Export Pipeline Analysis

Technical Memorandum #8

Paradise Sewer Project

March 31, 2022

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1. Introduction

The Town of Paradise (Town) is implementing the Paradise Sewer Project (Project), which involves identifying and implementing a long-term solution for collection, treatment, and reuse/disposal of its wastewater. HDR is under contract to assist the Town with the first two phases of the Project—final selection of a wastewater alternative (Phase 1), and preparation of an Environmental Impact Report (EIR) covering the selected alternative (Phase 2). The results of Phase 1 were presented in six technical memoranda and a Phase 1 Executive Summary. This technical memorandum (TM) is part of the Phase 2 effort.

The Project consists of two primary components—a wastewater collection system in Paradise and an 18-mile-long Export Pipeline System to convey wastewater to the City of Chico's Water Pollution Control Plant (WPCP). The export pipeline would begin at the southwest edge of Paradise and would run for approximately 8 miles along Skyway until reaching south Chico, at which point the pipeline would leave Skyway and continue west, crossing Butte Creek, Highway 99, and the Union Pacific Railroad, and terminating at the Chico WPCP at 4827 Chico River Road in Chico. The purpose of this TM 8 is to develop further information about the export pipeline system that would connect Paradise's collection system to the Chico WPCP.

The wastewater collection system in Paradise consists of a Core Collection System and Extended Collection System. The Core Collection System, serving the Town's sewer service area (SSA), was originally estimated to have a build-out average flow of 0.448 mgd (see HDR, TM 2—Design Criteria, November 2020); the SSA was later increased slightly in size (see HDR, TM 2A—Analysis of Additions to SSA and Flow, September 2021) after completion of this hydraulic analysis, resulting in a revised build-out flow for the SSA of 0.464 mgd. The build-out flow from the Extended Collection System is not known at this time, but for hydraulic analysis purposes, it was estimated to equal the original estimated flow from the Core Collection System, or an additional 0.448 mgd. This results in an estimated potential future average wastewater flow from within the Town of Paradise of 0.896 mgd. This hydraulic analysis addresses the 0.896 mgd build-out condition.

This TM is organized as follows:

- Section 1: Introduction
- Section 2: Hydraulic Analysis
- Section 3: System Layout
- Section 4: Future Operation and Maintenance Activities

Supporting information for this TM is provided in the following appendices:

- Appendix A: Plan and Profile Drawings
- Appendix B: Details

2. Hydraulic Analysis

The proposed export pipeline system would traverse about 18.2 miles in distance and would drop nearly 1,300 feet in elevation from Paradise's collection system to the Chico WPCP. The conveyance system must be designed to convey a wide range of flows. At initial startup of the system, the flow would be only about 0.1 million gallons per day (mgd), or 76 gallons per minute (gpm). However, once the system is being fully used, the peak hourly flow is estimated to be up to about 1.8 mgd, or 1,244 gpm. The intent of this design is to use the elevation drop or potential energy of the topography to convey the wastewater (as opposed to having pump stations along the export pipeline), while traversing the varying terrain along the proposed pipeline alignment.

2.1 Design Criteria

The Export Pipeline System was designed for the flow rates shown in Table 1.

Table 1. Design Flows

Design Flow	Million Gallons per Day (mgd)
Initial Flows (Minimum Flow Rate)	0.109
Average Daily Flow	0.896
Peak Diurnal Flow	1.344
Peak Hourly Flow	1.792

In sizing sewers or gravity force mains, the design is intended to maintain a minimum velocity of 2 feet per second (fps) to carry solids and properly scour the pipe as it flows, even at minimum flow conditions. In addition, the pipelines are designed to minimize excess velocities to prevent erosion of pipes and manholes at the various flow conditions. The design is intended to maintain velocities below 8 fps as much as possible, which is typically conducive of supercritical flow. When supercritical flow is unavoidable because of steeper slopes for a gravity sewer, transitions back to subcritical flow conditions would be handled with energy dissipation manholes to properly handle turbulent conditions associated with a hydraulic jump.

2.2 Design Concept and Hydraulics of the System

The design concept for this system is to convey the varying flows via gravity using the substantial change in elevation (i.e., without using pump stations). Pump stations used only to overcome dynamic head conditions (our condition coming down off the Ridge) are challenging to design and operate, especially when pumping under negative static head conditions, which would be the case in this application. This system is relatively unique in that the design is required to convey a wide range of flows (from very low initial flows to high build-out flows) a long distance that drops considerably in elevation. Also, the design of the system is intended to limit the bury depth of the pipeline and to prevent sewer depths that exceed 10 feet to maintain constructability and control cost.

The first section of the alignment, referred to as the Ridge Gravity Section, is about 35,700 feet or 6.8 miles long, drops about 1,070 feet in elevation, and ends at the Transition Chamber (see Figure 1). This section is designed as a traditional gravity sewer that runs partially full. Because of the wide

range from initial flows to build-out flow, it is necessary to have two gravity lines for the Ridge Gravity Section—one lower pipe of 8-inch diameter to handle low flows, and one 10-inch pipe installed 6 to 12 inches above the 8-inch pipe to handle higher flows. Flow would first fill the 8-inch pipe and, when its capacity was reached, flow beyond the 8-inch pipe's capacity would begin to spill over into the 10-inch pipe. This hydraulic transition from the 8-inch to the 10-inch would happen automatically (without the need for mechanical control) in the segments of the Ridge Gravity Section where the flows exceed the capacity of the 8-inch pipe. Note that the capacity of the 8-inch pipe varies along the alignment based on the slope. The capacity of the 8-inch pipe at the design minimum slope of 0.0045 foot/foot is 0.68 mgd.

The 8-inch sewer is designed with a minimum slope of 0.0045 foot/foot (0.45 percent) to convey the minimum flow rate of 0.109 mgd and to provide adequate scouring velocity. However, there are various sections of steeper pipe slopes, and the flow sometimes reaches a supercritical state under certain conditions. This is unavoidable because of the steep grade in some areas and the intent of the design to prevent excessive depth and cover over the sewer. To handle the transition from supercritical flows back to subcritical flow conditions, energy dissipation is required.

An energy dissipation manhole that uses a vortex reduces the energy and contains the hydraulic jump that occurs. In addition to energy dissipation manholes, standard type manholes are used for access and maintenance, and are spaced at a minimum of every 500 feet. Also, the manhole furthest upstream at the beginning of the system is intended to be equipped with a stainless steel bar rack with 2-inch clear openings to prevent any larger debris from entering the pipeline system. Details of these structures are provided in the drawings in Appendix A. The two Ridge Gravity Section sewers continue until they transition to the Gravity Force Main Section at Sta. 601+50 at the Transition Chamber.

The remainder of the pipeline alignment, referred to as the Gravity Force Main Section, is about 60,150 feet or 11.4 miles long, drops an additional 224 feet in elevation, and ends at the Flow Control and Metering Structure located adjacent to the Chico WPCP. The terrain that the Gravity Force Main Section traverses does not allow for a traditional gravity sewer because of peaks and valleys along the alignment. In addition, multiple crossings require deeper, trenchless installation of the pipeline, including crossings of Butte Creek (Sta. 553+50), Highway 99 (Sta. 526+50), and the Union Pacific Railroad (Sta. 373+63). Crossings of two minor waterways (Comanche Creek and Little Chico Creek) may be accomplished via suspension from existing bridges or trenchless methods. For this hydraulic analysis, the bridge suspension method was assumed. If trenchless methods are used for these two crossings, the hydraulic impacts would be very small and the basic conclusions reached here would still apply. Trenchless methods would include either micro-tunneling or horizontal directional drilling.

The Gravity Force Main Section is designed using the Transition Chamber to maintain pressure throughout the system. This is accomplished using a control plug valve near the end of the pipeline (in the Flow Control and Metering Structure) that would modulate or throttle to maintain a target level in the Transition Chamber. The volume of the Transition Chamber is sized for adequate attenuation of the inlet flows and provides an operating level range (5- to 15-foot depth) to maintain the pressure and flow in the downstream pipeline. A single 12-inch diameter Gravity Force Main is needed for full flow conditions to convey the maximum flow of 1.8 mgd (1,244 gpm) at the differential head

maintained in the Transition Chamber while providing adequate scouring velocity. Figure 2 shows the hydraulic grade line of the Gravity Force Main Section, which depicts the pressure being maintained in the system as the flow is conveyed.

The downstream control valve in the Flow Control and Metering Structure is controlled via level instrumentation (an ultrasonic transducer) in the Transition Chamber and a pressure transducer on the pipeline just upstream of the control valve. The control valve, pressure transducer, and magnetic-type flow meter are in the Flow Control and Metering Structure just upstream of a discharge chamber. The flow is conveyed from the discharge chamber via a gravity sewer directly to the Chico WPCP at its Influent Sewer Junction Box A.

The Gravity Force Main Section is also equipped with pressure-type cleanouts spaced every 500 feet that can be used to auger or flush the pipe periodically to dislodge or remove any accumulated material. Also, air release valves are installed at high points along the Gravity Force Main Section to remove air that can accumulate during operation.

This concept eliminated the need for pump stations, inverted siphons, and depressed sewers along the Gravity Force Main Section that are typically required for long pipeline/conveyance systems.

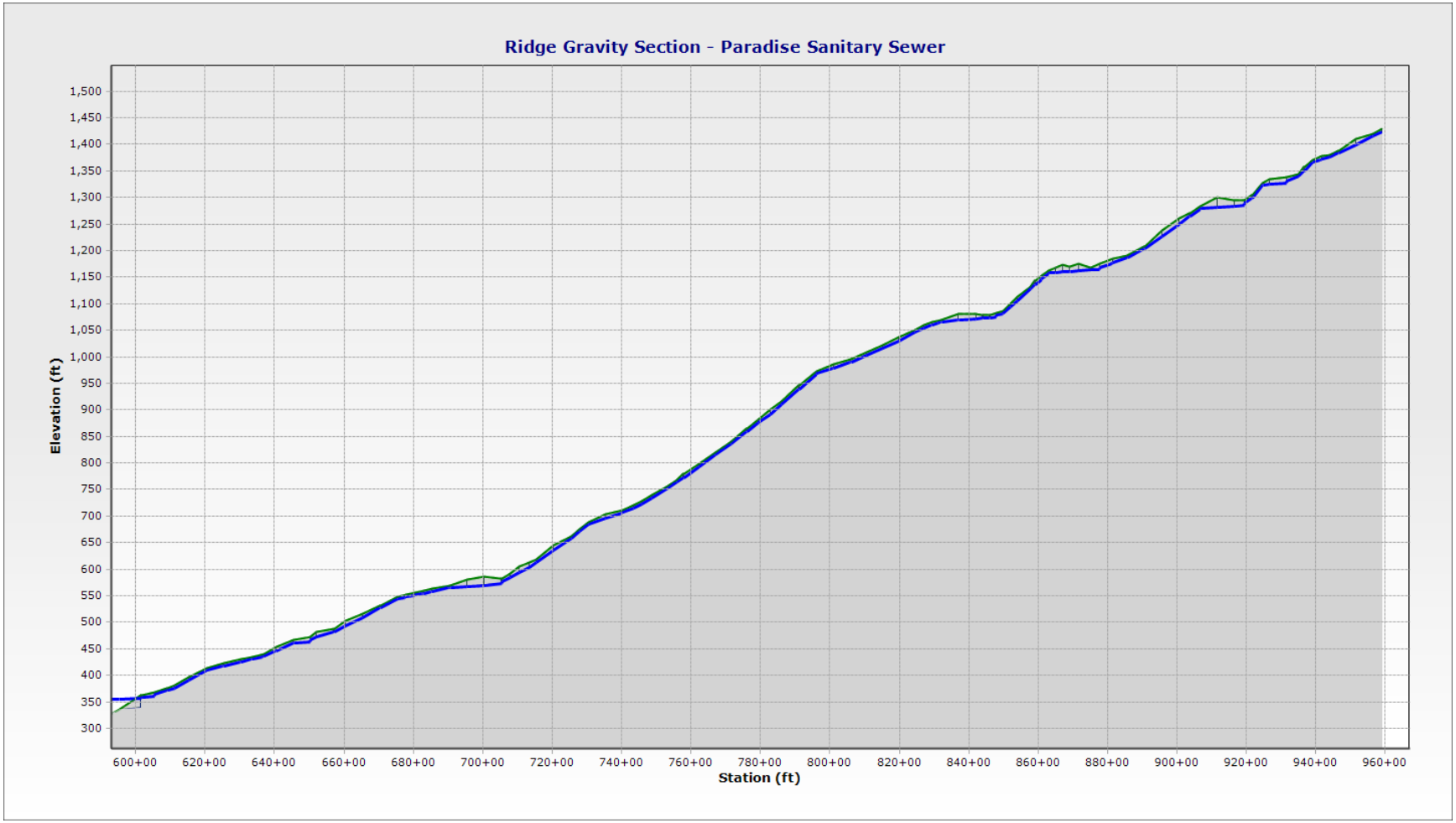

Figure 1. Hydraulic Profile of Ridge Gravity Section

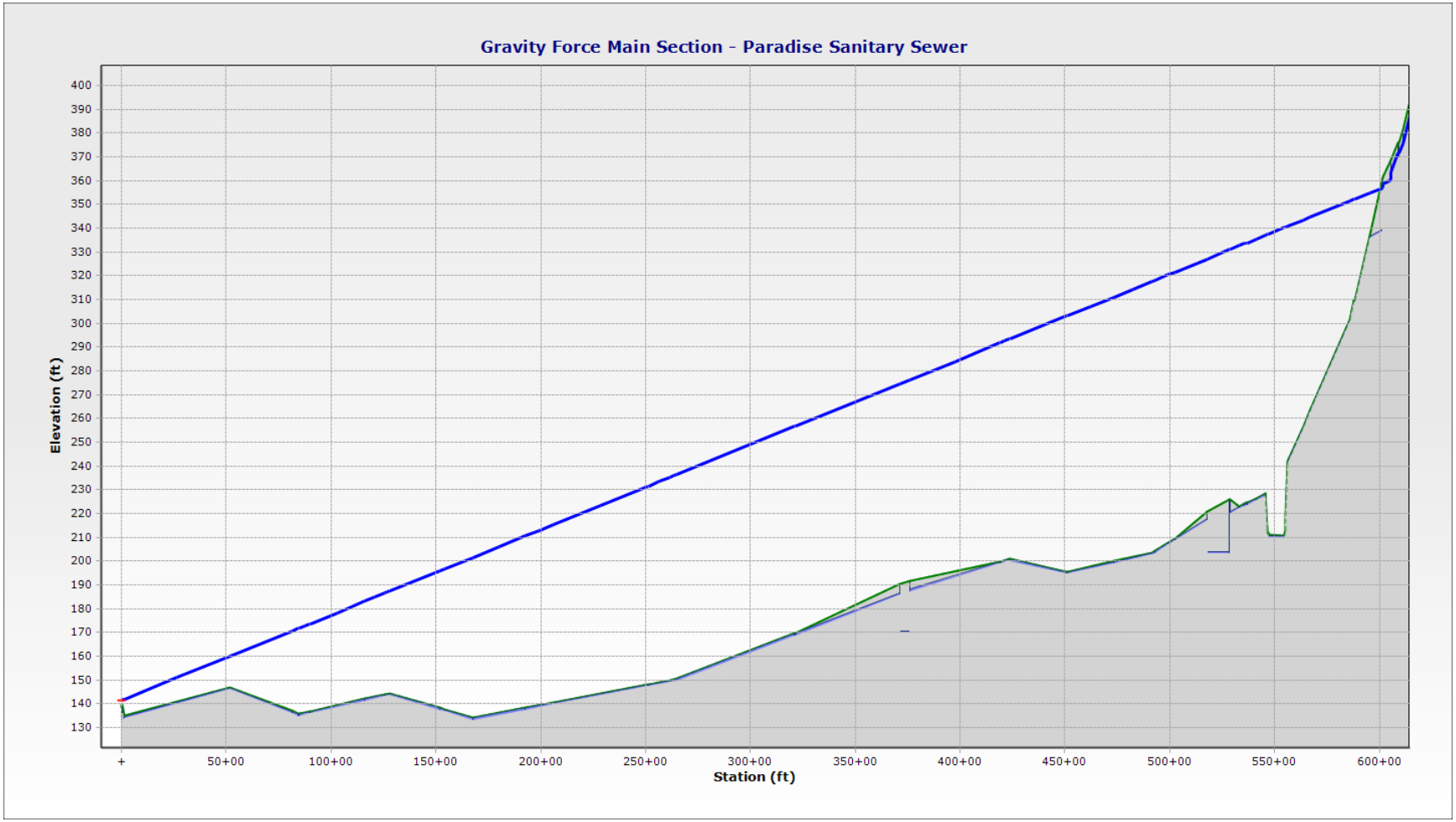

Figure 2. Hydraulic Profile of Gravity Force Main Section

2.3 Pipeline Materials

Various pipe materials have been considered for this application. To provide a low friction surface and a non-corrosive material, polyvinyl chloride (PVC) and high-density polyethylene (HDPE) were determined to be the best suited for the Ridge Gravity sewers and Gravity Force Main. Both PVC and HDPE would have a similar friction coefficient for gravity of Manning's n = 0.010 and for pressure pipe, a Hazen Williams friction factor of C=150.

C900 PVC pipe (pressure type) and ASTM D3034 PVC pipe (gravity type) will be considered for the Gravity Force Main Section and Ridge Gravity Section, respectively. PVC pipe requires very specific bedding and backfill conditions to transfer soil and live loads. Both types of pipe would be bell-and-spigot, gasketed joints.

HDPE pipe may also be considered. HDPE pipe is typically used in horizontal directional drill (HDD) installations of pressure pipe; however, it can also be used in gravity applications. The pipe is connected using pipe butt-fused joints and can provide significant deflections resulting in the use of less fittings.

The use of these pipe materials will be further evaluated during the detailed design phase.

3. System Layout

This section describes the Export Pipeline System route, components, easement requirements, and plan and profile layout.

3.1 Export Pipeline Route

A complete description of the export pipeline route is contained in the Environmental Impact Report (EIR) being prepared for the Paradise Sewer Project. The following text and Figure 3 contains a general description. In the case of any differences between the description below and the EIR text, the EIR text will govern.

The proposed export pipeline would start along Skyway at the south end of the Paradise collection system as gravity sewer lines and would continue southwest along Skyway. The pipelines would be installed within the existing Skyway right-of-way (ROW) where possible. Near Chico, at the bend where Skyway turns north, the pipeline would continue west, heading cross-country across private parcels.

The pipeline would cross Butte Creek in a trenchless crossing and would continue west along an old railroad alignment. The pipeline would turn southwest and cross Highway 99 with a trenchless crossing near Southgate Avenue.

The pipeline would then continue north along Entler Avenue and then turn west along an extension of Entler Avenue to where it intersects with Midway, and then turn north on Midway to the intersection of Midway and Hegan Lane. The pipeline would then turn west and travel along Hegan Lane, including a trenchless crossing of the Union Pacific Railroad. At the intersection of Hegan

Lane and Dayton Road, Hegan Lane becomes Elk Avenue. The pipeline would continue west along Elk Avenue. It would then turn south on Lone Pine Road and then west on Crouch Avenue. It would continue west and then north along Crouch Avenue, crossing Comanche Creek before reaching Chico Avenue. The pipeline would turn west along Chico Avenue and then north on Taffee Avenue, crossing Little Chico Creek before reaching Chico River Road. It would then continue west along Chico River Road until reaching the Chico WPCP. Figure 3 shows the Export Pipeline System alignment.

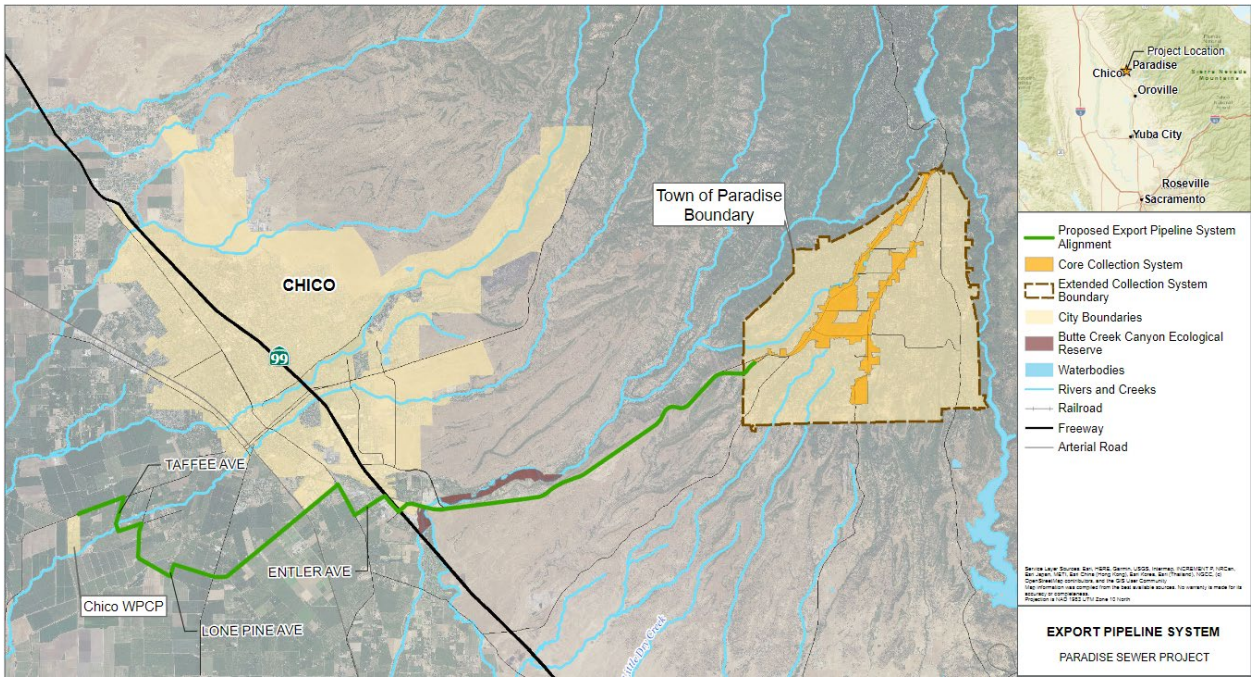

Figure 3. Export Pipeline System Alignment

3.2 Overview of Export Pipeline Components

To recap, the proposed export pipeline would include the following components:

- **Ridge Gravity Section:** Starting at Paradise, the export pipeline would consist of two gravity sewer pipes, one 8 inches in diameter and one 10 inches in diameter, each 6.8 miles long, installed at a depth of approximately 5 to 10 feet within the road ROW. Along the pipeline, there would be approximately 80 manholes spaced approximately 500 feet apart.

- **Transition Chamber:** A transition chamber would be installed after the gravity sewer reaches the flat topography near Chico, just before the pipeline leaves Skyway and continues west, heading cross-country. The chamber would be a below-ground concrete cylinder approximately 10 to 12 feet in diameter and 10 to 15 feet deep.

- **Gravity Force Main Section:** Flow leaving the transition chamber would be pressurized by gravity, and the pipe would flow full, creating a force main. This section would consist of

11.4 miles of 12-inch-diameter pipe at a minimum depth of 3 feet installed within the road ROW or permanent sewer easements obtained from property owners.

- **Butte Creek Crossing:** The trenchless crossing of Butte Creek would likely use horizontal directional drilling (HDD) technology.
- **Highway 99 Crossing:** The trenchless crossing of Highway 99 would likely use micro-tunneling methods.
- **Union Pacific Railroad Crossing:** The trenchless crossing of the Union Pacific Railroad would likely use micro-tunneling methods.
- **Additional Creek Crossings:** The export pipeline would cross two small creeks (Comanche Creek and Little Chico Creek) along Crouch Avenue or Taffee Avenue. These crossings would be accomplished using HDD technology.
- **Flow Control and Metering Structure:** A flow control and metering structure, located at or near the Chico WPCP, would consist of two cylindrical concrete manholes next to each other, each approximately 8 feet in diameter and 10 to 15 feet deep. The first manhole would be dry (i.e., the wastewater would remain within the pipe) and would contain a magnetic flow meter and a pressure gauge on the force main. The second manhole would be wet (i.e., the force main pipe would discharge to atmosphere) and would contain a modulating plug valve and sampler. The modulating plug valve would keep the transition chamber and force main full. In this manhole, the flow would go through the modulating plug valve and discharge to atmosphere, and would then flow by gravity to Influent Sewer Junction Box A at the Chico WPCP. Odor control would be provided at this structure.

3.3 Export Pipeline Easement Requirements

Wherever possible, the export pipeline would be constructed within public ROW. The Skyway segment of the pipeline would remain within public ROW. Once the pipeline leaves Skyway, it would cross several private parcels before coming back onto public roads (and public ROW).

Any location outside of public ROW would require ROW acquisition from private landowners. Typically, buried pipelines require purchase of a permanent easement, not full ownership of the land involved. The landowner retains the use of the surface of the land, although (typically) permanent structures or large trees cannot be placed over the pipeline. Permanent structures at or above the land surface (e.g., the transition chamber) typically involve a full purchase of the piece of property, sometimes called “fee title acquisition.” In all cases, easements must provide the ability to access any facility for maintenance or repair.

If the permanent easement or fee title would provide sufficient space to construct the facility, no additional ROW acquisition would be needed for construction. Often, however, some additional space is temporarily needed during construction, in which case a temporary easement must also be purchased.

Table 2 provides estimates of the amount of temporary and permanent easements required for the various facilities of the export pipeline.

Table 2. Approximate Easement Requirements for Export Pipeline

Facility	Permanent Easement	Total Easement Area (including permanent and temporary)
Pipeline	15 feet wide, along the pipeline	55 feet wide, along the pipeline
Transition Chamber	35 feet by 35 feet (fee title)	60 feet by 60 feet
Flow Control and Metering Structure	25 feet wide by 50 feet long (direction of pipe) (fee title or on Chico WPCP site)	75 feet wide by 80 feet long (direction of pipe)
Horizontal Directional Drilling Crossing	15 feet wide, along the pipeline	Launch Pit: 75 feet wide by 150 feet long (direction of pipe) Receiving Pit: 75 feet wide by 50 feet long (direction of pipe)
Micro-Tunnel Crossing	15 feet wide, along the pipeline	Launch Pit: 75 feet wide by 125 feet long (direction of pipe) Receiving Pit: 75 feet wide by 100 feet long (direction of pipe)

3.4 Approach to Layout

Preliminary plan and profile drawings were created for the proposed Export Pipeline System design, as were details of hydraulic structures. The plan and profile drawings can be found in Appendix A, while the hydraulic structure details can be found in Appendix B.

For the portion of the alignment along Skyway, the pipeline would be placed along the eastbound lanes, south of the edge of pavement. The Skyway portion of the alignment generally corresponds to the Ridge Gravity Section of the proposed system. The pipeline profile is designed with a minimum slope of 0.45 percent and a minimum cover depth of 3 feet. The steep terrain required that slope changes be minimized and energy dissipation be used to contain transitions from critical to subcritical flow. The design seeks to restrict cover depths to less than 10 feet wherever possible. Periodic reversals in grade along this segment means that greater cover depths are unavoidable along certain portions of the alignment. Field investigations in detailed design would confirm terrain layout so that further refinement of these deep portions can be made.

The transition from the Ridge Gravity Section to the Gravity Force Main Section occurs at the Transition Chamber, just before the alignment leaves the Skyway ROW. This section is designed as a fully pressurized line, with no minimum slopes required and fittings used to achieve significant changes in direction. A minimum cover depth of 3 feet is maintained from the transition chamber all the way to the Flow Control and Metering Structure. For trenchless crossings, a minimum cover depth of 20 feet is used. The alignment for this portion is placed just off the edge of pavement (either existing or planned future roads) and seeks to minimize road crossings, sometimes on the south, east, or west side of a respective roadway. Specifics of each trenchless crossing, in particular the Southgate Interchange crossing, will be refined in future design phases. Discussions with the City of Chico would be needed to coordinate pipeline construction with the future Southgate Interchange lane phasing and would impact the method, length, and placement of the respective trenchless crossing.

4. Future Operation and Maintenance Activities

Operation and maintenance activities associated with the export pipeline may include the following:

- Periodic inspection and cleaning/flushing of the gravity pipeline and manholes (Ridge Gravity Section) would be performed as is typical of municipal wastewater collection systems. The gravity sewer pipeline and manholes would be inspected one to two times per year depending on deposition observed within the system. Inspections would be accompanied with sewer jetting and vacuum equipment to clean sewers and manholes as required.

- Periodic inspection and cleaning/flushing of the pressure pipeline (Gravity Force Main Section) using the pressure-type cleanouts would be performed one to two times per year depending on performance and deposition that occurs within the system. Inspections would be accompanied with sewer jetting and vacuum equipment to clean the pipeline as required.

- Periodic flushing of the export pipeline and manholes would convey all flushed water to the Chico WPCP. During the early years of service, when flows are low, these maintenance activities may need to occur several times a year, and then less frequently after that.

- Periodic inspection and maintenance of the air release valves and the odor control canisters would occur every six months to ensure optimal performance of these devices. Air release valves would be inspected to ensure that they are operating properly. The odor control canisters would be replaced as needed when the carbon media becomes saturated and loses the ability to absorb odors.

- Periodic inspection and maintenance of instrumentation would occur monthly. This would include the flow meter, electric-actuated valve, level sensors, and pressure transducers within the Transition Chamber and the Flow Control and Metering Structure. This equipment would be replaced approximately every 5 to 10 years.

- Flow data and samples would be collected from the Flow Control and Metering Structure. The flow measurement data would be transmitted via radio or fiber optic lines; therefore, visits would not be required to obtain data. Wastewater samples would be collected at the structure at a frequency established by agreement with the City of Chico and could be as frequently as daily.

A

Plan and Profile Drawings

ISSUE	DATE	DESCRIPTION

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DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
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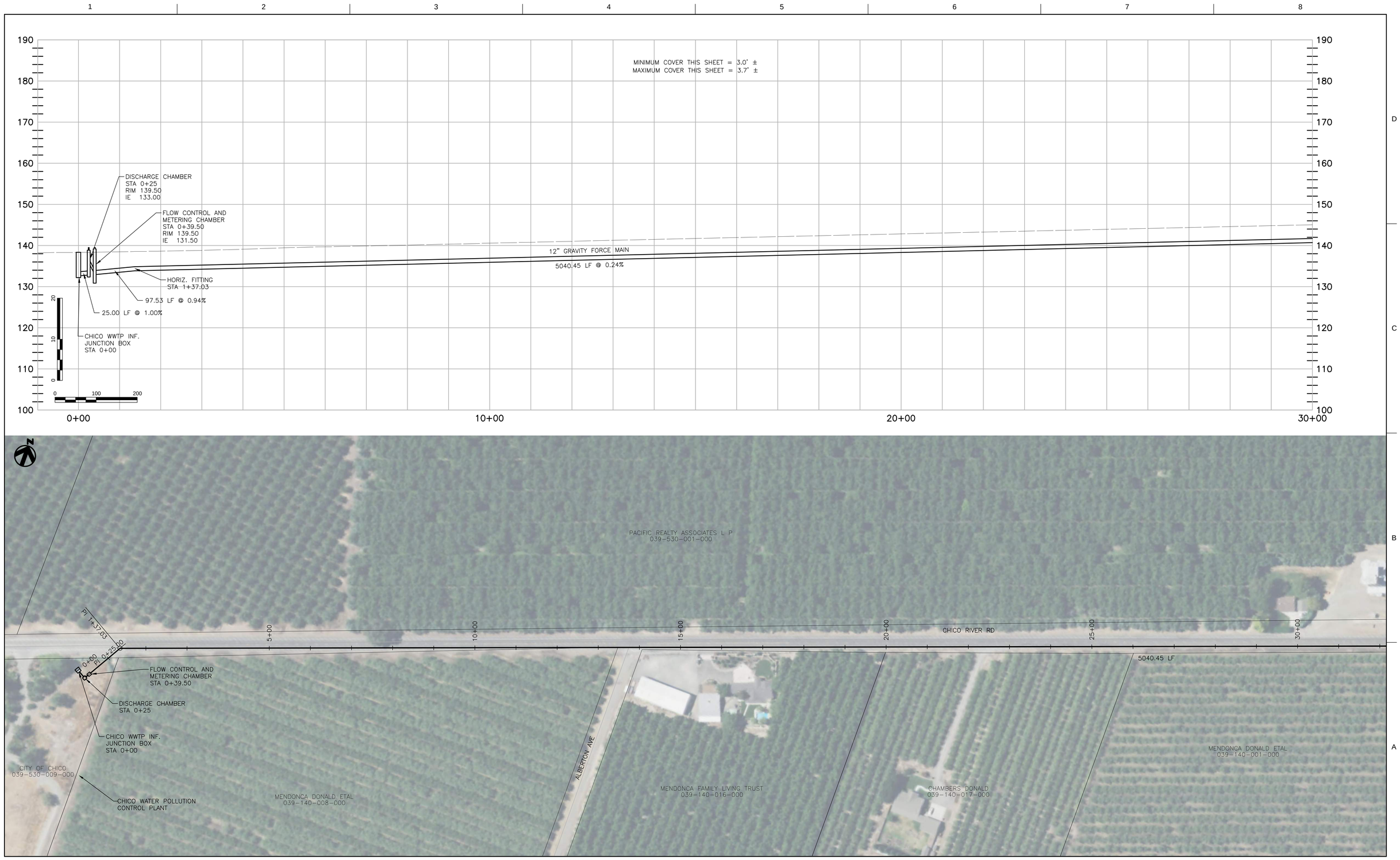

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DRAWN BY	WMG/KTW
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PROJECT NUMBER	10215320

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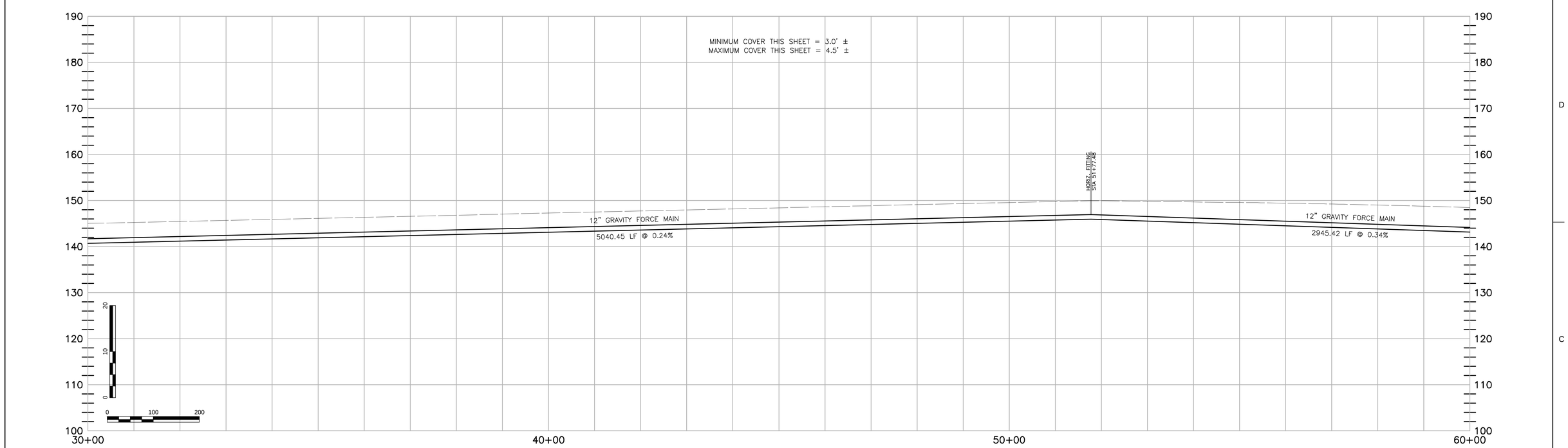

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PROJECT NUMBER	10215320

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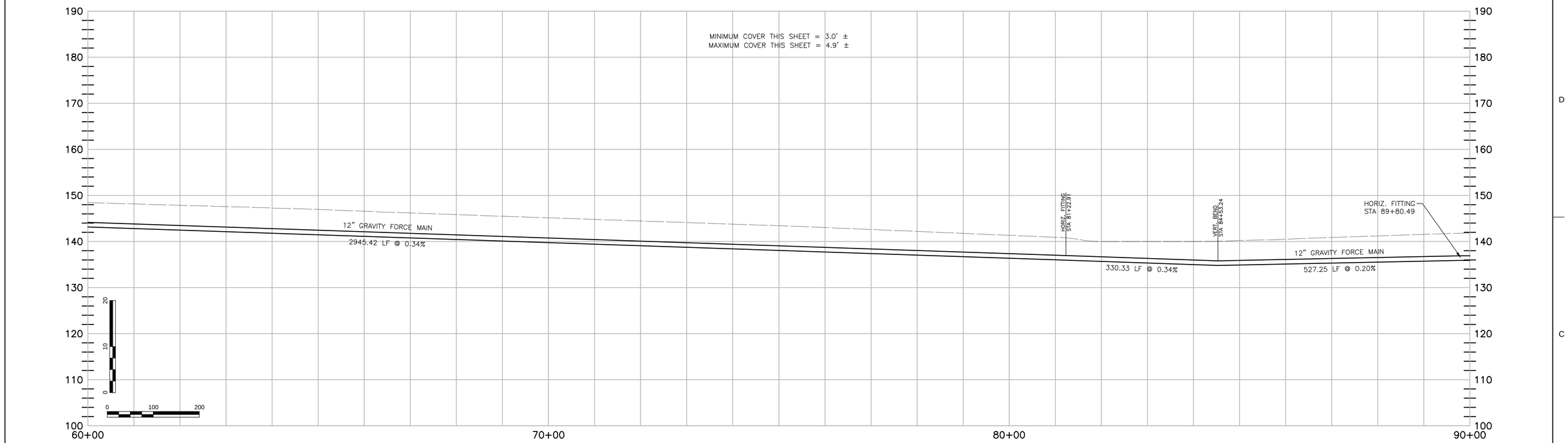

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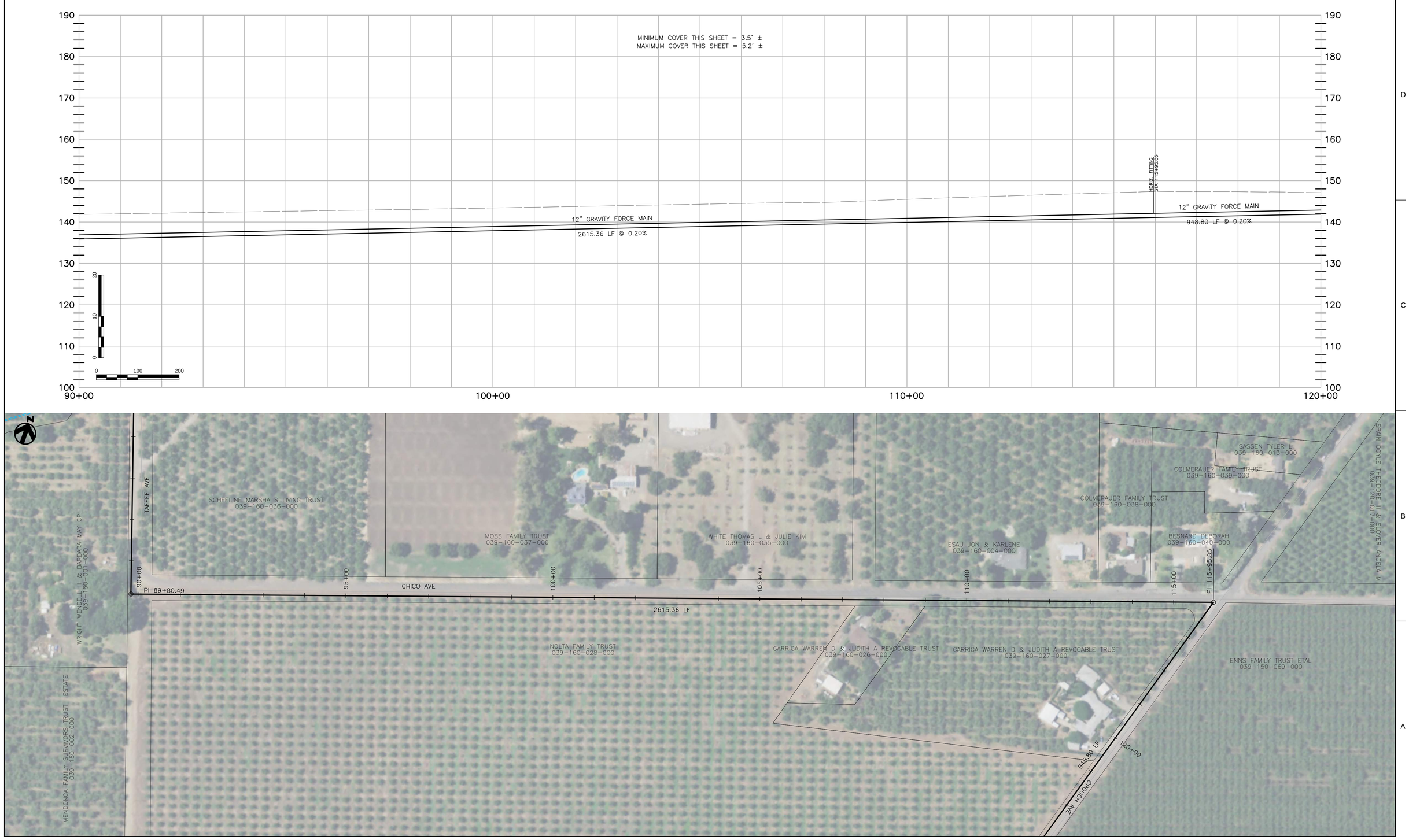

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MAXIMUM COVER THIS SHEET = 5.3' ±

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948.80 LF @ 0.20%

235.78 LF @ 0.20%

12" GRAVITY FORCE MAIN
2398.95 LF @ 0.26%

MANH. FITTING
STA. 125+44.65

VERT. BEND
STA. 127+80.42

190
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170
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150
140
130
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110
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PACIFIC REALTY ASSOCIATES L P
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DRAWN BY	WMG/KTW
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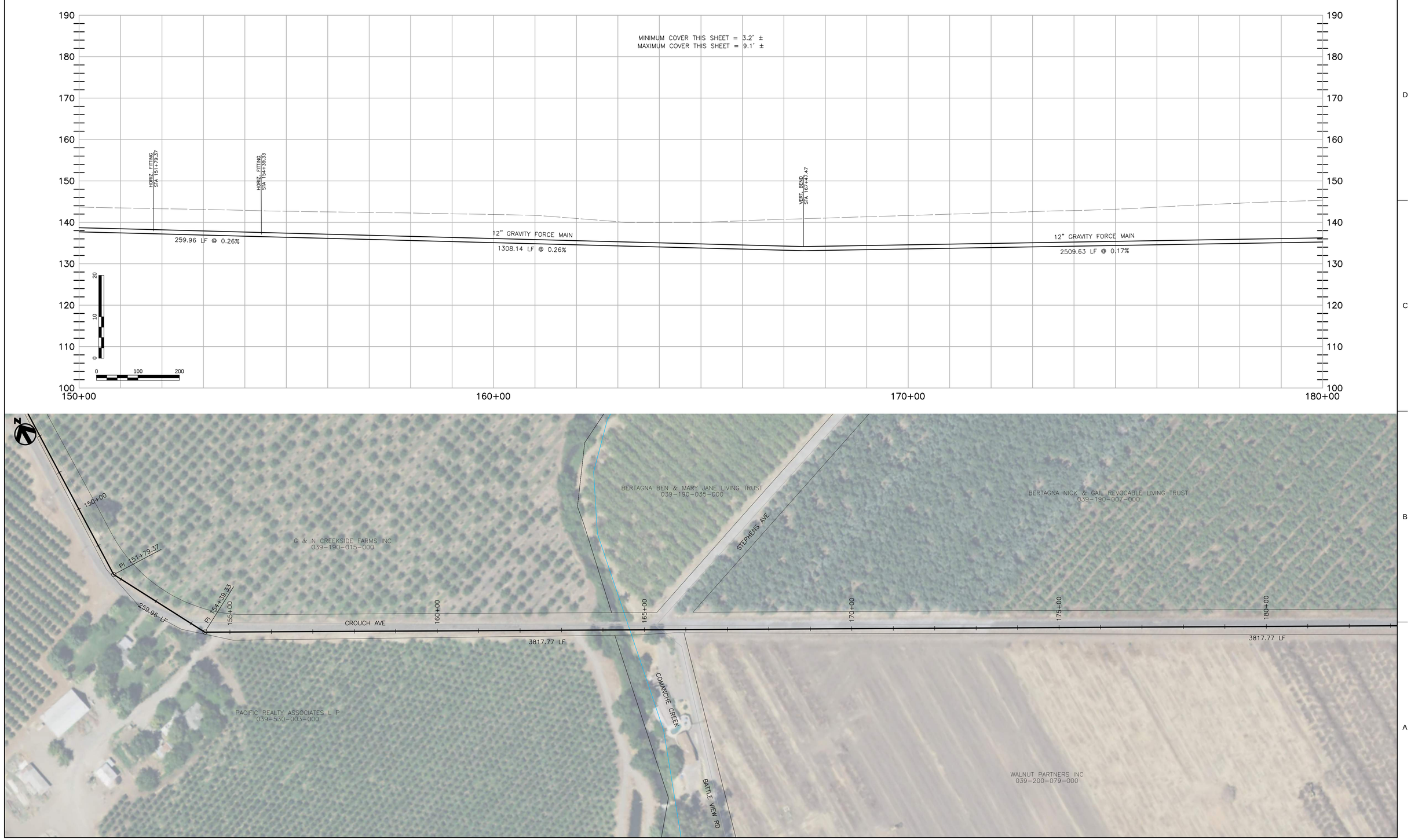

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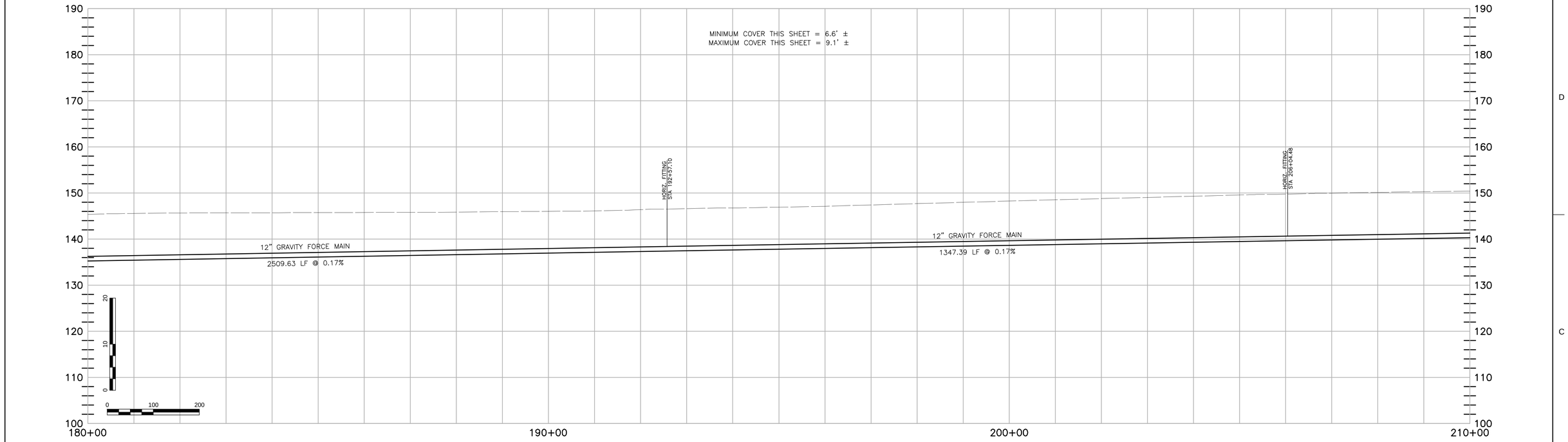

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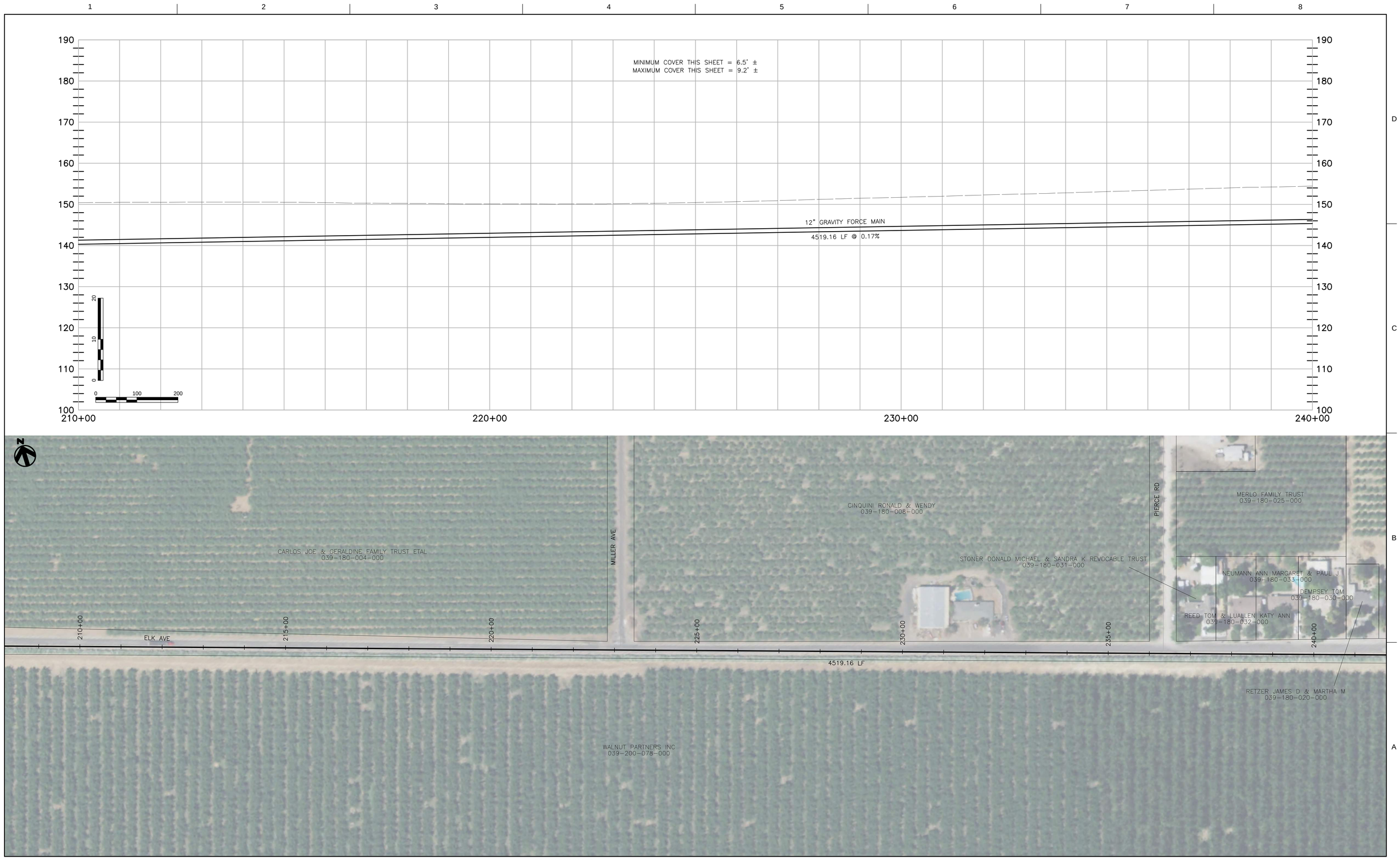

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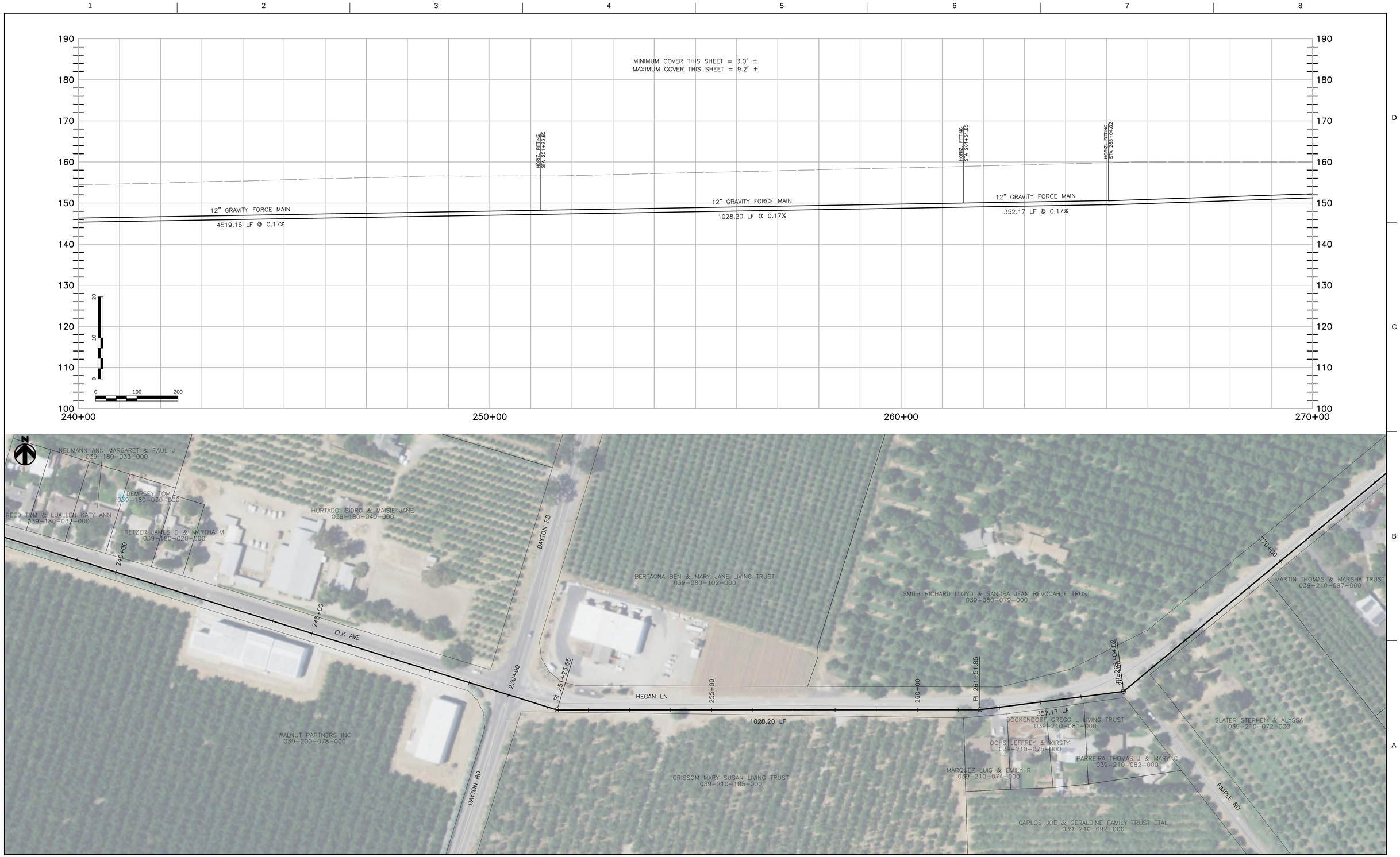
SCALE 1" = 100' H' 1" = 10' V

SHEET 8



TOWN OF Paradise CALIFORNIA INC. 1979

HDR

ISSUE	DATE	DESCRIPTION

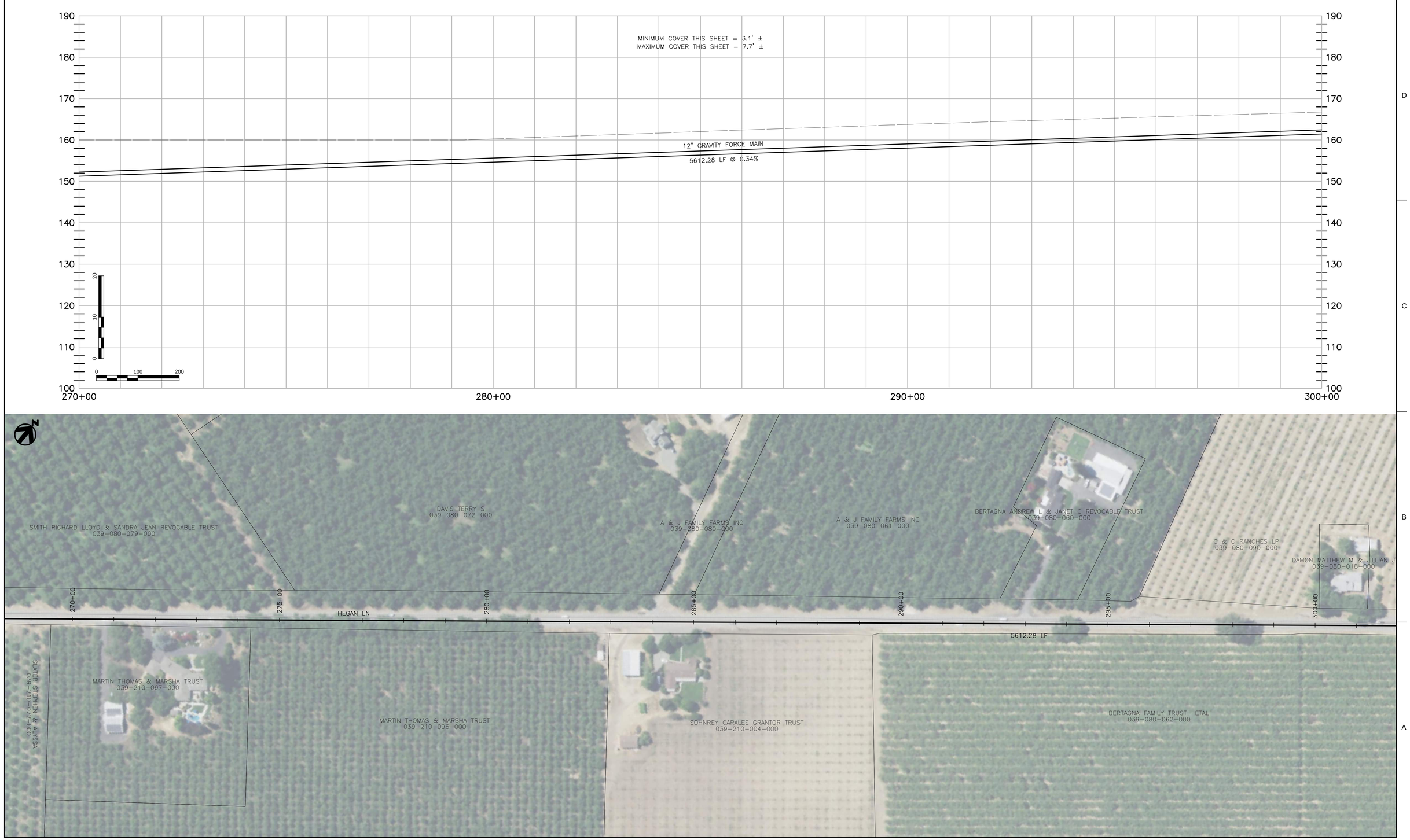
PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 240+00 TO STA. 270+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V

SHEET 9



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

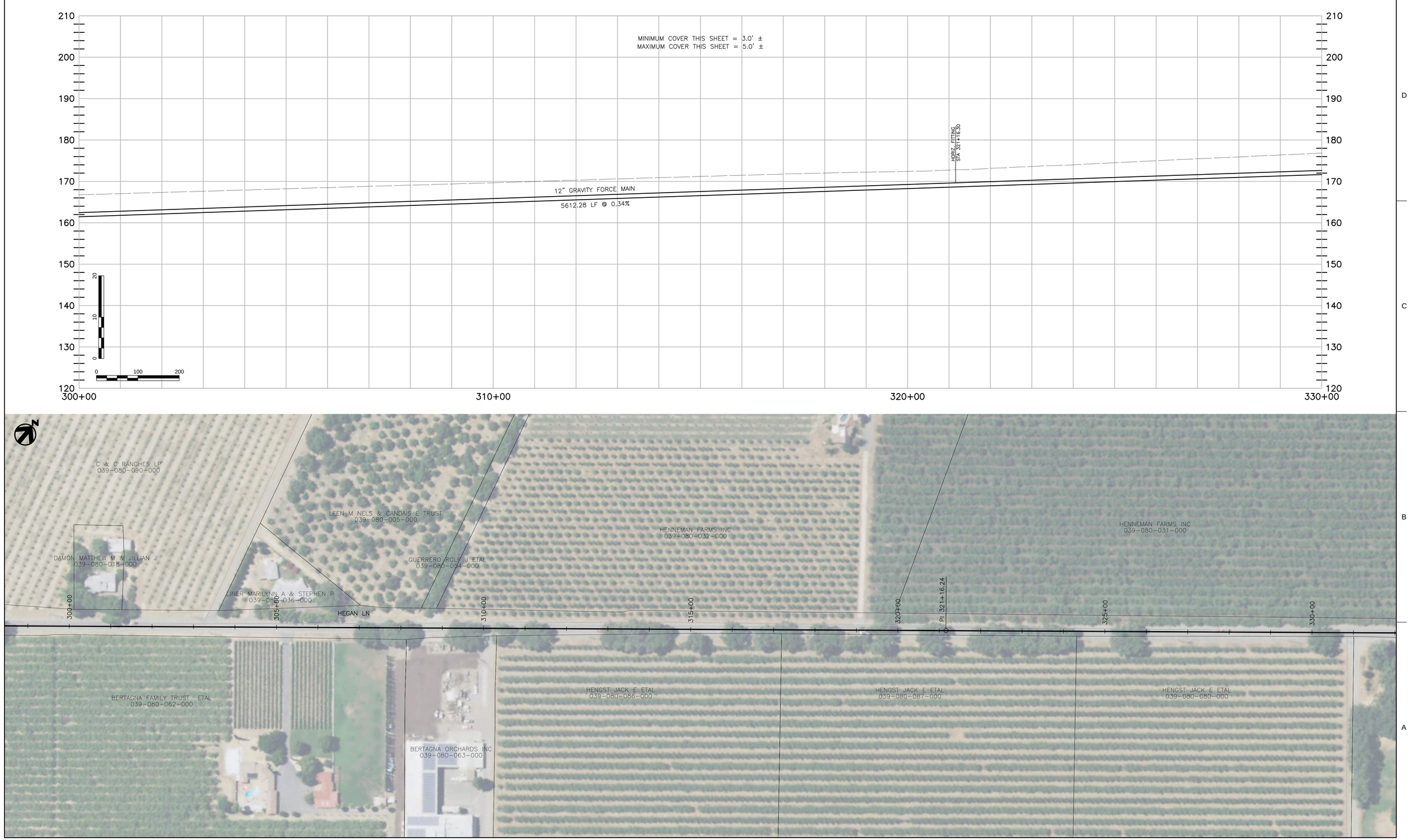
PARADISE SEWER PROJECT
STA. 270+00 TO STA. 300+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 10



ISSUE	DATE	DESCRIPTION

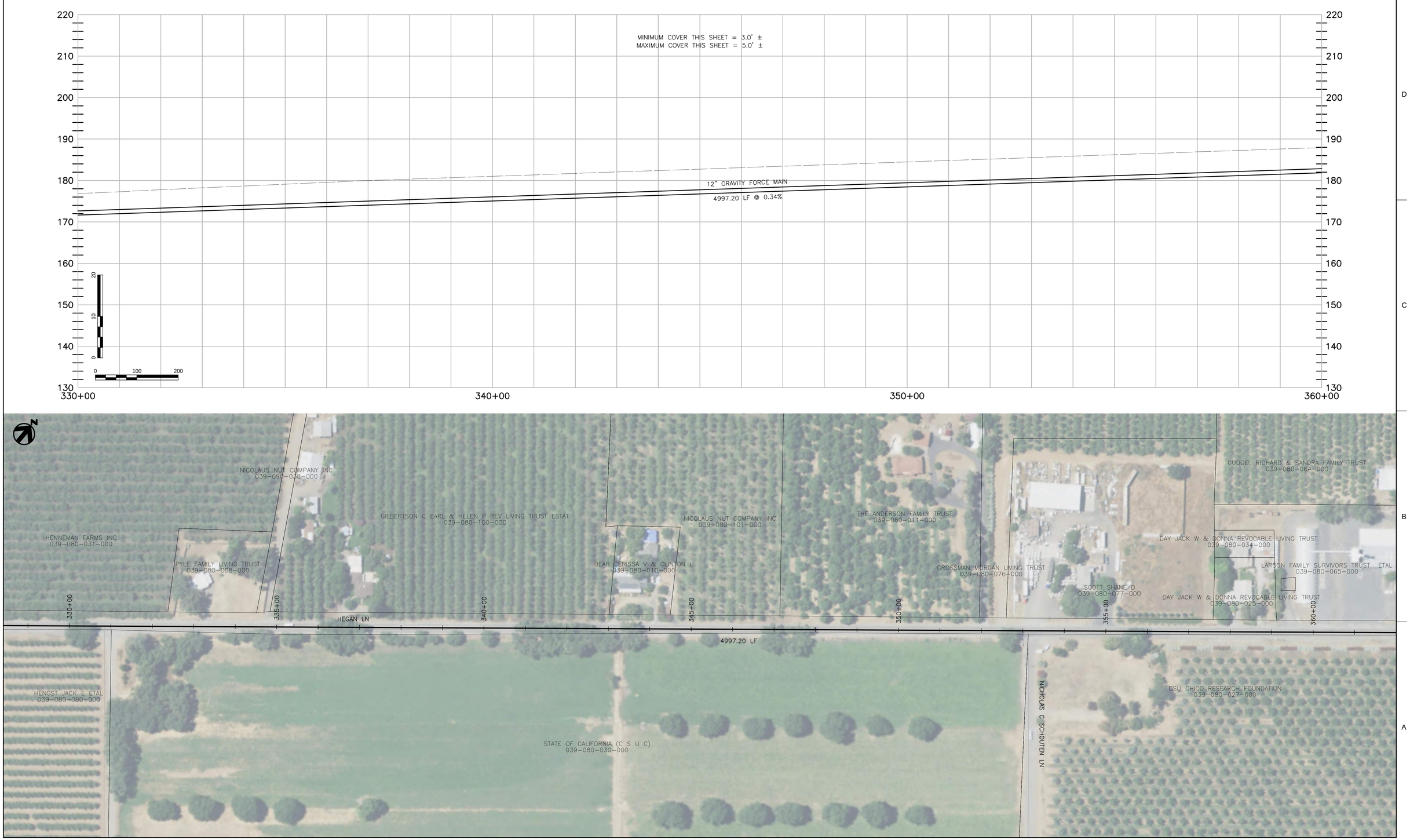
PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 300+00 TO STA. 330+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V

SHEET 11



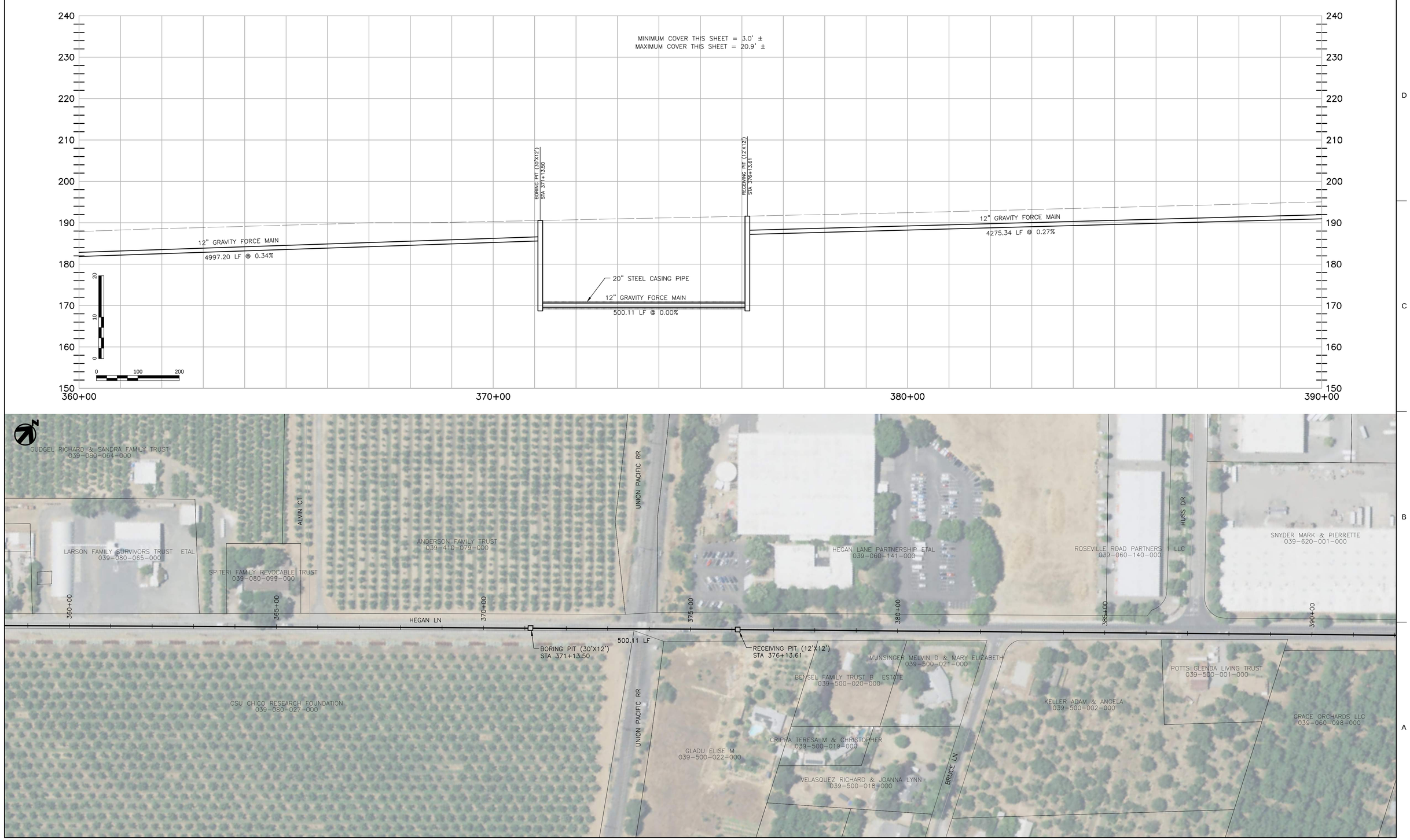
	PROJECT MANAGER	
	DESIGNED BY	
	DRAWN BY	WMG/KTW
	QA / QC	
ISSUE DATE DESCRIPTION	PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 330+00 TO STA. 360+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V

SHEET 12



ISSUE	DATE	DESCRIPTION

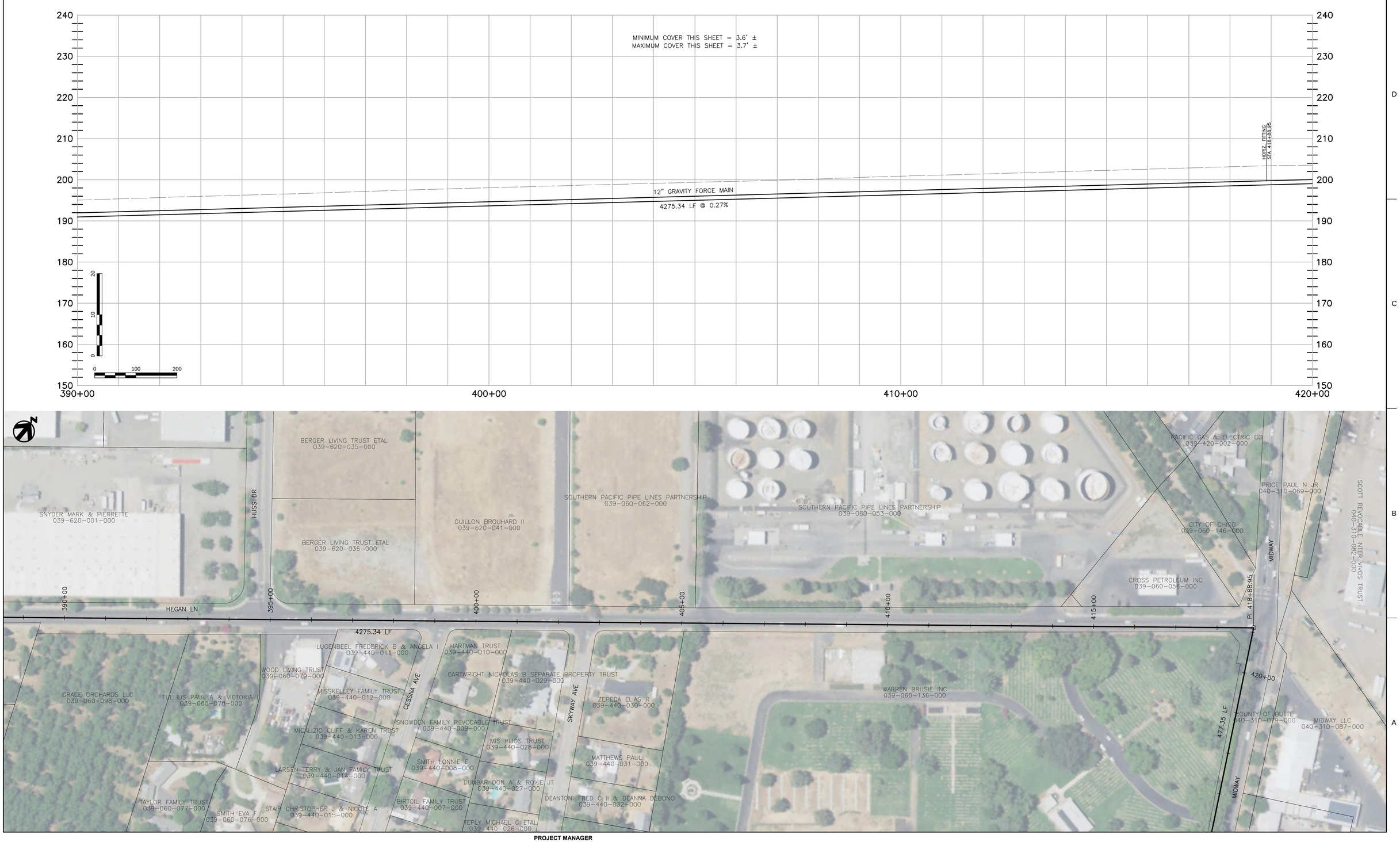
PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 360+00 TO STA. 390+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V

SHEET 13



ISSUE	DATE	DESCRIPTION

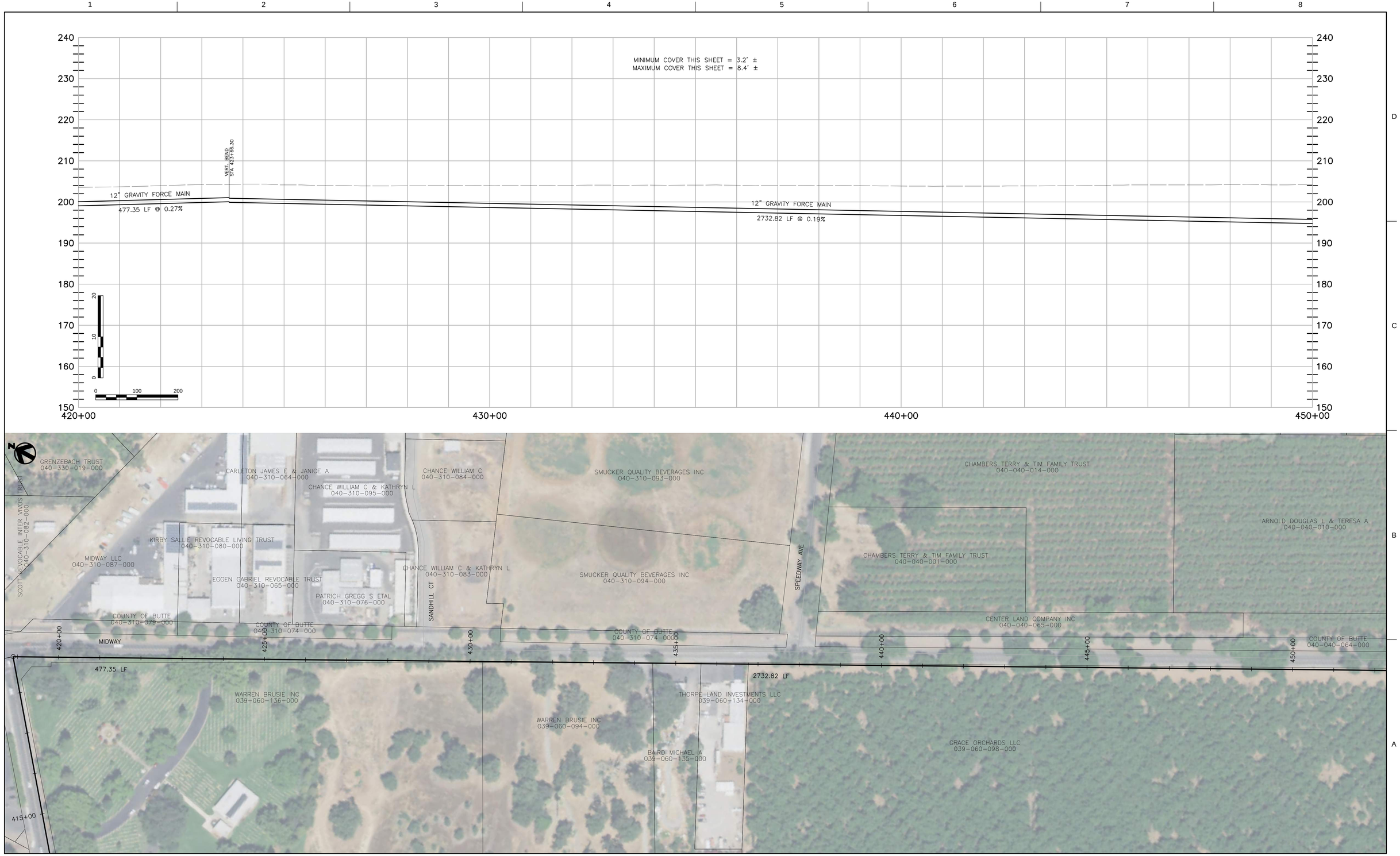
PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 390+00 TO STA. 420+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V

SHEET 14



ISSUE	DATE	DESCRIPTION

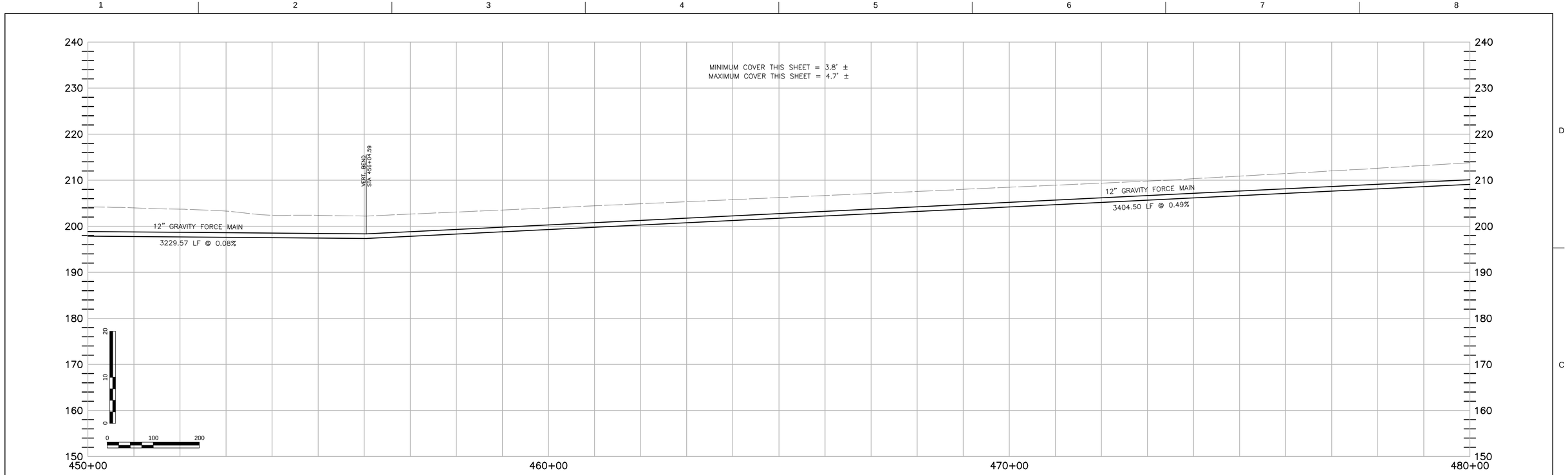
PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

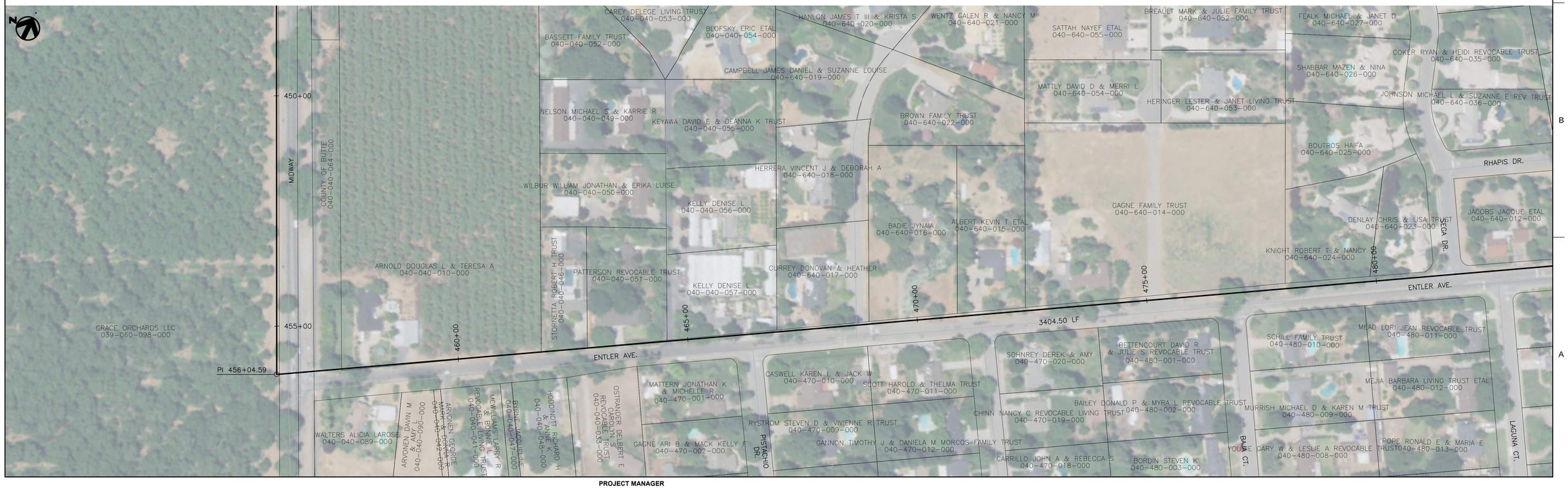
PARADISE SEWER PROJECT
STA. 420+00 TO STA. 450+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME: Sheet Files.dwg
SCALE: 1" = 100' H' 1" = 10' V

SHEET 15





		PROJECT MANAGER
		DESIGNED BY
		DRAWN BY WMG/KTW
		QA / QC
ISSUE	DATE	DESCRIPTION
		PROJECT NUMBER 10215320

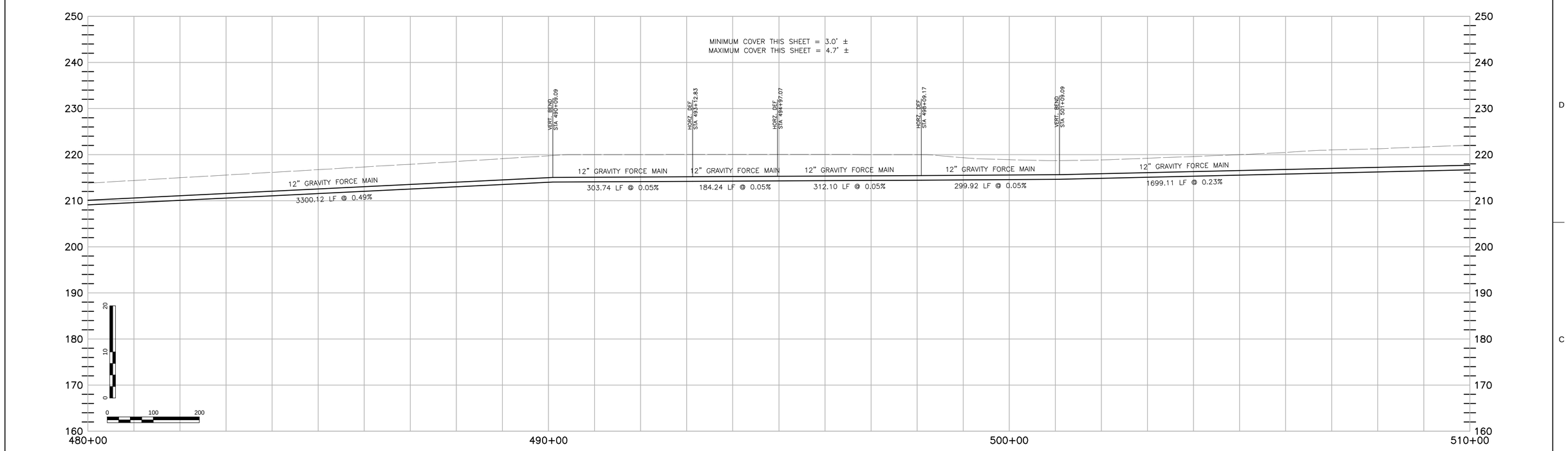
PARADISE SEWER PROJECT
STA. 450+00 TO STA.480+00
PRELIMINARY - CONCEPTUAL ONLY

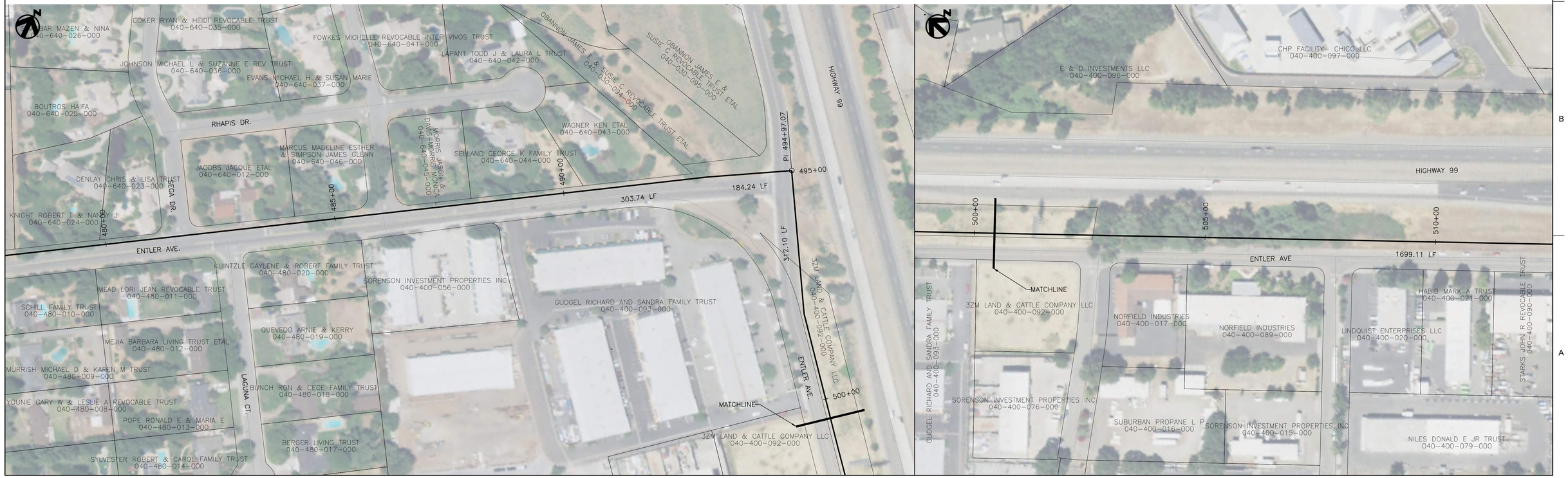
0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 16





ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

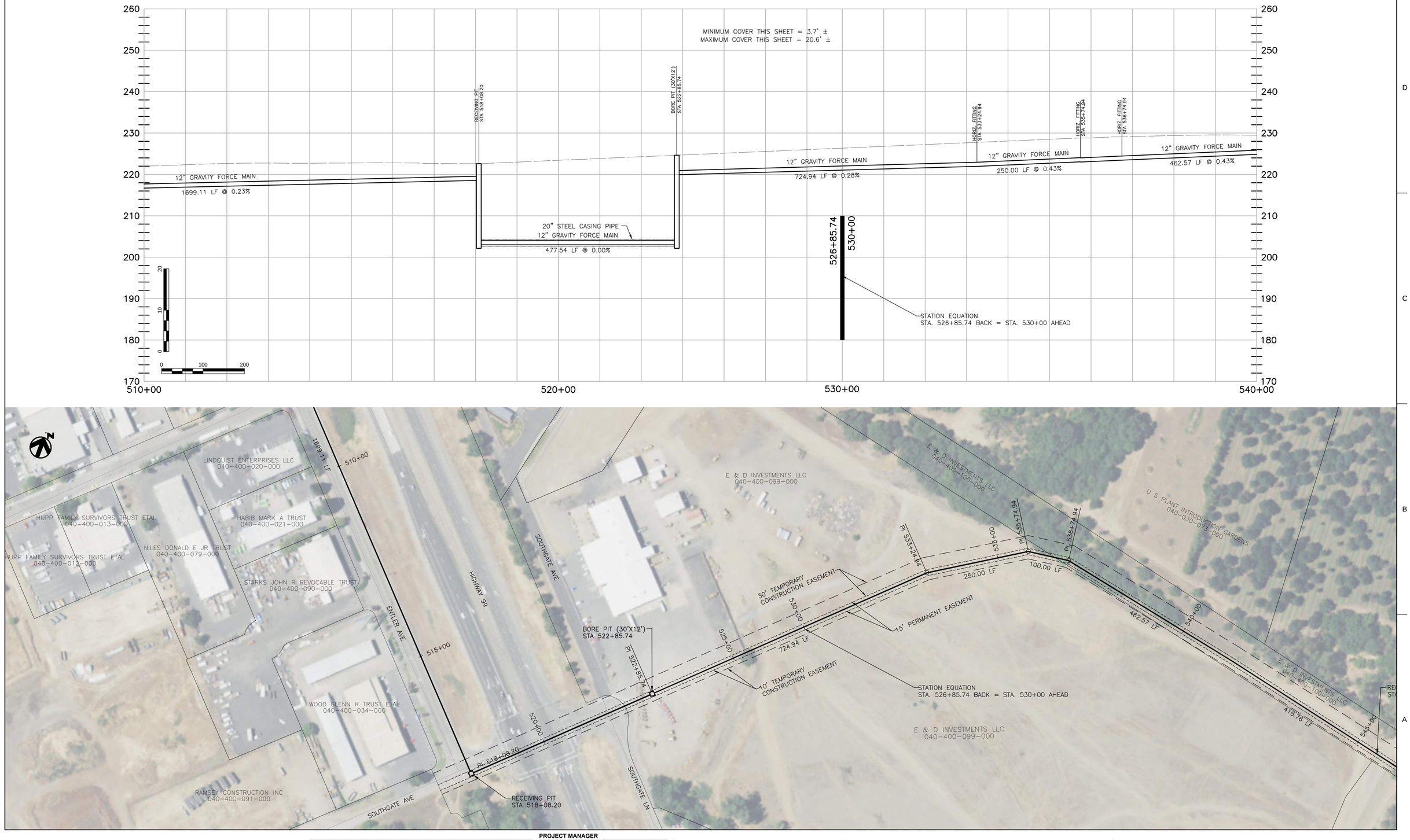
PARADISE SEWER PROJECT
STA. 480+00 TO STA. 510+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 17



	PROJECT MANAGER	
	DESIGNED BY	
	DRAWN BY	WMG/KTW
	QA / QC	
ISSUE DATE DESCRIPTION	PROJECT NUMBER	10215320

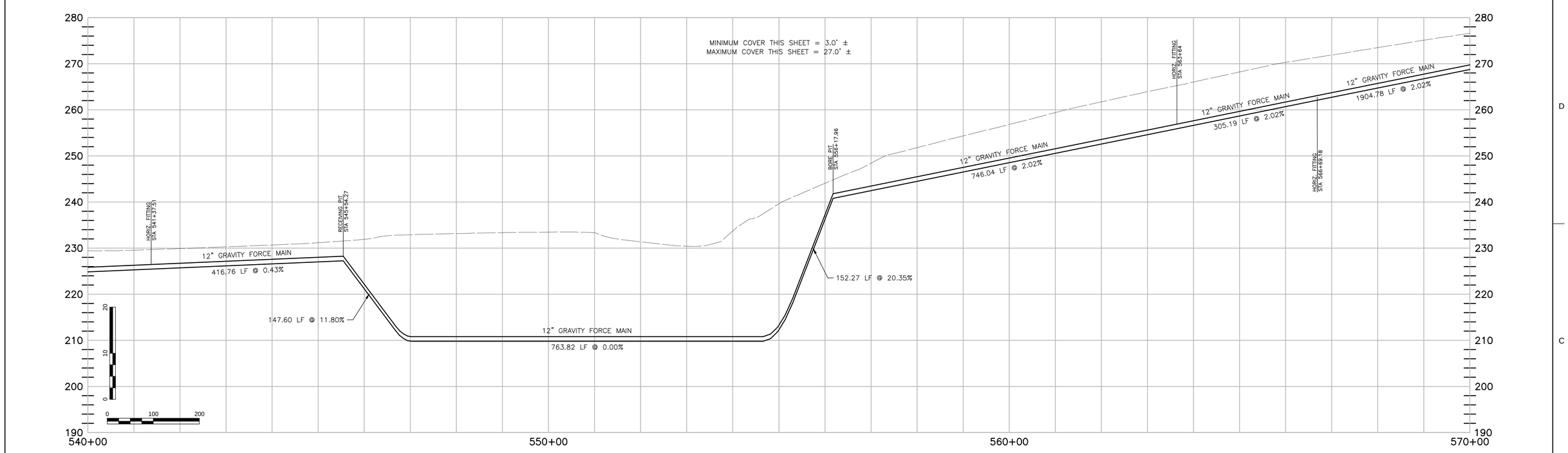
PARADISE SEWER PROJECT
STA. 510+00 TO STA. 540+00
PRELIMINARY - CONCEPTUAL ONLY

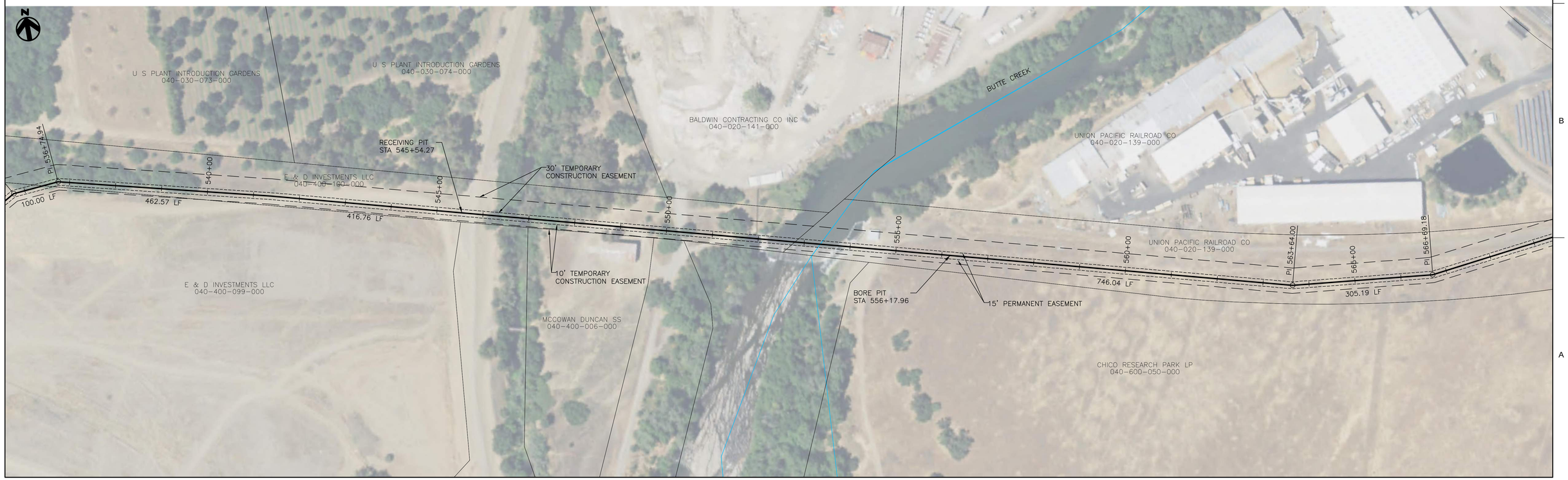
0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 18





		PROJECT MANAGER
		DESIGNED BY
		DRAWN BY WMG/KTW
		QA / QC
ISSUE	DATE	DESCRIPTION
		PROJECT NUMBER 10215320

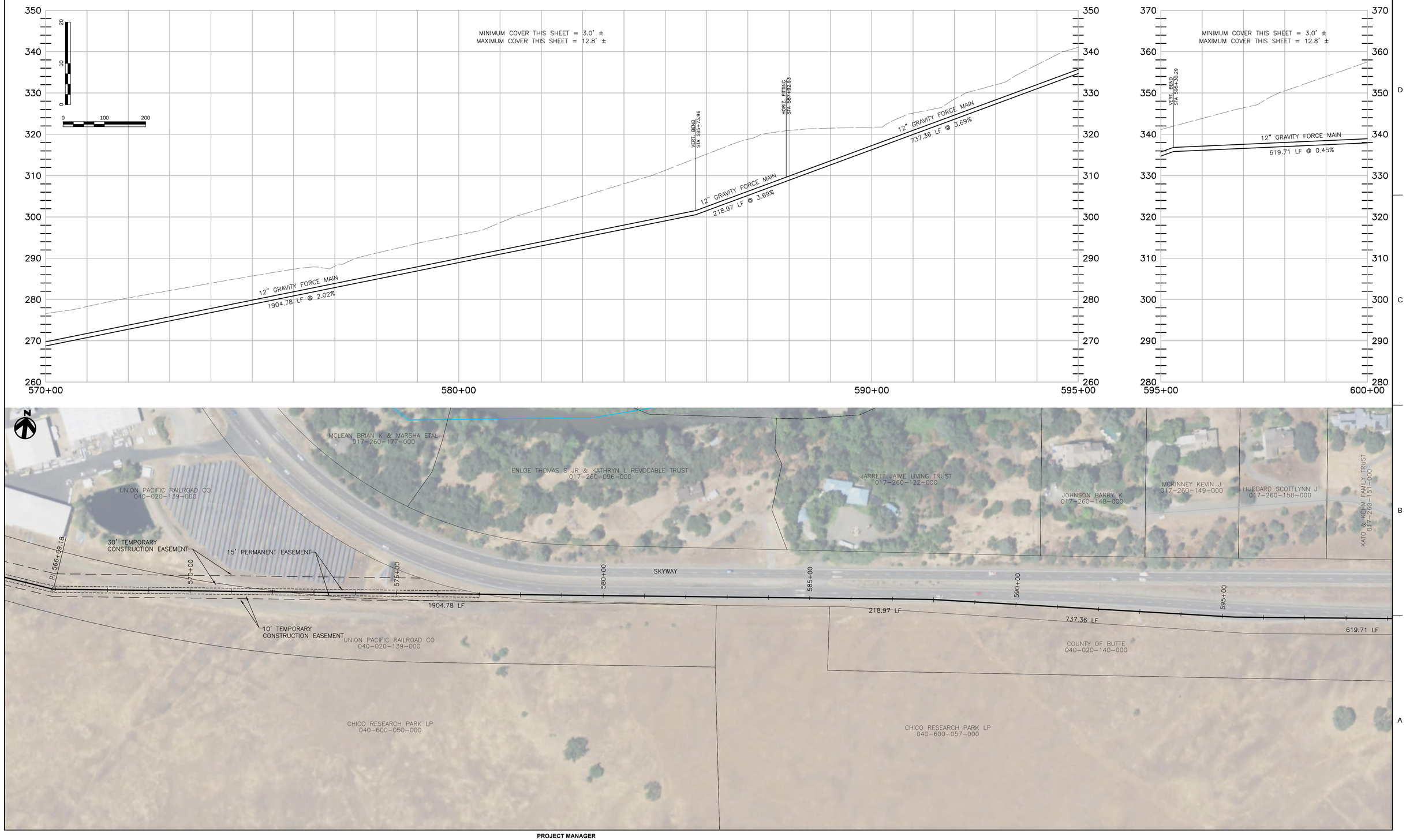
PARADISE SEWER PROJECT
STA. 540+00 TO STA. 570+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 19

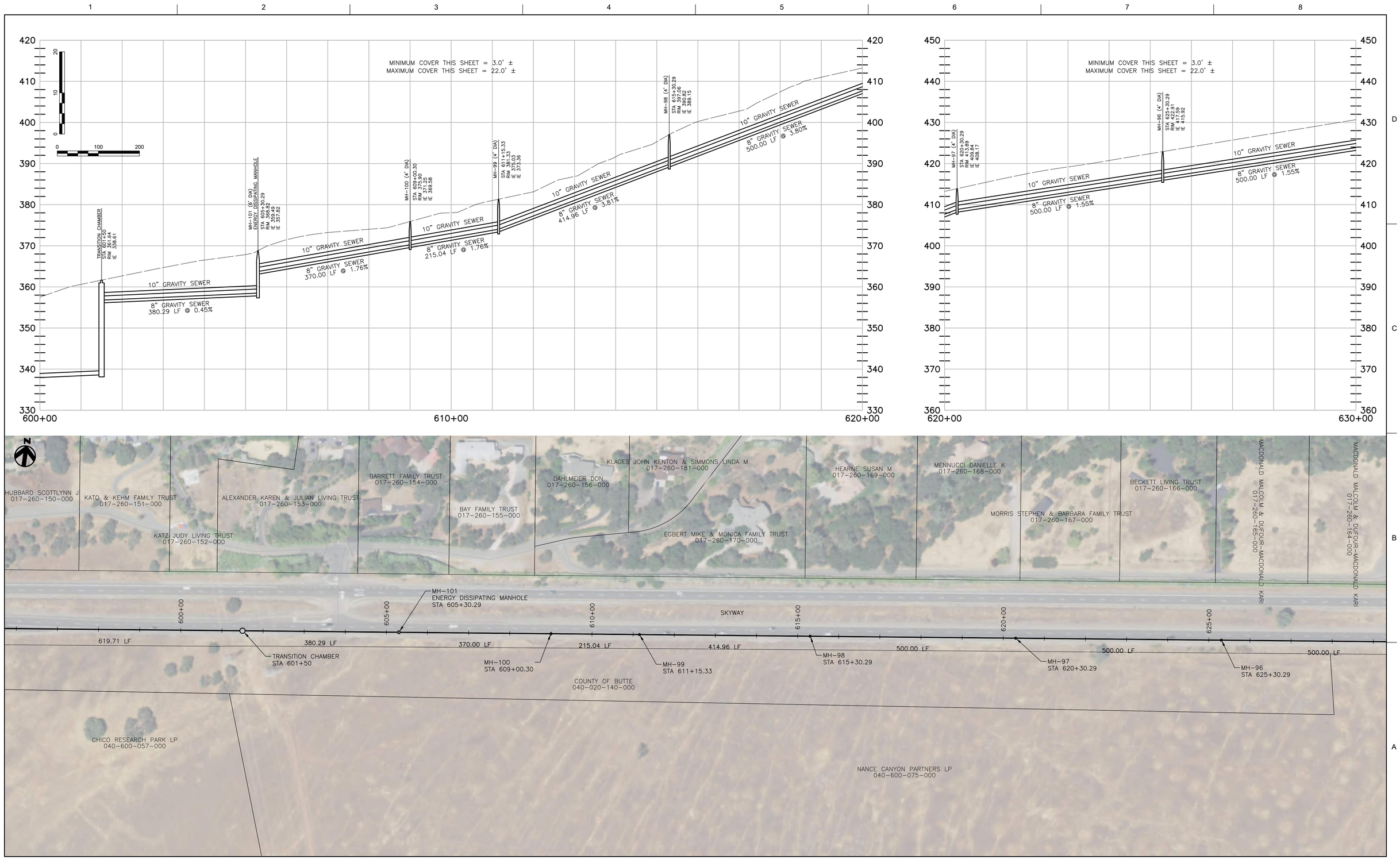


ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 570+00 TO STA. 600+00
PRELIMINARY - CONCEPTUAL ONLY

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V
SHEET	20



	PROJECT MANAGER	
	DESIGNED BY	
	DRAWN BY	WMG/KTW
	QA / QC	
ISSUE DATE DESCRIPTION	PROJECT NUMBER	10215320

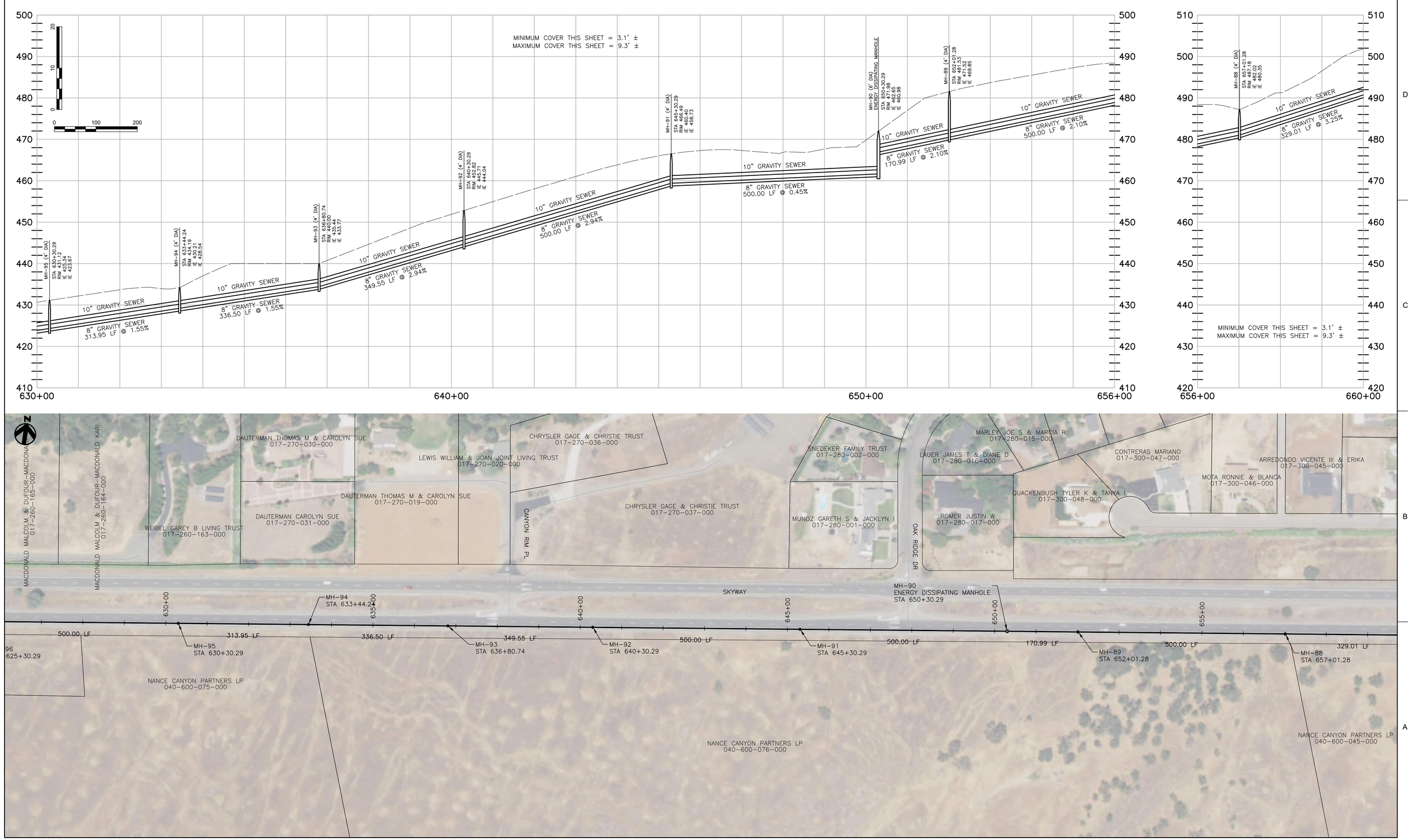
PARADISE SEWER PROJECT
STA. 600+00 TO STA. 630+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 21



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

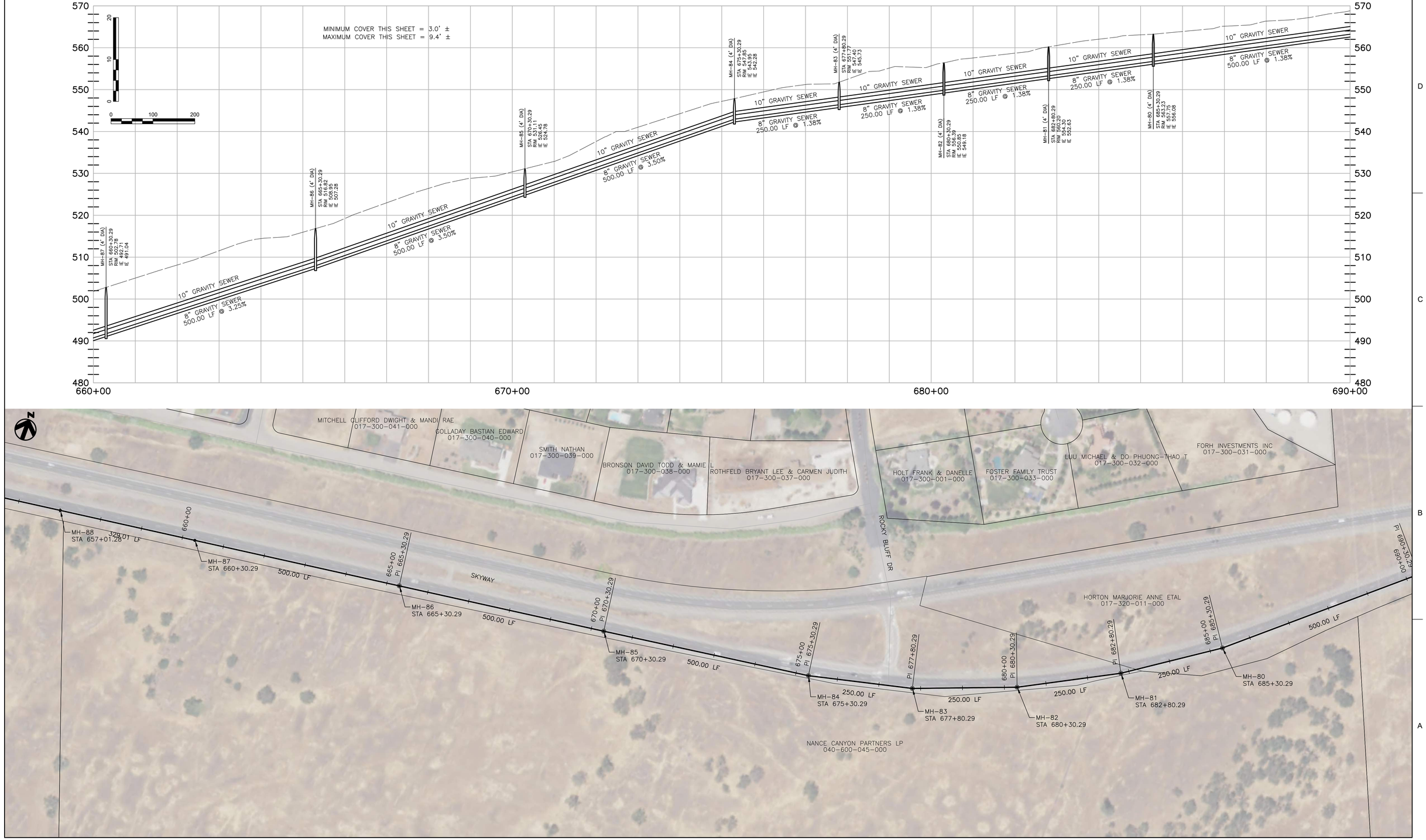
PARADISE SEWER PROJECT
STA. 630+00 TO STA. 660+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 22

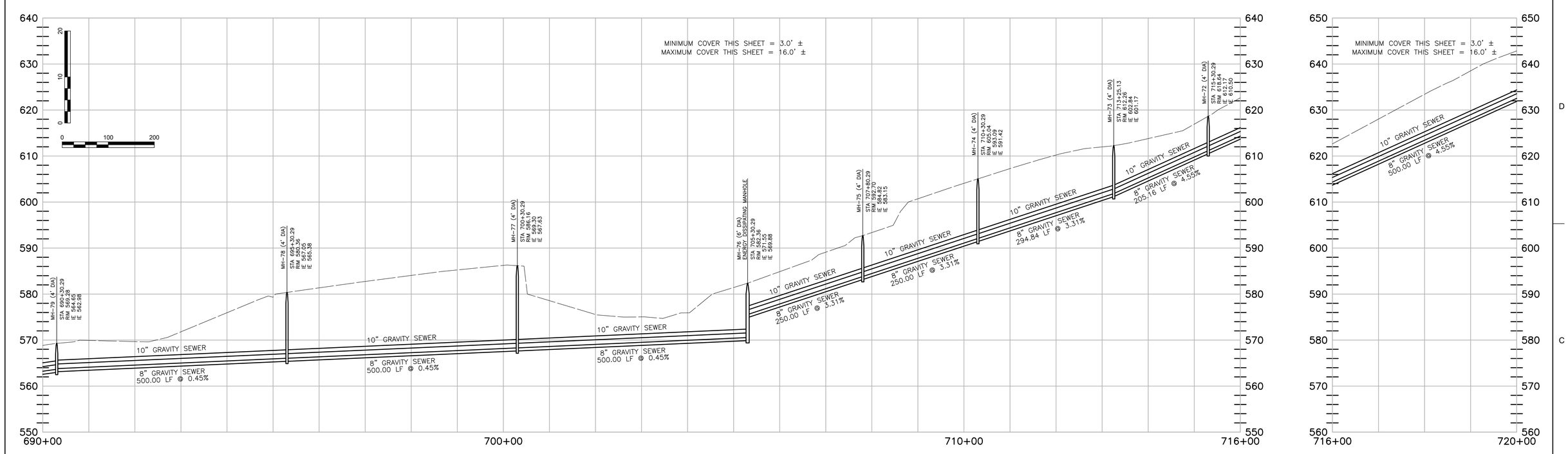


	PROJECT MANAGER	
	DESIGNED BY	
	DRAWN BY	WMG/KTW
	QA / QC	
ISSUE DATE DESCRIPTION	PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 660+00 TO STA. 690+00
PRELIMINARY - CONCEPTUAL ONLY

FILENAME Sheet Files.dwg
SCALE 1" = 100' H' 1" = 10' V

SHEET 23



	PROJECT MANAGER	
	DESIGNED BY	
	DRAWN BY	WMG/KTW
	QA / QC	
ISSUE DATE DESCRIPTION	PROJECT NUMBER	10215320

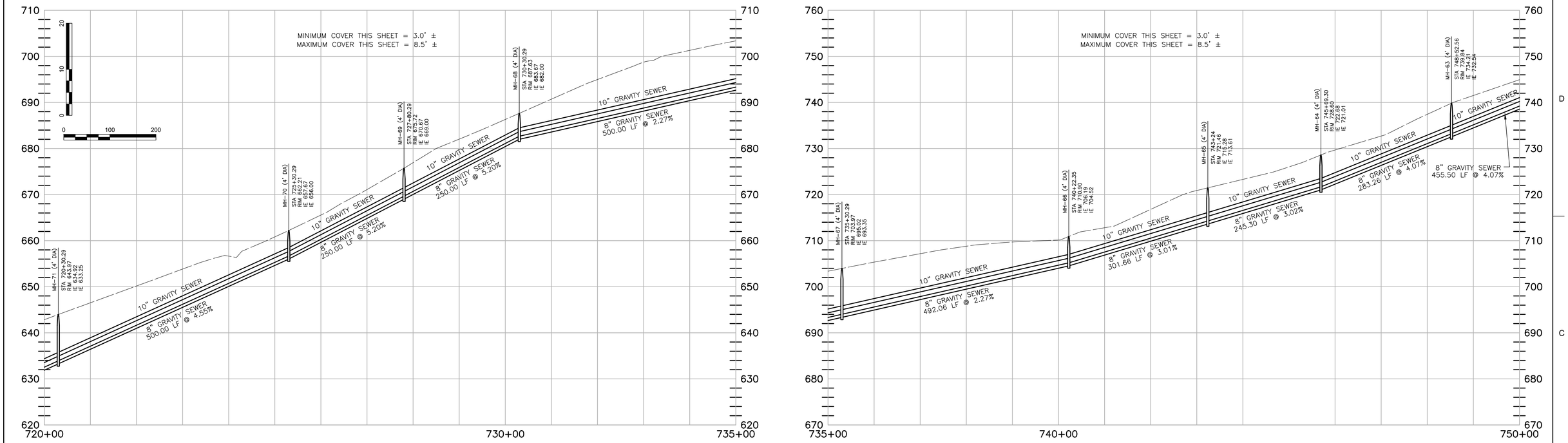
PARADISE SEWER PROJECT
STA. 690+00 TO STA. 720+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 24



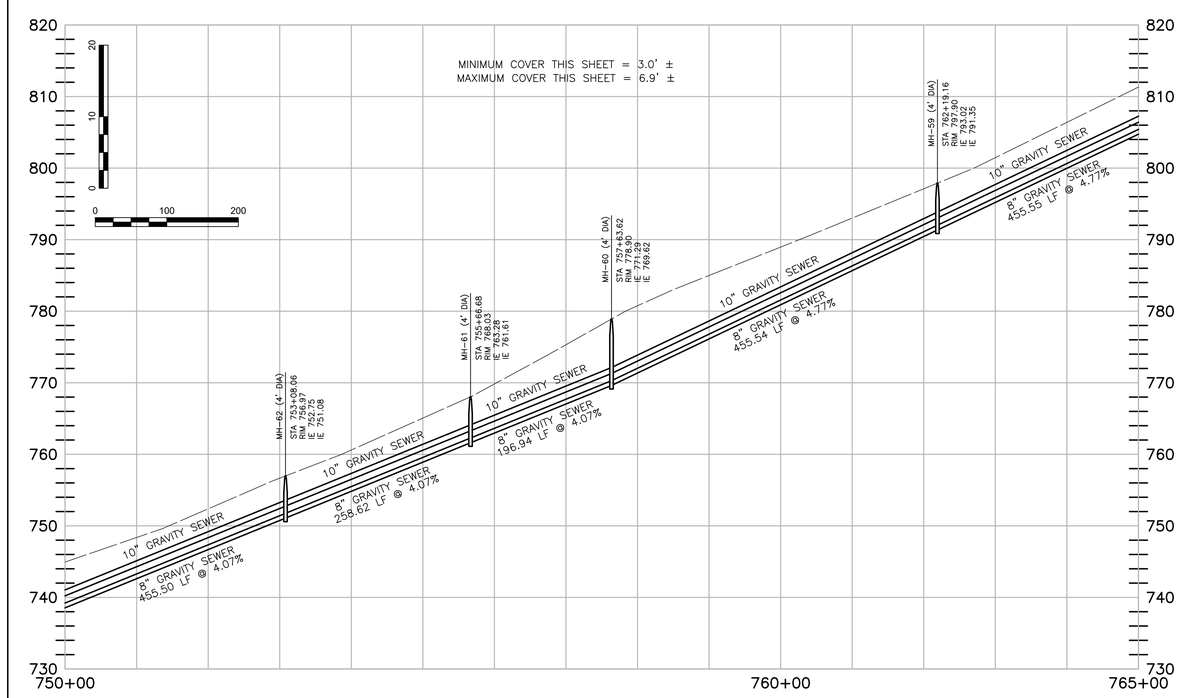
ISSUE	DATE	DESCRIPTION

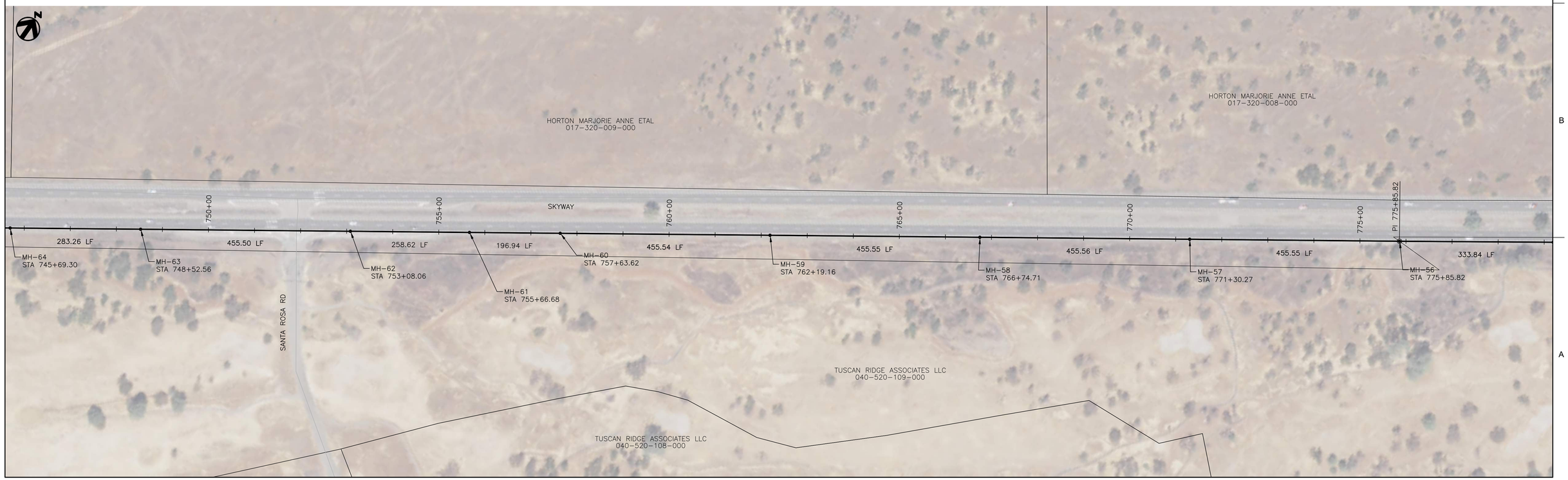
PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 720+00 TO STA. 750+00
PRELIMINARY - CONCEPTUAL ONLY

FILENAME: Sheet Files.dwg
SCALE: 1" = 100' H' 1" = 10' V

SHEET 25





ISSUE	DATE	DESCRIPTION

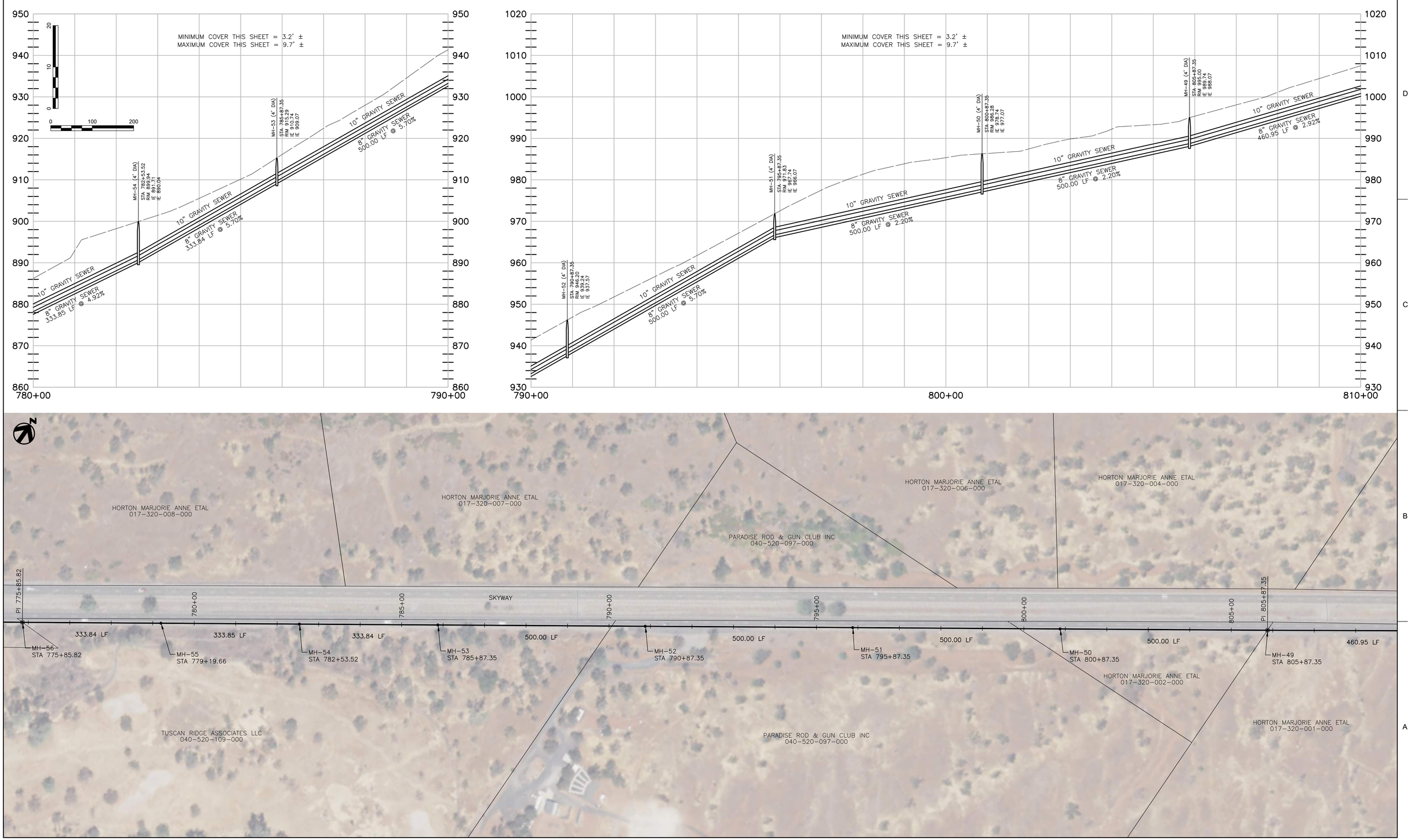
PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 750+00 TO STA. 780+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V

SHEET 26



ISSUE	DATE	DESCRIPTION

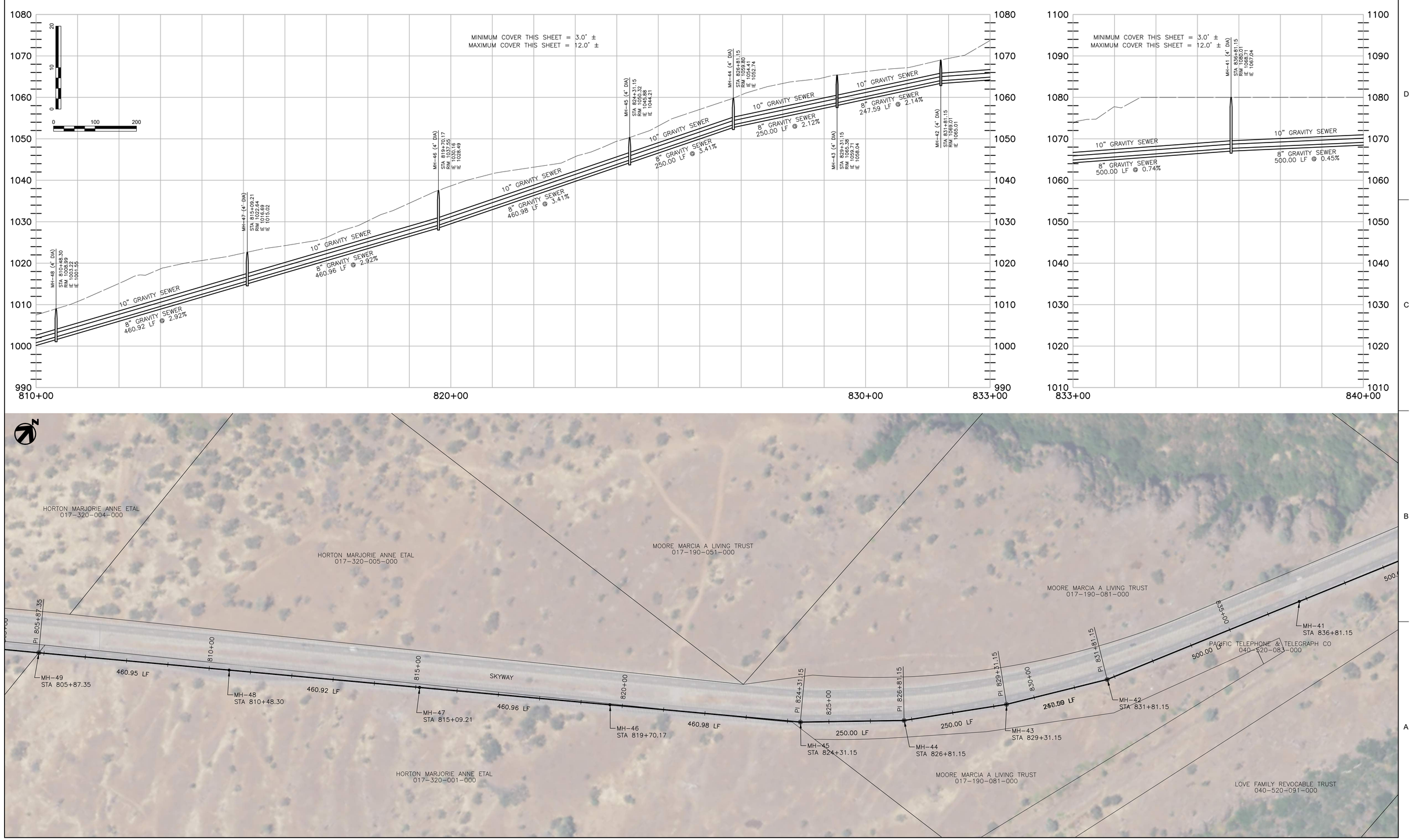
PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 780+00 TO STA. 810+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V

SHEET 27



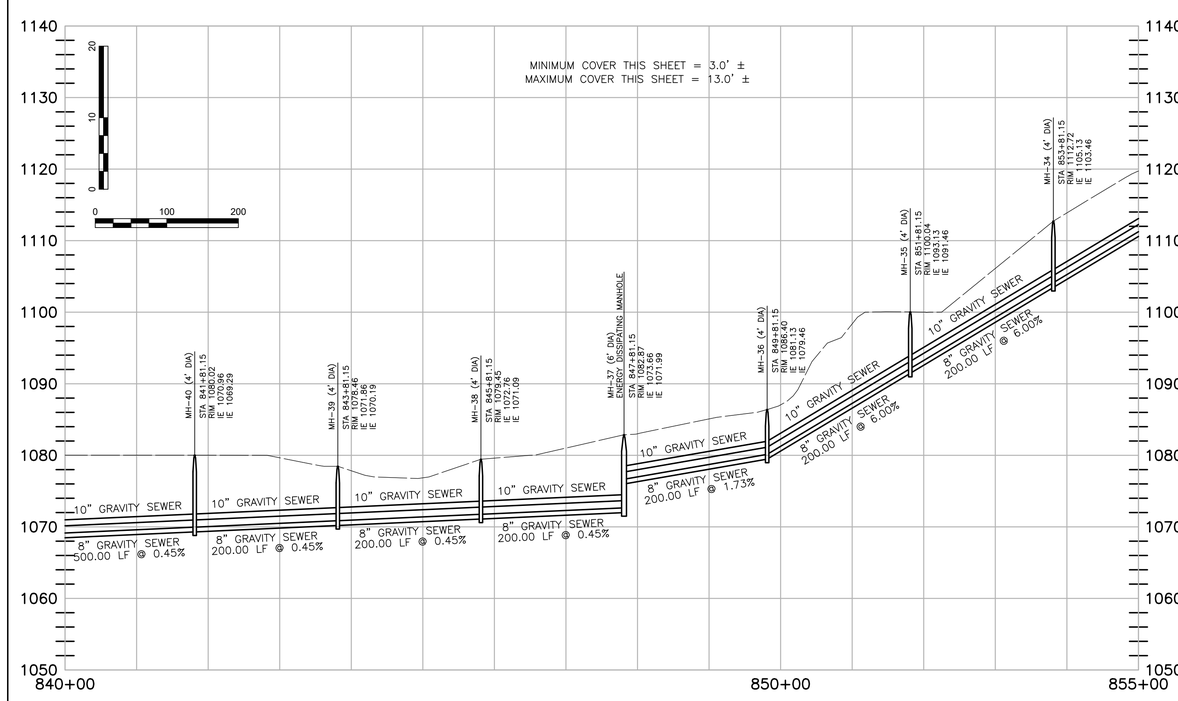
	PROJECT MANAGER	
	DESIGNED BY	
	DRAWN BY	WMG/KTW
	QA / QC	
ISSUE DATE DESCRIPTION	PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 810+00 TO STA. 840+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME Sheet Files.dwg
SCALE 1" = 100' H' 1" = 10' V

SHEET 28



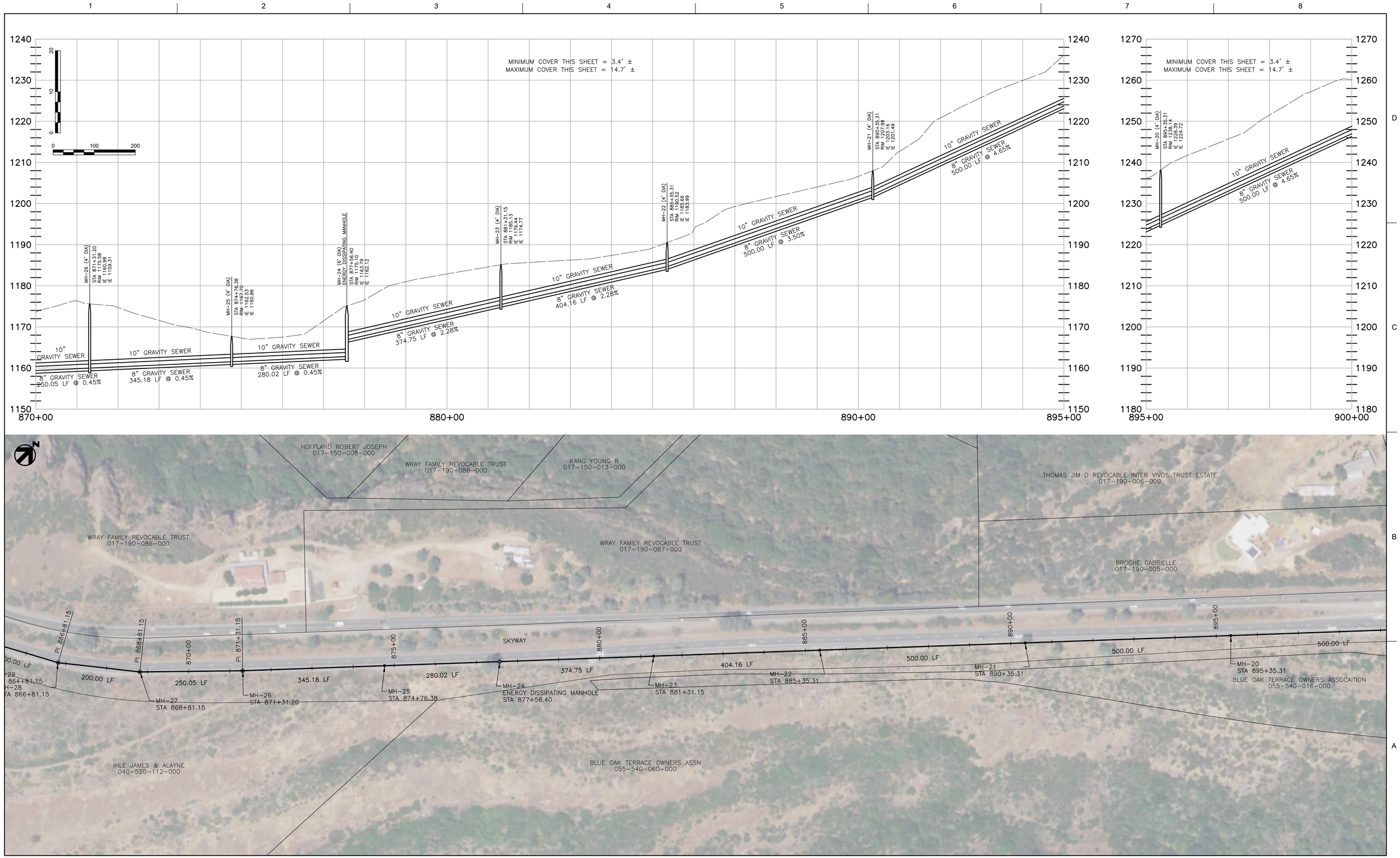
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 840+00 TO STA. 870+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V
SHEET	29



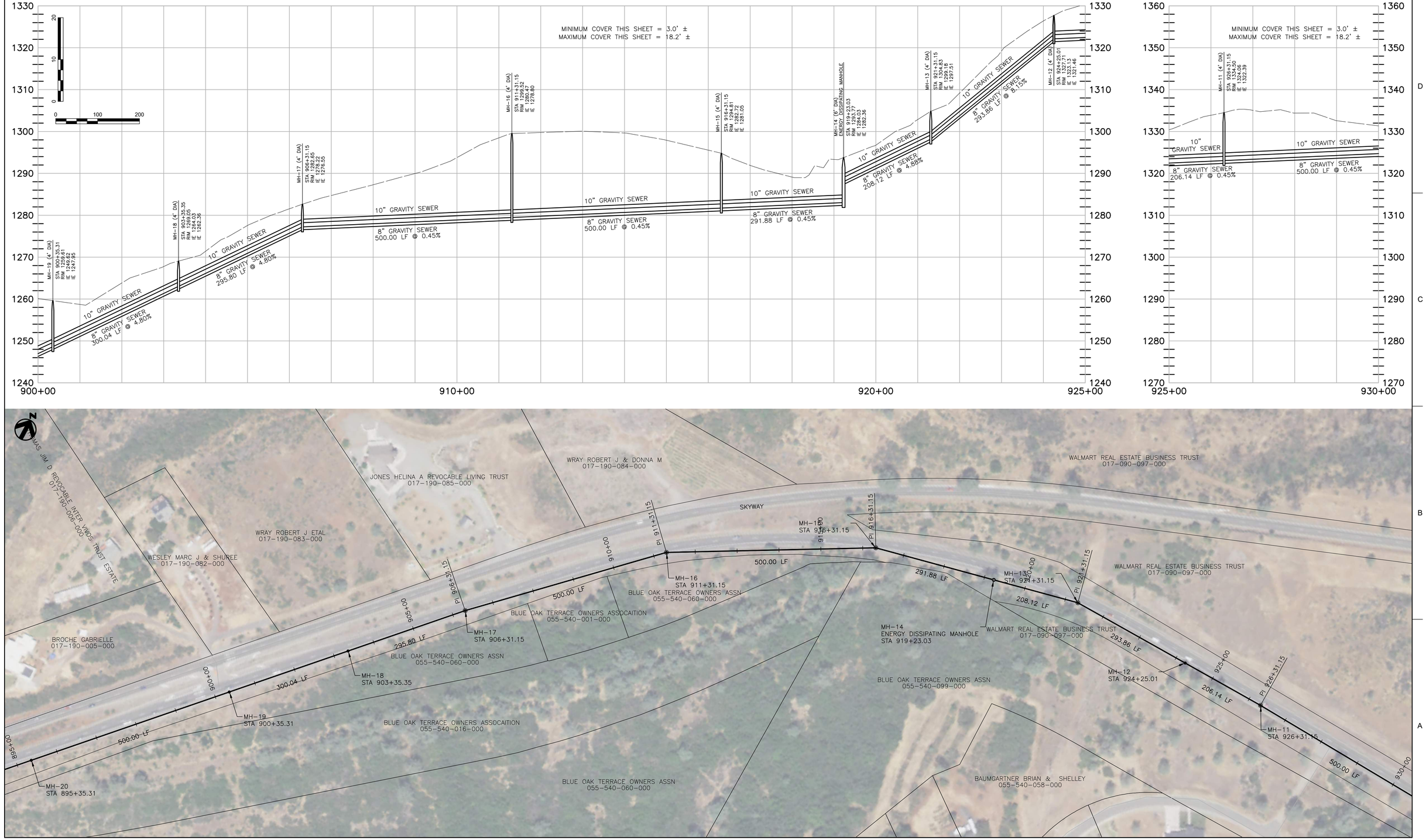
ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
STA. 870+00 TO STA. 900+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME	Sheet Files.dwg
SCALE	1" = 100' H' 1" = 10' V
SHEET	30



ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

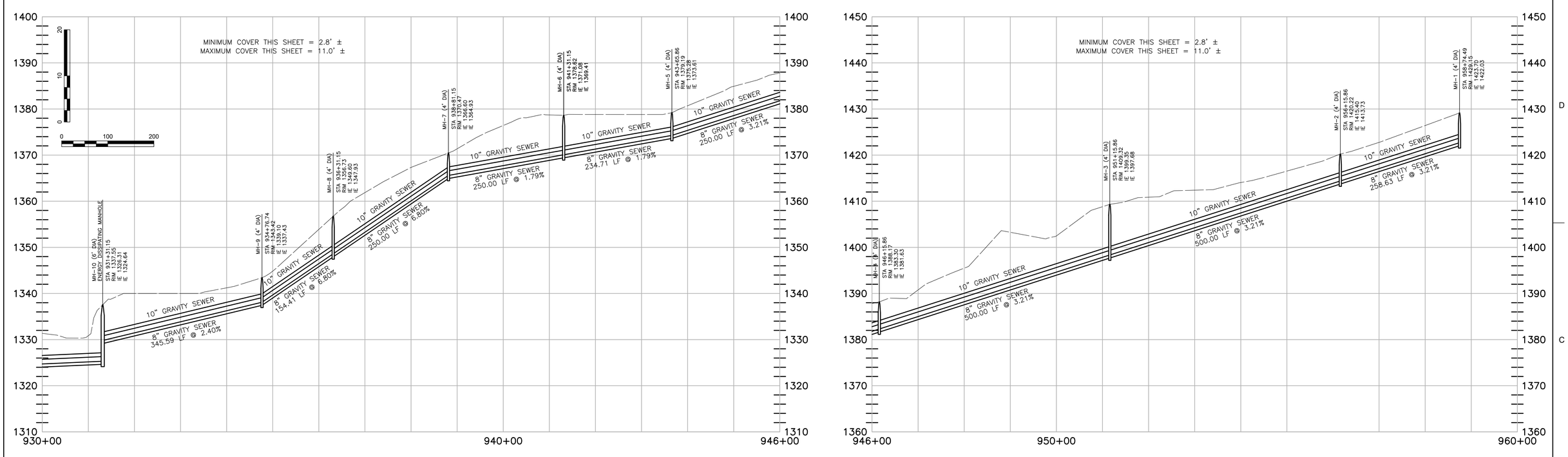
PARADISE SEWER PROJECT
STA. 900+00 TO STA. 930+00
PRELIMINARY - CONCEPTUAL ONLY

0 100 200

FILENAME Sheet Files.dwg

SCALE 1" = 100' H' 1" = 10' V

SHEET 31



	PROJECT MANAGER	
	DESIGNED BY	
	DRAWN BY	WMG/KTW
	QA / QC	
ISSUE DATE DESCRIPTION	PROJECT NUMBER	10215320

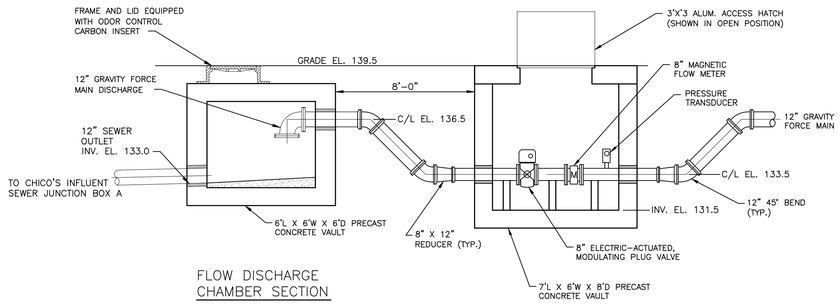
PARADISE SEWER PROJECT
STA. 930+00 TO STA. 960+00
PRELIMINARY - CONCEPTUAL ONLY

FILENAME: Sheet Files.dwg
SCALE: 1" = 100' H; 1" = 10' V

SHEET 32

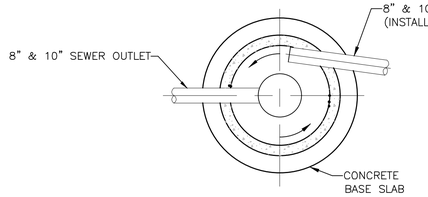
B

Details

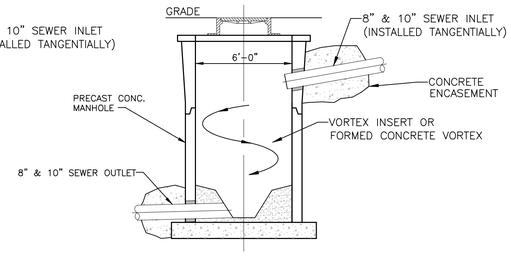


FLOW DISCHARGE CHAMBER SECTION

FLOW CONTROL AND METERING CHAMBER SECTION

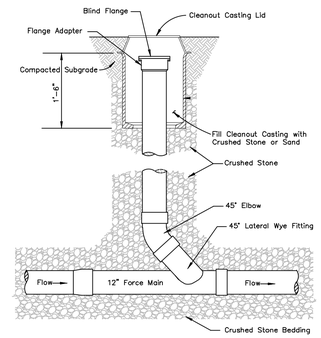


PLAN

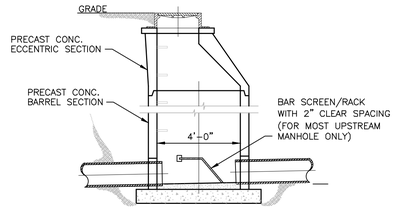


SECTION

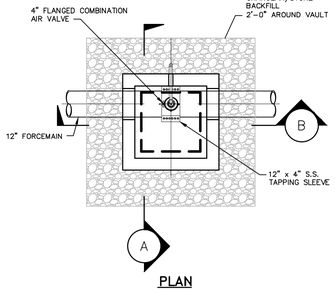
ENERGY DISSIPATION MANHOLE (VORTEX TYPE)



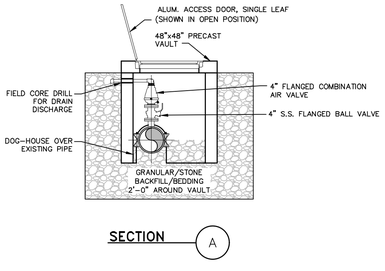
ONE-WAY PRESSURE TYPE CLEANOUT
N.T.S.



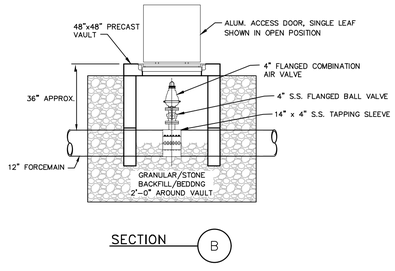
STANDARD MANHOLE DETAIL



PLAN

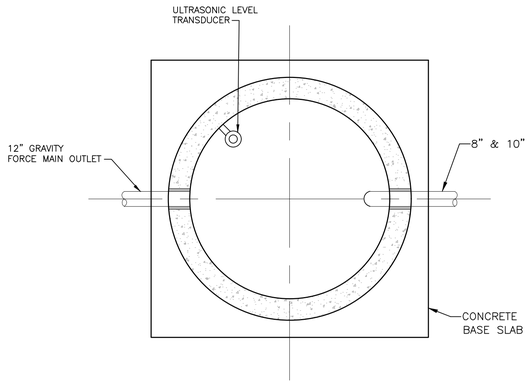


SECTION A

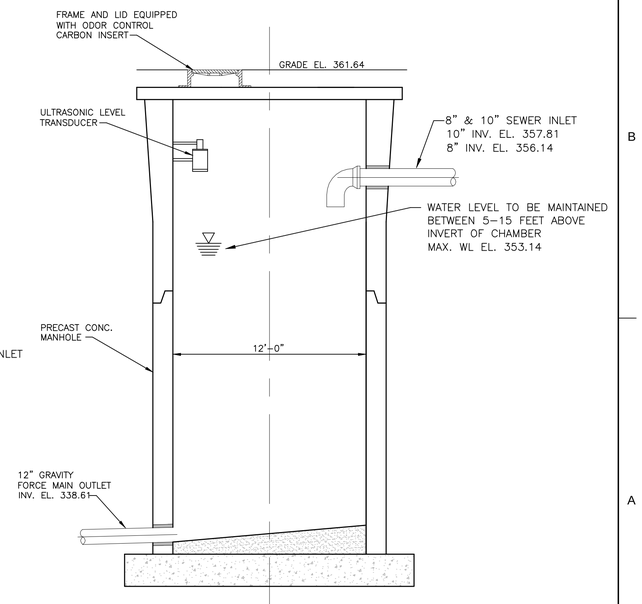


SECTION B

AIR RELEASE VALVE VAULT DETAIL



PLAN



SECTION

TRANSITION CHAMBER

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	WMG/KTW
QA / QC	
PROJECT NUMBER	10215320

PARADISE SEWER PROJECT
DETAILS
PRELIMINARY - CONCEPTUAL ONLY

0 1' 2' 3' 4' 8'

FILENAME	Sheet Files.dwg
SCALE	1/4" = 1'-0"
SHEET	33