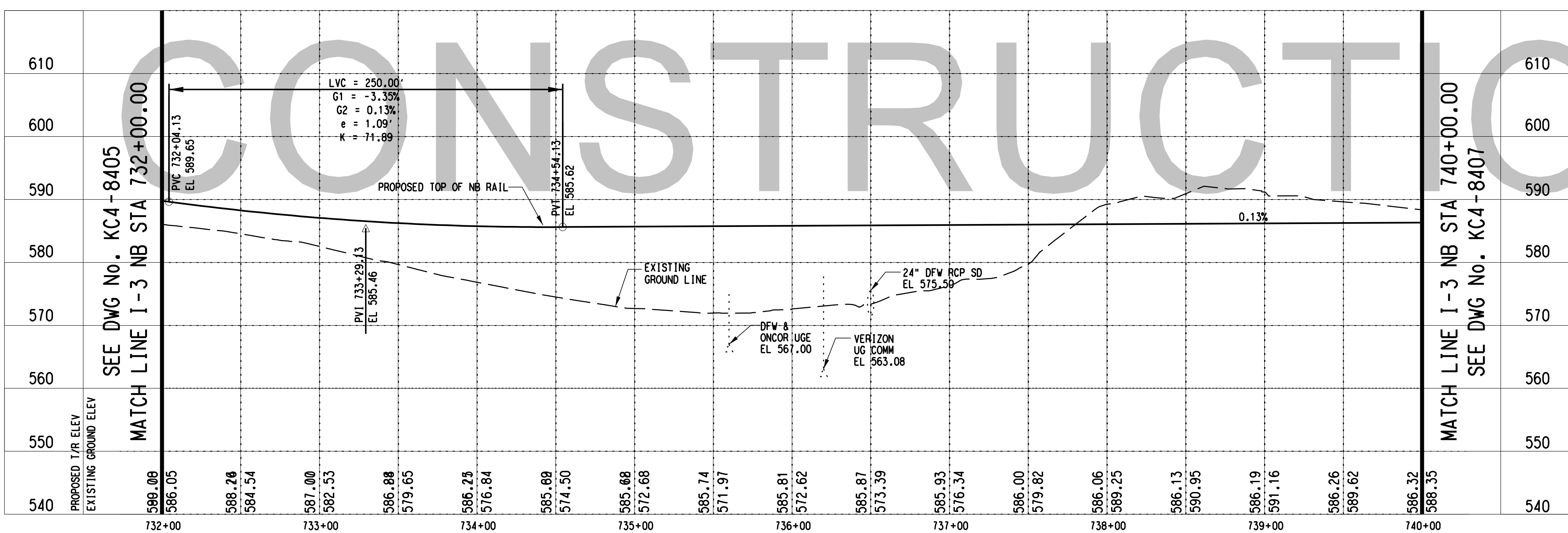
CONTRACT	DWG No.	REV
C-1018691-01	KC4-8405	B



HORIZ SCALE (IN FEET) 0 20 40 80

VERT SCALE (IN FEET) 0 5 10 15 20

I3-J (NB)		I3-JJ (SB)	
Rc=	5214.22′	Rc=	5300.00′
Ls=	115.00′	Ls=	115.00′
Lc=	215.44′	Lc=	220.87′
Ea=	1.75"	Ea=	1.75"
Eu=	1.49"	Eu=	1.44"
V=	65 MPH	V=	65 MPH



NOT FOR CONSTRUCTION

IN-PROGRESS 60% DESIGN

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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PARSONS

PARSONS TRANSPORTATION GROUP,INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/06/12

CAES

CONTRACT SHEET No. OF

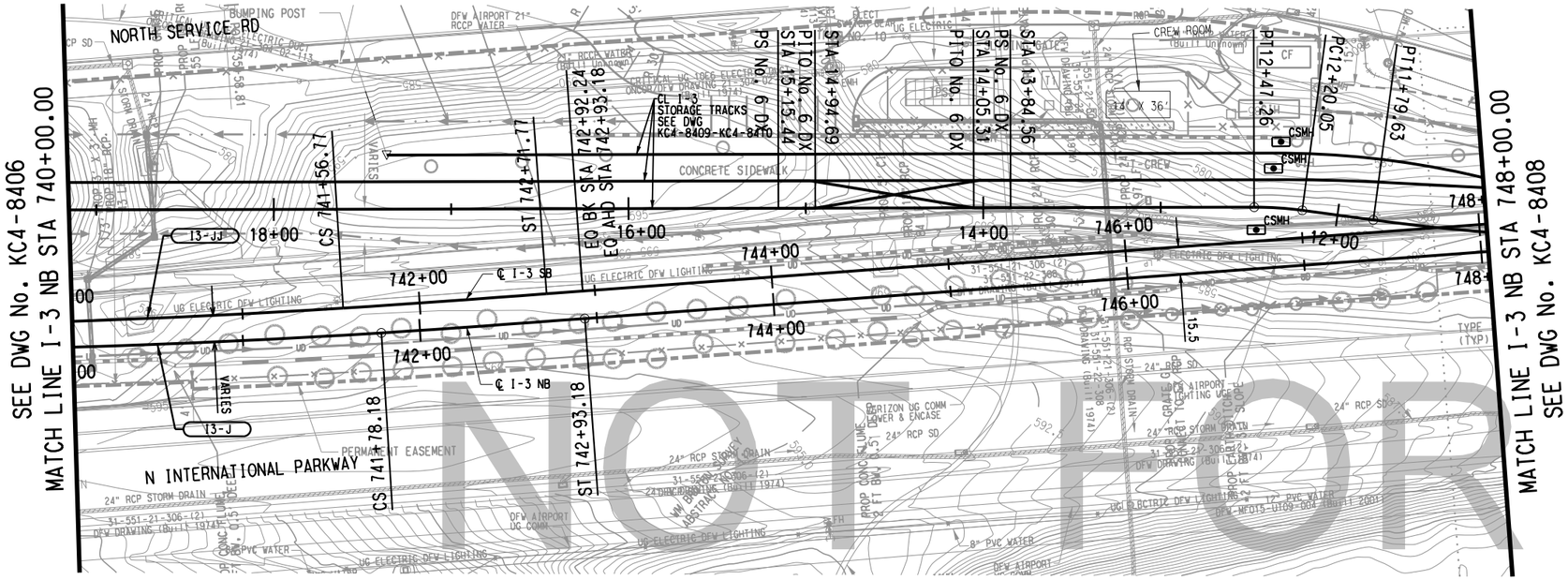
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 732+00 TO 740+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8406	B

DWG No. KC4-8407

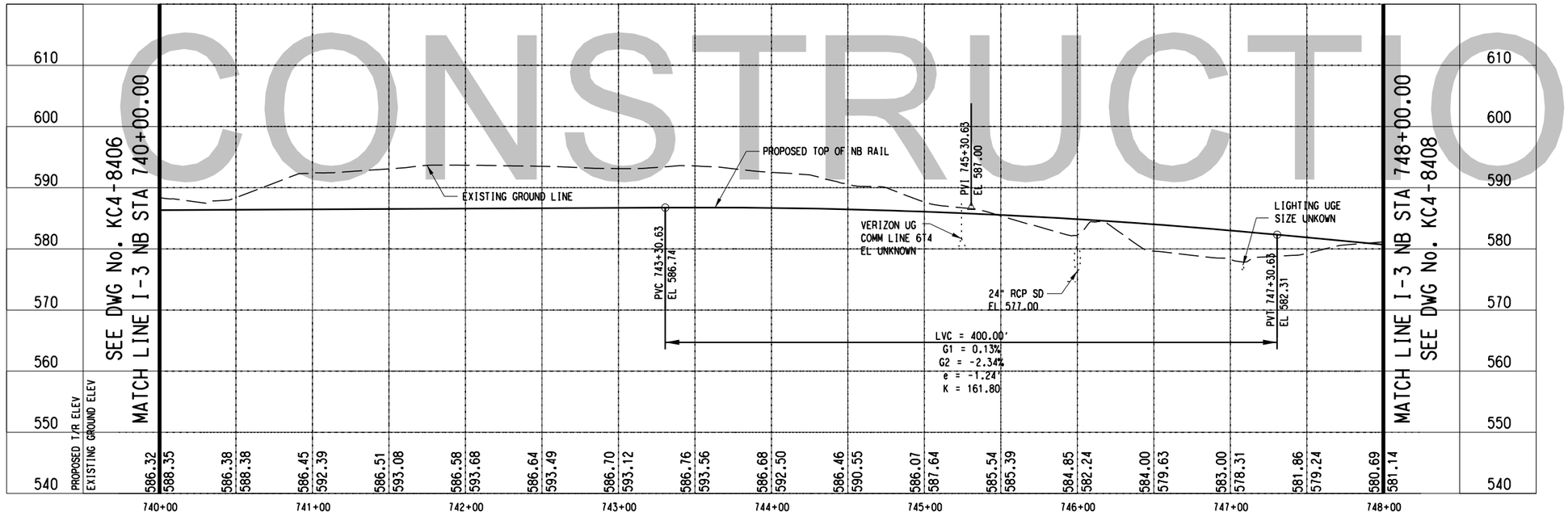
P0032



HORIZ SCALE (IN FEET) 0 20 40 80
VERT SCALE (IN FEET) 0 5 10 15 20

I3-J (NB)		I3-JJ (SB)	
Rc=	5214.22'	Rc=	5300.00'
Ls=	115.00'	Ls=	115.00'
Lc=	215.44'	Lc=	220.87'
Eo=	1.75"	Eo=	1.75"
Eu=	1.49"	Eu=	1.44"
V=	65 MPH	V=	65 MPH

NOTE:
FOR STORAGE TRACK DETAILS SEE DWG KC4-8409 AND DWG KC4-8410



REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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KRIT WEERACHARTKUL, P.E 96648

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PARSONS

PARSONS TRANSPORTATION GROUP, INC
1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. OF

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 740+00 TO STA 748+00

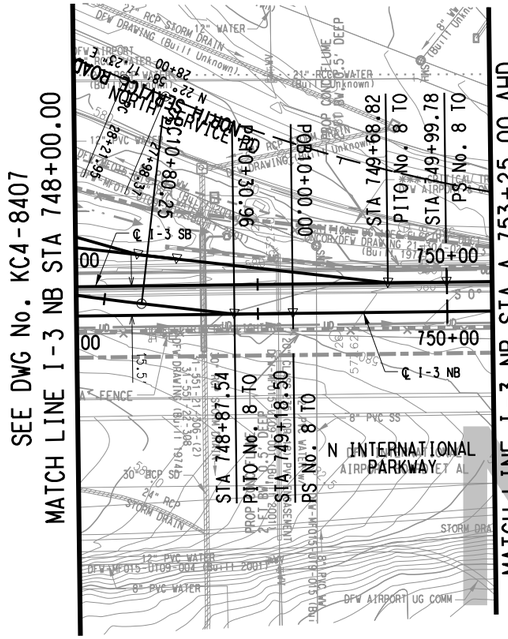
SCALE	AS SHOWN
DRAWN	W. ALI
DESIGNED	G. NATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/06/12

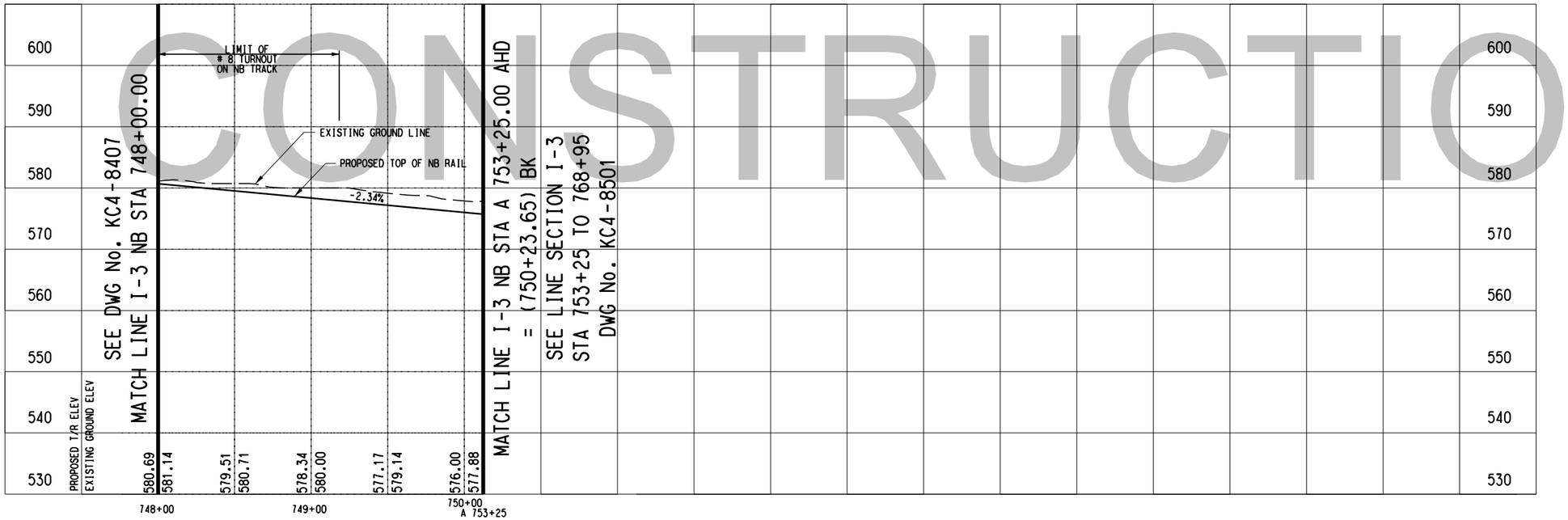
CAES

CONTRACT C-1018691-01 | DWG No. KC4-8407 | REV B

DWG No. KC4-8408

P0033





* - DESIGN EXCEPTION REQUIRED

SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. OF

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/06/12

CAES

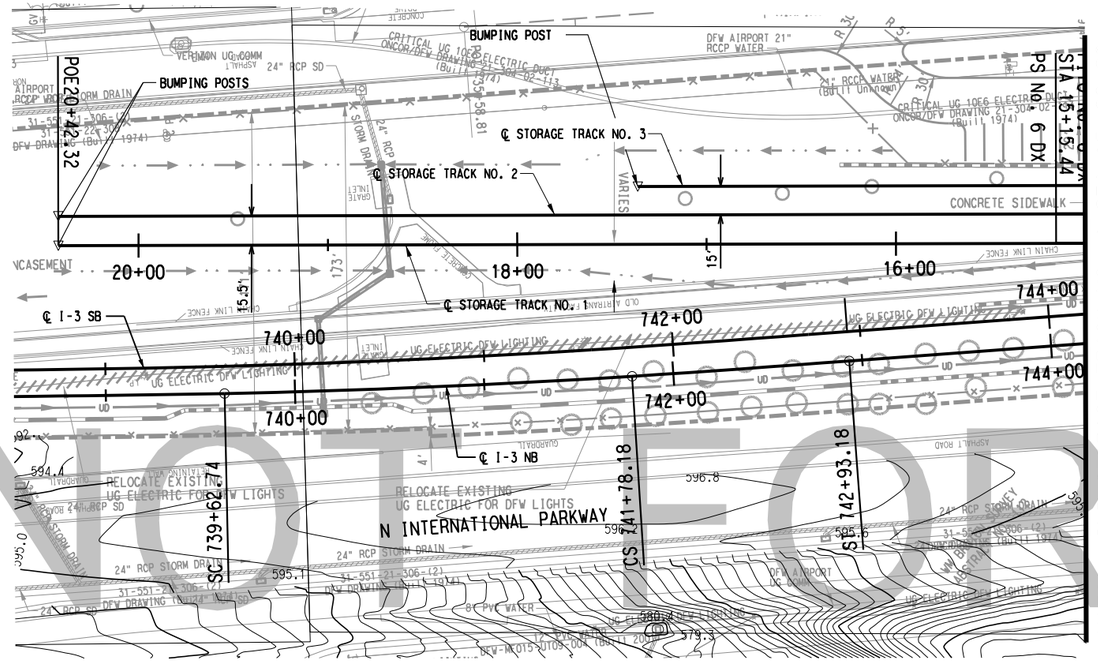
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA 748+00 TO STA 753+25 AHD
= (750+23.65) BK

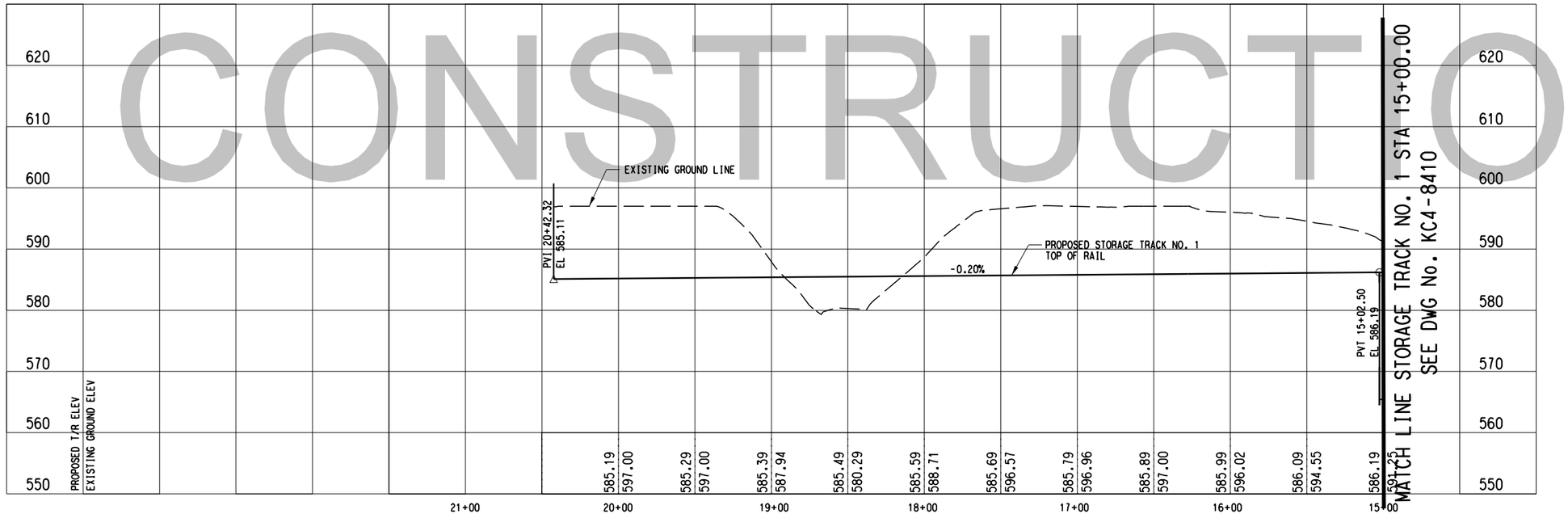
CONTRACT C-1018691-01 | DWG No. KC4-8408 | REV B

DWG No. KC4-8409

P0032A



SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20



IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. OF

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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1301 W. PRES GEORGE BUSH HWY - RICHARDSON, TX 75080

FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/05/12

CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

STORAGE TRACK PLAN AND PROFILE
STA 15+00 TO STA 20+42.32

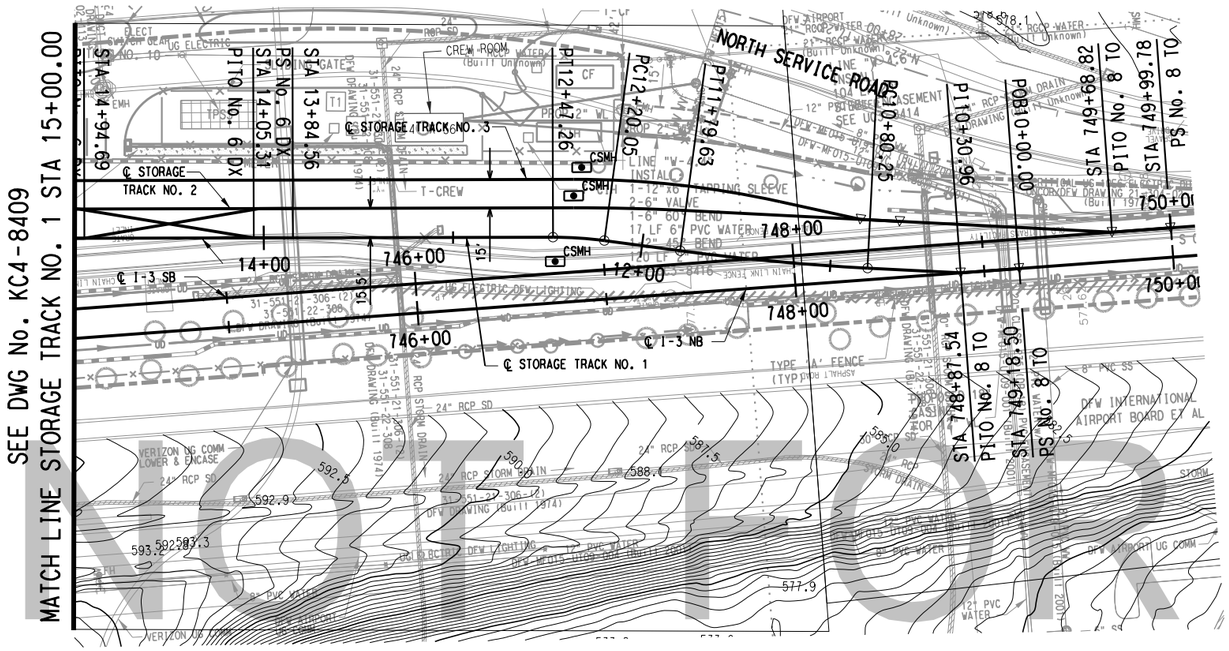
CONTRACT C-1018691-01

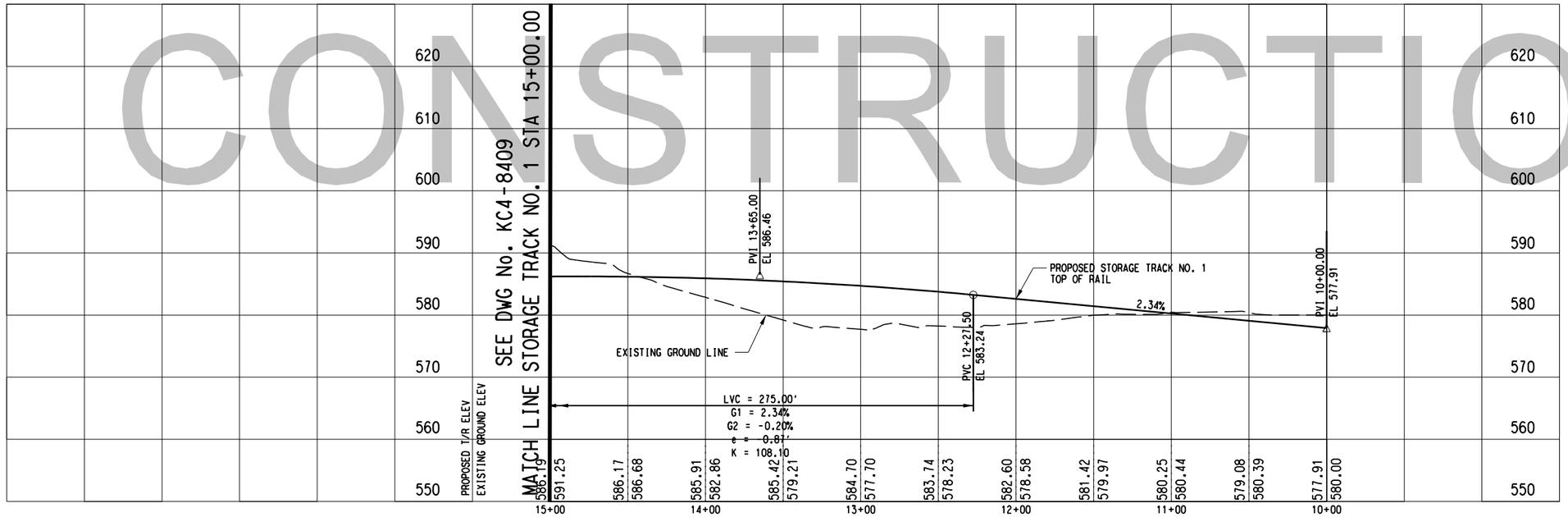
DWG No. KC4-8409

REV B

DWG No. KC4-8410

P0033A





REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. MATOLI
CHECKED	K. WEERACHARTKUL
IN CHARGE	K. WEERACHARTKUL
DATE	01/05/12

CAES

IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. OF

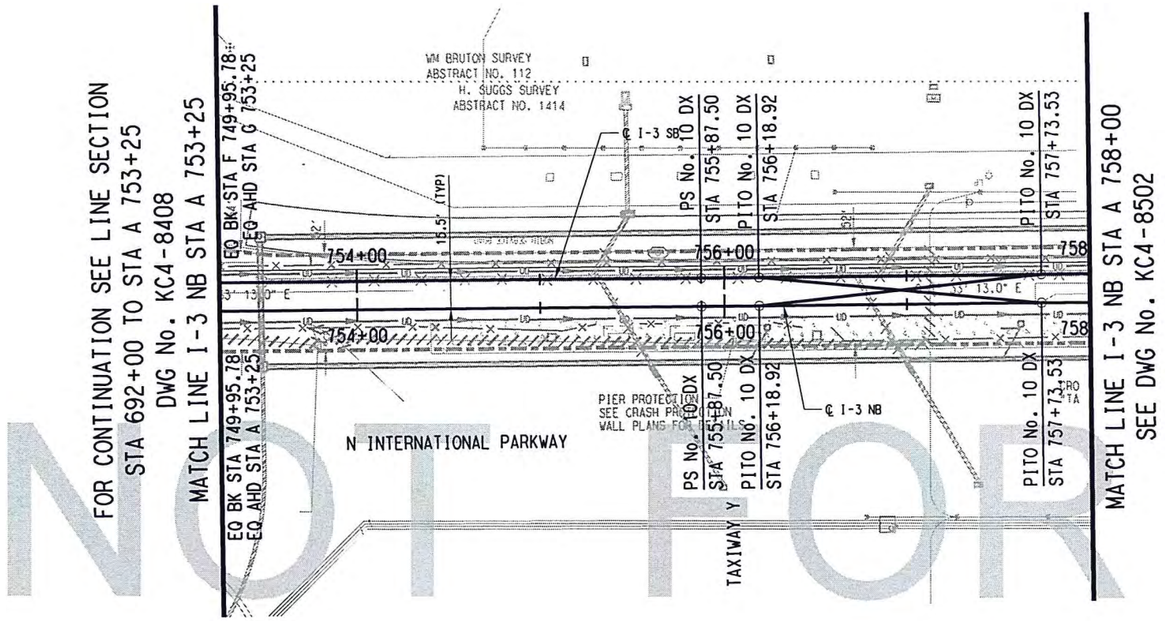
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

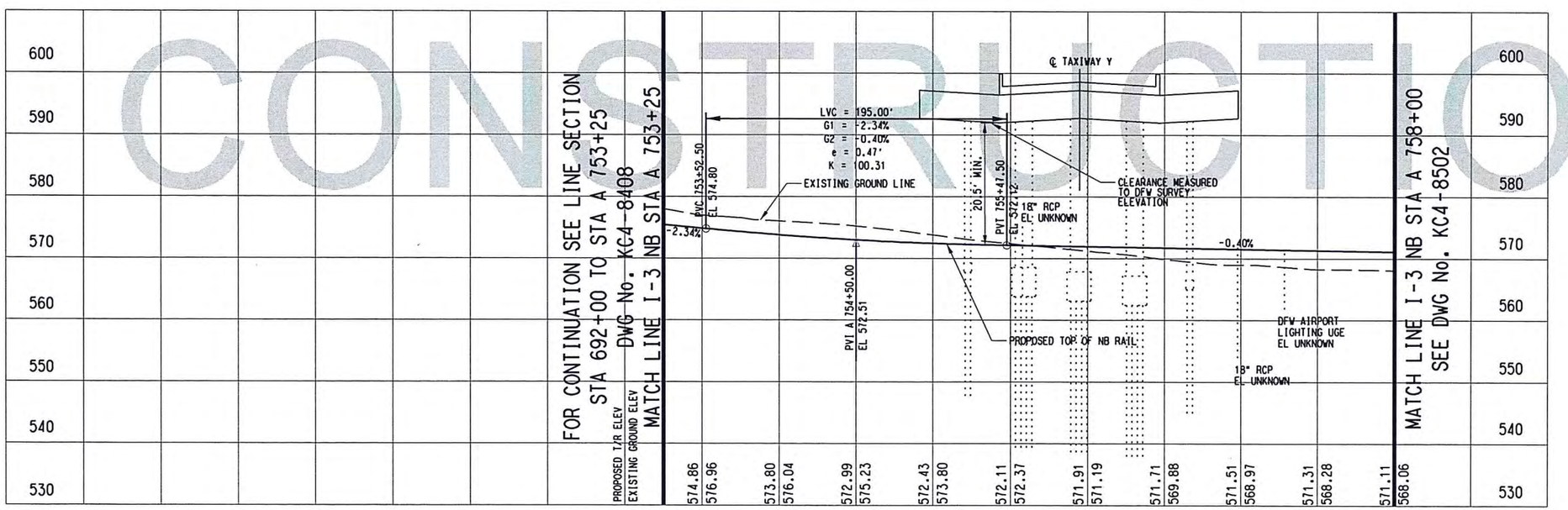
STORAGE TRACK PLAN AND PROFILE
STA 10+00 TO STA 15+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8410	B

DWG No. KC4-8501

P0033





REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. MATOLI
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	15 FEB 12

CAES

IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. 10 OF 12

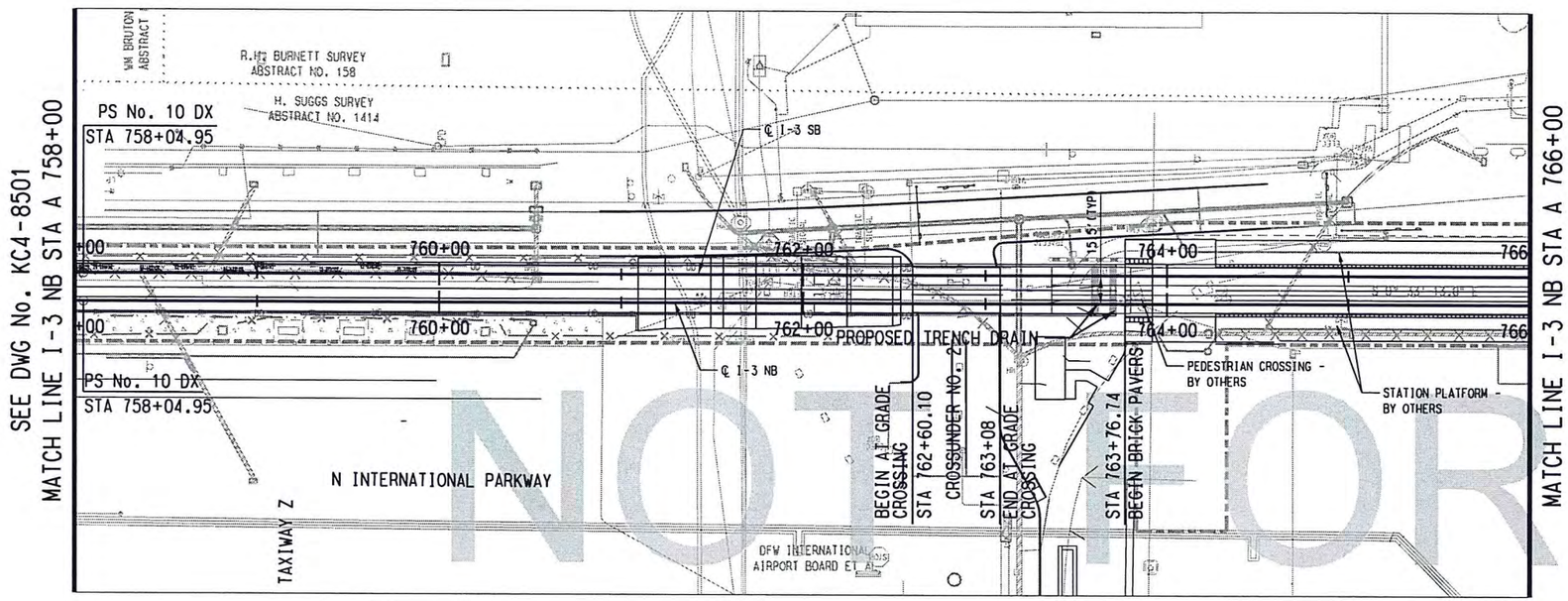
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

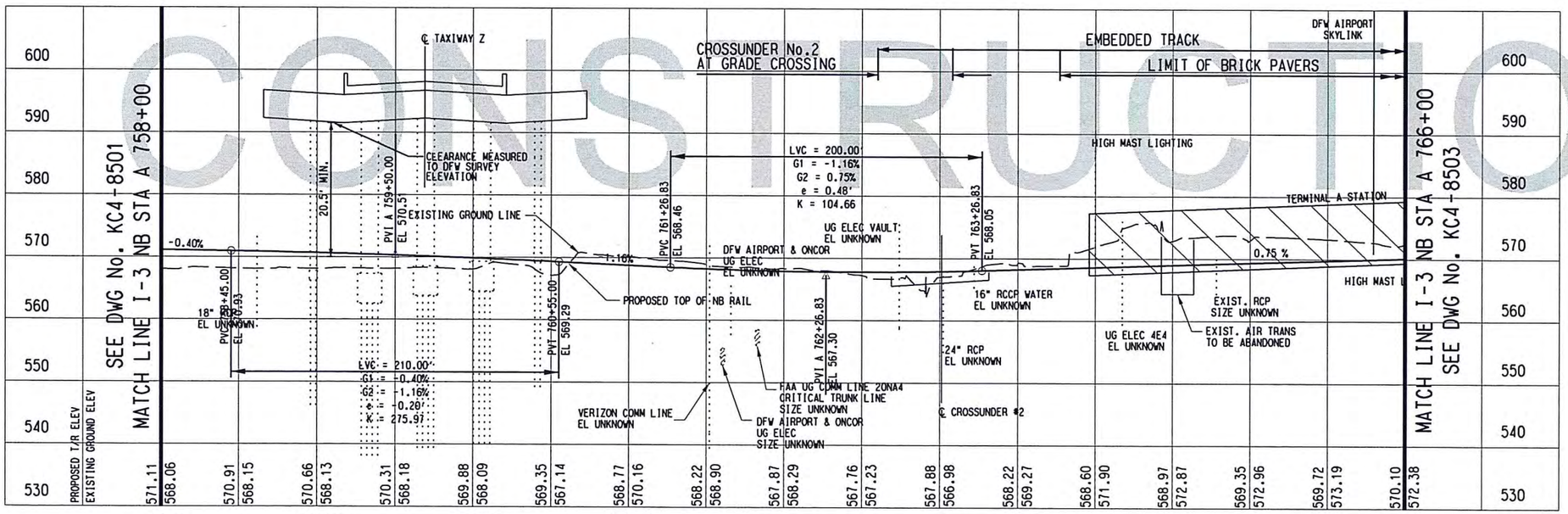
TRACK PLAN AND PROFILE
STA A 753+25 TO STA A 758+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8501	B

DWG No. KC4-8502

P0034





REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

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FIRM REGISTRATION NO: F-1481

KSWRP
KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. MATOLI
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	15 FEB 12

CAES

IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. 11 OF 12

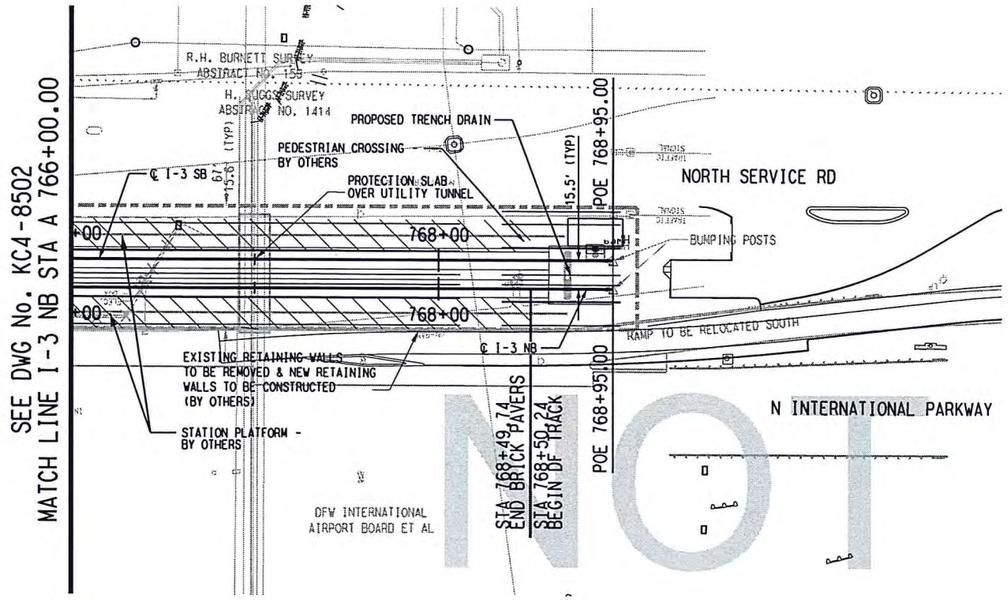
LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

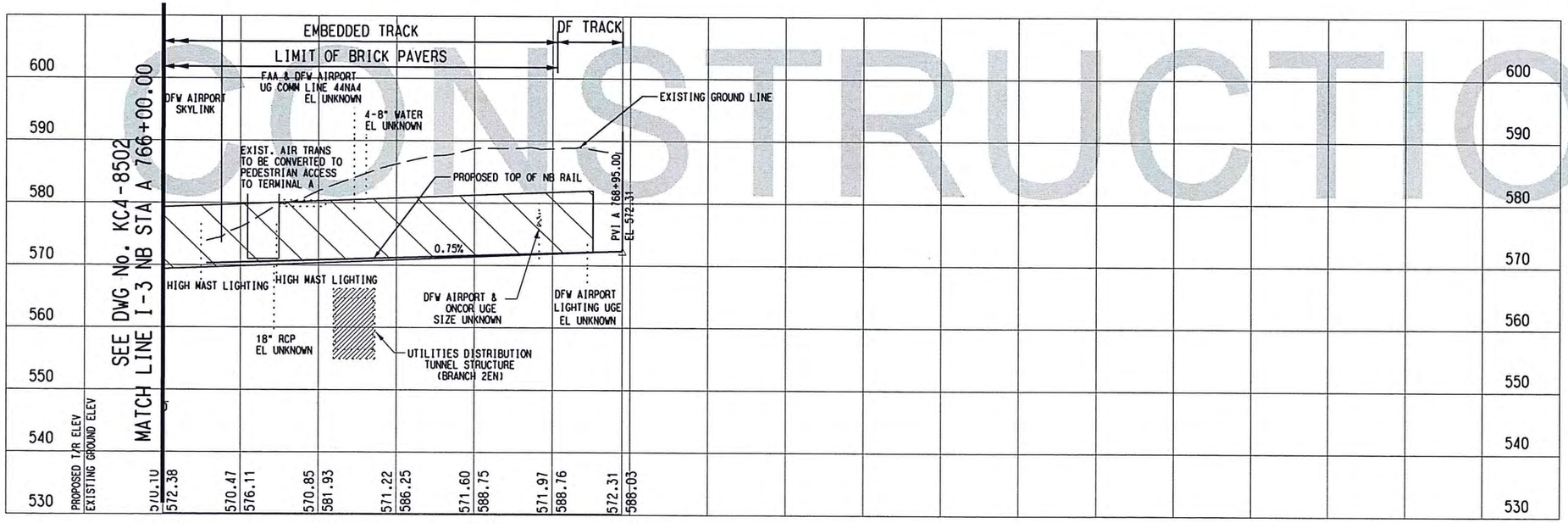
TRACK PLAN AND PROFILE
STA A 758+00 TO STA A 766+00

CONTRACT	DWG No.	REV
C-1018691-01	KC4-8502	B

DWG No. KC4-8503

P0035





SCALE (IN FEET)
HORIZ 0 20 40 80
SCALE (IN FEET)
VERT 0 5 10 15 20

LEGEND

- STATION CONCOURSE/ PLATFORM (BY OTHERS)
- STREET/ALLEY/ DRIVE RECONSTRUCTION (WORK DONE BY DFW)

IN-PROGRESS 60% DESIGN

CONTRACT SHEET No. 12 OF 12

REV	AMEND	CR	DATE	DESCRIPTION	BY	ENG	CHK	APP

IN-PROGRESS

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FIRM REGISTRATION NO: F-1481

KSWRP

KIEWIT, STACY AND WITBECK, REYES, PARSONS, a Joint Venture

DART PROJECT

DART®

SCALE	AS SHOWN
DRAWN	M. ALI
DESIGNED	G. NATOLI
CHECKED	K. BUSH
IN CHARGE	K. WEERACHARTKUL
DATE	15 FEB 12

CAES

LIGHT RAIL TRANSIT SYSTEM
LINE SECTION I-3

TRACK PLAN AND PROFILE
STA A 766+00 TO STA A 768+95

CONTRACT C-1018691-01 | DWG No. KC4-8503 | REV B