Draft Environmental Impact Statement

Infrastructure Improvements at the Yap International Airport and the Yap Seaport

Yap State, Federated States of Micronesia

ID# EISX-007-USN-1775813621

APRIL 2026

Appendix D
Airport Stormwater Protection Report (Nov 2025)



FY26 YAAD229010 Runway Extension
Yap, Federated States of Micronesia (FSM)

Contract No. N62742-17-D-0003
A/E Task Order No.: N62742-22-F0338
eProject Work Order No. 1719021

FY26 YAAD229020 Aircraft Parking Apron and Taxiway
Yap, Federated States of Micronesia (FSM)

Contract No. N62742-20-D-0002
A/E Task Order No.: N62742-21-F0314
eProject Work Order No. 1687159

Includes project scope for the following:
Contract Nos. N62742-20-D-0002 and N62742-17-D-0003
A/E Task Order Nos.: N62742-23-F0331 and N62742-22-F0331
eProject Work Order Nos. 1708905 and 1719022

Stormwater Protection Report

04 November 2025
Pre-Final Submittal

Naval Facilities Engineering Command Pacific
258 Makalapa Drive, Suite 100
Joint Base Pearl Harbor-Hickam, Hawaii 96860



Project Summary

This document is the Stormwater Protection Report for the design of Fiscal Year 2026 (FY26) YAAD229010 Runway Extension and FY26 YAAD229020 Aircraft Parking Apron and Taxiway at Yap International Airport, Federated States of Micronesia (FSM). The purpose of the Runway Extension project is to construct a runway extension that provides a total paved runway length of 9,100 feet with a minimum of 8,000 feet useable in either direction at the Yap International Airport. The purpose of the Aircraft Parking Apron and Taxiway project is to provide a parking apron for five modified commercial aircraft and to construct a full parallel taxiway to support the extended runway and any associated improvements of existing airfield infrastructure, as required.

The Yap International Airport is capable of being an important divert location for aircraft transiting the Indo-Pacific area; however, the current runway is too short to adequately support military aircraft operations and lacks other critical required facilities such as aircraft arresting systems capabilities. The Runway Extension project provides additional runway pavement with installation of aircraft arresting system foundations and all other requirements to support the future extended runway operations including airfield lighting, pavement markings, signage, shoulders, stormwater control, utility connections, airport fence extensions, and all necessary supporting facilities.

The purpose of the Aircraft Parking Apron and Taxiway projects are to complete the design of a transient aircraft parking apron, new full-length parallel taxiway, connector taxiways to the runway, taxiway shoulders, site grading, fire hydrants, water tank and Water Pump House, taxiway edge lighting, and signage. This project also includes the permanent relocation of an existing public roadway, including new asphalt access road, repaving existing roads, a gate for flight line access, and supporting facilities as needed around the Yap International Airport, FSM.

The overall site covers approximately 530 acres, 375 acres of which will be disturbed during construction. The general grading concept is to cut material along the north side of the runway to construct the new taxiway and apron, and to place suitable cut material as fill along the south side of the runway. Finished slopes are generally 3H:1V, with some steeper portions. All slopes 3H:1V and steeper will be protected with erosion control blanket. All areas disturbed other than paved and hard surfaced areas will be seeded per the Specifications. Paved and roof (impervious) surfaces cover approximately 55 acres, and new paving will comprise 40 additional acres of impervious surface, the majority of which will pass through five new stormwater detention ponds. All site drainage is generally to the south-southeast, where it is picked up in several watercourses leading ultimately to the Pacific Ocean, which is approximately one and one-quarter miles from the southern project perimeter.

Attachments

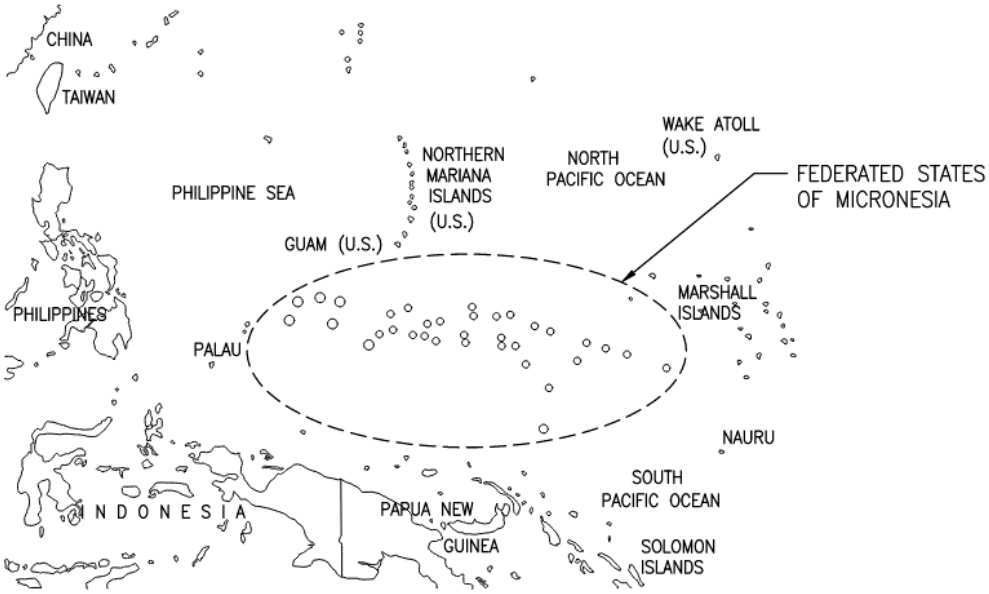
Appendix A. Location and Vicinity Map

Appendix B. General Sheets and Site Grading Plans

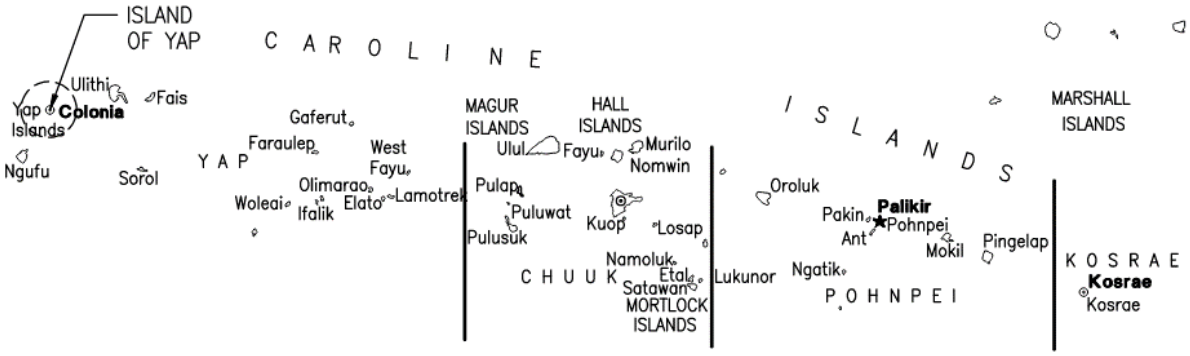
Appendix C. Storm Drainage Narrative

Appendix D. Storm Drainage Calculations

Appendix A. Location and Vicinity Map

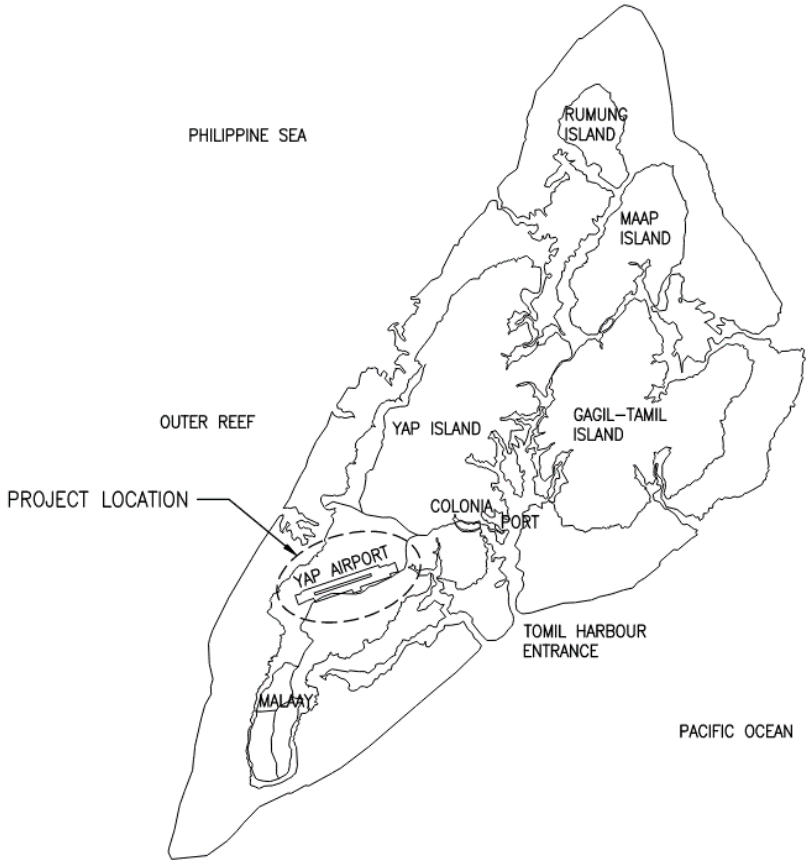


SOUTH PACIFIC OCEAN



FEDERATED STATES OF MICRONESIA

LOCATION MAP



ISLAND OF YAP

VICINITY MAP

Appendix B. General Sheets and Site Grading Plans

Appendix B.1
Existing Topography Plan



A EXISTING SITE TOPOGRAPHY
SCALE: 1:400

GRAPHIC SCALE
0 400 800
SCALE: 1:400

NORTH ARROW
TRUE N

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Jacobs
JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102
A/E Contract No. N62742-17-D-0003
A/E Task Order No. N62742-22F-0338
JEG: WFX43623
A/E INFO

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA HAWAII
YAP INTERNATIONAL AIRPORT, FSM
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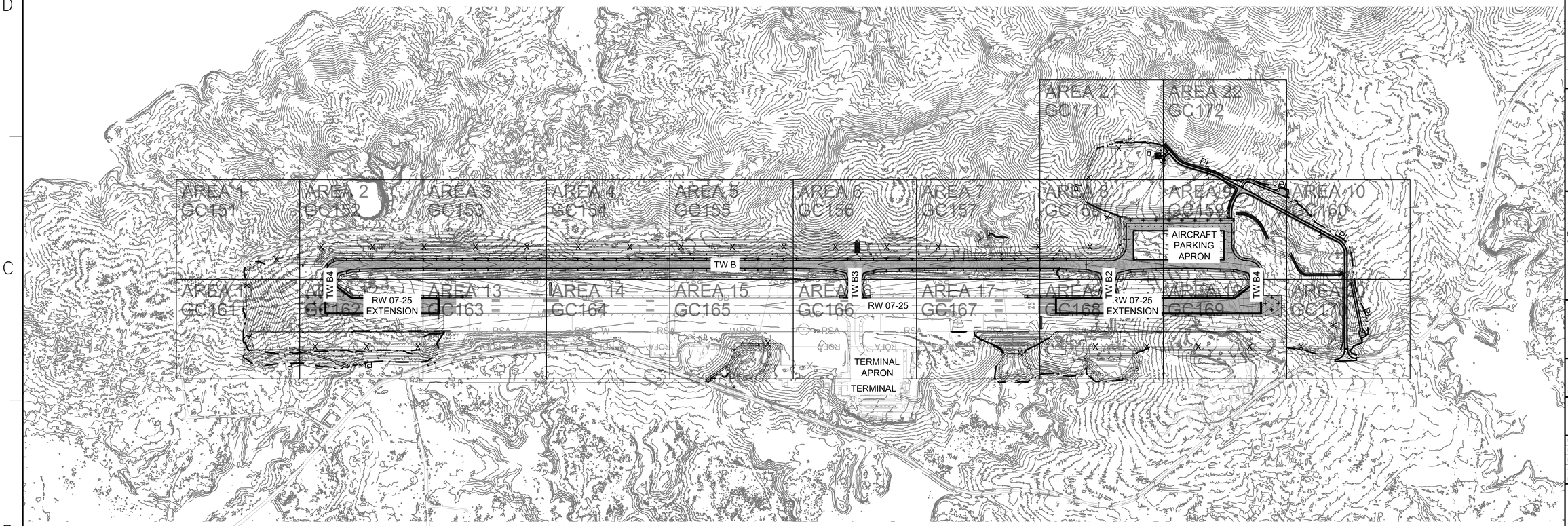
FY25/FY26 MCAF/MCON PROJECTS
EXISTING SITE TOPOGRAPHY

SCALE: AS SHOWN

EX-1

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PLOTTED: 08/22/2024 1:17pm
USER: KITZMIMA

Appendix B.2
Erosion and Sediment Control Plan



A1 OVERALL EROSION CONTROL PLAN
SCALE: 1"=500'

GRAPHIC SCALE

0 500' 1000'

SCALE: 1"=500'

NORTH ARROW

TRUE N

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DOUGLAS PRESTON STEWART

Name

CO 29899 NOV 4, 2025

Registration Number # Date

SEAL

Jacobs / BURNS MCDONNELL

1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034306115

A/E INITIALS

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

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DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

OVERALL EROSION CONTROL PLAN

SCALE: AS SHOWN

EPROJECT NO.: 1687159; 1719021

CONSTR. CONTR. NO.
-

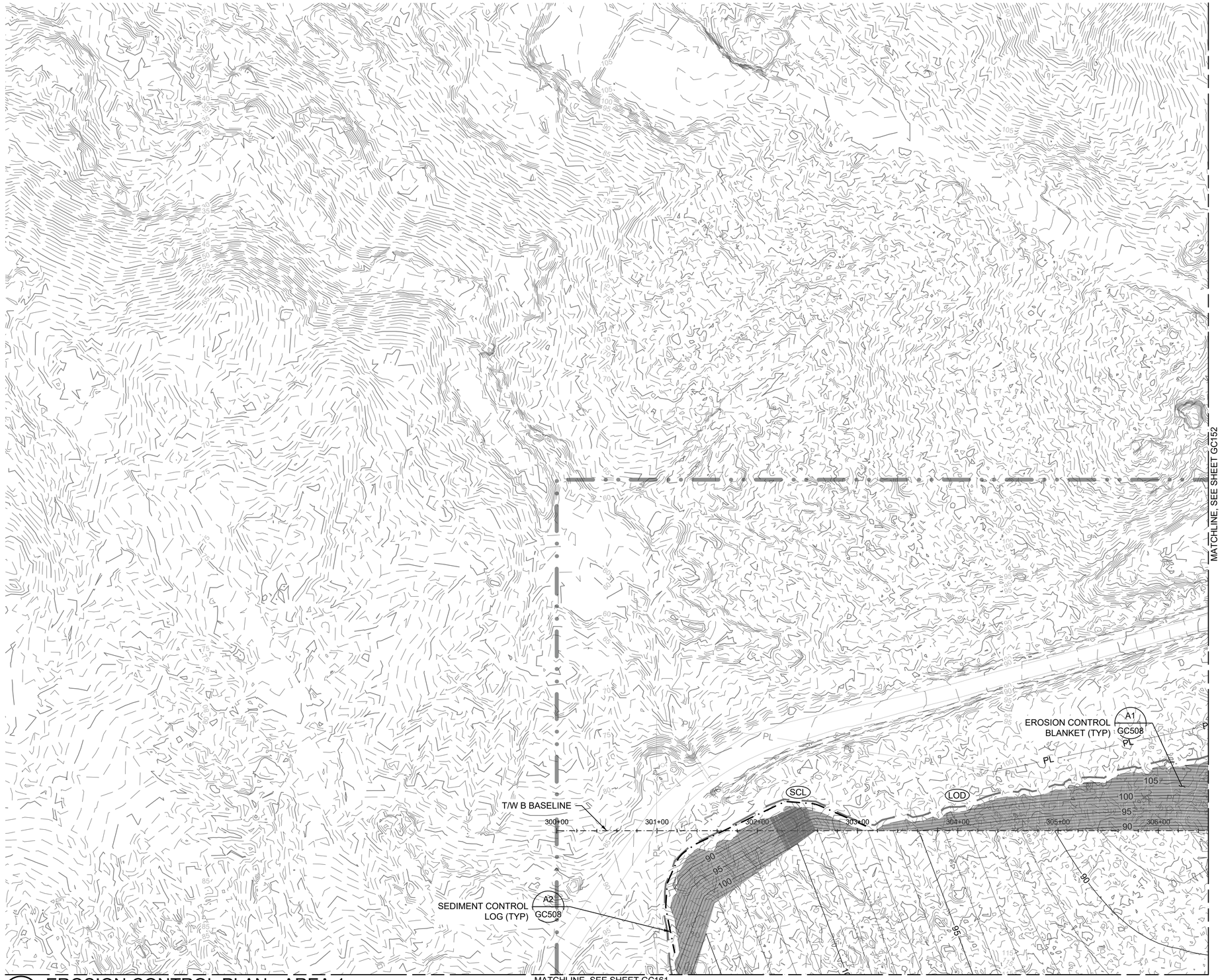
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USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 1
SCALE: 1"=50'

GENERAL SHEET NOTES

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C. MAINTAIN ALL EROSION AND SEDIMENTATION CONTROLS UNTIL FINAL VEGETATION HAS BEEN ESTABLISHED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SEDIMENTATION IS NO LONGER A CONCERN.

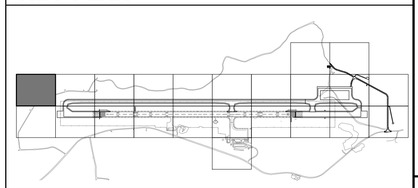
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- 90 MAJOR CONTOUR (5' INTERVAL)
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- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

SYM	DESCRIPTION	DATE

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ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: 034308115
A/E INFO

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DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
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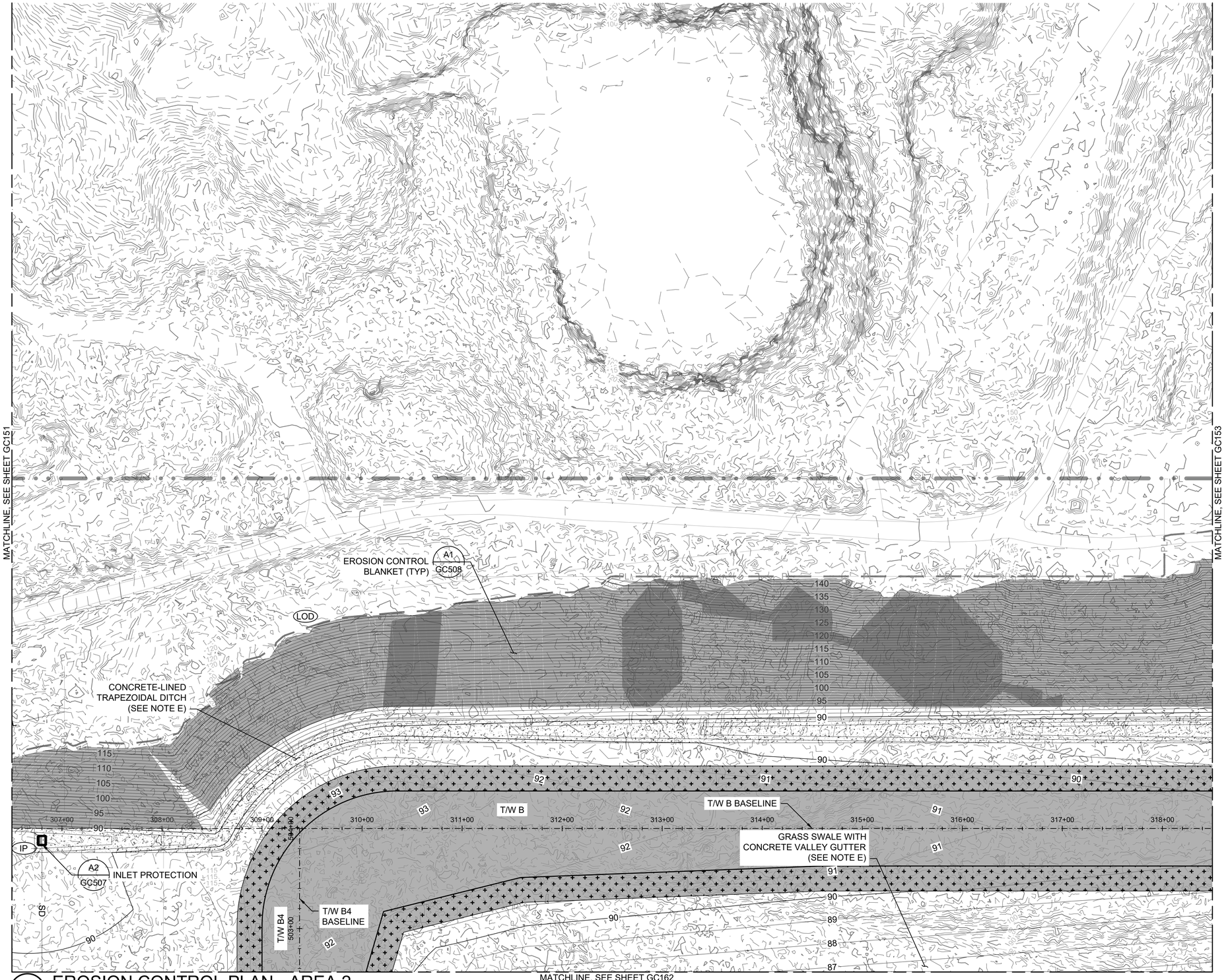
EROSION CONTROL PLAN - AREA 1

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
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A1 EROSION CONTROL PLAN - AREA 2
SCALE: 1"=50'

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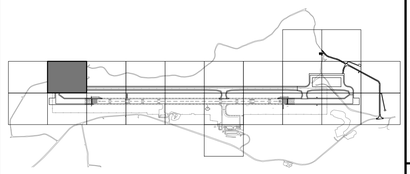
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LEGEND

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- MINOR CONTOUR (1' INTERVAL)
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- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

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JEG: E0A30615 A/E INFO

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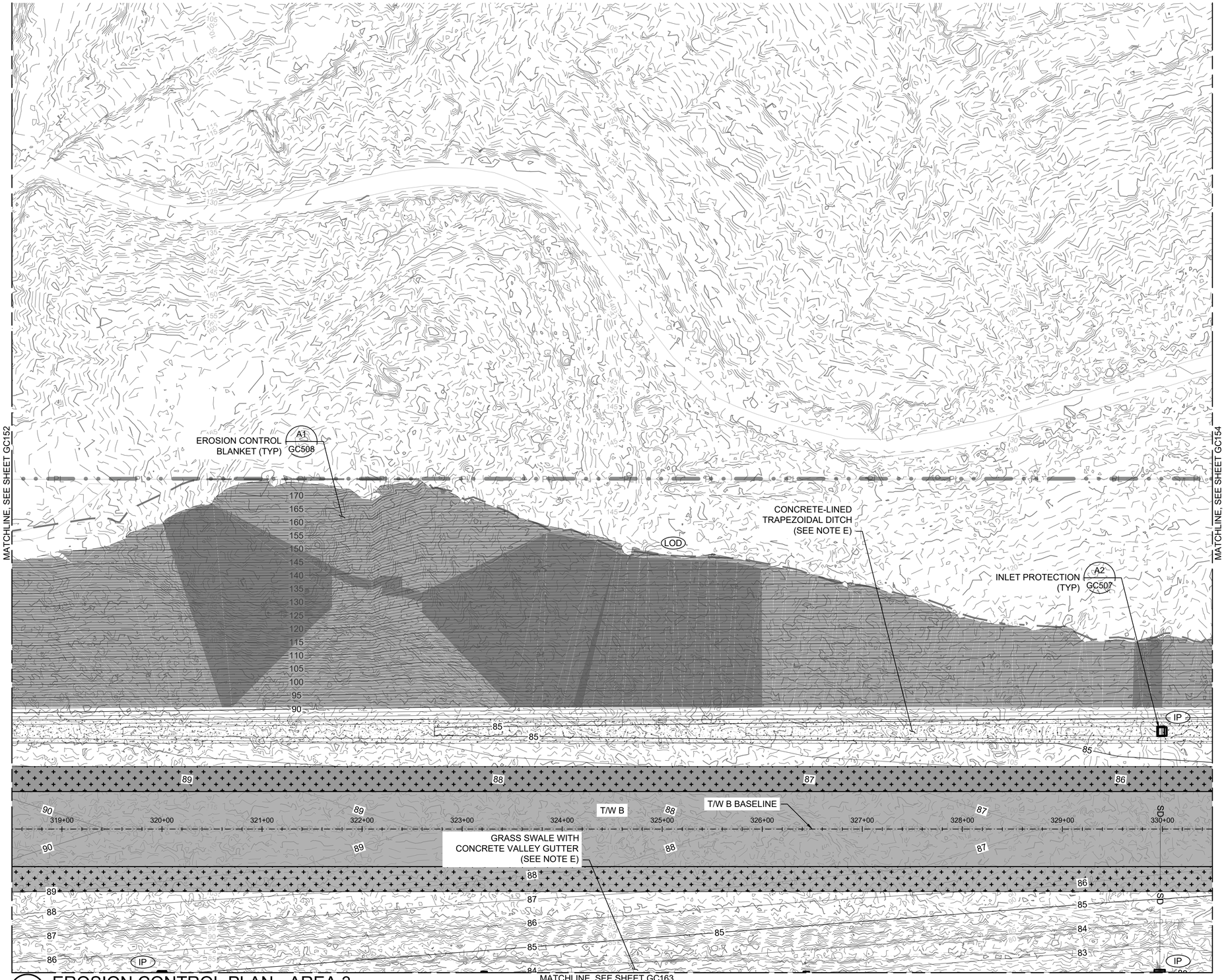
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PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
EROSION CONTROL PLAN - AREA 2

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
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USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 3
SCALE: 1"=50'

GENERAL SHEET NOTES

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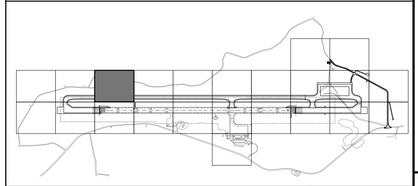
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- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW

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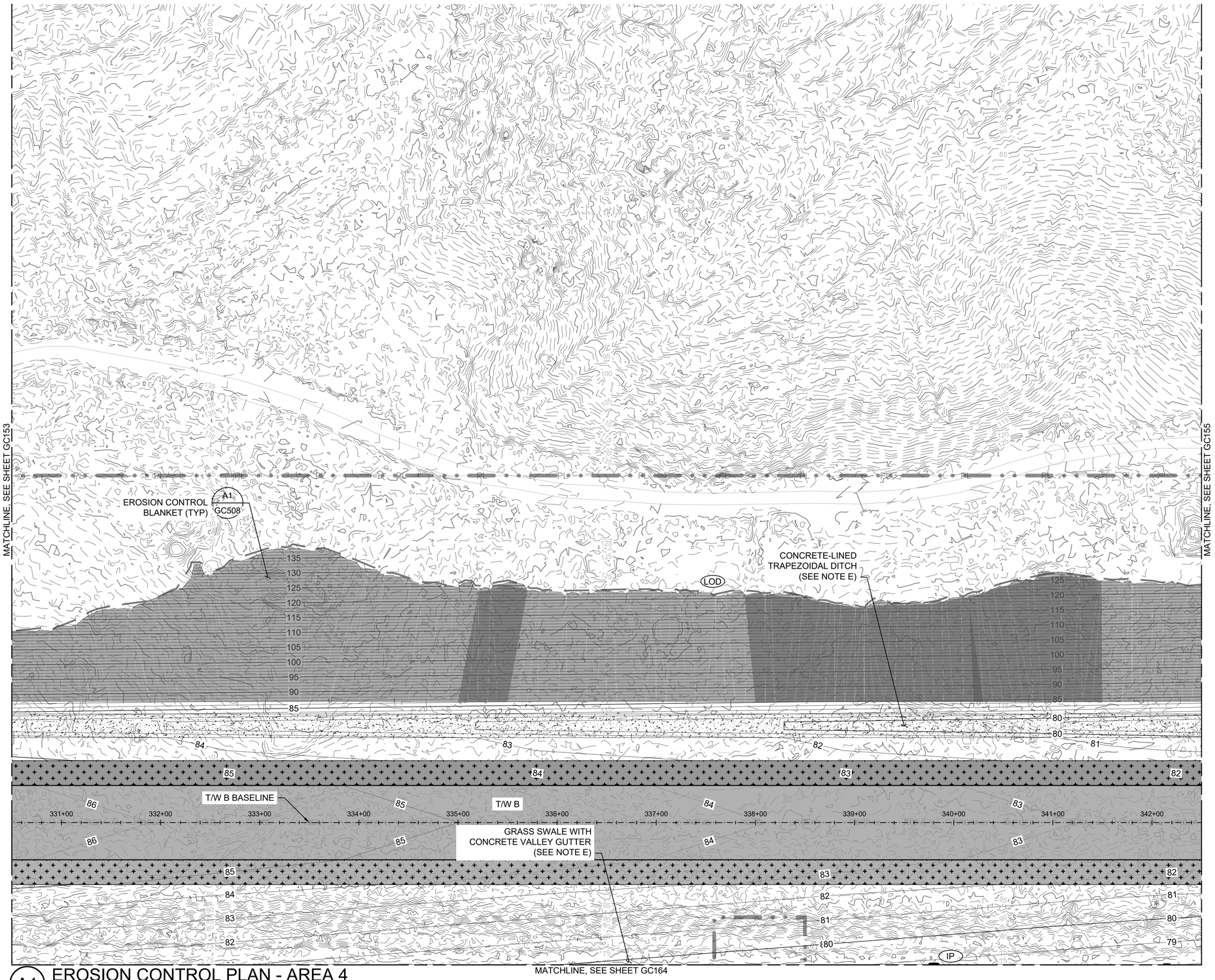
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
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EROSION CONTROL PLAN - AREA 3

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
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GC153

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LAYOUT NAME: GC153
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USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 4

SCALE: 1"=50'

GENERAL SHEET NOTES

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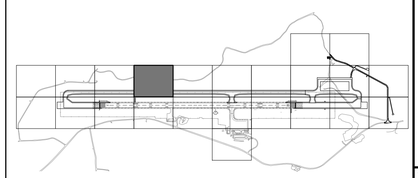
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- LOD LIMIT OF DISTURBANCE
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KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

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Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA09615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAUDRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

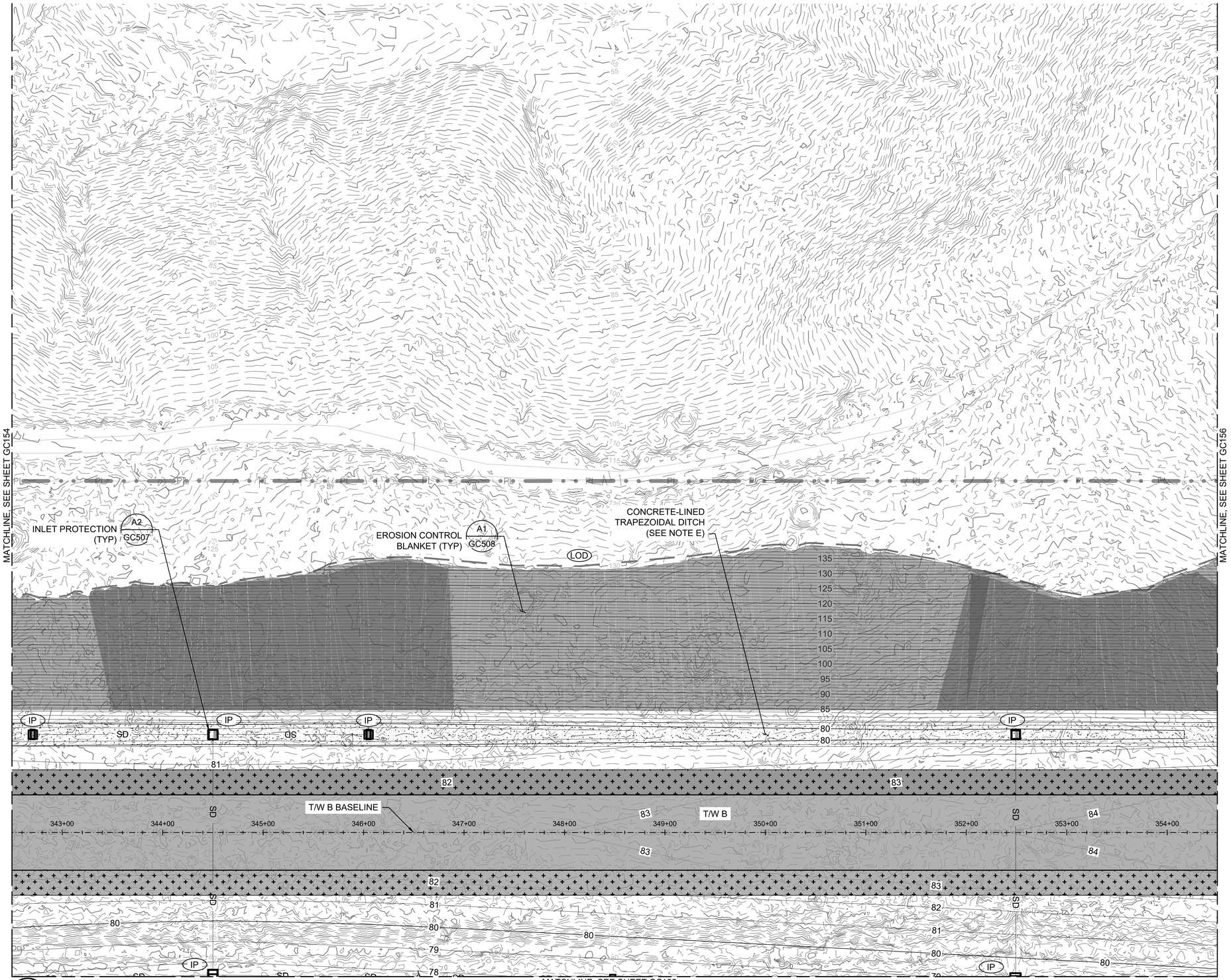
EROSION CONTROL PLAN - AREA 4

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.:
SHEET OF

GC154

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC154
PLOTTED: 10/29/2025 7:39:46 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 5
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

C. MAINTAIN ALL EROSION AND SEDIMENTATION CONTROLS UNTIL FINAL VEGETATION HAS BEEN ESTABLISHED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SEDIMENTATION IS NO LONGER A CONCERN.

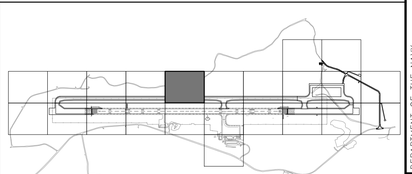
D. ALL DISTURBED AREAS NOT TO BE PAVED OR OTHERWISED HARD-SURFACED SHALL BE SEEDED WITH TEMPORARY AND PERMANENT MIXES IN ACCORDANCE WITH THE SPECIFICATIONS.

E. REFER TO SHEET GI002 FOR GENERAL EROSION AND SEDIMENTATION CONTROL NOTES. REFER TO SHEETS GC507 AND GC508 FOR EROSION AND SEDIMENTATION CONTROL DETAILS. REFER TO CG SERIES FOR DITCH AND SWALE INFO

LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP INLET PROTECTION
- RRB REINFORCED ROCK BERM
- SR SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
- CONCRETE-LINED DITCH / SWALE (TRAPEZOIDAL OR VALLEY GUTTER)
- EROSION CONTROL BLANKET (3:1 AND STEEPER SLOPES) (STRAW/COCONUT)
- SCL 12" SEDIMENT LOGS FOR SLOPE PROTECTION
- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

DATE	SYM	DESCRIPTION

NAVFAC

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ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034306115 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/CM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PACIFIC
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
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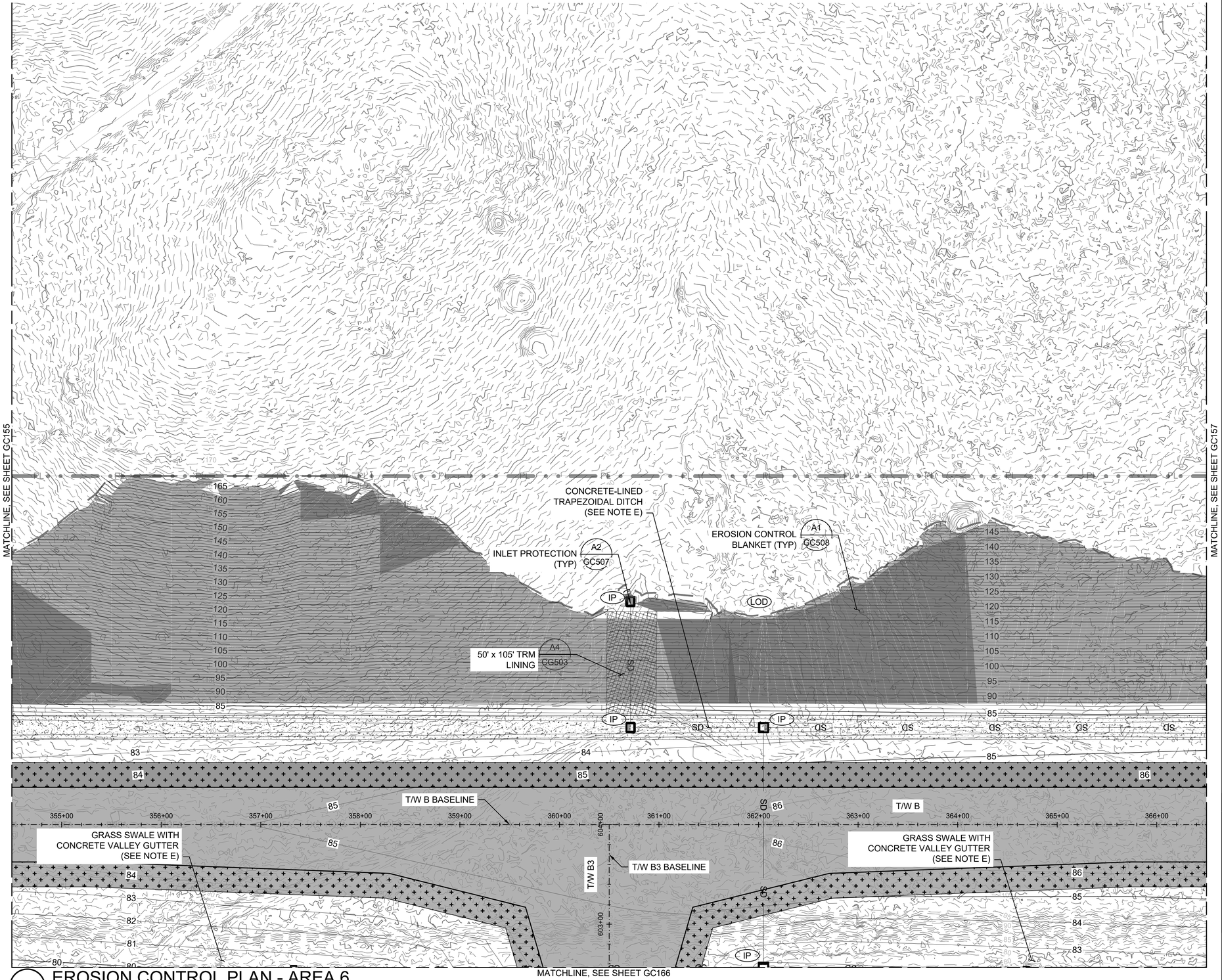
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 5

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.
-
NAVFAC DRAWING NO.
SHEET OF
GC155

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC155
PLOTTED: 10/29/2025 7:40:24 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 6
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

C. MAINTAIN ALL EROSION AND SEDIMENTATION CONTROLS UNTIL FINAL VEGETATION HAS BEEN ESTABLISHED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SEDIMENTATION IS NO LONGER A CONCERN.

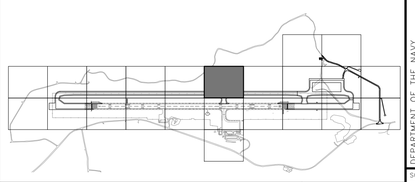
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E. REFER TO SHEET GI002 FOR GENERAL EROSION AND SEDIMENTATION CONTROL NOTES. REFER TO SHEETS GC507 AND GC508 FOR EROSION AND SEDIMENTATION CONTROL DETAILS. REFER TO CG SERIES FOR DITCH AND SWALE INFO

LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP INLET PROTECTION
- RRB REINFORCED ROCK BERM
- SR SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
- CONCRETE-LINED DITCH / SWALE (TRAPEZOIDAL OR VALLEY GUTTER)
- EROSION CONTROL BLANKET (3:1 AND STEEPER SLOPES) (STRAW/COCONUT)
- SCL 12" SEDIMENT LOGS FOR SLOPE PROTECTION
- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

SYM	DESCRIPTION	DATE

NAVFAC

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Jacobs / BURNS MCDONNELL
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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034306115 A/E INFO

APPROVED

CO COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

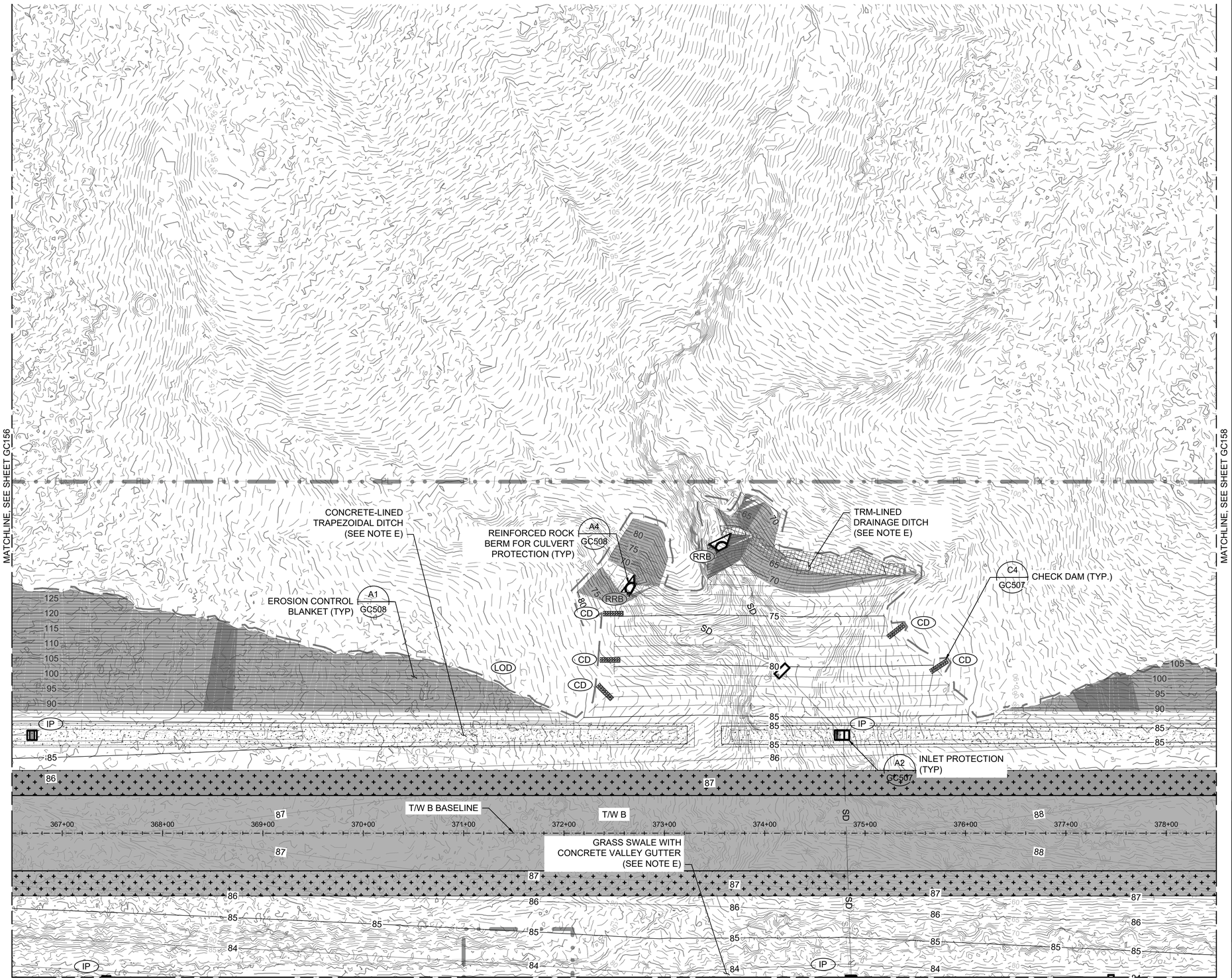
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PACIFIC
NAVFAC PACIFIC ~ NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC, MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
EROSION CONTROL PLAN - AREA 6

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
GC156

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p:\010_p\020_gc151_gc172.dwg
LAYOUT NAME: GC156
PLOTTED: 10/29/2025 7:41:01 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 7
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

C. MAINTAIN ALL EROSION AND SEDIMENTATION CONTROLS UNTIL FINAL VEGETATION HAS BEEN ESTABLISHED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SEDIMENTATION IS NO LONGER A CONCERN.

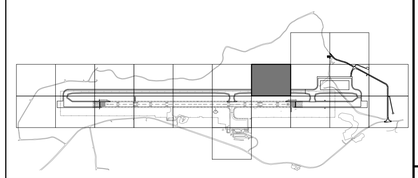
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LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP INLET PROTECTION
- RRB REINFORCED ROCK BERM
- SR SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
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- SCL 12" SEDIMENT LOGS FOR SLOPE PROTECTION
- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

SYM	DESCRIPTION	DATE

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA09615
A/E INFO

APPROVED:
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ACTIVITY
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DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
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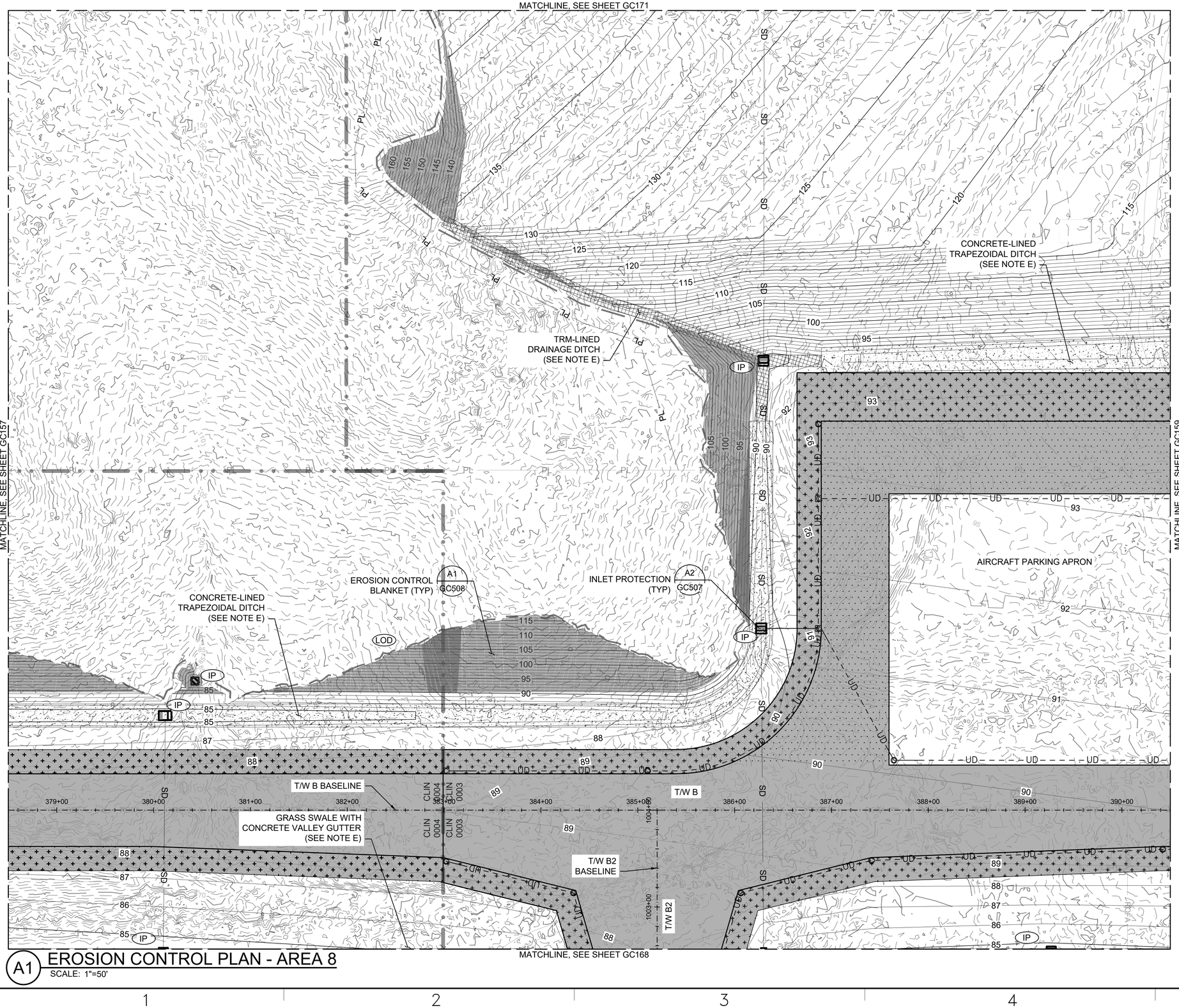
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 7

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
GC157

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC157
PLOTTED: 10/29/2025 7:41:39 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 8
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

C. MAINTAIN ALL EROSION AND SEDIMENTATION CONTROLS UNTIL FINAL VEGETATION HAS BEEN ESTABLISHED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SEDIMENTATION IS NO LONGER A CONCERN.

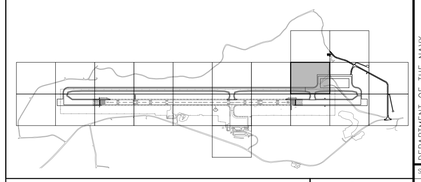
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LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP INLET PROTECTION
- RRB REINFORCED ROCK BERM
- SR SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
- CONCRETE-LINED DITCH / SWALE (TRAPEZOIDAL OR VALLEY GUTTER)
- EROSION CONTROL BLANKET (3:1 AND STEEPER SLOPES) (STRAW/COCONUT)
- SCL 12" SEDIMENT LOGS FOR SLOPE PROTECTION
- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

SYM	DESCRIPTION	DATE

NAVFAC

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A/E Task Order No. N62742-22F-0338
JEG: EIA00615
A/E INFO

APPROVED:
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PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVFAC PACIFIC
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC, MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 8

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
GC158

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p:\010_p\020_gc\51_gc172.dwg
LAYOUT NAME: GC158
PLOTTED: 10/29/2025 7:42:14 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 9

SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

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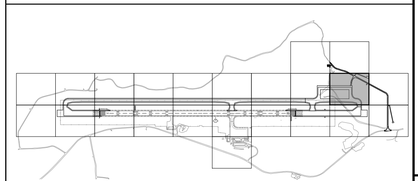
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LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
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- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NO.	DESCRIPTION	DATE

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JEG: 034306/15 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

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FIRE PROTECTION					JCC

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NAVFAC PACIFIC

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EROSION CONTROL PLAN - AREA 9

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET GC159 OF

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC159
PLOTTED: 10/29/2025 7:42:53 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 10
SCALE: 1"=50'

GENERAL SHEET NOTES

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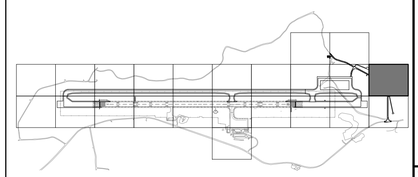
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LEGEND

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- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
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- RRB REINFORCED ROCK BERM
- SR SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
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- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NO.	DESCRIPTION	DATE
SYM		

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA09615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 10

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF

GC160

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC160
PLOTTED: 10/29/2025 7:43:28 PM
USER: Tyler, Ryan

MATCHLINE, SEE SHEET GC151

R/W 7-25 BASELINE

100+00 101+00 102+00 103+00 104+00 105+00 106+00

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

EROSION CONTROL BLANKET (TYP) A1 GC508

SEDIMENT CONTROL LOG (TYP) A2 GC508

LOD

SCL

PL

MATCHLINE, SEE SHEET GC162

GENERAL SHEET NOTES

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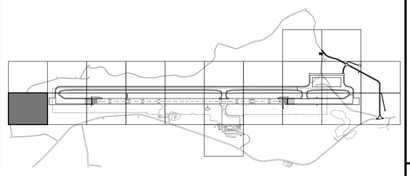
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- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

A1 EROSION CONTROL PLAN - AREA 11

SCALE: 1"=50'

DATE	SYM	DESCRIPTION

NAVFAC

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Jacobs / BURNS MCDONNELL

1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: DA40615 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 11

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF

GC161

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC161
PLOTTED: 10/29/2025 7:44:02 PM
USER: Tyler, Ryan

MATCHLINE, SEE SHEET GC152

MATCHLINE, SEE SHEET GC161

MATCHLINE, SEE SHEET GC163

CLIN 0002
CLIN 0004
CLIN 0002

T/W B4

T/W B4 BASELINE

R/W 7-25

R/W 7-25 BASELINE

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

IP — A2 GC507 — INLET PROTECTION

RRB

SCL

LOD

EROSION CONTROL BLANKET (TYP) — A1 GC508

OUTFALL 1

SEDIMENT CONTROL LOG (TYP) — A2 GC508

A1 EROSION CONTROL PLAN - AREA 12

SCALE: 1"=50'

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- RCE — ROCK CONSTRUCTION ENTRANCE
- LOD — LIMIT OF DISTURBANCE
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN

GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW — TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NO.	DESCRIPTION	DATE

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034306115 A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

WITNITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK
PM/DM			MAU/DRK
BRANCH MANAGER			SMK
CHIEF ENG			EAM
FIRE PROTECTION			JCC

DEPARTMENT OF THE NAVY
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MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 12

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
GC162

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC162
PLOTTED: 10/29/2025 7:44:42 PM
USER: Tyler, Ryan

MATCHLINE, SEE SHEET GC153

MATCHLINE, SEE SHEET GC162

MATCHLINE, SEE SHEET GC164

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

INLET PROTECTION (TYP) A2 GC507

R/W 7-25

R/W 7-25 BASELINE

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

EX. CONCRETE U-CHANNEL

EROSION CONTROL BLANKET (TYP) A1 GC508

ROCK CONSTRUCTION ENTRANCE C3 GC507

STABILIZED STAGING AREA "SSA" INCLUDES STOCKPILE PROTECTION "SP" AREAS C2 GC508 C1 GC508

OUTFALL 2

SEDIMENT CONTROL LOG (TYP) A2 GC508

EXISTING WATERCOURSES FROM OUTFALL 2 AND EXISTING CULVERTS THROUGH STAGING AREA TO REMAIN. PROTECT WATERCOURSES AGAINST SEDIMENT ENTERING FROM STAGING AREA. PROVIDE TEMPORARY STABILIZED CROSSING(S) AS NEEDED.

A1 EROSION CONTROL PLAN - AREA 13
SCALE: 1"=50'

GENERAL SHEET NOTES

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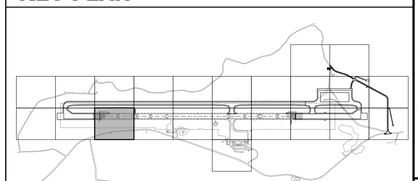
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- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

DATE | SYM | DESCRIPTION

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034308/15 A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

KEYNOTE

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PACIFIC
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 13

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
GC163

PRE-FINAL SUBMITTAL

FILE NAME: p:\010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC163
PLOTTED: 10/29/2025 7:45:17 PM
USER: Tyler, Ryan

MATCHLINE, SEE SHEET GC154

INLET PROTECTION (TYP) — A2 GC507 — IP

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

R/W 7-25

R/W 7-25 BASELINE

131+00 132+00 133+00 134+00 135+00 136+00 137+00 138+00 139+00 140+00 141+00 142+00

MATCHLINE, SEE SHEET GC163

MATCHLINE, SEE SHEET GC165

EX. CONCRETE U-CHANNEL

ROCK CONSTRUCTION ENTRANCE — C3 GC507 — RCE

LOD

C2 GC508 — STABILIZED STAGING AREA "SSA"

C1 GC508 — INCLUDES STOCKPILE PROTECTION AREAS "SP"

ARFF

SSA

SP

A1 EROSION CONTROL PLAN - AREA 14
SCALE: 1"=50'

GENERAL SHEET NOTES

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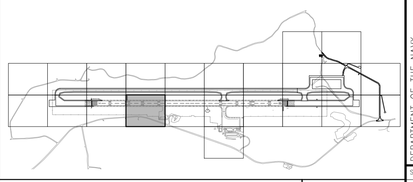
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- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW — TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

DATE	SYM	DESCRIPTION

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ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034306/15 — A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES: DPS	DRW: MAK	REV: VTO
PM/DM		MAI/DRK
BRANCH MANAGER		SMK
CHIEF ENG		EAM
FIRE PROTECTION		JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PACIFIC
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
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EROSION CONTROL PLAN - AREA 14

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
GC164

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC164
PLOTTED: 10/29/2025 7:45:53 PM
USER: Tyler, Ryan

MATCHLINE, SEE SHEET GC155

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

INLET PROTECTION (TYP) A2 GC507

R/W 7-25 BASELINE

R/W 7-25

143+00 144+00 145+00 146+00 147+00 148+00 149+00 150+00 151+00 152+00 153+00 154+00

MATCHLINE, SEE SHEET GC166

OUTFALL 3 DETENTION POND

OUTFALL 3

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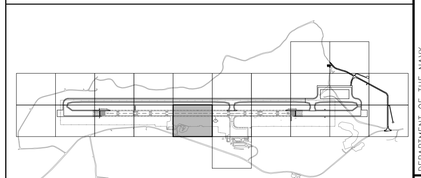
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- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

A1 EROSION CONTROL PLAN - AREA 15

SCALE: 1"=50'

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date

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Jacobs / BURNS MCDONNELL

1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034306115 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

KEYPOINT

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

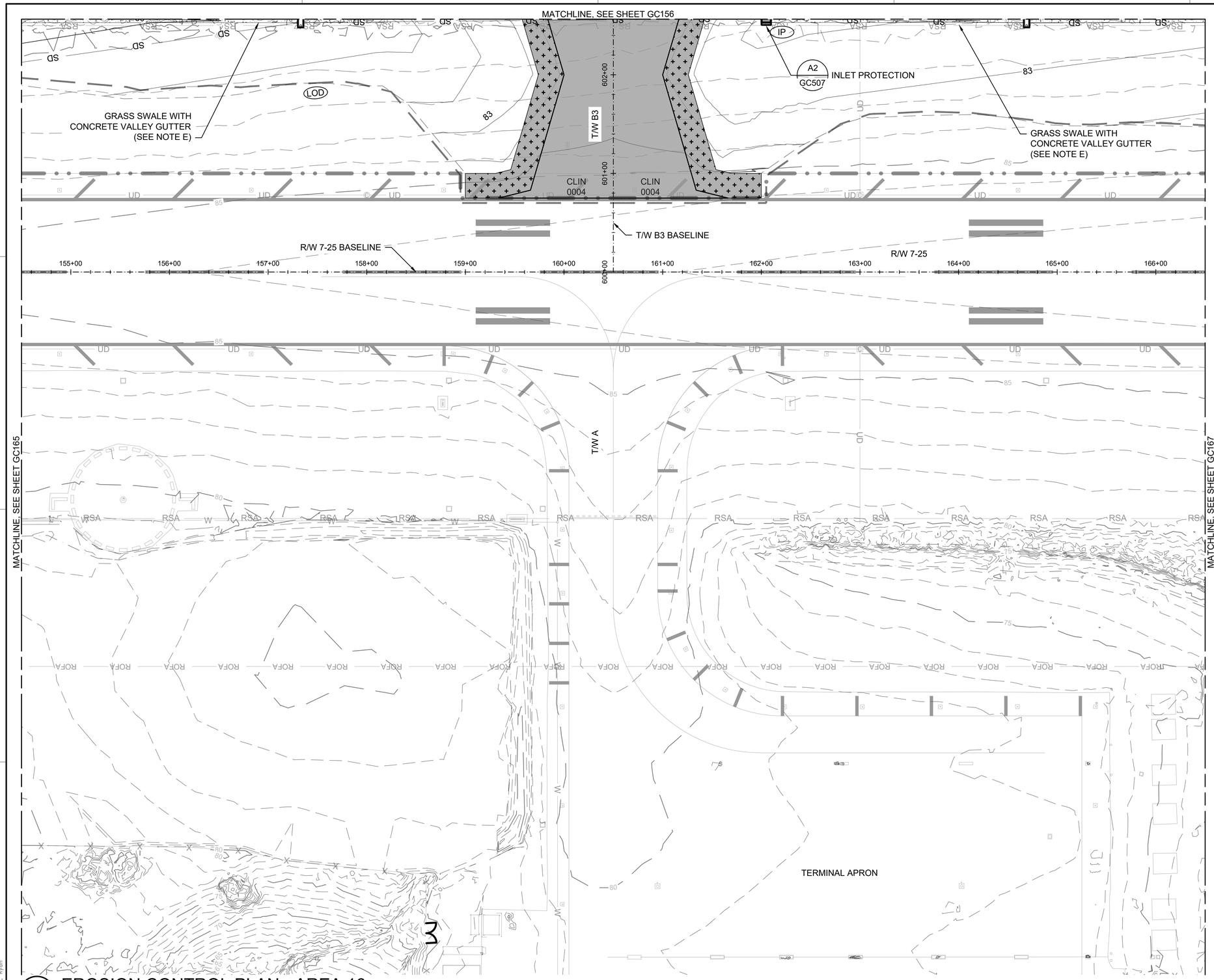
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 15

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
GC165

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC165
PLOTTED: 10/29/2025 7:46:28 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 16
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

C. MAINTAIN ALL EROSION AND SEDIMENTATION CONTROLS UNTIL FINAL VEGETATION HAS BEEN ESTABLISHED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SEDIMENTATION IS NO LONGER A CONCERN.

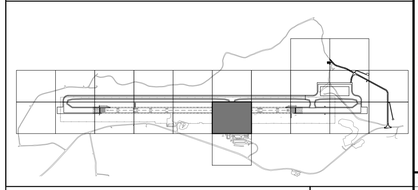
D. ALL DISTURBED AREAS NOT TO BE PAVED OR OTHERWISED HARD-SURFACED SHALL BE SEEDED WITH TEMPORARY AND PERMANENT MIXES IN ACCORDANCE WITH THE SPECIFICATIONS.

E. REFER TO SHEET GI002 FOR GENERAL EROSION AND SEDIMENTATION CONTROL NOTES. REFER TO SHEETS GC507 AND GC508 FOR EROSION AND SEDIMENTATION CONTROL DETAILS. REFER TO CG SERIES FOR DITCH AND SWALE INFO

LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP INLET PROTECTION
- RRB REINFORCED ROCK BERM
- SR SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
- CONCRETE-LINED DITCH / SWALE (TRAPEZOIDAL OR VALLEY GUTTER)
- EROSION CONTROL BLANKET (3:1 AND STEEPER SLOPES) (STRAW/COCONUT)
- SCL 12" SEDIMENT LOGS FOR SLOPE PROTECTION
- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW (TRUE N)

NO.	DESCRIPTION	DATE

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Name
CO 29899 NOV 4, 2025
Registration Number # Date
HAWAII

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG. 03430615 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

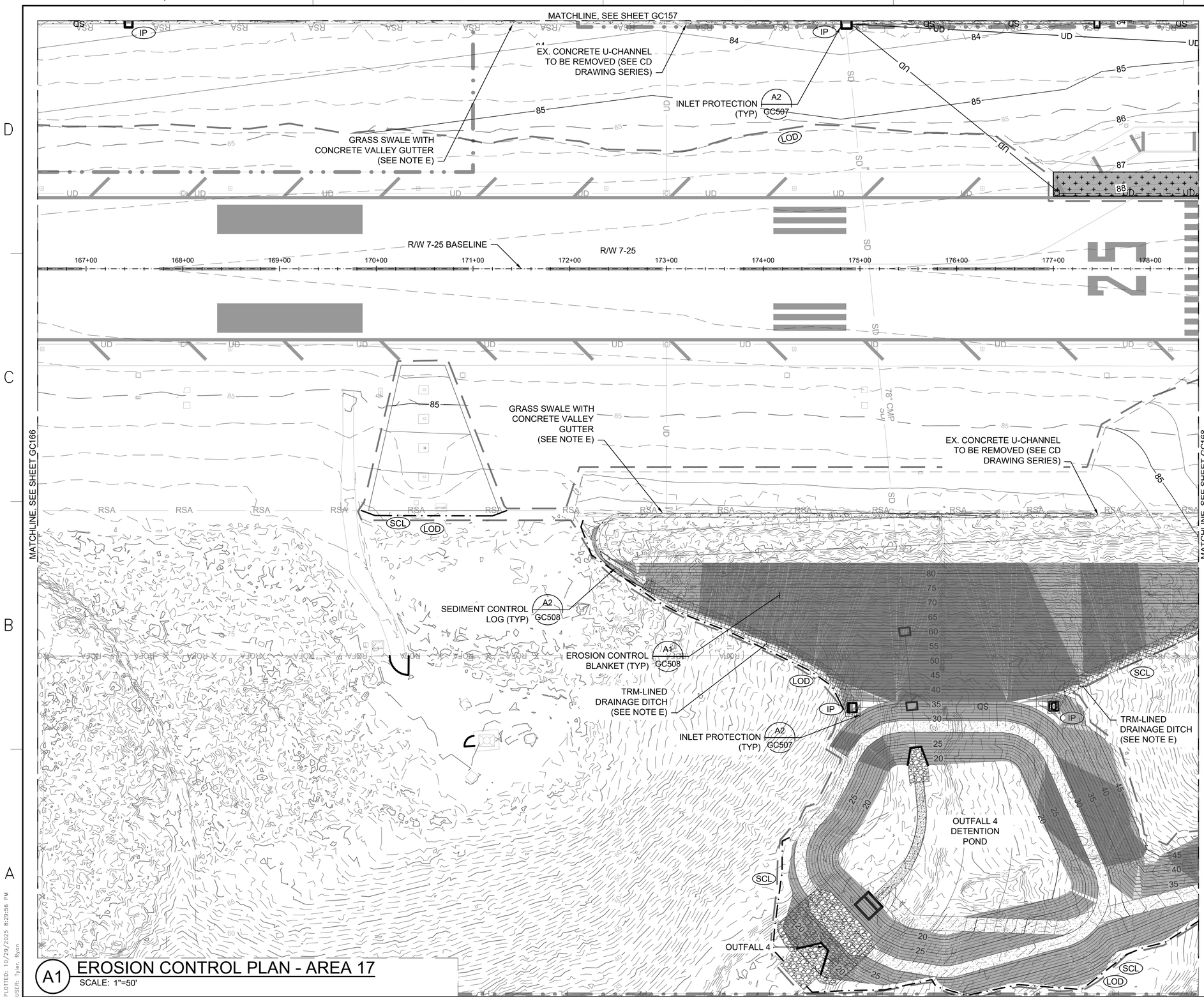
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NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
EROSION CONTROL PLAN - AREA 16

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
GC166

PRE-FINAL SUBMITTAL

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FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC166
PLOTTED: 10/29/2025 7:47:02 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 17
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

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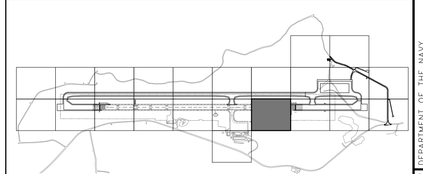
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LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP — INLET PROTECTION
- RRB — REINFORCED ROCK BERM
- SR — SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
- CONCRETE-LINED DITCH / SWALE (TRAPEZOIDAL OR VALLEY GUTTER)
- EROSION CONTROL BLANKET (3:1 AND STEEPER SLOPES) (STRAW/COCONUT)
- SCL — 12" SEDIMENT LOGS FOR SLOPE PROTECTION
- CD — CHECK DAM
- OUTFALL RIRRAP APRON
- SSA — STABILIZED STAGING AREA
- RCE — ROCK CONSTRUCTION ENTRANCE
- LOD — LIMIT OF DISTURBANCE
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NO.	DATE	SYM	DESCRIPTION

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CO 29899 NOV 4, 2025
Registration Number # Date

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: DA90615 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM			MAI/DRK		
BRANCH MANAGER			SMK		
CHIEF ENG			EAM		
FIRE PROTECTION			JCC		

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MAKALAPA, HAWAII
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YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 17

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
GC167

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC167
PLOTTED: 10/29/2025 8:29:56 PM
USER: Tyler, Ryan

MATCHLINE, SEE SHEET GC158

MATCHLINE, SEE SHEET GC167

MATCHLINE, SEE SHEET GC169

EX. CONCRETE U-CHANNEL TO BE REMOVED (SEE CD DRAWING SERIES)

INLET PROTECTION (TYP)

GRASS SWALE WITH CONCRETE VALLEY GUTTER (SEE NOTE E)

T/W B2 BASELINE

R/W 7-25

R/W 7-25 BASELINE

CLIN 0003 CLIN 0001

TRM-LINED DRAINAGE DITCH (SEE NOTE E)

EROSION CONTROL BLANKET (TYP) A1 GC508

SEDIMENT CONTROL LOG (TYP) A2 GC508

OUTFALL 5 DETENTION POND

OUTFALL 5

LOD

SCL

A1 EROSION CONTROL PLAN - AREA 18
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

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LEGEND

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- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
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- RRB REINFORCED ROCK BERM
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- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
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- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN

GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

SYM	DESCRIPTION	DATE

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ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034308115 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
MAKALAPA, HAWAII
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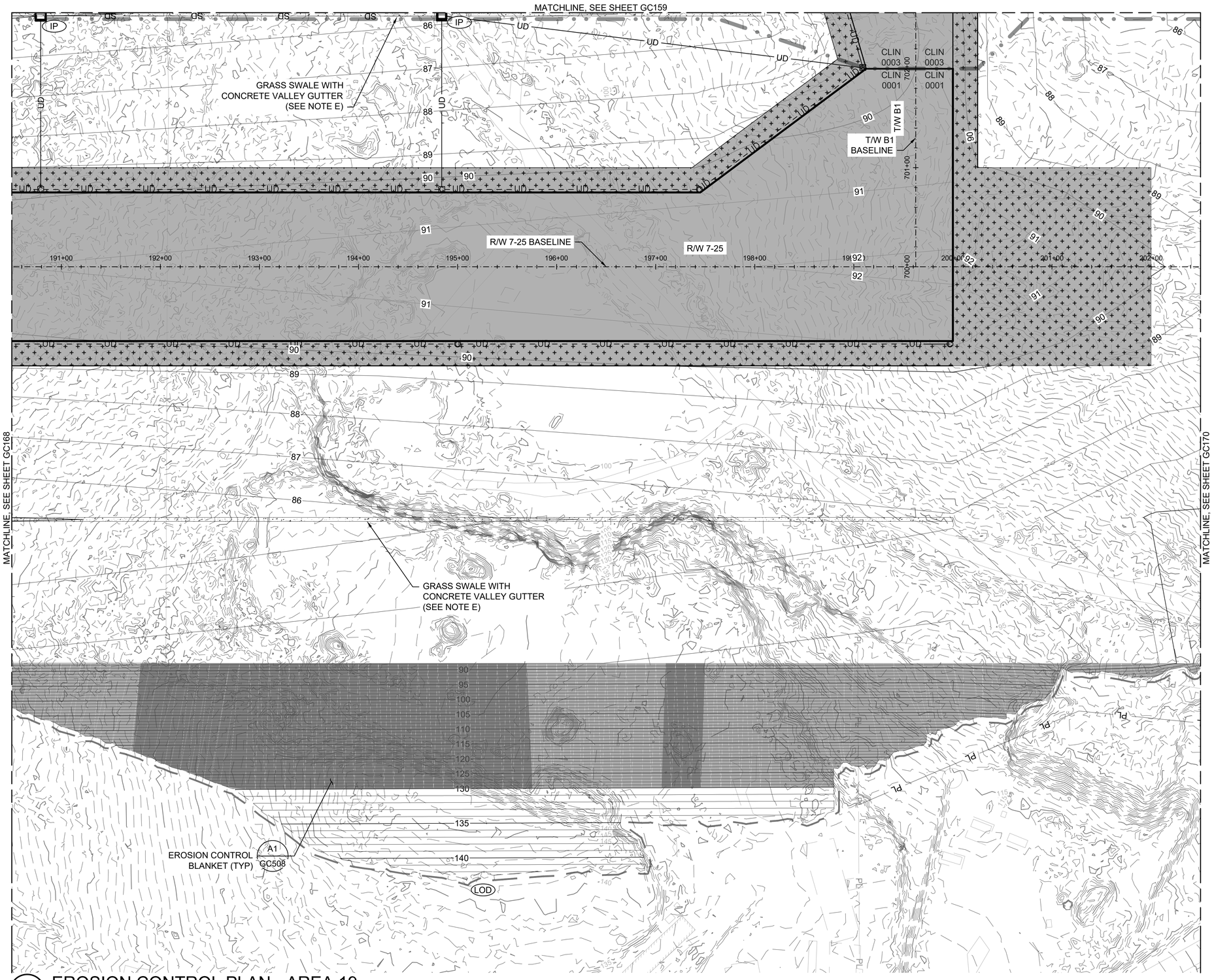
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 18

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
GC168

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC168
PLOTTED: 10/29/2025 7:48:15 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 19
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

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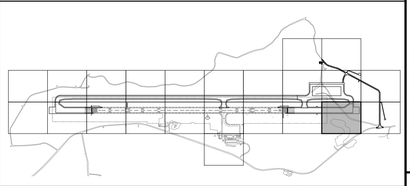
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LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP — INLET PROTECTION
- RRB — REINFORCED ROCK BERM
- SR — SURFACE ROUGHENING ON ALL FINISHED GRADES
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- RIRRAP LINING
- CONCRETE-LINED DITCH / SWALE (TRAPEZOIDAL OR VALLEY GUTTER)
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- CD — CHECK DAM
- OUTFALL RIRRAP APRON
- SSA — STABILIZED STAGING AREA
- RCE — ROCK CONSTRUCTION ENTRANCE
- LOD — LIMIT OF DISTURBANCE
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NO.	DATE	SYM	DESCRIPTION

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Jacobs / BURNS MCDONNELL
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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3436615 A/E INFO

APPROVED
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ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 19

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
GC169

PRE-FINAL SUBMITTAL

FILE NAME: p:\010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC169
PLOTTED: 10/29/2025 7:48:49 PM
USER: Tyler, Ryan

MATCHLINE, SEE SHEET GC160

MATCHLINE, SEE SHEET GC169

SCL

A2 GC508 SEDIMENT CONTROL LOG (TYP)

PERIMETER ROAD BASELINE

TRM-LINED V-DITCH (SEE NOTE E)

R/W 7-25 BASELINE

203+00 204+00 205+00 206+00 207+00 208+00 209+00

824+00 825+00 826+00 827+00 828+00 829+00 830+00 831+00 832+00

LOD

A1 GC508 EROSION CONTROL BLANKET (TYP)

OUTFALL 6

RIPRAP-LINED TOE OF SLOPE PROTECTION (SEE NOTE E)

OUTFALL 6A SEDIMENT BASIN

PERIMETER ROAD BASELINE

A1 EROSION CONTROL PLAN - AREA 20

SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

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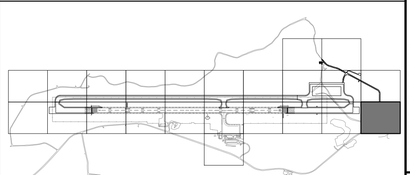
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LEGEND

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- SCL 12" SEDIMENT LOGS FOR SLOPE PROTECTION
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- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

SYM	DESCRIPTION	DATE

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A/E Task Order No. N62742-22F-0338
JEG: E0A0061S A/E INFO

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PM/CM					MAI/DRK
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FIRE PROTECTION					JCC

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NAVFAC PACIFIC MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION CONTROL PLAN - AREA 20

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF

GC170

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-gc151-gc172.dwg
LAYOUT NAME: GC170
PLOTTED: 10/29/2025 8:31:59 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 21
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

C. MAINTAIN ALL EROSION AND SEDIMENTATION CONTROLS UNTIL FINAL VEGETATION HAS BEEN ESTABLISHED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SEDIMENTATION IS NO LONGER A CONCERN.

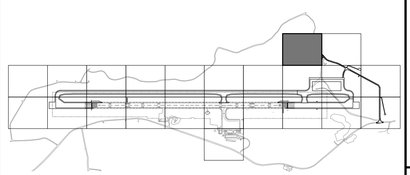
D. ALL DISTURBED AREAS NOT TO BE PAVED OR OTHERWISED HARD-SURFACED SHALL BE SEEDED WITH TEMPORARY AND PERMANENT MIXES IN ACCORDANCE WITH THE SPECIFICATIONS.

E. REFER TO SHEET GI002 FOR GENERAL EROSION AND SEDIMENTATION CONTROL NOTES. REFER TO SHEETS GC507 AND GC508 FOR EROSION AND SEDIMENTATION CONTROL DETAILS. REFER TO CG SERIES FOR DITCH AND SWALE INFO

LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- 90 EXISTING MAJOR CONTOUR (5' INTERVAL)
- 90 MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP INLET PROTECTION
- RRB REINFORCED ROCK BERM
- SR SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
- CONCRETE-LINED DITCH / SWALE (TRAPEZOIDAL OR VALLEY GUTTER)
- EROSION CONTROL BLANKET (3:1 AND STEEPER SLOPES) (STRAW/COCONUT)
- SCL 12" SEDIMENT LOGS FOR SLOPE PROTECTION
- CD CHECK DAM
- OUTFALL RIRRAP APRON
- SSA STABILIZED STAGING AREA
- RCE ROCK CONSTRUCTION ENTRANCE
- LOD LIMIT OF DISTURBANCE
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

SYM	DESCRIPTION	DATE

NAVFAC

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 034308115 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
EROSION CONTROL PLAN - AREA 21

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
GC171

PRE-FINAL SUBMITTAL

FILE NAME: p:\010_p\020_gc151_gc172.dwg
LAYOUT NAME: GC171
PLOTTED: 10/29/2025 8:34:10 PM
USER: Tyler, Ryan



A1 EROSION CONTROL PLAN - AREA 22
SCALE: 1"=50'

GENERAL SHEET NOTES

A. PRIOR TO EARTHWORK OPERATIONS, APPLICABLE EROSION AND SEDIMENTATION CONTROLS MUST BE IN PLACE AND ACCEPTED BY THE CONTRACTING OFFICER.

B. DO NOT PLACE EROSION AND SEDIMENTATION CONTROL DEVICES WITHIN 250' OF THE R/W 7-25 CENTERLINE (RSA) WHEN RUNWAY IS ACTIVE AND OPEN TO INBOUND/OUTBOUND TRAFFIC.

C. MAINTAIN ALL EROSION AND SEDIMENTATION CONTROLS UNTIL FINAL VEGETATION HAS BEEN ESTABLISHED IN ACCORDANCE WITH PROJECT SPECIFICATIONS AND SEDIMENTATION IS NO LONGER A CONCERN.

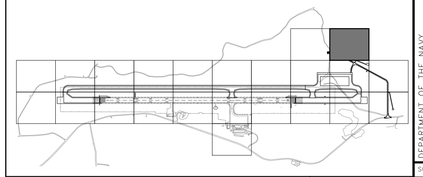
D. ALL DISTURBED AREAS NOT TO BE PAVED OR OTHERWISED HARD-SURFACED SHALL BE SEEDED WITH TEMPORARY AND PERMANENT MIXES IN ACCORDANCE WITH THE SPECIFICATIONS.

E. REFER TO SHEET GI002 FOR GENERAL EROSION AND SEDIMENTATION CONTROL NOTES. REFER TO SHEETS GC507 AND GC508 FOR EROSION AND SEDIMENTATION CONTROL DETAILS. REFER TO CG SERIES FOR DITCH AND SWALE INFO

LEGEND

- EXISTING MINOR CONTOUR (1' INTERVAL)
- EXISTING MAJOR CONTOUR (5' INTERVAL)
- MAJOR CONTOUR (5' INTERVAL)
- MINOR CONTOUR (1' INTERVAL)
- IP — INLET PROTECTION
- RRB — REINFORCED ROCK BERM
- SR — SURFACE ROUGHENING ON ALL FINISHED GRADES
- TURF REINFORCEMENT MAT (TRM)
- RIRRAP LINING
- CONCRETE-LINED DITCH / SWALE (TRAPEZOIDAL OR VALLEY GUTTER)
- EROSION CONTROL BLANKET (3:1 AND STEEPER SLOPES) (STRAW/COCONUT)
- SCL — 12" SEDIMENT LOGS FOR SLOPE PROTECTION
- CD — CHECK DAM
- OUTFALL RIRRAP APRON
- SSA — STABILIZED STAGING AREA
- RCE — ROCK CONSTRUCTION ENTRANCE
- LOD — LIMIT OF DISTURBANCE
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

SYM	DESCRIPTION	DATE

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JEG: E0A30615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
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SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
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FIRE PROTECTION					JCC

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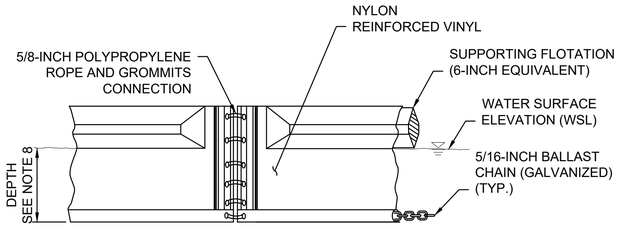
EROSION CONTROL PLAN - AREA 22

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
GC172

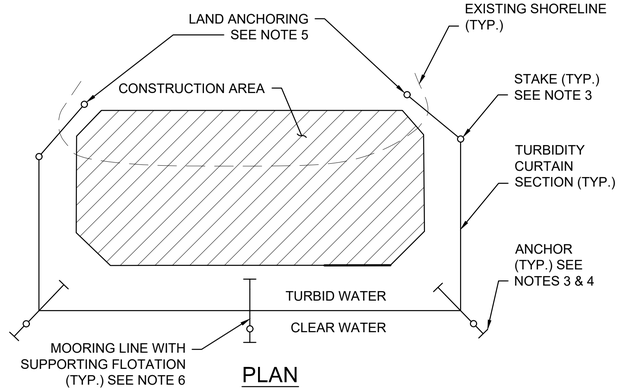
PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p:\010_p-020-gc151-gc172.dwg
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PLOTTED: 10/29/2025 8:35:34 PM
USER: Tyler, Ryan



ELEVATION

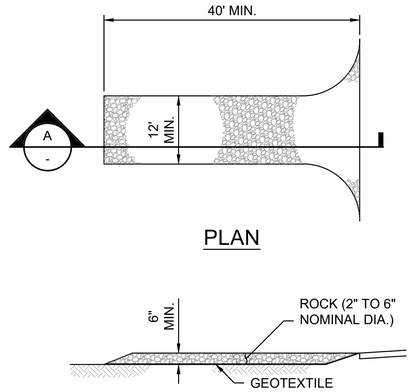


PLAN

NOTES

1. INSTALL FLOATING TURBIDITY CURTAINS BEFORE THE START OF ANY CONSTRUCTION ACTIVITIES THAT COULD IMPACT THE AREA OF CONCERN.
2. DO NOT INSTALL CURTAINS ACROSS THE MAIN FLOW OF A SIGNIFICANT MOVING WATER BODY. DO NOT INSTALL CURTAINS WHERE THE FLOW OF WATER WILL REMOVE ACCUMULATED SEDIMENT OR SIGNIFICANTLY MOVE THE CURTAIN.
3. INSTALL CURTAIN STAKES IN A VERTICAL POSITION UNLESS OTHERWISE DIRECTED. INSTALL ANCHORS AND STAKES AT NO MORE THAN 100-FOOT SPACING.
4. INSTALL ANCHORS MADE OF WOODEN STAKES (2- BY 4-INCH RECTANGULAR OR 2½-INCH MINIMUM DIAMETER) OR METAL STAKES (1⅓ POUNDS PER LINEAR FOOT).
5. EXTEND THE ENDS OF CURTAINS WELL UP INTO THE SHORELINE AS APPROVED, ESPECIALLY IF HIGH WATER CONDITIONS ARE EXPECTED. SECURE THE ENDS FIRMLY TO THE SHORELINE (PREFERABLY TO RIGID BODIES SUCH AS TREES OR PILES) TO FULLY ENCLOSE THE AREA WHERE SEDIMENT MAY ENTER INTO THE WATER BODY.
6. PROVIDE MINIMUM ½-INCH NYLON ROPE FOR ADJUSTMENT LINE FOR MOORING SYSTEM. ENSURE THE MOORING LINE IS SECURELY ATTACHED AND IS SUFFICIENTLY BUOYANT TO REMAIN AFLOAT UNDER NORMAL LOAD CONDITIONS.
7. EXTEND THE NYLON REINFORCED VINYL FABRIC THROUGH THE ENTIRE DEPTH OF THE WATER (TO THE CHANNEL BOTTOM) UNLESS TIDAL ACTIONS ARE PRESENT.
8. REMOVE CAPTURED SEDIMENT BEHIND CURTAINS PRIOR TO REMOVING THE CURTAINS. DO NOT DISPERSE SEDIMENT INTO ADJACENT WATER BODY.
9. FLOATING TURBIDITY CURTAIN SHOWN HERE IS SUITABLE ONLY FOR NO CURRENT, WAVE, WIND, AND/OR TIDAL ACTION.

C1 FLOATING TURBIDITY CURTAIN
SCALE: NTS

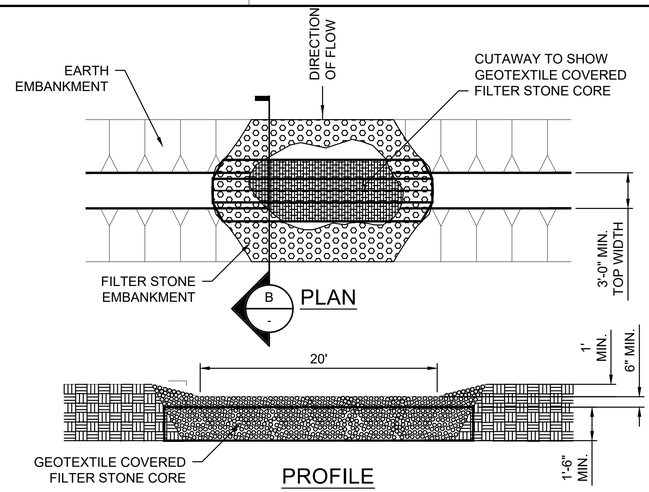


PLAN

SECTION A

RCE
SYMBOL

C3 ROCK CONSTRUCTION ENTRANCE
NTS



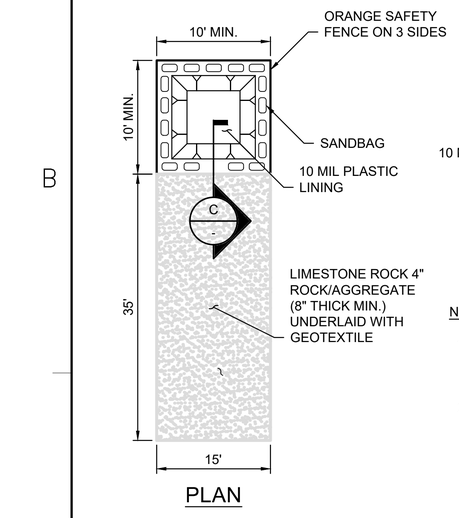
SECTION B

NOTES:

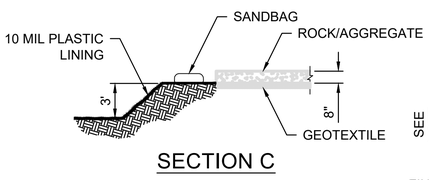
1. FILTER STONE CORE IS 2" ROCK.

CD
SYMBOL

C4 ROCK CHECK DAM
SCALE: NTS



PLAN



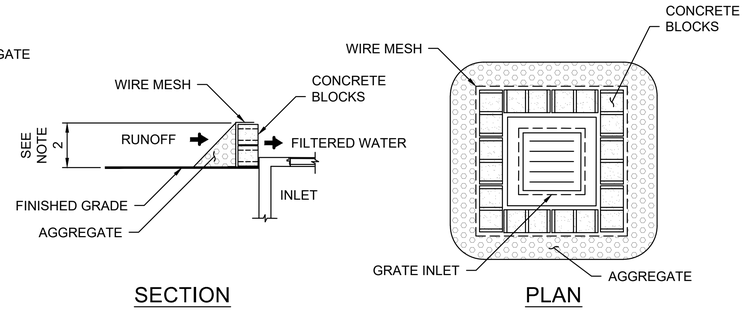
SECTION C

NOTES:

1. VERBALLY INSTRUCT THE CONCRETE TRUCK DRIVERS WHERE THE PIT IS AND TO WASHOUT THEIR TRUCKS IN THE PIT AND NOWHERE ELSE.
2. UPON THE CONCRETE SETTING UP (CURING, DRYING OUT), THE CONCRETE WASTE MUST BE REMOVED FROM THE PROJECT SITE AND DISPOSED OF PROPERLY. AFTER REMOVAL OF THE CONCRETE WASTE, THE WASHOUT PIT MUST BE FILLED WITH CLEAN FILL MATERIAL AND COMPACTED T0 IN-SITU CONDITIONS, OR AS DIRECTED BY THE PROJECT SPECIFICATIONS.
3. CONCRETE WASHOUT PITS MUST NOT BE LOCATED DIRECTLY ADJACENT TO, NOR AT ANY TIME DRAIN INTO THE STORM SEWER SYSTEM OR ANY OTHER SWALE, DITCH, OR WATERWAY.
4. CONSTRUCT ENTRY ROAD AND BOTTOM OF WASHOUT AREA TO SUPPORT EXPECTED LOADINGS FROM TRUCKS EQUIPMENT.

CWA
SYMBOL

A1 CONCRETE WASHOUT AREA
SCALE: 1" = 1'



SECTION

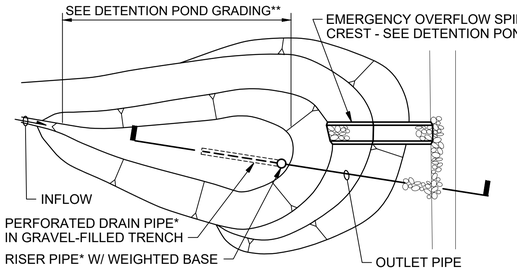
PLAN

NOTES:

1. PLACE CONCRETE BLOCKS IN A SINGLE ROW AROUND PERIMETER OF INLET ON THEIR SIDES, WITH ENDS OF ADJACENT BLOCKS ABUTTING.
2. HEIGHT OF BARRIER VARIES. USE STACKS OF 4", 8", OR 12" BLOCKS. MIN. HEIGHT OF BARRIER MUST BE 12" AND MAX. HEIGHT MUST BE 24".
3. PLACE HARDWARE CLOTH/WIRE MESH W/ MAX. 1/2" OPENINGS OVER VERTICAL FACE OF CONCRETE BLOCKS.
4. THE AGGREGATE MUST BE 3/4"-2" ANGULAR CLEAN STONE, WHICH WILL SLOW THE FLOW OF THE WATER AND ALLOW IT TO FILTER THROUGH AND OVER THE MATERIAL BEFORE ENTERING THE INLET.

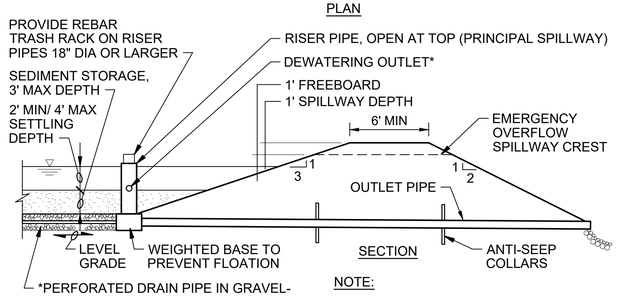
IP
SYMBOL

A2 INLET PROTECTION
SCALE: NTS



NOTES:
*SEDIMENT DEWATERING MAY BE ACCOMPLISHED WITH PERFORATED DRAIN PIPE IN TRENCH AS SHOWN OR WITH A PERFORATED RISER COVERED WITH FILTER FABRIC AND GRAVEL "CONE".

**ONLY DETENTION PONDS OUTFALL 6 POND AND OUTFALL 6A POND WILL BE TEMPORARY SEDIMENT BASINS.



SECTION

NOTE:

A FILTER FABRIC FENCE OR SIMILAR FILTER MUST BE CONSTRUCTED TO FILTER RUNOFF FROM THE POND PRIOR TO DISCHARGE FROM THE CONSTRUCTION SITE.

A4 SEDIMENT BASIN
SCALE: NTS

NO.	DESCRIPTION	DATE

NAVFAC

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A/E Contract No. N62742-20-D-0002
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JEG: EIA0061S
A/E INFO

APPROVED:
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ACTIVITY
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DES:	DPS	DRW:	MAK	REV:	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
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EROSION & SEDIMENTATION CONTROL DETAILS

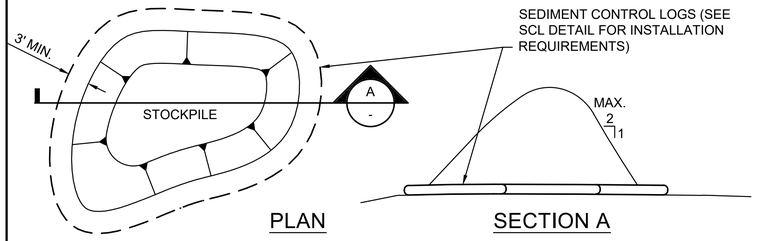
SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.: 1
SHEET OF

GC507

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-gc501-gc508.dwg
LAYOUT NAME: GC507
PLOTTED: 10/29/2025 12:30:08 PM
USER: Tyler, Ryan



STOCKPILE PROTECTION INSTALLATION NOTES

1. INSTALL PERIMETER CONTROLS IN ACCORDANCE WITH THEIR RESPECTIVE DESIGN DETAILS. SEDIMENT CONTROL LOGS ARE SHOWN IN THE STOCKPILE PROTECTION DETAILS; HOWEVER, OTHER TYPES OF PERIMETER CONTROLS INCLUDING SILT FENCE OR ROCK SOCKS MAY BE SUITABLE IN SOME CIRCUMSTANCES. CONSIDERATIONS FOR DETERMINING THE APPROPRIATE TYPE OF PERIMETER CONTROL FOR A STOCKPILE INCLUDE WHETHER THE STOCKPILE IS LOCATED ON A PERVIOUS OR IMPERVIOUS SURFACE, THE RELATIVE HEIGHTS OF THE PERIMETER CONTROL AND STOCKPILE, THE ABILITY OF THE PERIMETER CONTROL TO CONTAIN THE STOCKPILE WITHOUT FAILING IN THE EVENT THAT MATERIAL FROM THE STOCKPILE SHIFTS OR SLUMPS AGAINST THE PERIMETER, AND OTHER FACTORS.
2. STABILIZE THE STOCKPILE SURFACE WITH SURFACE ROUGHENING, TEMPORARY SEEDING AND MULCHING, EROSION CONTROL BLANKETS, OR SOIL BINDERS. SOILS STOCKPILED FOR AN EXTENDED PERIOD (TYPICALLY FOR MORE THAN 60 DAYS) SHALL BE SEEDED AND MULCHED WITH A TEMPORARY GRASS COVER ONCE THE STOCKPILE IS PLACED (TYPICALLY WITHIN 14 DAYS). USE OF MULCH ONLY OR A SOIL BINDER IS ACCEPTABLE IF THE STOCKPILE WILL BE IN PLACE FOR A MORE LIMITED TIME PERIOD (TYPICALLY 30-60 DAYS).
3. FOR TEMPORARY STOCKPILES ON THE INTERIOR PORTION OF A CONSTRUCTION SITE, WHERE OTHER DOWNGRADIENT CONTROLS, INCLUDING PERIMETER CONTROL, ARE IN PLACE, STOCKPILE PERIMETER CONTROLS MAY NOT BE REQUIRED.

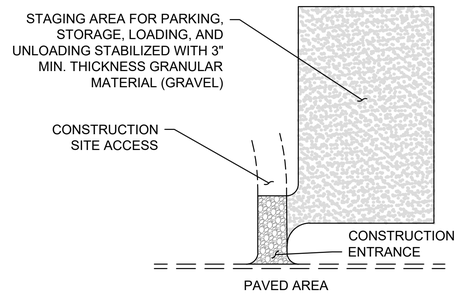
STOCKPILE PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHALL BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.
4. IF PERIMETER PROTECTION MUST BE MOVED TO ACCESS SOIL STOCKPILE, REPLACE PERIMETER CONTROLS BY THE END OF THE WORKDAY.
5. STOCKPILE PERIMETER CONTROLS CAN BE REMOVED ONCE ALL THE MATERIAL FROM THE STOCKPILE HAS BEEN USED.

C1 STOCKPILE PROTECTION

SCALE: NTS

SP
SYMBOL



STABILIZED STAGING AREA INSTALLATION NOTES:

1. SEE PLAN VIEW FOR GENERAL LOCATION OF STAGING AREA. MAY MODIFY LOCATION AND SIZE OF STABILIZED STAGING AREA WITH PRIOR APPROVAL.
2. STABILIZED STAGING AREA MUST BE LARGE ENOUGH TO FULLY CONTAIN PARKING, STORAGE, AND UNLOADING AND LOADING OPERATIONS.
3. STAGING AREA MUST BE STABILIZED PRIOR TO ANY OTHER OPERATIONS ON THE SITE.
4. THE STABILIZED STAGING AREA MUST CONSIST OF A MINIMUM OF 3" OF GRANULAR MATERIAL (GRAVEL).

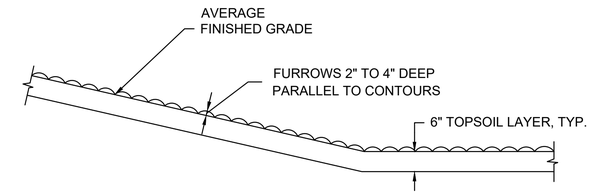
STABILIZED STAGING AREA MAINTENANCE NOTES:

1. PROVIDE ADDITIONAL THICKNESS OF GRANULAR MATERIAL IF ANY RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.
2. STABILIZED STAGING AREA MUST BE ENLARGED TO CONTAIN PARKING, STORAGE, AND UNLOADING AND LOADING OPERATIONS.
3. ANY ACCUMULATED DIRT OR MUD MUST BE REMOVED FROM THE SURFACE OF THE STABILIZED STAGING AREA.
4. THE STABILIZED STAGING AREA MUST BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL MUST BE REMOVED OR USED ON SITE WITH PRIOR APPROVAL, AND THE AREA TOPSOILED, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

C2 STABILIZED STAGING AREA

SCALE: NTS

SSA
SYMBOL



SURFACE ROUGHENING INSTALLATION NOTES:

1. SURFACE ROUGHENING MUST BE PROVIDED ON ALL FINISHED GRADES (SLOPES AND "FLAT" AREAS) WITHIN 2 DAYS OF COMPLETION OF FINISHED GRADE (FOR AREAS NOT RECEIVING TOPSOIL) OR WITHIN 2 DAYS OF TOPSOIL PLACEMENT.
2. AREAS WHERE BUILDING FOUNDATIONS, PAVEMENT, OR SOD IS PLACED WITHIN 7-DAYS OF FINISHED GRADING DO NOT NEED SURFACE ROUGHENED.
3. DISTURBED SURFACES MUST BE ROUGHENED USING RIPPING OR TILLING EQUIPMENT ON THE CONTOUR OR TRACKING UP AND DOWN A SLOPE USING EQUIPMENT TREADS.

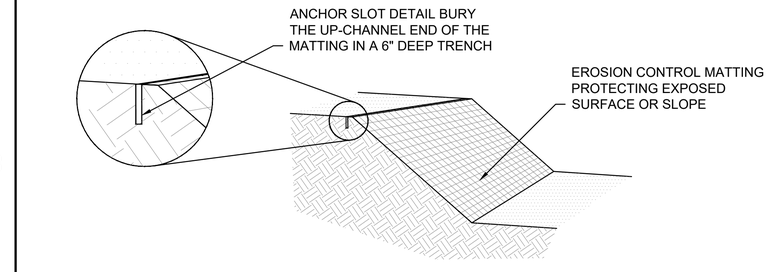
SURFACE ROUGHENING MAINTENANCE NOTES:

1. VEHICLES AND EQUIPMENT MUST GENERALLY BE CONFINED TO ACCESS DRIVES AND MUST NOT BE DRIVEN OVER AREAS THAT HAVE BEEN SURFACE ROUGHENED.
2. IN NON-TURF GRASS FINISHED AREAS, SEEDING AND MULCHING MUST TAKE PLACE DIRECTLY OVER SURFACE ROUGHENED AREAS WITHOUT FIRST SMOOTHING OUT THE SURFACE.
3. IN AREAS NOT SEEDED AND MULCHED AFTER SURFACE ROUGHENING, SURFACES MUST BE RE-ROUGHENED AS NECESSARY TO MAINTAIN GROOVE DEPTH AND SMOOTH OVER ANY RILL EROSION.

C4 SURFACE ROUGHENING

SCALE: NTS

SR
SYMBOL



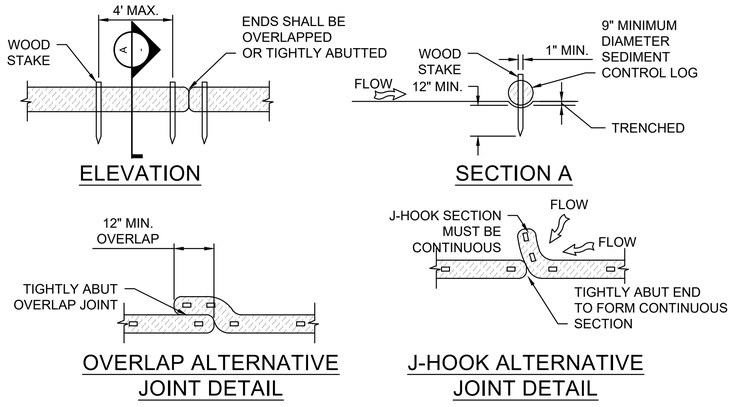
ROLLED EROSION CONTROL BLANKET GENERAL NOTES:

1. BLANKETS MUST BE INSTALLED PARALLEL TO THE DIRECTION OF FLOW OVER THE SURFACE WHICH IS PROTECTED.
2. THE UP-CHANNEL END OF THE BLANKET MUST BE BURIED IN A TRENCH MEASURING 6 INCHES DEEP AND 6 INCHES WIDE FOR THE ENTIRE WIDTH OF THE END. THE SOIL MUST BE BACKFILLED INTO THE TRENCH AND TAMPED FIRMLY. STAPLES MUST BE PLACED EVERY 12 INCHES ALONG THE END OF THE BLANKET.
3. EDGES OF ADJACENT BLANKETS MUST BE OVERLAPPED A MINIMUM OF 4 INCHES AND MUST BE STAPLED EVERY 3 FEET ALONG THE OVERLAP.
4. WHEN JOINING BLANKETS END TO END, A TRENCH SIMILAR TO THE ONE DUG AT THE BEGINNING OF THE ORIGINAL STRIP MUST BE DUG WITH THE UP-CHANNEL END OF THE NEW STRIP BEING PLACED IN A LIKE MANNER IN THE TRENCH AS THE BEGINNING END OF THE ORIGINAL STRIP. THE END OF THE STRIP BEING FOLDED UNDER AT LEAST 12 INCHES. STAPLES MUST BE INSTALLED AT 12 INCH INTERVALS ALONG THE WIDTH OF THE STRIP NOT MORE THAN 6 INCHES FROM THE TRENCH.
5. IN SITUATIONS WHERE ERODIBLE SOILS, STEEP SLOPES OR HIGH VELOCITY FLOWS ARE ENCOUNTERED, A FOLD OF THE BLANKET MUST BE INSERTED INTO A 6 INCH TRENCH AND TAMPED FIRMLY. STAPLES MUST BE INSTALLED AT 12 INCH INTERVALS ALONG THE TRENCH.
6. STAPLES FOR ANCHORING SOIL STABILIZING MATERIALS MUST BE MADE OF 10 GAUGE WIRE OR HEAVIER. THEY MUST BE 6 TO 10 INCHES IN LENGTH, WITH THE LONGER STAPLES BEING USED IN LOOSE OR UNSTABLE SOILS. THERE MUST BE ONE STAPLE FOR EACH FOUR (4) SQUARE FEET OF BLANKETS TO ASSURE PROPER BONDING BETWEEN THE SOIL AND THE BLANKET MATERIAL.

A1 ROLLED EROSION CONTROL BLANKET

SCALE: NTS

ECB
SYMBOL



SEDIMENT CONTROL LOG INSTALLATION NOTES:

1. SEE PLAN VIEW FOR LOCATION AND LENGTH OF SEDIMENT CONTROL LOG.
2. SEDIMENT CONTROL LOGS MUST BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
3. SEDIMENT CONTROL LOGS MUST CONSIST OF STRAW, COMPOST, EXCELSIOR, OR COCONUT FIBER.
4. NOT FOR USE IN CONCENTRATED FLOW AREAS.
5. THE SEDIMENT CONTROL LOG MUST BE TRENCHED IN APPROPRIATELY.
6. 9" DIAMETER SEDIMENT CONTROL LOGS ARE THE MINIMUM ACCEPTABLE.

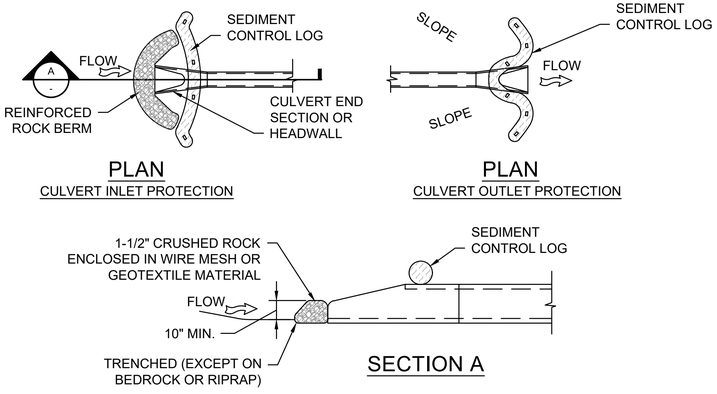
SEDIMENT CONTROL LOG MAINTENANCE NOTES:

1. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOGS MUST BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN 1/2 THE HEIGHT OF THE CREST OF LOG.
2. SEDIMENT CONTROL LOG MUST BE REMOVED AT THE END OF CONSTRUCTION. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT MUST BE STABILIZED.

A2 SEDIMENT CONTROL LOG

SCALE: NTS

SCL
SYMBOL



INSTALLATION NOTES:

1. 1-1/2" CRUSHED ROCK MUST BE FRACTURED FACE ON ALL SIDES.
2. WIRE MESH MUST BE FABRICATED OF WIRE TWISTED INTO A MESH WITH A MAXIMUM OPENING OF 1.0 INCH (COMMONLY TERMED "CHICKEN WIRE").
3. WIRE MESH MUST BE SECURED USING "HOG RINGS" OR WIRE TIES AT APPROXIMATELY 6-INCH CENTERS ALONG ALL JOINTS AND AT APPROXIMATELY 2-INCH CENTERS ON ENDS OF BERM.
4. THE ENDS OF THE REINFORCED ROCK BERM MUST BE HIGHER THAN THE CENTER OF THE BERM AND ALLOW FOR ADEQUATE OVERTOPPING CAPACITY IN THE CENTER.

MAINTENANCE NOTES:

1. SEDIMENT ACCUMULATED UPSTREAM OF CULVERT INLET FILTER MUST BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF FILTER IS 1/2 THE HEIGHT OF THE REINFORCED ROCK BERM.
2. REINFORCED ROCK BERMS FOR CULVERT PROTECTION ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED.
3. WHEN CULVERT INLET FILTERS ARE REMOVED, ANY DISTURBED AREA MUST BE SEEDED OR OTHERWISE STABILIZED.

A4 REINFORCED ROCK BERM FOR CULVERT PROTECTION

SCALE: NTS

RRB
SYMBOL

NO.	DESCRIPTION	DATE

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CO 29899 — NOV 4, 2025
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SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA09615
A/E INFO

APPROVED:
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ACTIVITY
SATISFACTORY TO DATE

DES.	DPS	DRW	MAK	REV. VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

EROSION & SEDIMENTATION CONTROL DETAILS

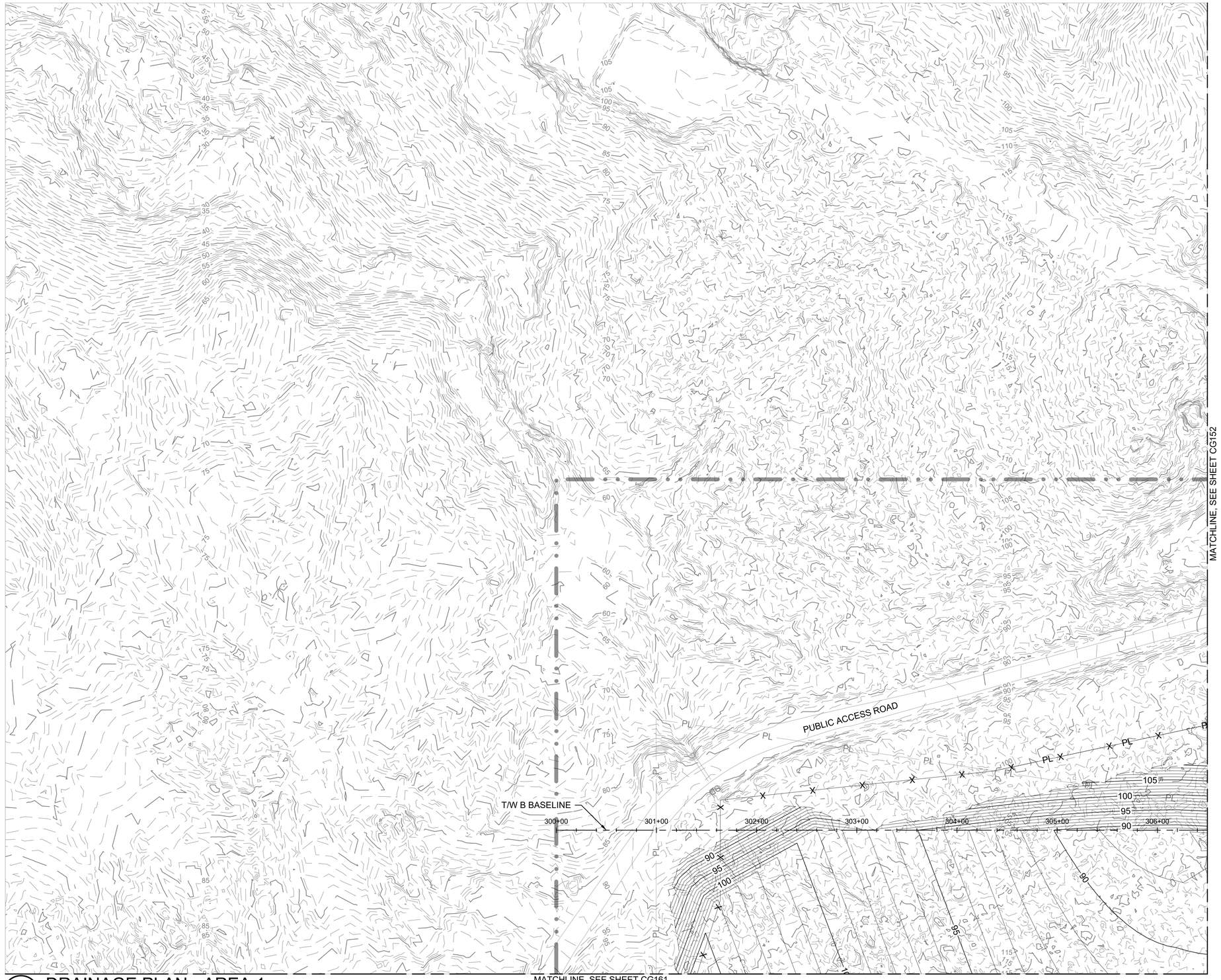
SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
GC508

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FILE NAME: p-010_p-020-gc501-gc508.dwg
LAYOUT NAME: GC508
PLOTTED: 10/29/2025 12:30:17 PM
USER: Tyler, Ryan

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Appendix B.3
Grading and Drainage Plan



A1 DRAINAGE PLAN - AREA 1
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

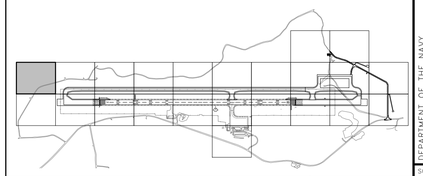
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
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- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

NO.	DESCRIPTION	DATE

NAVFAC

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1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: D3430615
A/E INFO

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PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

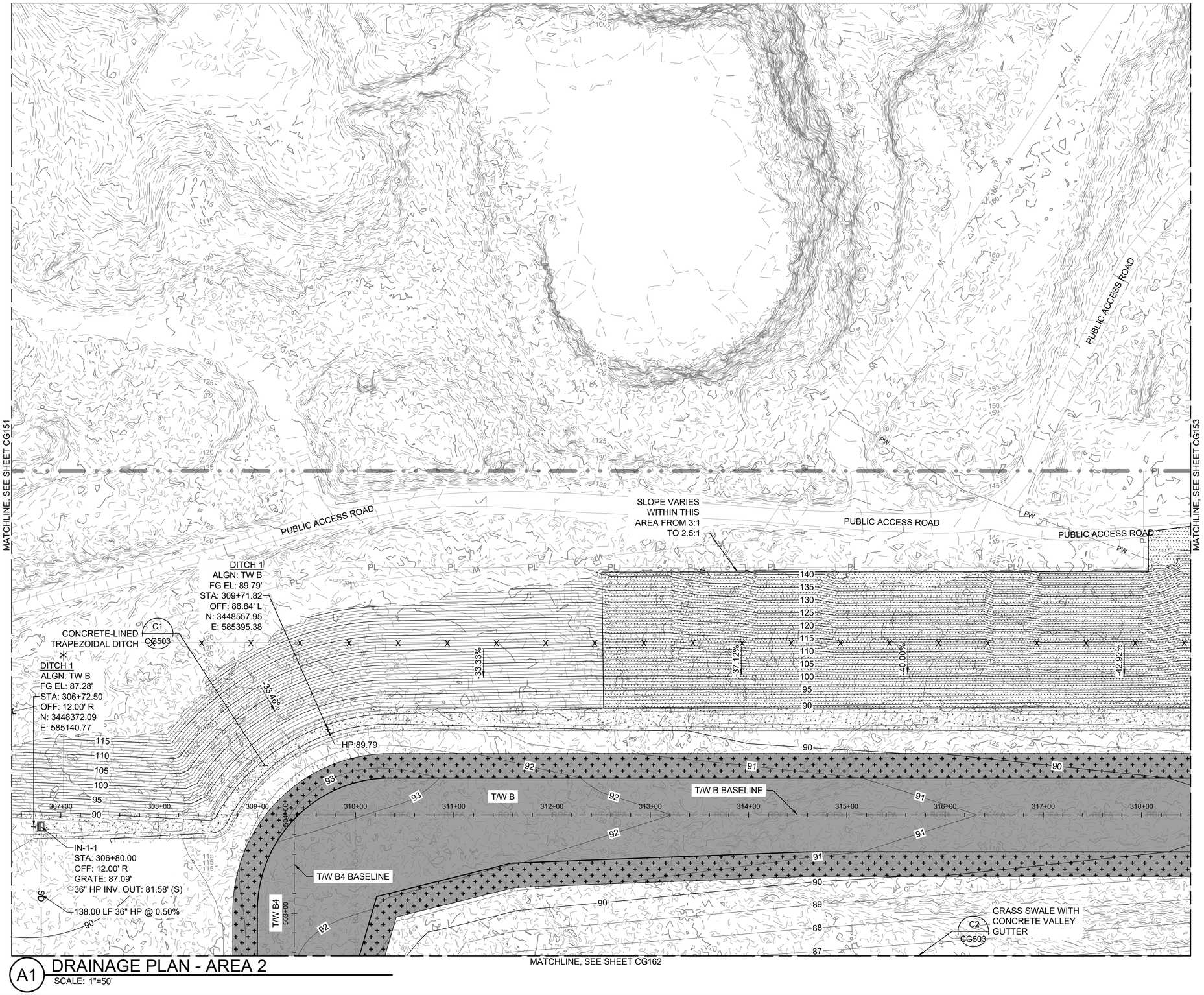
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC, MAKALAPA, HAWAII
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YAP, FEDERATED STATES OF MICRONESIA (FSM)
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
DRAINAGE PLAN - AREA 1

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
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FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG151
PLOTTED: 10/29/2025 12:44:51 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 2
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

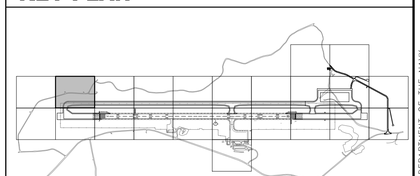
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

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- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

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1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: D3A30615
A/E INFO

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BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 2

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
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FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG152
PLOTTED: 10/29/2025 12:48:57 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 3
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

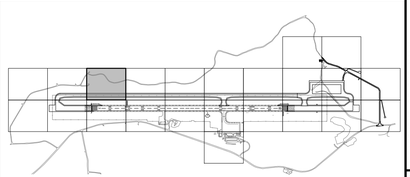
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

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- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

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A/E Task Order No. N62742-22F-0338
JEG. D3430615 A/E INFO

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BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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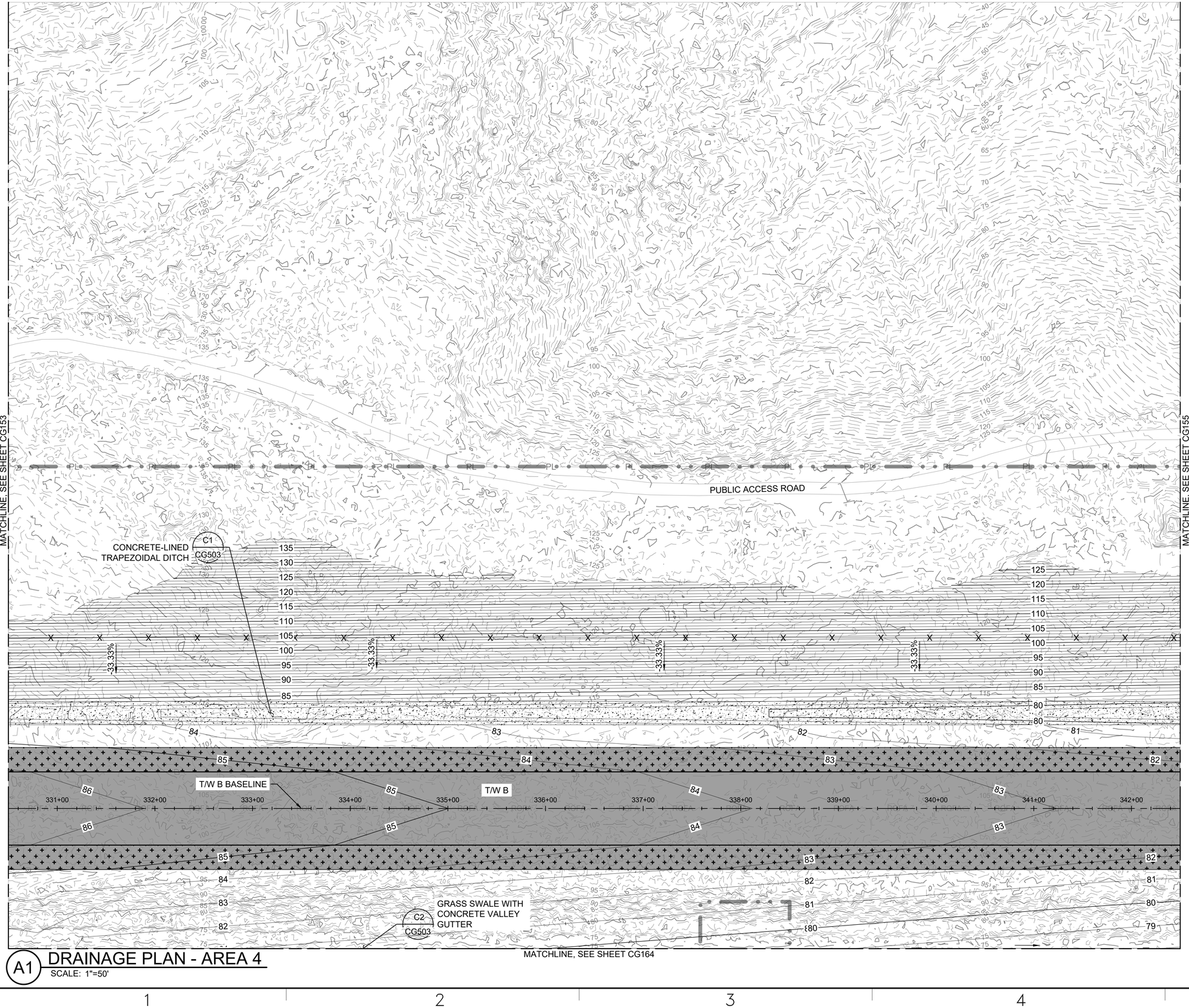
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 3

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG153

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FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG153
PLOTTED: 10/29/2025 12:52:58 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 4
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

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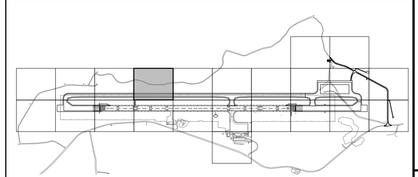
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

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- UNDERDRAIN MANHOLE
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- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

SYM	DESCRIPTION	DATE

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A/E Task Order No. N62742-22F-0338
JEG: 034308115
A/E INFO

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PM/DM					MAV/DRK
BRANCH MANAGER					SMK
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FIRE PROTECTION					JCC

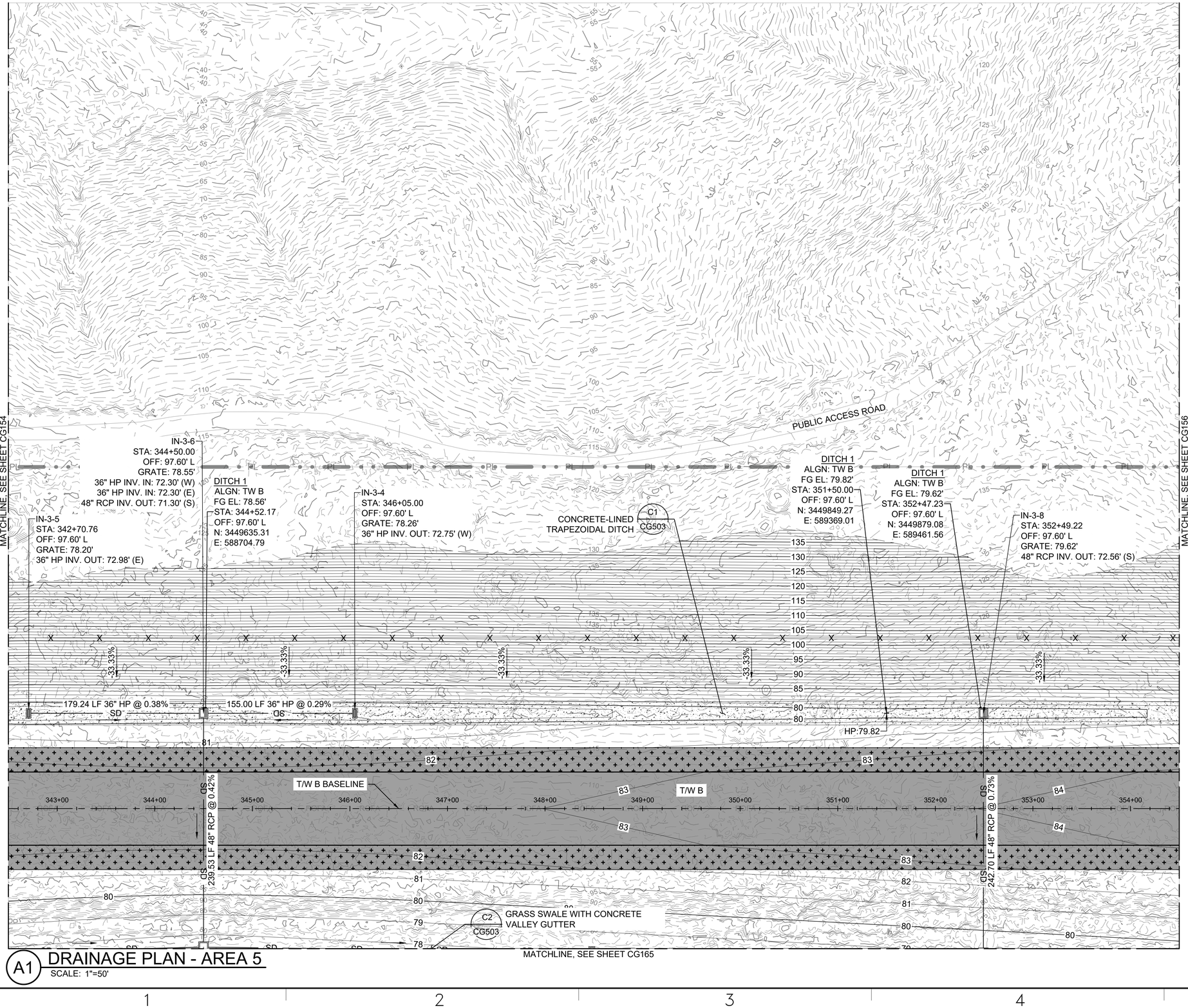
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
DRAINAGE PLAN - AREA 4

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
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LAYOUT NAME: CG154
PLOTTED: 10/29/2025 12:57:13 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 5
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

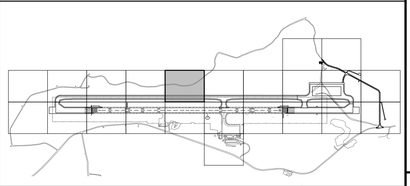
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
- SD — STORM DRAIN PIPE (SIZE AND TYPE AS INDICATED)
- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD — PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

DATE	SYM	DESCRIPTION

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 03436615 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 5

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG155

PRE-FINAL SUBMITTAL

FILE NAME: p:\010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG155
PLOTTED: 10/29/2025 1:01:30 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 6
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

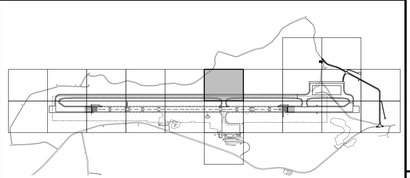
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 MAJOR CONTOURS
- SD STORM DRAIN PIPE (SIZE AND TYPE AS INDICATED)
- UD NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW POTABLE WATER LINE
- FW FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

NO.	DESCRIPTION	DATE

NAVFAC

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ARLINGTON, VA 22201-5765
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

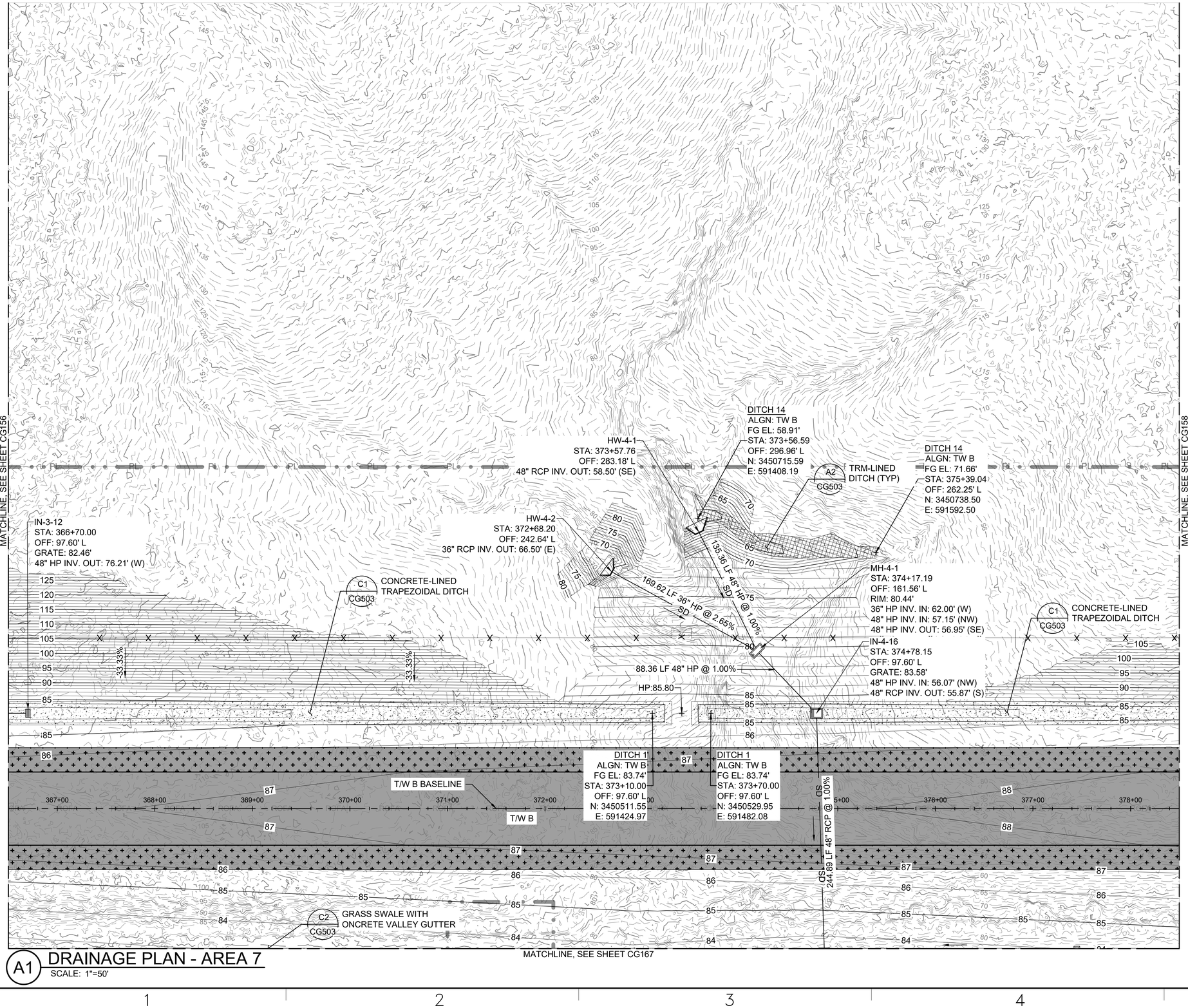
DRAINAGE PLAN - AREA 6

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO.
NAVFAC DRAWING NO.
SHEET OF
CG156

PRE-FINAL SUBMITTAL

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FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG156
PLOTTED: 10/29/2025 1:06:18 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 7
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

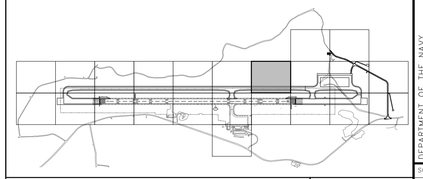
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
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- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NO.	DESCRIPTION	DATE
STM		

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ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3436015 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 7

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.:
NAVFAC DRAWING NO.
SHEET OF
CG157

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG157
PLOTTED: 10/29/2025 1:10:58 PM
USER: Morris, Tyler

MATCHLINE, SEE SHEET CG171

MATCHLINE, SEE SHEET CG157

MATCHLINE, SEE SHEET CG159

MATCHLINE, SEE SHEET CG168

DITCH 13
ALGN: TW B
FG EL: 138.26'
STA: 382+99.95
OFF: 608.19' L
N: 3451301.08
E: 592210.69

TRM-LINED DITCH (TYP) A2 CG503

DITCH 13
ALGN: TW B
FG EL: 89.41'
STA: 386+30.00
OFF: 464.00' L
N: 3451265.04
E: 592569.05

503.76 LF 60" RCP @ 5.75%

C1 CG503 CONCRETE-LINED TRAPEZOIDAL DITCH

DITCH 5
ALGN: TW B
FG EL: 91.05'
STA: 386+89.55
OFF: 465.50' L
N: 3451284.72
E: 592625.27

IN-5-24
STA: 386+30.00
OFF: 464.00' L
GRATE: 89.41'
60" RCP INV. IN: 81.90' (N)
60" RCP INV. OUT: 81.70' (S)

HP:89.90

DITCH 6
ALGN: TW B
FG EL: 89.90'
STA: 386+27.40
OFF: 403.74' L
N: 3451206.88
E: 592585.05

276.51 LF 60" RCP @ 2.21%

DITCH 6
ALGN: TW B
FG EL: 87.78'
STA: 386+27.40
OFF: 187.50' L
N: 3451001.05
E: 592651.35

IN-5-16
STA: 386+27.40
OFF: 187.50' L
GRATE: 87.78'
60" RCP INV. IN: 75.60' (N)
60" RCP INV. OUT: 75.40' (S)

DITCH 1
ALGN: TW B
FG EL: 87.78'
STA: 386+27.30
OFF: 187.58' L
N: 3451001.10
E: 592651.23

IN-4-14
STA: 380+12.13
OFF: 97.60' L
GRATE: 84.26'
48" RCP INV. IN: 75.26' (NE)
48" RCP INV. OUT: 75.06' (S)

IN-4-17
STA: 380+42.75
OFF: 133.25' L
GRATE: 82.75'
48" RCP INV. OUT: 75.50' (SW)

DITCH 1
ALGN: TW B
FG EL: 84.45'
STA: 379+08.56
OFF: 97.60' L
N: 3450695.08
E: 591994.70

C1 CG503 CONCRETE-LINED TRAPEZOIDAL DITCH

HP:84.45

47.00 LF 48" RCP @ 0.51%

334.70 LF 60" RCP @ 1.24%

244.78 LF 48" RCP @ 0.50%

C2 CG503 GRASS SWALE WITH CONCRETE VALLEY GUTTER

AIRCRAFT PARKING APRON

T/W B BASELINE

T/W B

T/W B2 BASELINE

T/W B2

CLIN 0004

CLIN 0003

A1 DRAINAGE PLAN - AREA 8
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
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- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN

GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

NO.	DESCRIPTION	DATE

NAVFAC

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA00615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND (FSM)
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

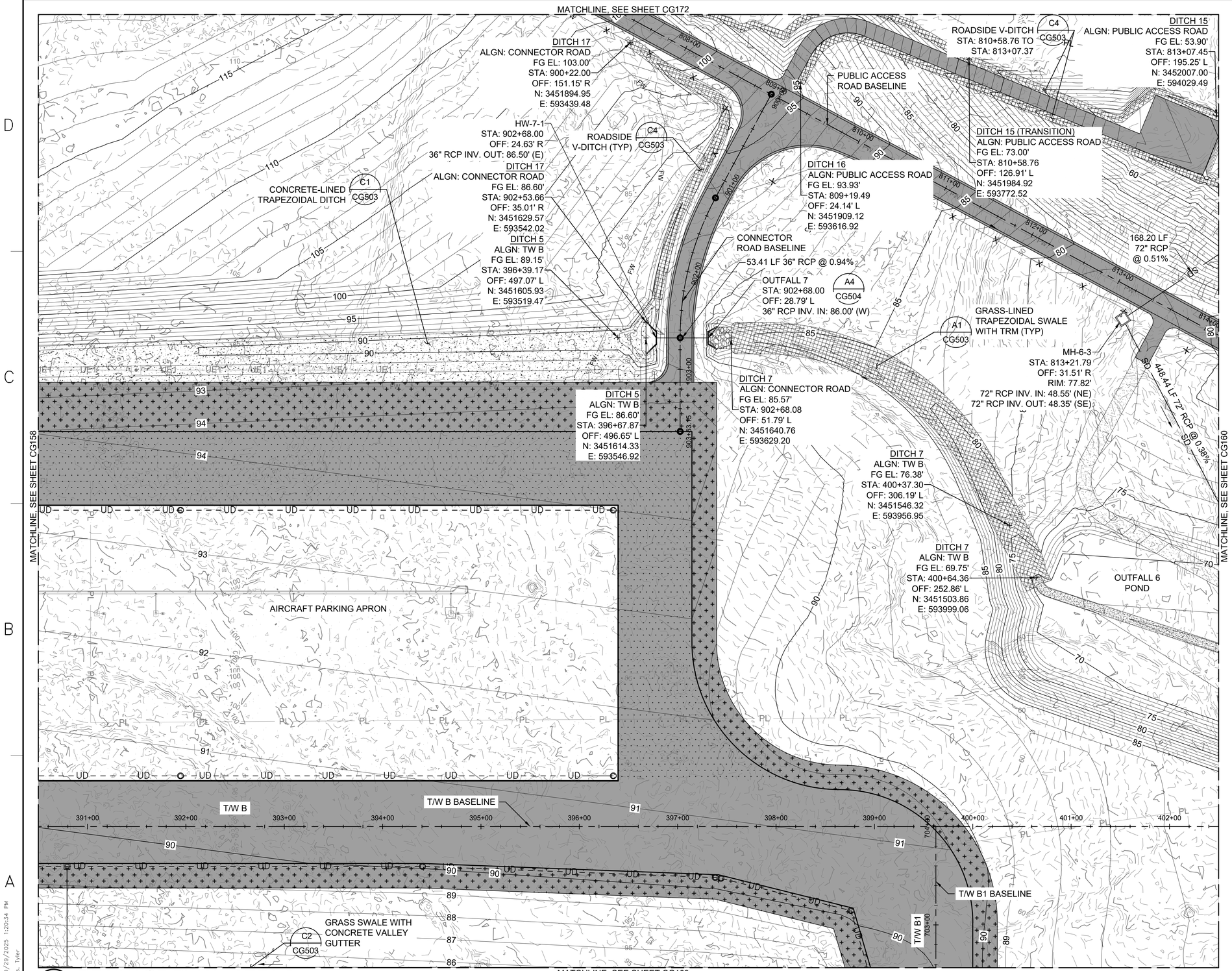
DRAINAGE PLAN - AREA 8

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG158

PRE-FINAL SUBMITTAL

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FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG158
PLOTTED: 10/29/2025 1:15:41 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 9
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

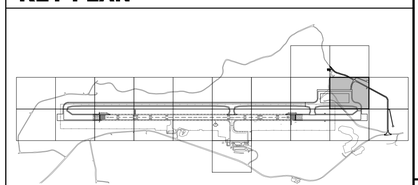
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

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- MINOR CONTOURS
- 90 — MAJOR CONTOURS
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- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD — PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% — SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB — DROP INLET
- D — MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NO.	DESCRIPTION	DATE

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HAWAII

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

AE Contract No. N62742-20-D-0002
AE Task Order No. N62742-22F-0338
JEG: 034/30615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

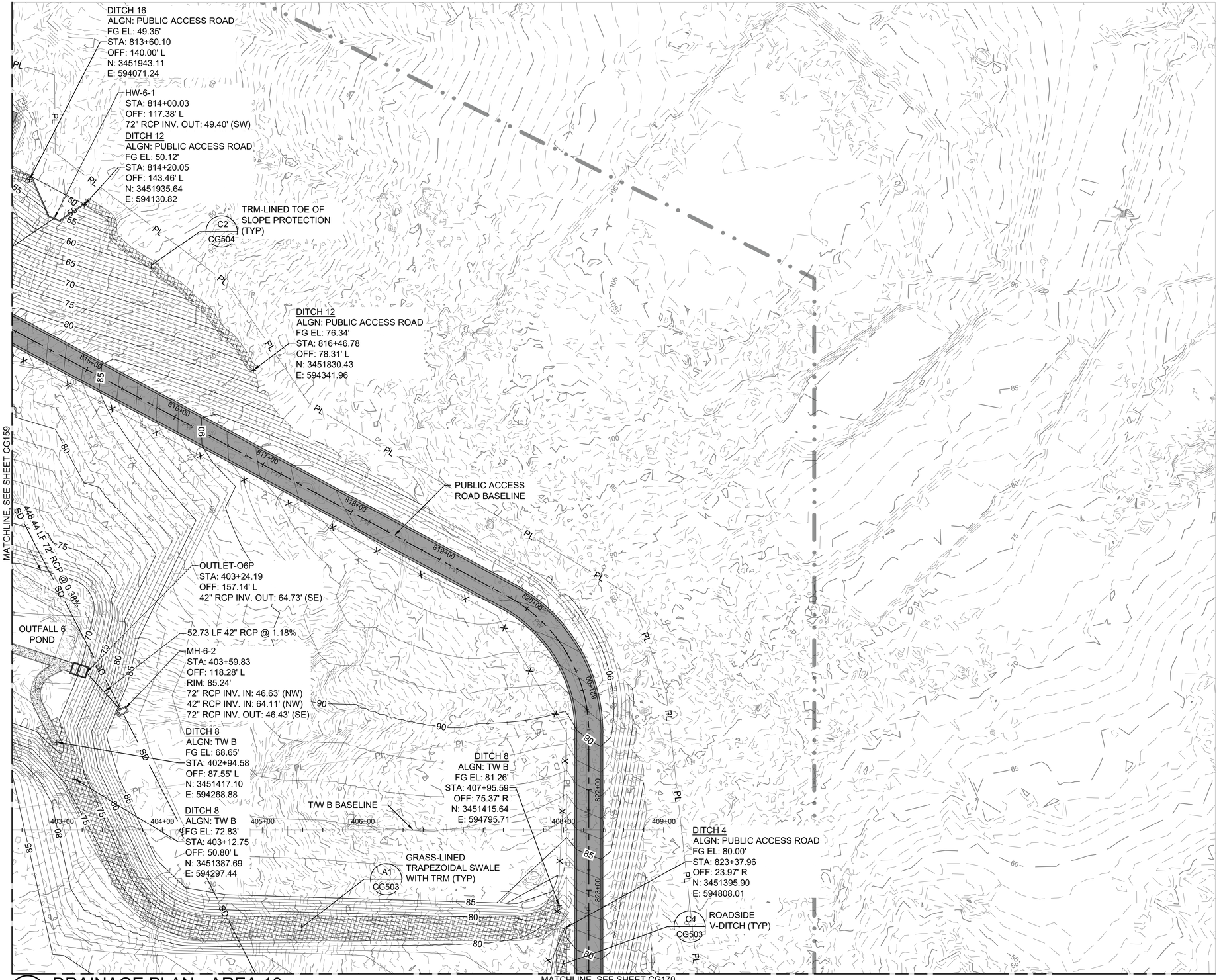
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 9

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET CG159 OF

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG159
PLOTTED: 10/29/2025 1:20:34 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 10
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
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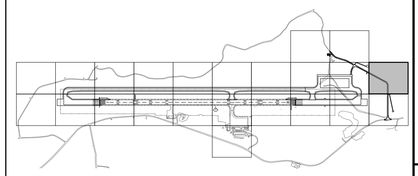
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

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- UNDERDRAIN MANHOLE
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- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

NO.	DESCRIPTION	DATE

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA00615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)
MAKALAPA, HAWAII

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 10

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF

CG160

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG160
PLOTTED: 10/29/2025 1:25:09 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 11
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

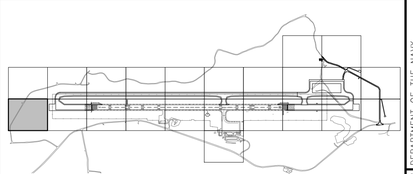
SHEET NOTES

1. TERMINATE / BEGIN CONCRETE-LINED SWALE VALLEY GUTTERS AT DRAINAGE STRUCTURES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
- SD — STORM DRAIN PIPE (SIZE AND TYPE AS INDICATED)
- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NO.	DESCRIPTION	DATE

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA09615
A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE

ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JGC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

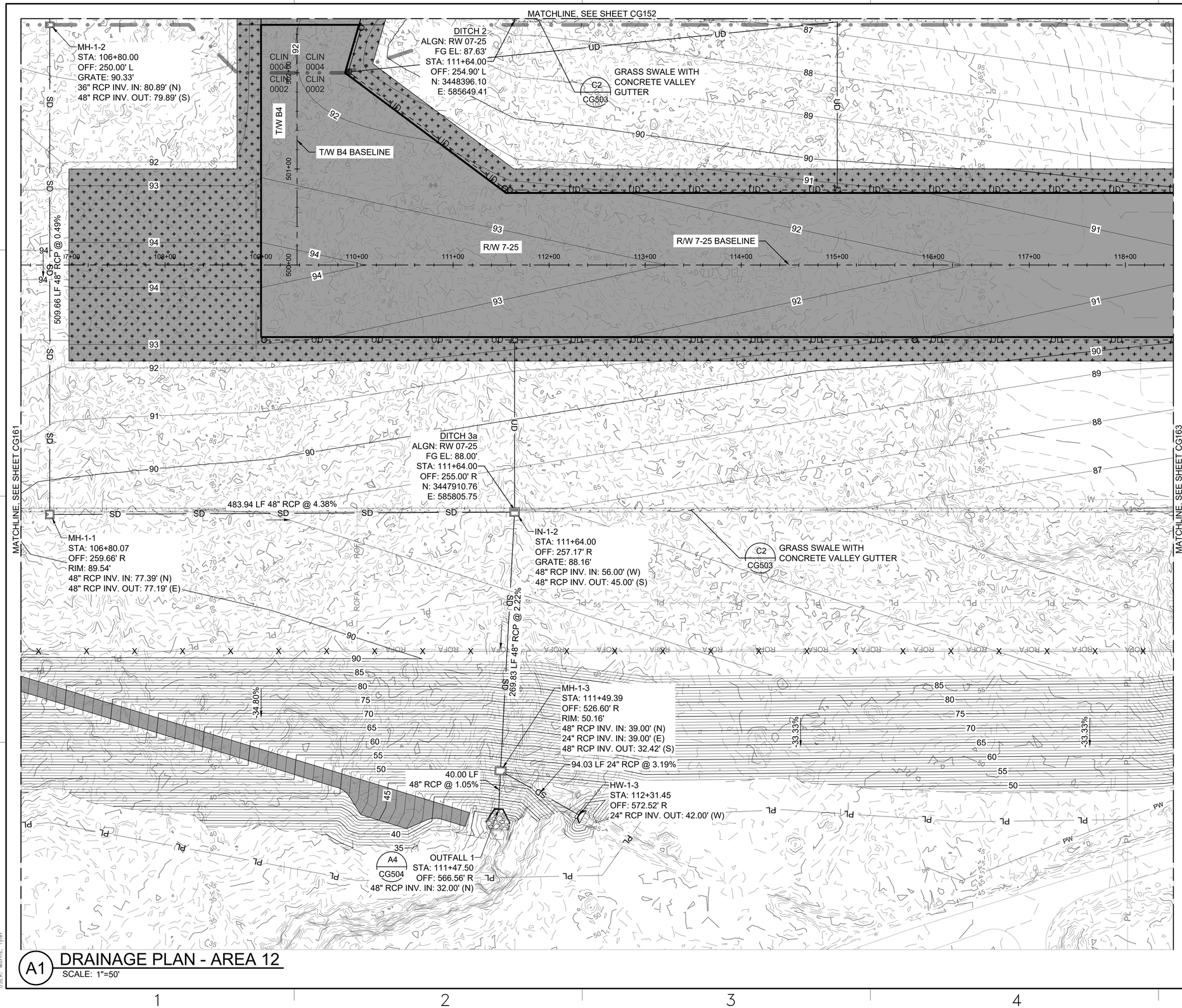
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 11

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG161

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG161
PLOTTED: 10/29/2025 1:29:59 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 12
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

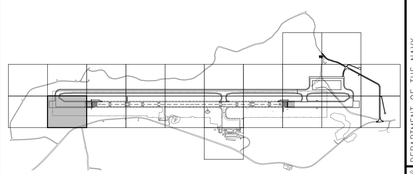
SHEET NOTES

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LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
- SD — STORM DRAIN PIPE (SIZE AND TYPE AS INDICATED)
- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

NO.	DESCRIPTION	DATE

NAVFAC

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SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA0061S
A/E INITIALS

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

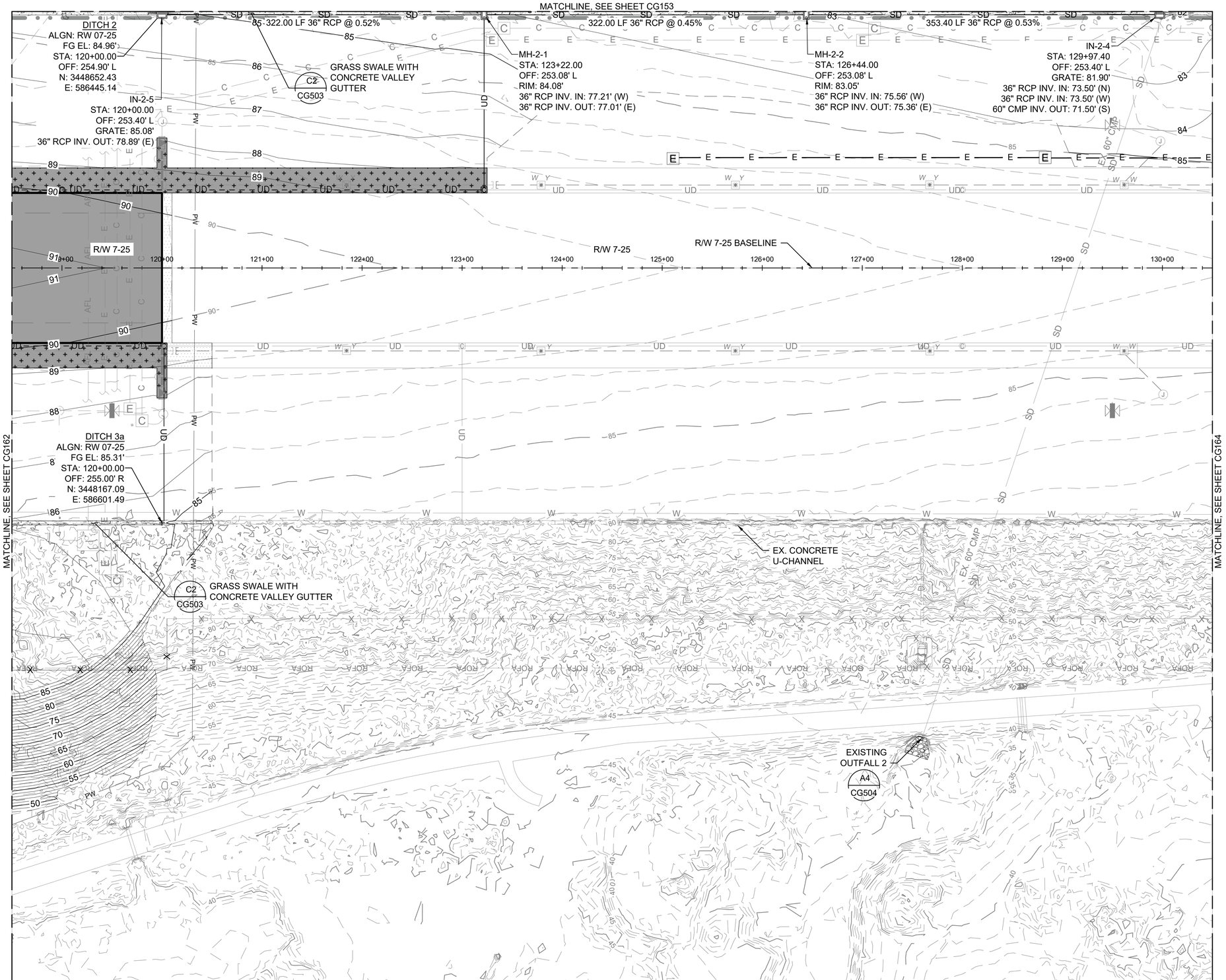
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NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
YAP INTERNATIONAL AIRPORT, FSM
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC, MAKALAPA, HAWAII
YAP, FEDERATED STATES OF MICRONESIA (FSM)
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
DRAINAGE PLAN - AREA 12

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG162

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG162
PLOTTED: 10/29/2025 1:34:56 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 13
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

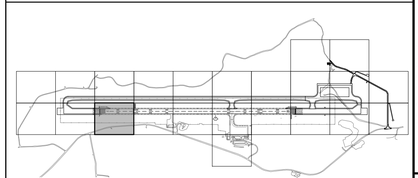
SHEET NOTES

1. TERMINATE / BEGIN CONCRETE-LINED SWALE VALLEY GUTTERS AT DRAINAGE STRUCTURES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
- SD — STORM DRAIN PIPE (SIZE AND TYPE AS INDICATED)
- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% — SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB — DROP INLET
- D — MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

DATE | SYM | DESCRIPTION

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: D3439615 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC
YAP INTERNATIONAL AIRPORT, FSM
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP, FEDERATED STATES OF MICRONESIA (FSM
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
DRAINAGE PLAN - AREA 14

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG163

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG163
PLOTTED: 10/29/2025 11:45:04 PM
USER: Morris, Tyler

MATCHLINE, SEE SHEET CG154

DITCH 2
ALGN: RW 07-25
FG EL: 81.35'
STA: 131+30.00
OFF: 254.90' L
N: 3448998.90
E: 587520.72

DITCH 2
ALGN: RW 07-25
FG EL: 82.37'
STA: 130+80.00
OFF: 254.90' L
N: 3448983.57
E: 587473.13

C2
CG503
GRASS SWALE WITH CONCRETE VALLEY GUTTER

DITCH 2
ALGN: RW 07-25
FG EL: 78.64'
STA: 139+80.00
OFF: 254.90' L
N: 3449259.52
E: 588329.78

IN-3-14
STA: 139+80.00
OFF: 253.40' L
GRATE: 78.77'
36" RCP INV. OUT: 72.75' (E)

SD
235.00 LF 36" RCP @ 0.31%

MH-3-13
STA: 142+15.00
OFF: 252.58' L
RIM: 78.06'
36" RCP INV. IN: 72.01' (W)
36" RCP INV. OUT: 71.81' (E)

R/W 7-25

R/W 7-25 BASELINE

131+00 132+00 133+00 134+00 135+00 136+00 137+00 138+00 139+00 140+00 141+00 142+00

EX. CONCRETE U-CHANNEL

ARFF

MATCHLINE, SEE SHEET CG163

MATCHLINE, SEE SHEET CG165

A1 DRAINAGE PLAN - AREA 14
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

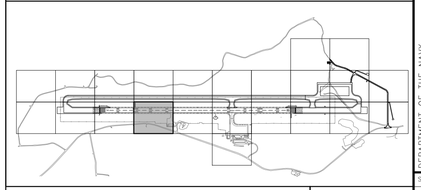
SHEET NOTES

1. TERMINATE / BEGIN CONCRETE-LINED SWALE VALLEY GUTTERS AT DRAINAGE STRUCTURES.

LEGEND

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- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

NO.	DESCRIPTION	DATE

NAVFAC

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Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG. D3430615 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PACIFIC
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

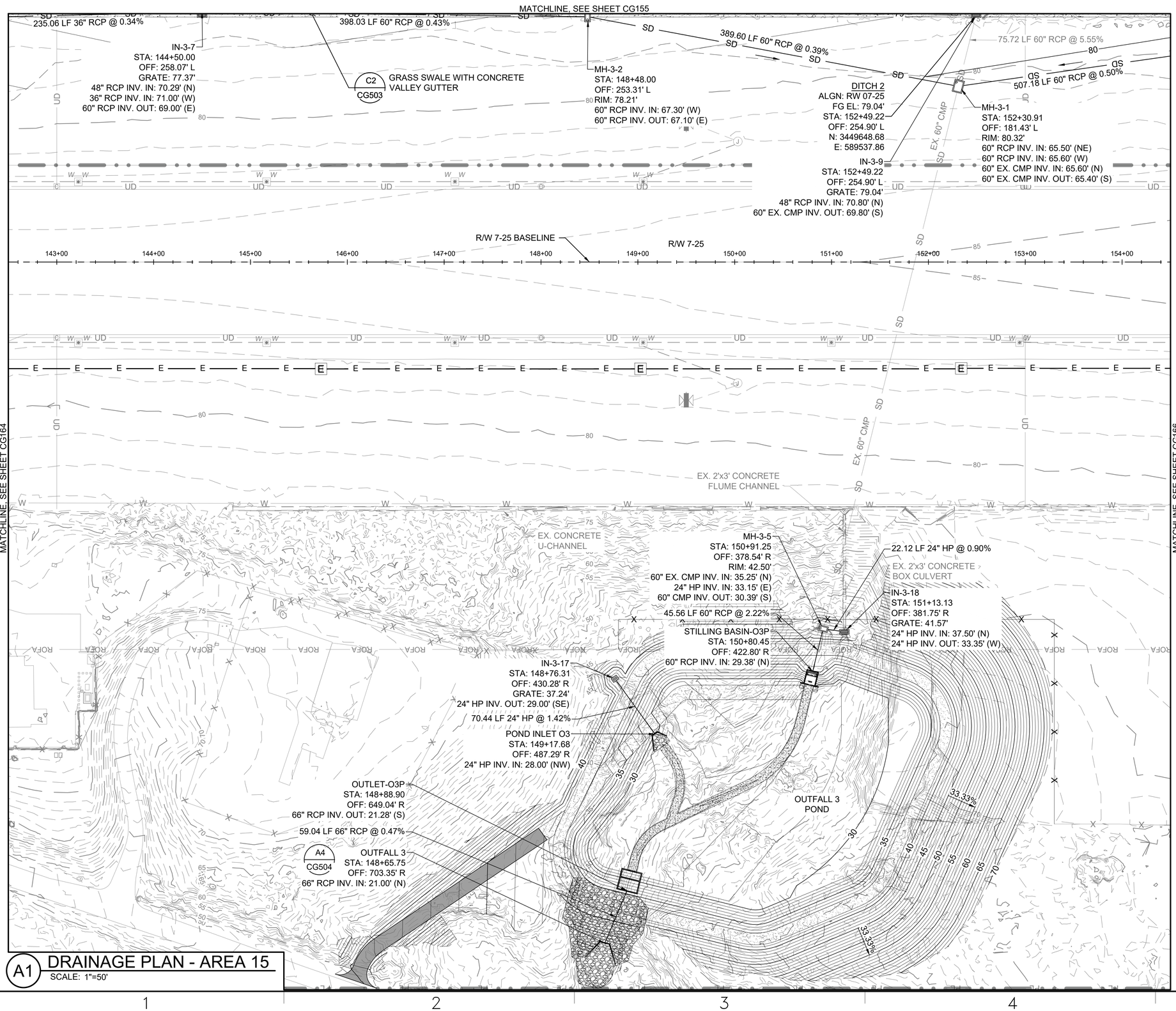
DRAINAGE PLAN - AREA 13

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG164

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p:\010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG164
PLOTTED: 10/29/2025 1:39:50 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 15
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

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D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

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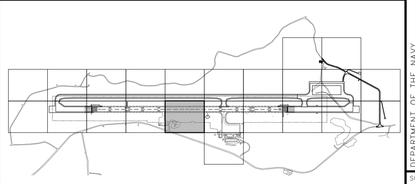
SHEET NOTES

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- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% — SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB — DROP INLET
- D — MANHOLE
- PW — POTABLE WATER LINE
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- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW (TRUE N)

NO.	DATE	SYM	DESCRIPTION

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: DIA00615
A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC — MAKALAPA, HAWAII
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
YAP INTERNATIONAL AIRPORT, FSM — YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 15

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET — OF
CG165

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p:\010_p\020\cg151-cg172.dwg
LAYOUT NAME: CG165
PLOTTED: 10/29/2025 1:50:01 PM
USER: Morris, Tyler

MATCHLINE, SEE SHEET CG156

507.18 LF 60" RCP @ 0.50%

GRASS SWALE WITH CONCRETE VALLEY GUTTER C2 CG503

MH-3-3
STA: 157+33.00
OFF: 253.05' L
RIM: 80.35'
48" RCP INV. IN: 69.05' (E)
60" RCP INV. OUT: 68.05' (SW)

DITCH 2
ALGN: RW 07-25
FG EL: 80.40'
STA: 158+20.84
OFF: 254.90' L
N: 3449823.95
E: 590081.96

472.02 LF 48" RCP @ 0.54%

T/W B3

T/W B3 BASELINE

CLIN 0004

CLIN 0004

264.04 LF 36" RCP @ 1.12%

DITCH 2
ALGN: RW 07-25
FG EL: 81.58'
STA: 162+10.00
OFF: 255.00' L
N: 3449943.36
E: 590452.34

IN-3-11
STA: 162+05.00
OFF: 257.17' L
GRATE: 81.74'
48" RCP INV. IN: 71.60' (N)
36" RCP INV. IN: 72.60' (E)
48" RCP INV. OUT: 71.60' (W)

275.00 LF 36" RCP @ 0.50%

MH-3-4
STA: 164+69.00
OFF: 252.58' L
RIM: 82.27'
36" RCP INV. IN: 75.76' (E)
36" RCP INV. OUT: 75.56' (W)

C2 CG503 GRASS SWALE WITH CONCRETE VALLEY GUTTER

R/W 7-25 BASELINE

R/W 7-25

155+00 156+00 157+00 158+00 159+00 160+00 161+00 162+00 163+00 164+00 165+00 166+00

602+00 601+00 600+00

T/W A

TERMINAL APRON

MATCHLINE, SEE SHEET CG165

MATCHLINE, SEE SHEET CG167

A1 DRAINAGE PLAN - AREA 16
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

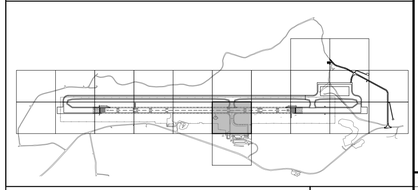
SHEET NOTES

1. TERMINATE / BEGIN CONCRETE-LINED SWALE VALLEY GUTTERS AT DRAINAGE STRUCTURES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
- SD — STORM DRAIN PIPE (SIZE AND TYPE AS INDICATED)
- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW (TRUE N)

DATE | SYM | DESCRIPTION

NAVFAC

FOR REVIEW ONLY

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG. D3430615 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE

ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

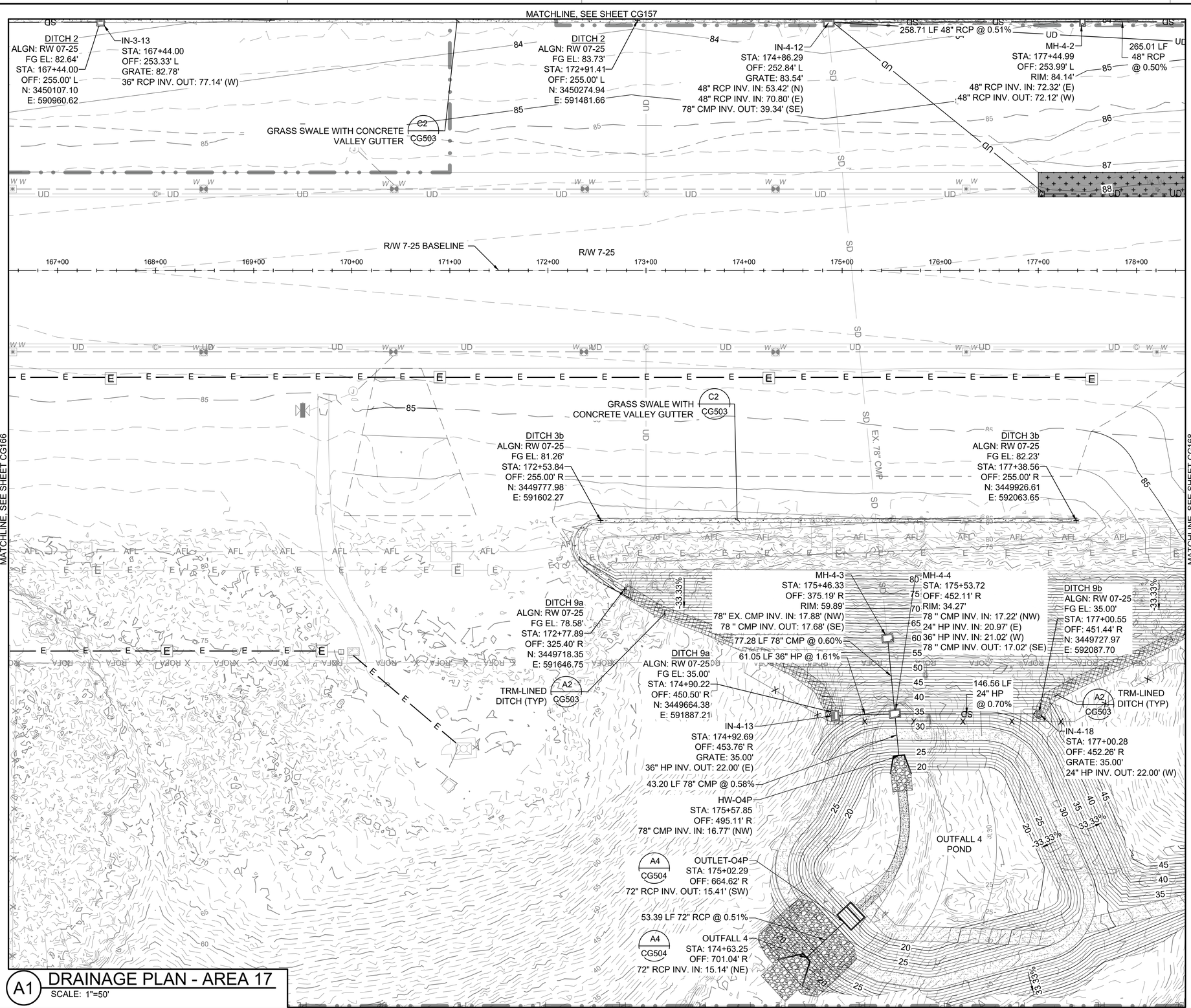
DRAINAGE PLAN - AREA 16

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG166

PRE-FINAL SUBMITTAL

FILE NAME: p:\010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG166
PLOTTED: 10/29/2025 1:54:54 PM
USER: Morris, Tyler

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES



GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

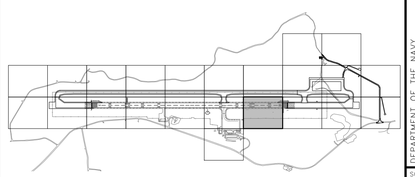
SHEET NOTES

1. TERMINATE / BEGIN CONCRETE-LINED SWALE VALLEY GUTTERS AT DRAINAGE STRUCTURES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
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- 90 — MAJOR CONTOURS
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- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

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NO.	DESCRIPTION	DATE

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ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE

ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PACIFIC
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MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
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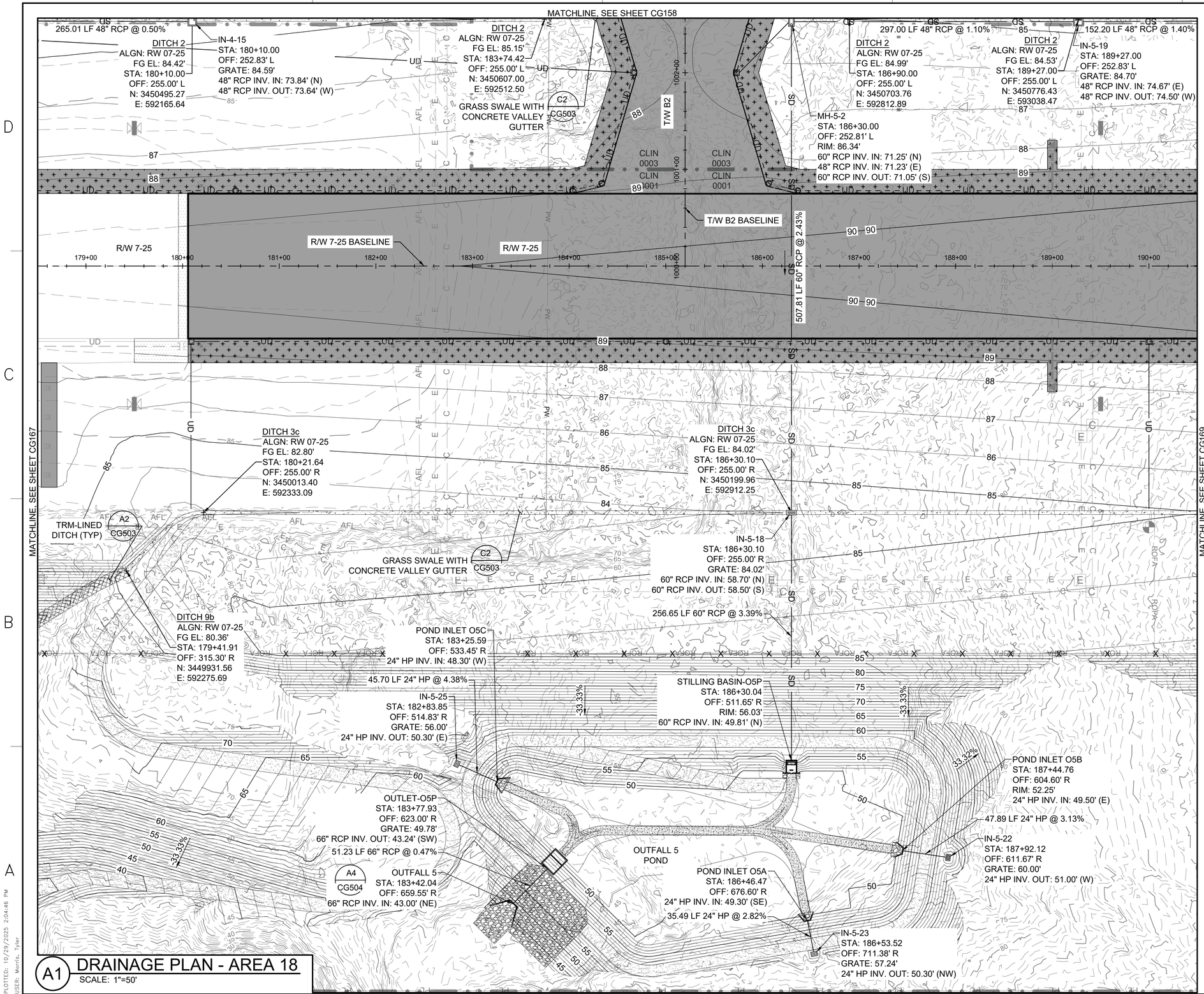
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 17

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG167

PRE-FINAL SUBMITTAL

FILE NAME: p:\010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG167
PLOTTED: 10/29/2025 1:59:43 PM
USER: Morris, Tyler



GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
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   B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

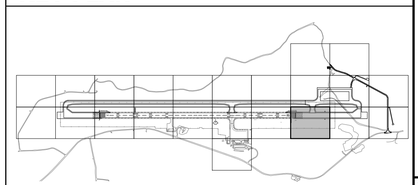
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- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% — SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB — DROP INLET
- D — MANHOLE
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- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X — CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'

SCALE: 1"=50'

NORTH ARROW

TRUE N

DATE | SYM | DESCRIPTION

NAVFAC

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ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: DIA0061 A/E INITIALS

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP, FEDERATED STATES OF MICRONESIA (FSM

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
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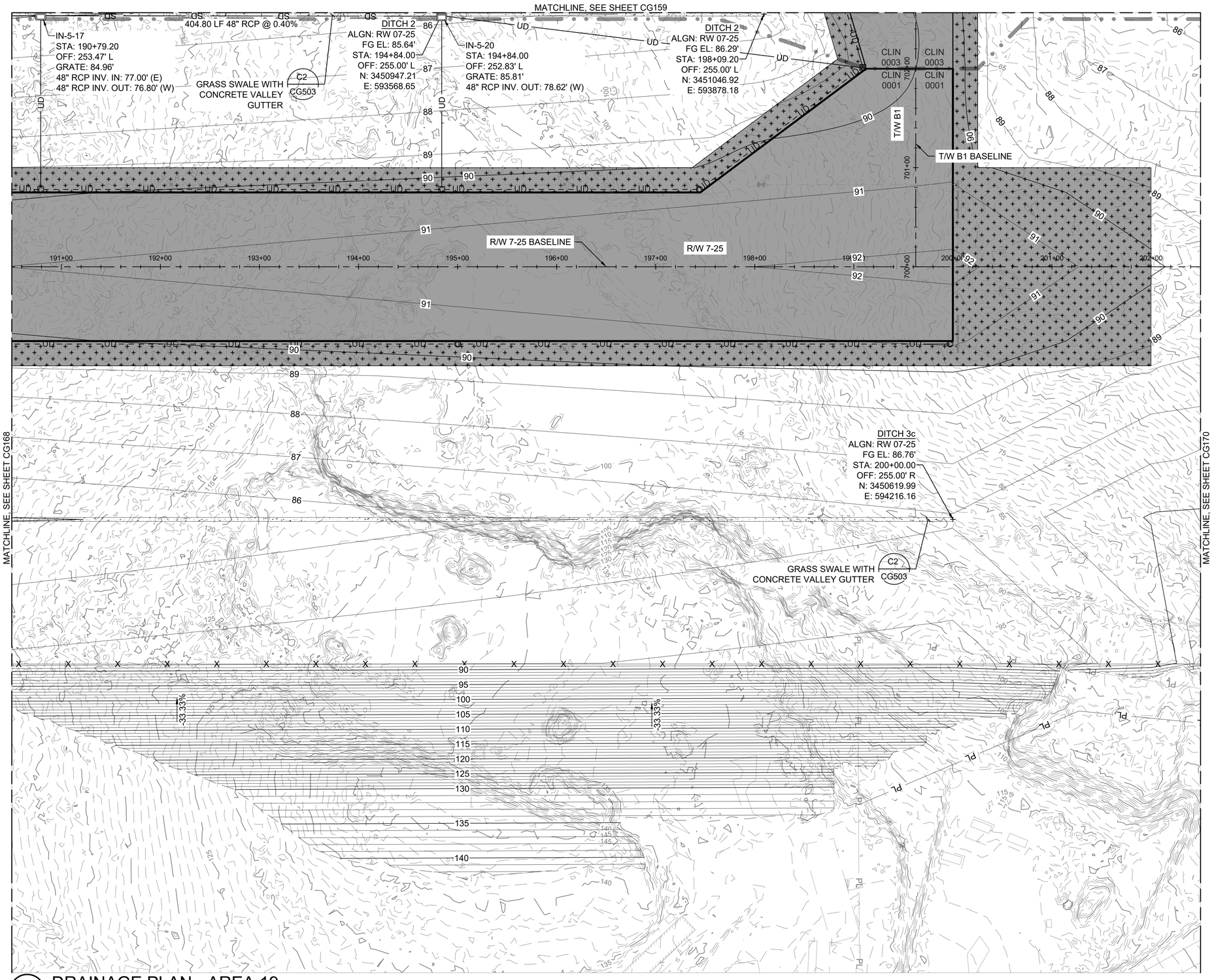
DRAINAGE PLAN - AREA 18

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG168

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG168
PLOTTED: 10/29/2025 2:04:46 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 19
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
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D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

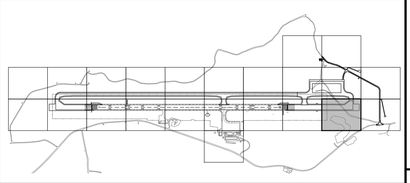
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- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
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- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

DATE | SYM | DESCRIPTION

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ARLINGTON, VA 22201-5765
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3436615 A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
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MAKALAPA, HAWAII
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YAP, FEDERATED STATES OF MICRONESIA (FSM)

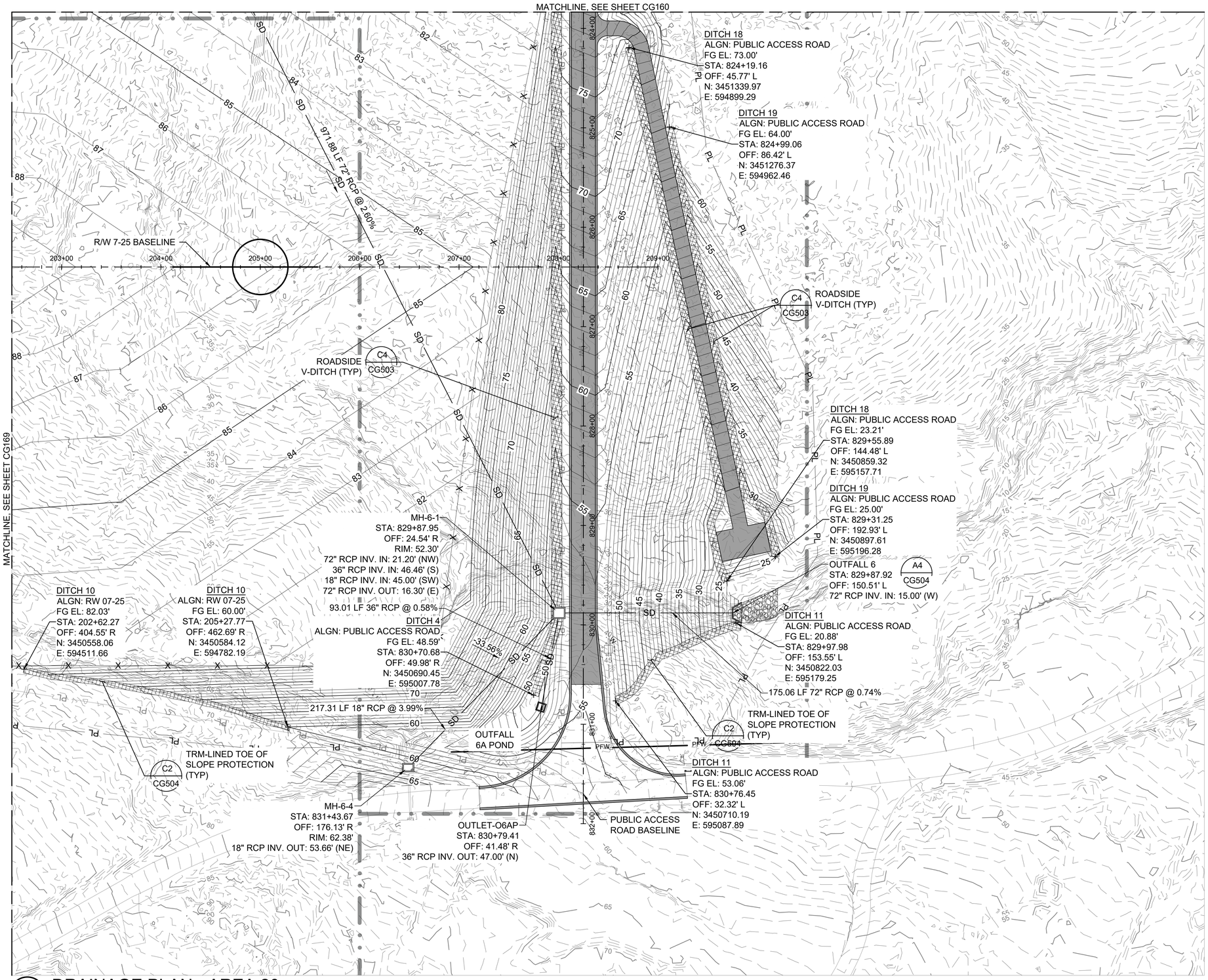
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 19

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG169

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG169
PLOTTED: 10/29/2025 2:09:41 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 20
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
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C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

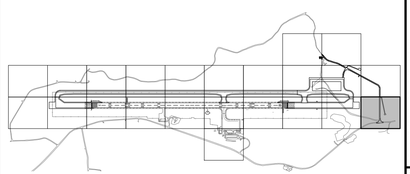
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

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- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

DATE	SYM	DESCRIPTION

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA00615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY:
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
DRAINAGE PLAN - AREA 20

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG170

PRE-FINAL SUBMITTAL

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FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG170
PLOTTED: 10/29/2025 2:14:06 PM
USER: Morris, Tyler



A1 DRAINAGE PLAN - AREA 21
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
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B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

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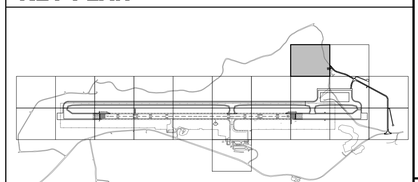
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

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- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

NO.	DESCRIPTION	DATE
STM		

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JEG: E0430615 A/E INFO

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FIRE PROTECTION					JCC

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MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PLAN - AREA 21

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG171

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-cg151-cg172.dwg
LAYOUT NAME: CG171
PLOTTED: 10/29/2025 2:18:42 PM
USER: Morris, Tyler

MATCHLINE, SEE SHEET CG171

DITCH 15
ALGN: PUBLIC ACCESS ROAD
FG EL: 122.50'
STA: 800+25.00
OFF: 20.79' L
N: 3452077.19
E: 592765.43

ROADSIDE V-DITCH
STA: 800+25.00 TO
STA: 804+29.49

C4
CG503

PUBLIC ACCESS
ROAD BASELINE

DITCH 15 (TRANSITION)
ALGN: PUBLIC ACCESS ROAD
FG EL: 116.24'
STA: 804+30.00
OFF: 25.32' L
N: 3451963.25
E: 593127.40

TRM-LINED TOE OF
SLOPE PROTECTION
STA: 804+30.00 TO
STA: 810+58.76

C2
CG504

MATCHLINE, SEE SHEET CG159

A1 DRAINAGE PLAN - AREA 22
SCALE: 1"=50'

GENERAL SHEET NOTES

A. DRAINAGE PIPE DESIGNATED AS "HP" DENOTES HIGH-PERFORMANCE POLYPROPYLENE PIPE MEETING PROJECT SPECIFICATION 33 40 00.

B. CONTOUR INTERVALS:
B.A. WITHIN RSA/TSA: 0.2' MINOR, 1.0' MAJOR.
B.B. OUTSIDE RSA/TSA: 1.0' MINOR, 5.0' MAJOR.

C. REFER TO CG200 DRAWING SERIES FOR DRAINAGE PROFILES.

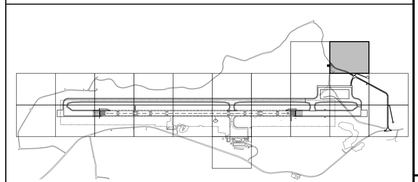
D. REFER TO CG450 DRAWING SERIES FOR POND GRADING DETAILS.

E. REFER TO CU100 AND CU200 DRAWING SERIES FOR CIVIL UTILITIES AND PROFILES.

LEGEND

- EXISTING MINOR CONTOURS (1' INTERVALS)
- 90 — EXISTING MAJOR CONTOURS (5' INTERVALS)
- MINOR CONTOURS
- 90 — MAJOR CONTOURS
- SD — STORM DRAIN PIPE (SIZE AND TYPE AS INDICATED)
- UD — NON-PERFORATED UNDERDRAIN PIPE (6" PVC)
- UD - - - PERFORATED UNDERDRAIN PIPE (6" PVC)
- UNDERDRAIN CLEANOUT
- UNDERDRAIN MANHOLE
- 1.00% SURFACE GRADIENT
- LIMIT OF DISTURBANCE
- CB DROP INLET
- D MANHOLE
- PW — POTABLE WATER LINE
- FW — FIRE WATER LINE AND HYDRANT
- PCC LINED DRAINAGE SWALE (TRAPEZOIDAL OR VALLEY GUTTER AS INDICATED)
- DRAINAGE POND ACCESS ROAD
- RIPRAP LINING
- TURF REINFORCEMENT MAT (TRM)
- CLIN 000X CONTRACT LINE ITEM NUMBER (CLIN) DELINEATOR
- PAVEMENT SHOULDER

KEY PLAN



GRAPHIC SCALE

0 50' 100'
SCALE: 1"=50'

NORTH ARROW
TRUE N

SYM	DESCRIPTION	DATE

NAVFAC

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: E0A30615
A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
YAP INTERNATIONAL AIRPORT, FSM
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND (FSM)
MAKALAPA, HAWAII
YAP, FEDERATED STATES OF MICRONESIA

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

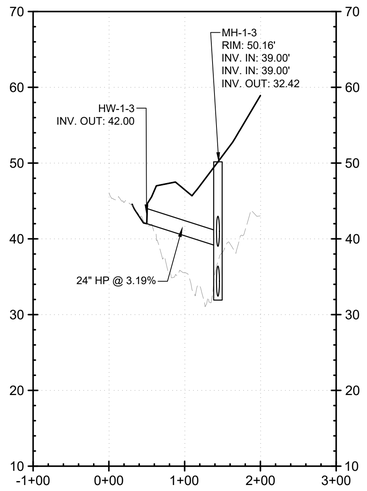
DRAINAGE PLAN - AREA 22

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG172

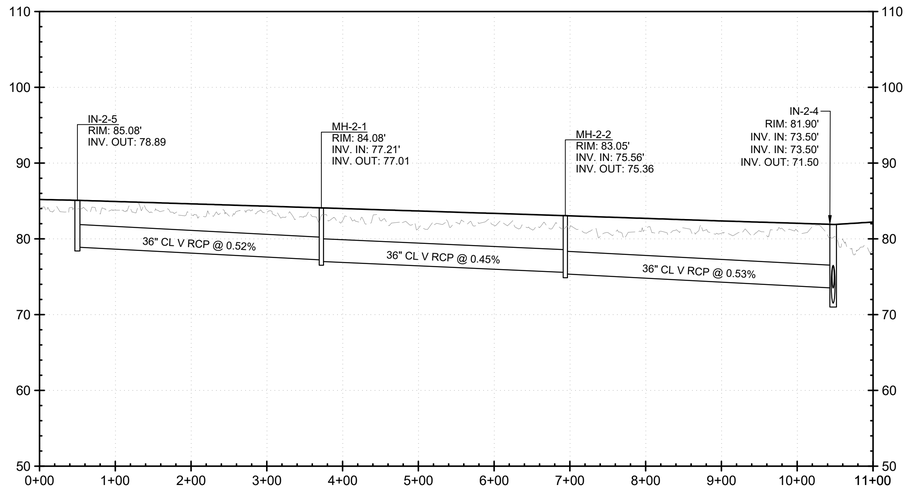
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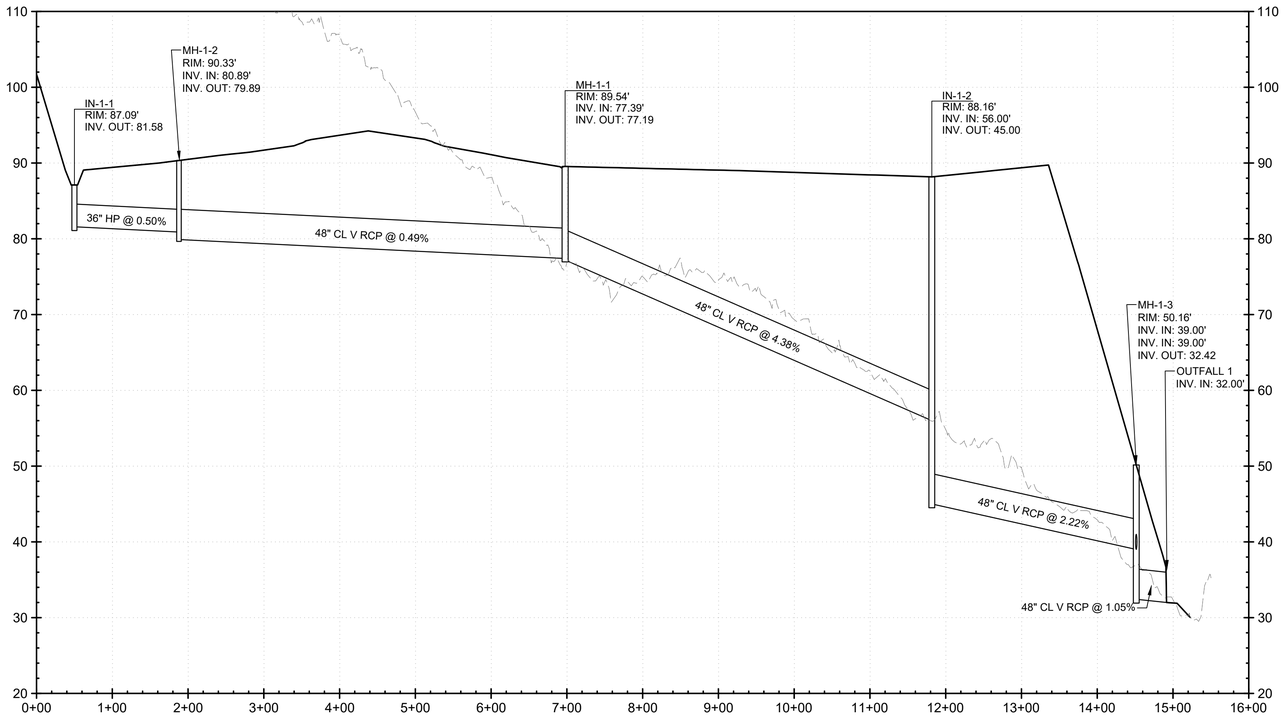
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USER: Morris, Tyler



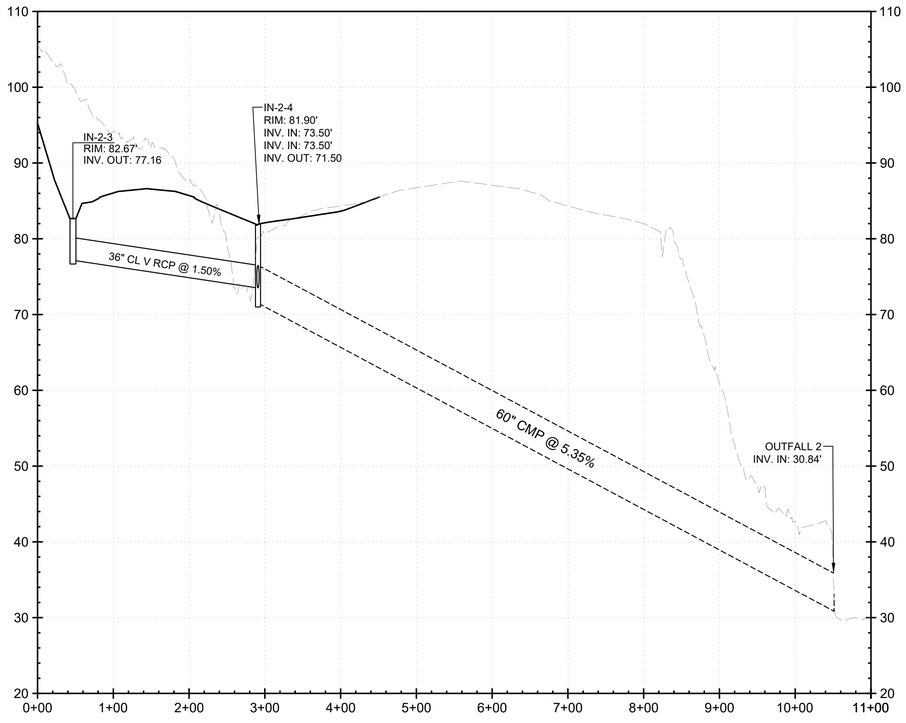
HW-1-3 TO MH-1-3



IN-2-5 TO IN-2-4



IN-1-1 TO OUTFALL 1



IN-2-3 TO OUTFALL 2

A1 DRAINAGE PROFILES
SCALE: 1"=100' HORIZ. 1"=10' VERT.

0 100 200
HORIZONTAL
SCALE: 1"=100'

0 10' 20'
VERTICAL
SCALE: 1"=10'

FILE NAME: p-010_p-020-cg201-cg206.dwg
LAYOUT NAME: CG201
PLOTTED: 10/29/2025 2:25:55 PM
USER: Morris, Tyler

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Jacobs / BURNS MCDONNELL

1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG. 034308.15

A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	DPS	DRW	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
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FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

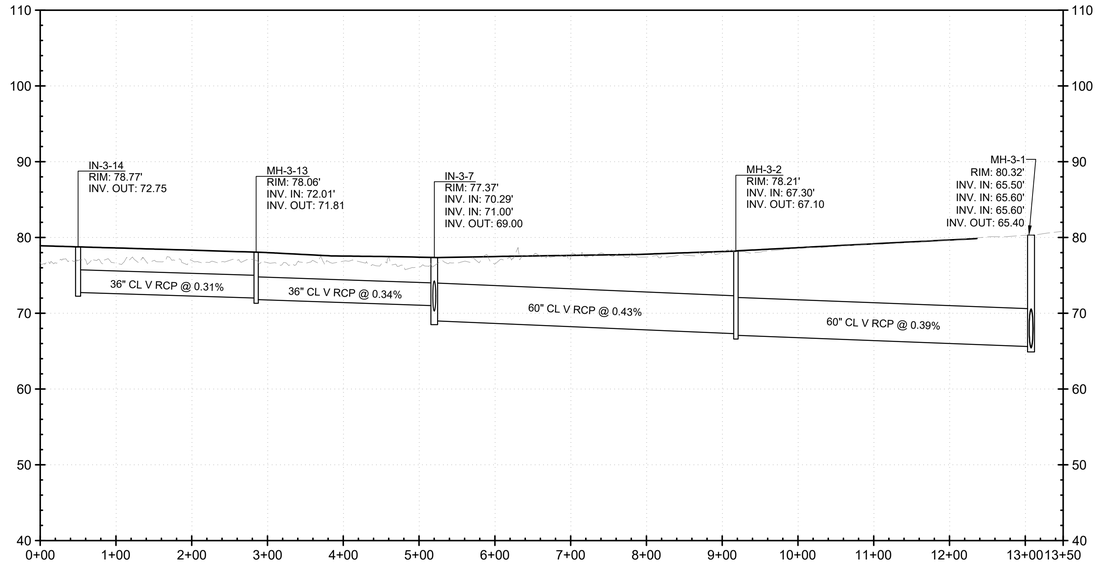
DRAINAGE PROFILES

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF

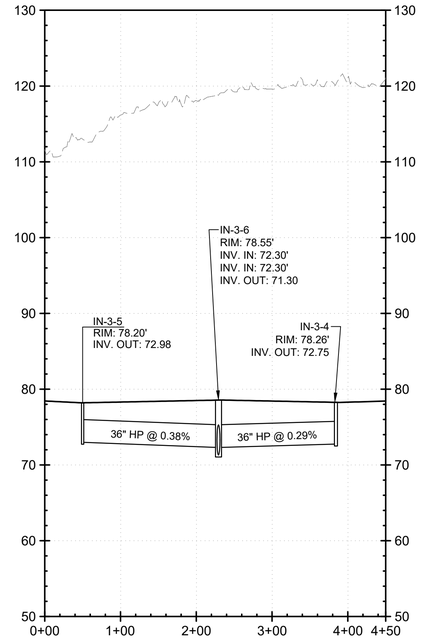
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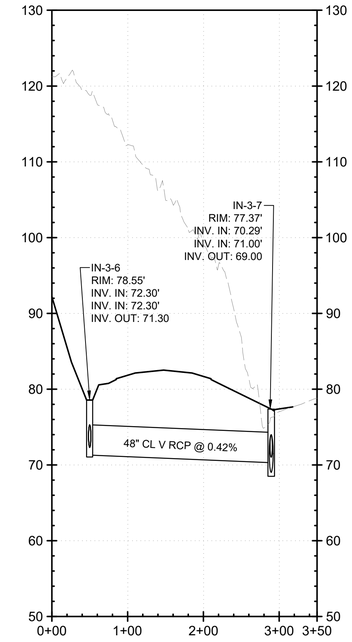
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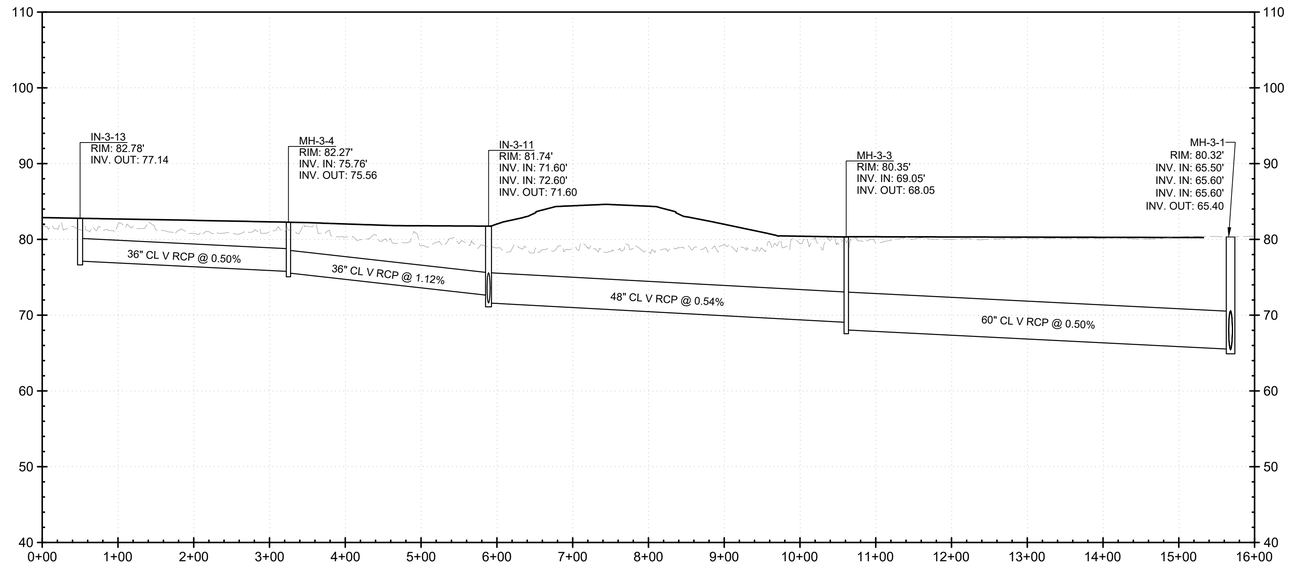
IN-3-14 TO MH-3-1



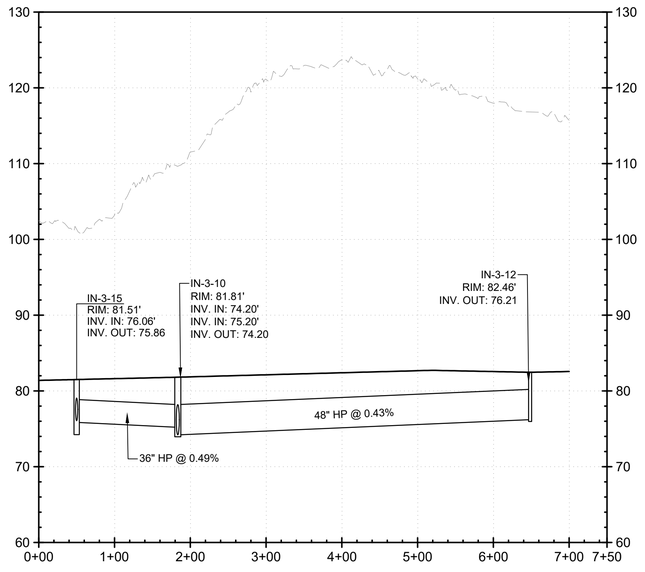
IN-3-4 TO IN-3-6 & IN-3-5 TO IN-3-6



IN-3-6 TO IN-3-7



IN-3-13 TO MH-3-1



IN-3-12 TO IN-3-10 & IN-3-15 TO IN-3-10

A1 DRAINAGE PROFILES
SCALE: 1"=100' HORIZ. 1"=10' VERT.

0 100 200
HORIZONTAL
SCALE: 1"=100'

0 10' 20'
VERTICAL
SCALE: 1"=10'

NO.	DESCRIPTION	DATE

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ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3A09615 A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES: DPS	DRW: MAK	REV: VTO
PM/DM		MAI/DRK
BRANCH MANAGER		SMK
CHIEF ENG		EAM
FIRE PROTECTION		JCC

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DRAINAGE PROFILES

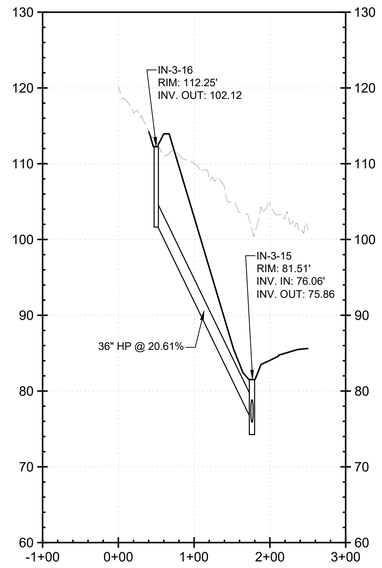
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EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF

CG202

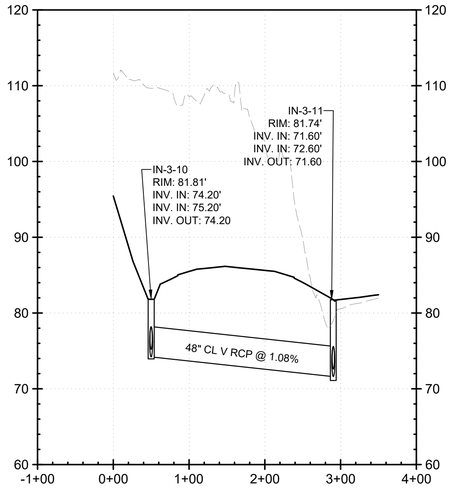
PRE-FINAL SUBMITTAL

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PLOTTED: 10/29/2025 2:27:13 PM
USER: Morris, Tyler

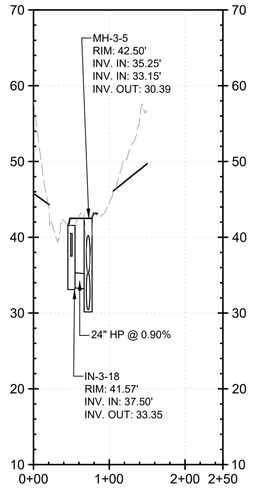
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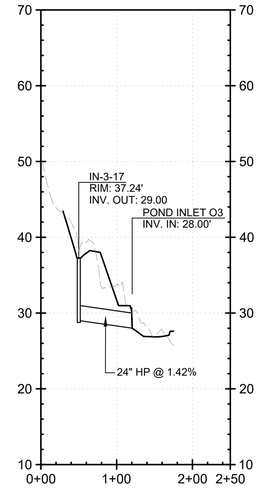
IN-3-16 TO IN-3-15



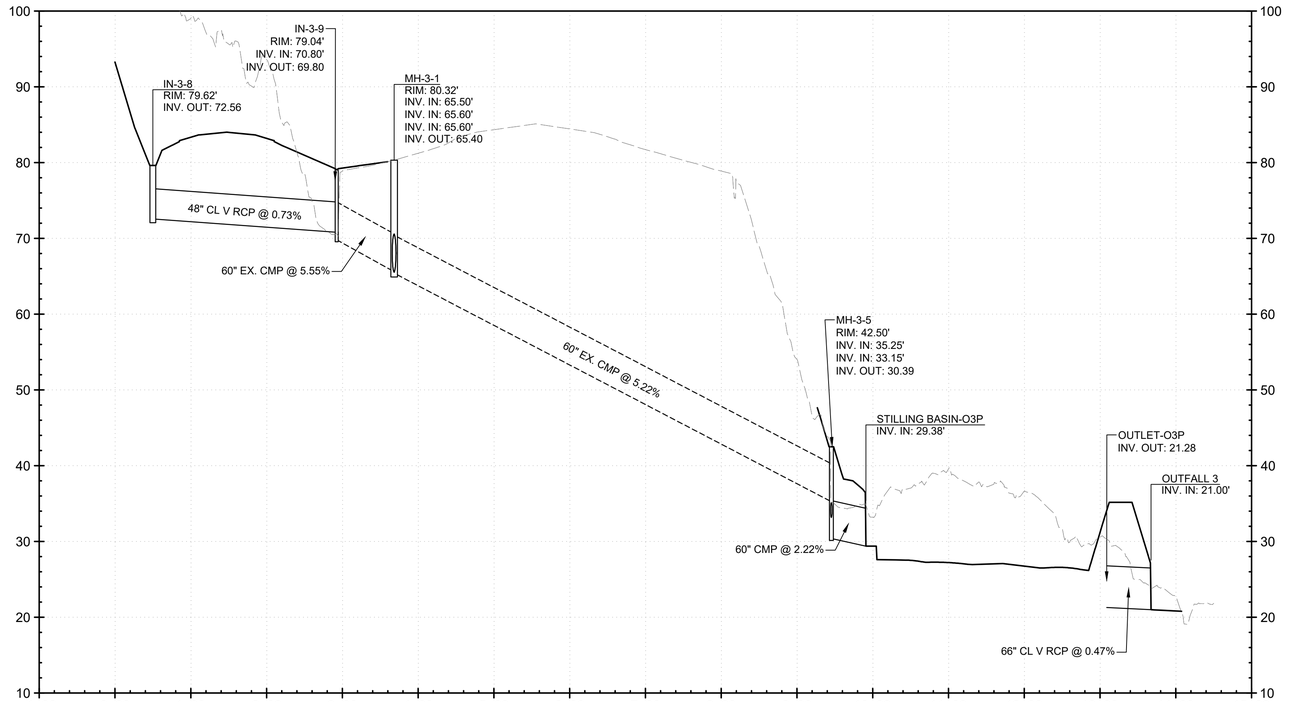
IN-3-10 TO IN-3-11



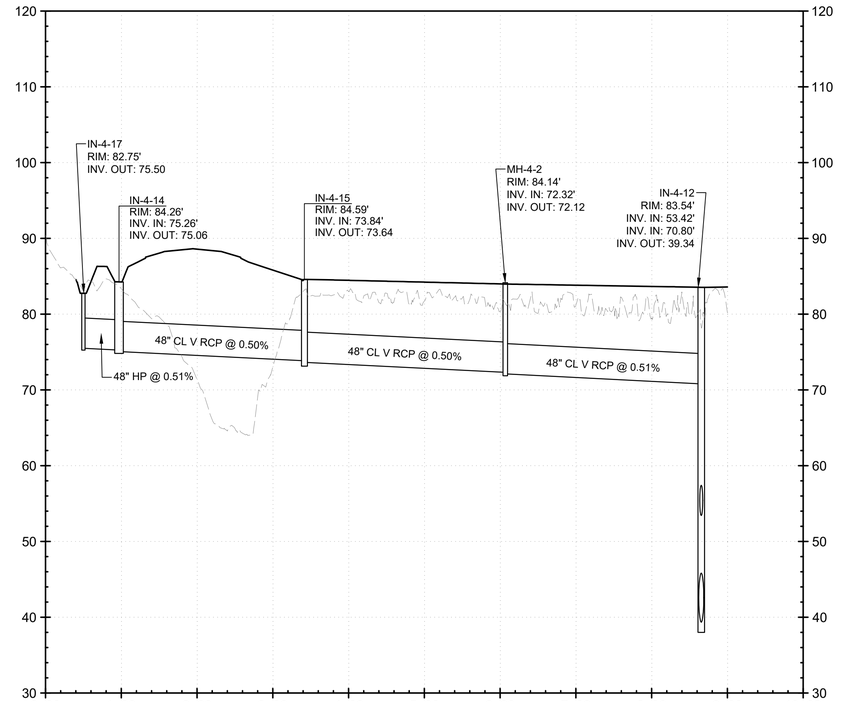
IN-3-18 TO MH-3-5



IN-3-17 TO POND INLET O3



IN-3-8 TO OUTFALL 3



IN-4-17 TO IN-4-12

HORIZONTAL SCALE: 1"=100'

VERTICAL SCALE: 1"=10'

A1 DRAINAGE PROFILES

SCALE: 1"=100' HORIZ. 1"=10' VERT.

DATE	
SYM	DESCRIPTION

NAVFAC

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: 03430615 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ MAKALAPA, HAWAII
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PROFILES

SCALE: AS SHOWN

EPROJECT NO.: 1687159; 1719021

CONSTR. CONTR. NO. -

NAVFAC DRAWING NO.

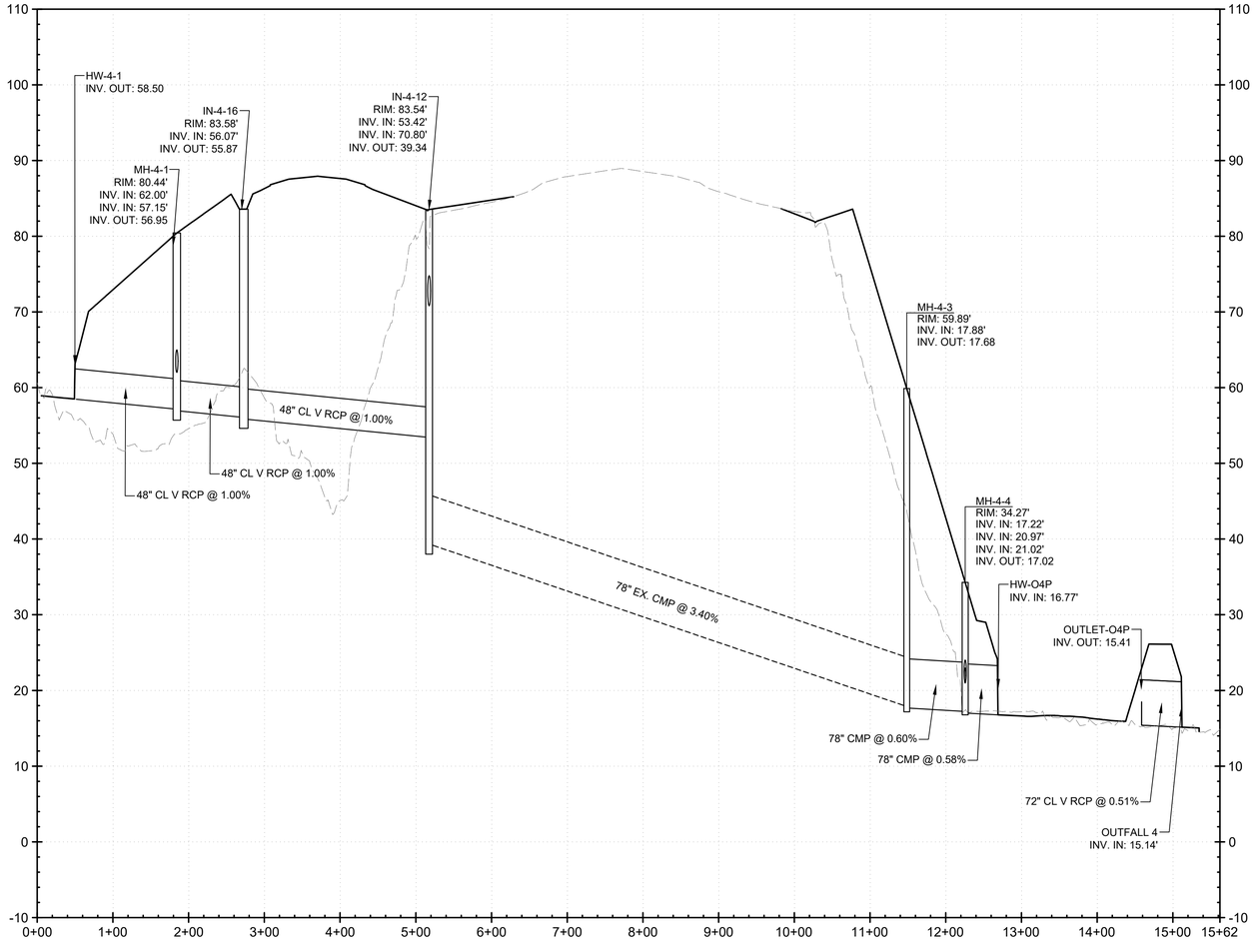
SHEET OF

CG203

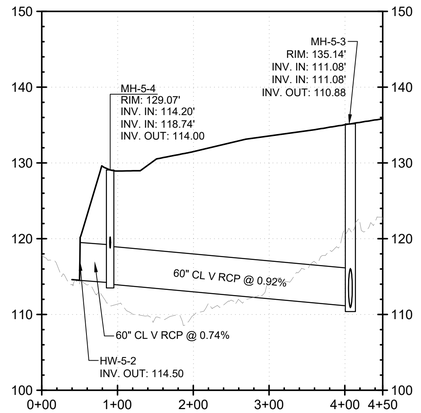
PRE-FINAL SUBMITTAL

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LAYOUT NAME: CG203
PLOTTED: 10/29/2025 2:28:19 PM
USER: Morris, Tyler

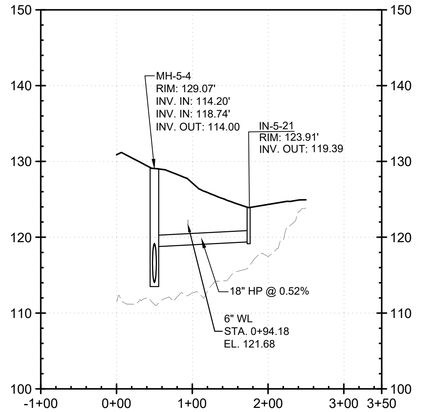
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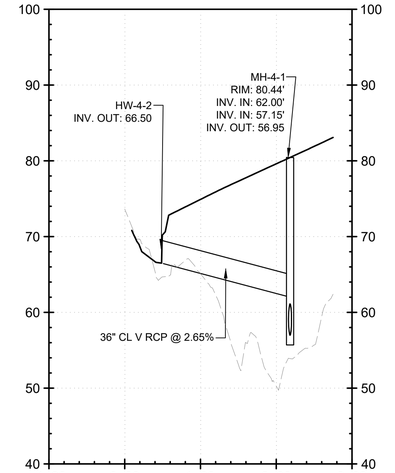
HW-4-1 TO OUTFALL 4



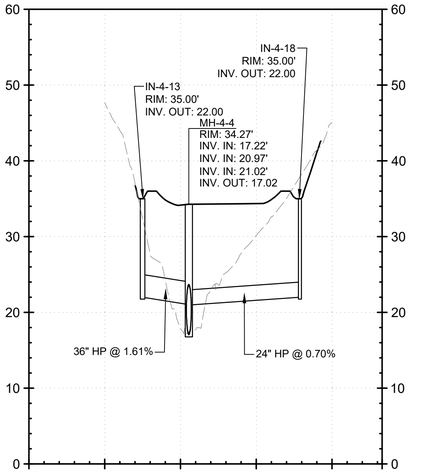
HW-5-2 TO MH-5-3



IN-5-21 TO MH 5-4



HW-4-2 TO MH-4-1



IN 4-13 TO IN 4-18

A1 DRAINAGE PROFILES
SCALE: 1"=100' HORIZ. 1"=10' VERT.

0 100 200
HORIZONTAL
SCALE: 1"=100'

0 10' 20'
VERTICAL
SCALE: 1"=10'

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A/E Task Order No. N62742-22F-0338
JEG: 034308 15
A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
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DES	DPS	DRW	MAK	REV VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ MAKALAPA, HAWAII
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DRAINAGE PROFILES

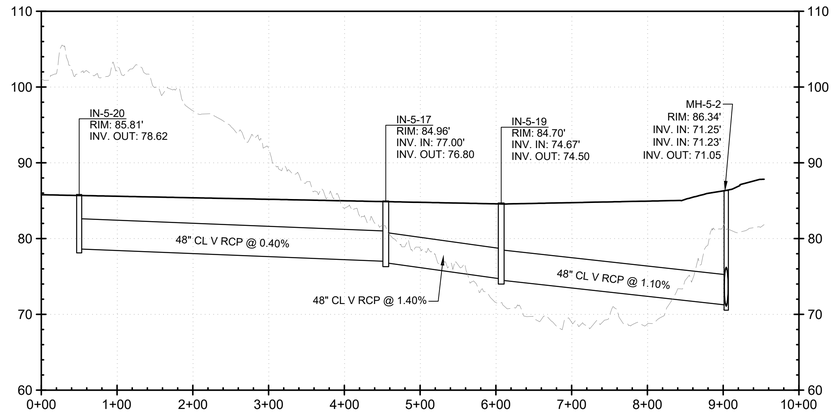
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EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF

CG204

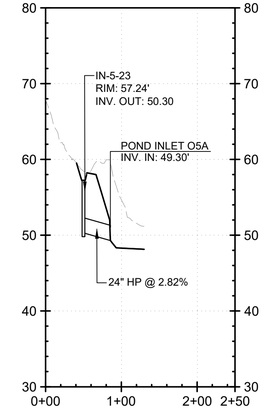
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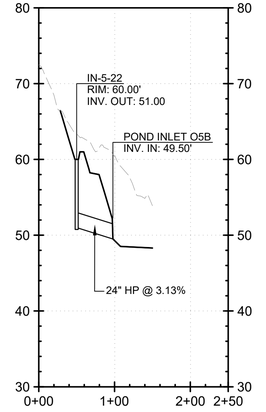
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PLOTTED: 10/29/2025 2:29:34 PM
USER: Morris, Tyler



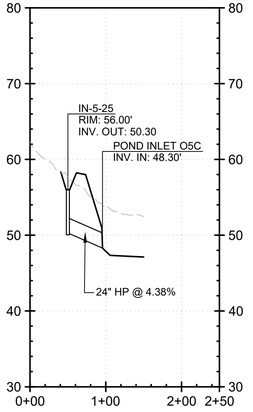
IN-5-20 TO MH-5-2



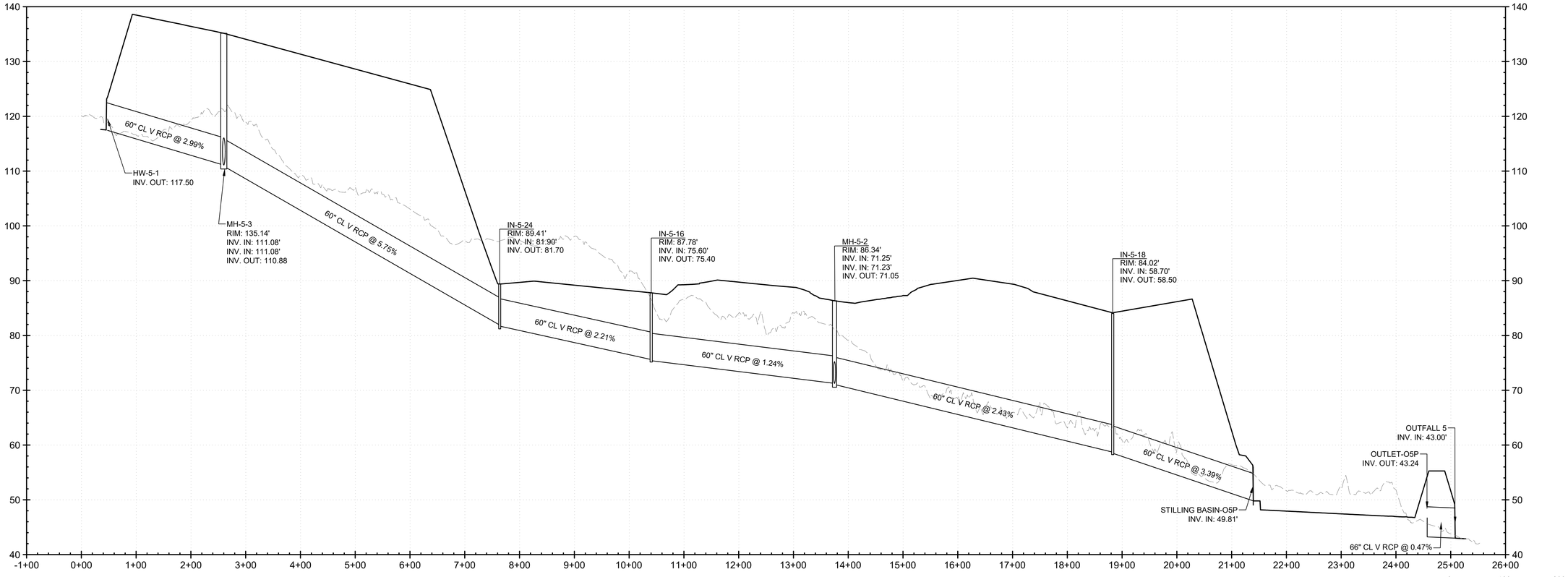
IN-5-23 TO POND INLET O5A



IN-5-22 TO POND INLET O5B



IN-5-25 TO POND INLET O5C



HW-5-1 TO OUTFALL 5

HORIZONTAL SCALE: 1"=100'

VERTICAL SCALE: 1"=10'

A1 DRAINAGE PROFILES

SCALE: 1"=100' HORIZ. 1"=10' VERT.

STM	DESCRIPTION	DATE

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Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

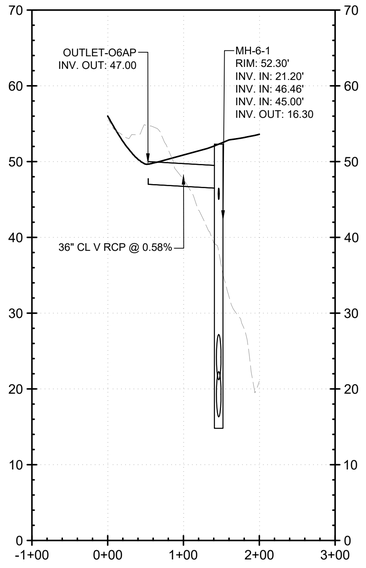
DRAINAGE PROFILES

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG205

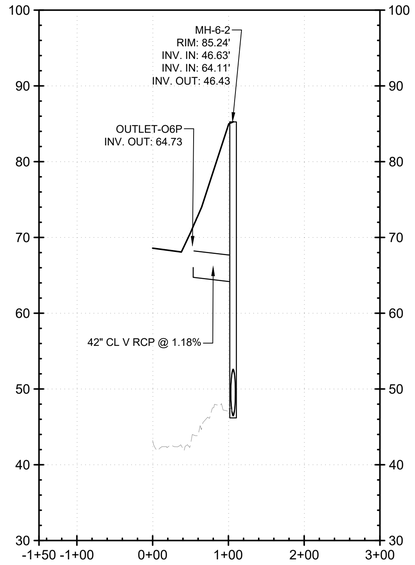
PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

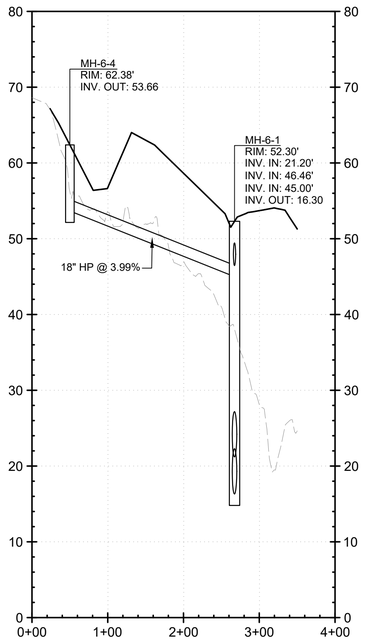
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LAYOUT NAME: CG205
PLOTTED: 10/29/2025 2:30:49 PM
USER: Morris, Tyler



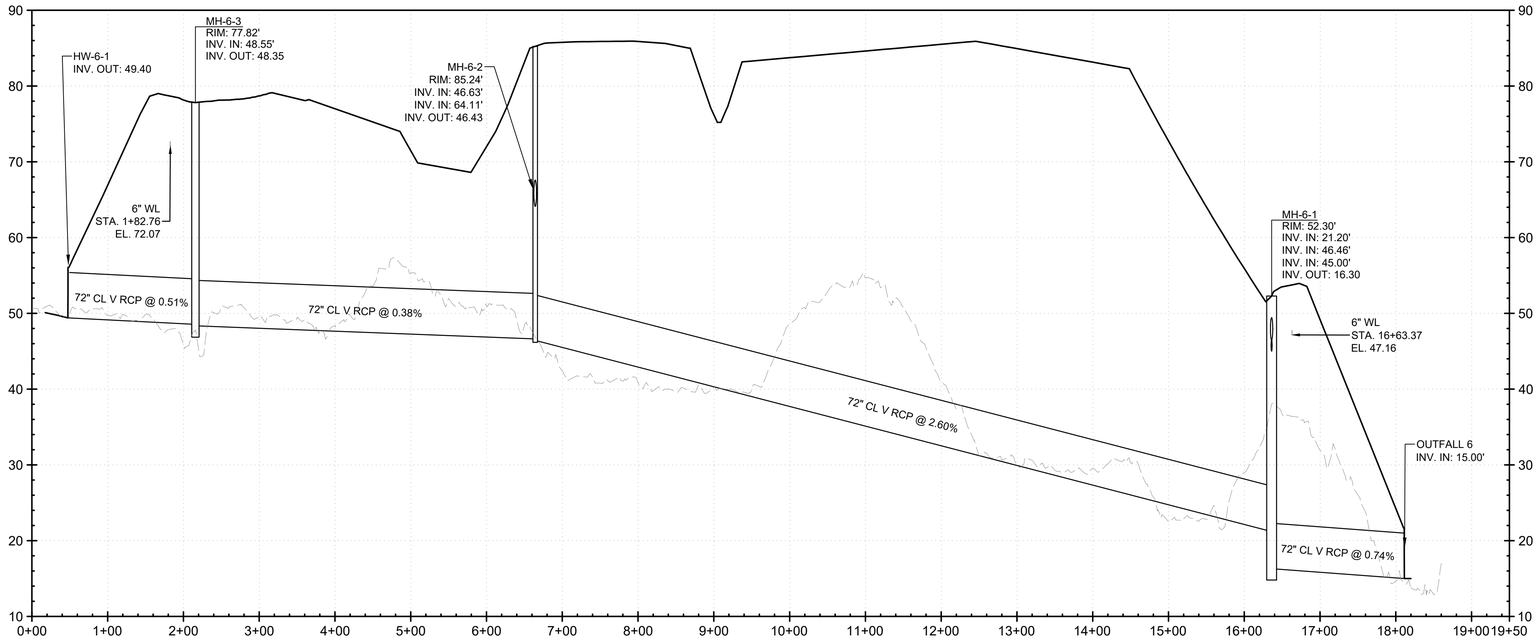
OUTLET-O6AP TO MH-6-1



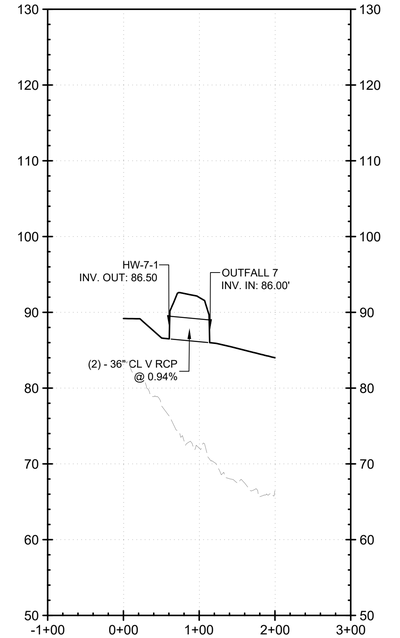
OUTLET-O6P TO MH-6-2



MH-6-4 TO MH-6-1



HW-6-1 TO OUTFALL 6



HW-7-1 TO OUTFALL 7

HORIZONTAL
SCALE: 1"=100'

VERTICAL
SCALE: 1"=10'

A1 DRAINAGE PROFILES
SCALE: 1"=100' HORIZ. 1"=10' VERT.

NO.	DESCRIPTION	DATE

NAVFAC

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DOUGLAS PRESTON STEWART
Name
CO 29899 — Registration Number #
NOV 4, 2025 — Date

SEAL

Jacobs / BURNS MCDONNELL

1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: DIA90615

A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE PROFILES

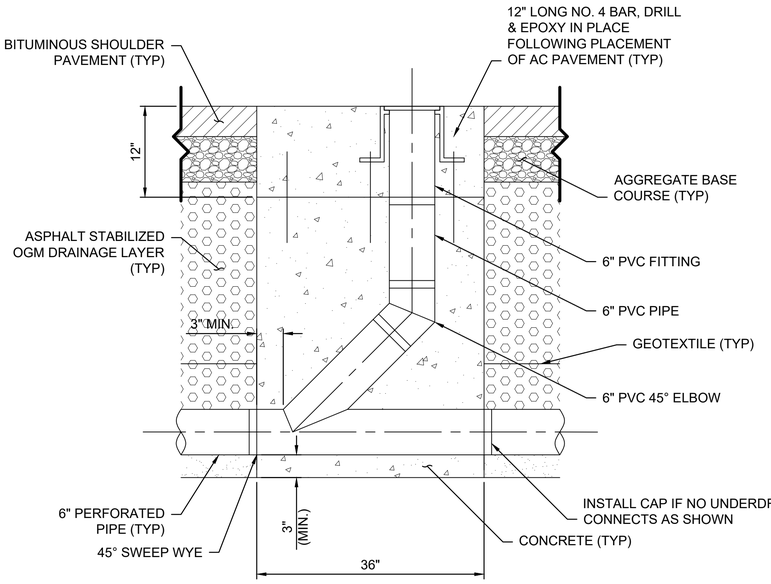
SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF

CG206

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg201-cg206.dwg
LAYOUT NAME: CG206
PLOTTED: 10/29/2025 2:32:05 PM
USER: Morris, Tyler

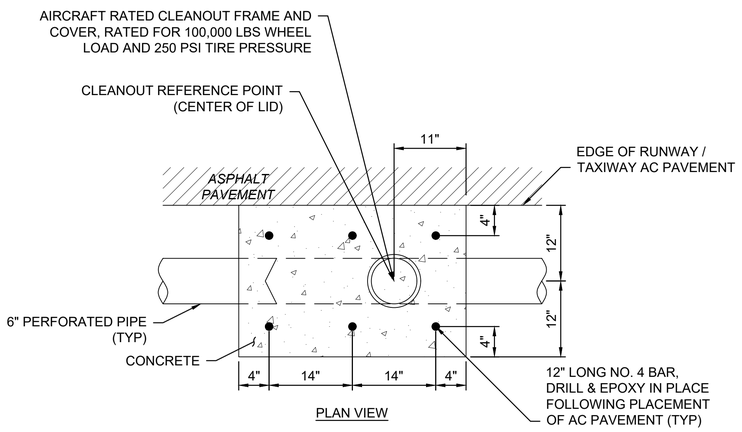
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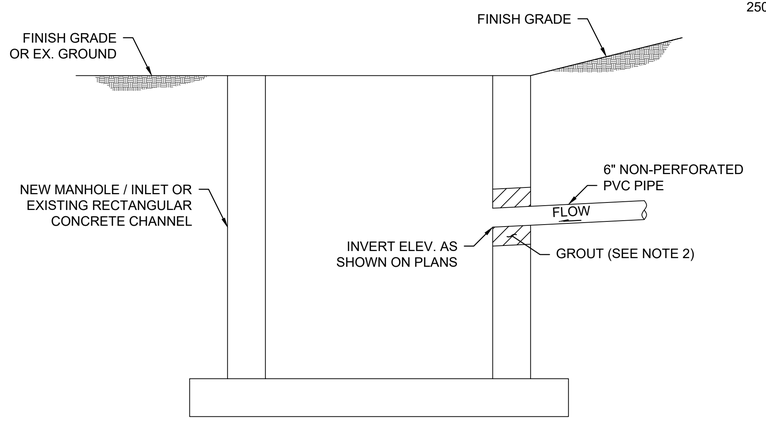
SECTION VIEW

A1 UNDERDRAIN CLEANOUT

SCALE: 1" = 1'-0"



PLAN VIEW

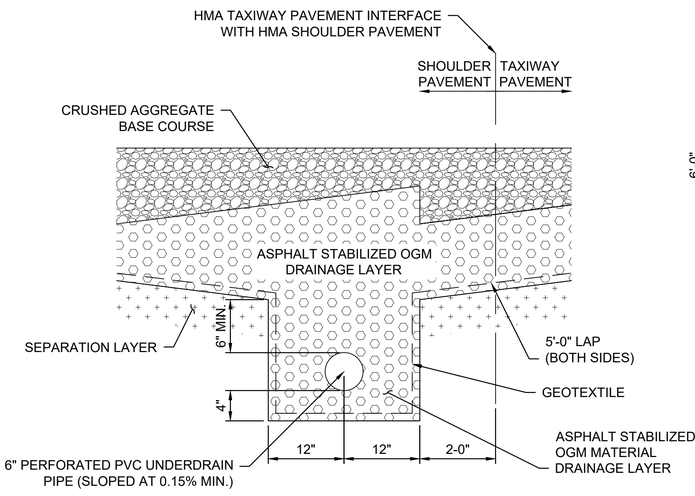


NOTES:

1. CORE STRUCTURE FOR PENETRATION.
2. GROUT ANNULAR SPACE AROUND PIPE AT STRUCTURE.
3. TRIM PIPE ON INTERIOR FLUSH WITH INSIDE WALL.
4. SUBDRAIN PENETRATIONS MAY BE PRECAST INTO DRAINAGE STRUCTURES, AT PLAN INVERT ELEVATIONS, IN LIEU OF CORE AND GROUT.

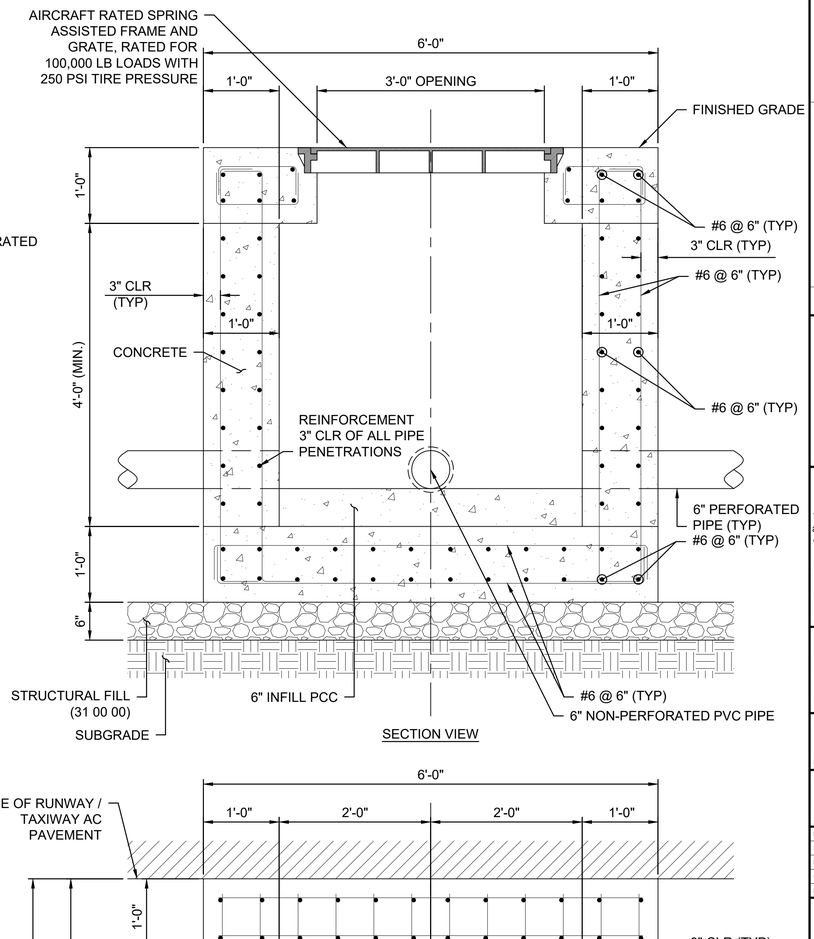
C3 UNDERDRAIN CONNECTION TO STRUCTURE

SCALE: NTS

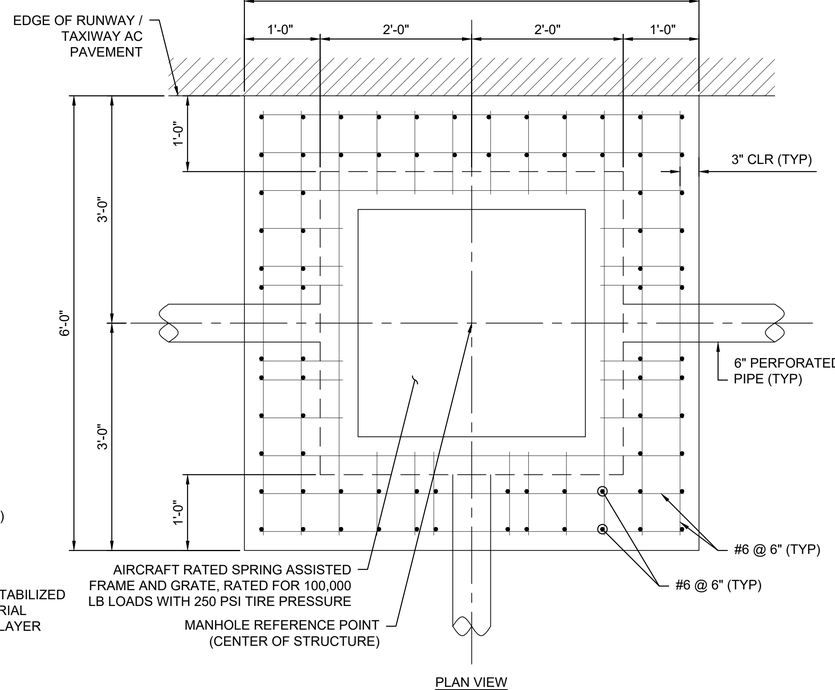


A3 UNDERDRAIN INSTALLATION ALONG EDGE OF PAVEMENT

SCALE: NTS



SECTION VIEW



PLAN VIEW

A4 UNDERDRAIN MANHOLE

SCALE: 1" = 1'-0"

DATE	SYM	DESCRIPTION

NAVFAC

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CO 29899 — NOV 4, 2025
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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3439015
A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

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DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

SCALE:	AS SHOWN
EPROJECT NO.:	1687159; 1719021
CONSTR. CONTR. NO.	-
NAVFAC DRAWING NO.	
SHEET	OF

CG501

PRE-FINAL SUBMITTAL

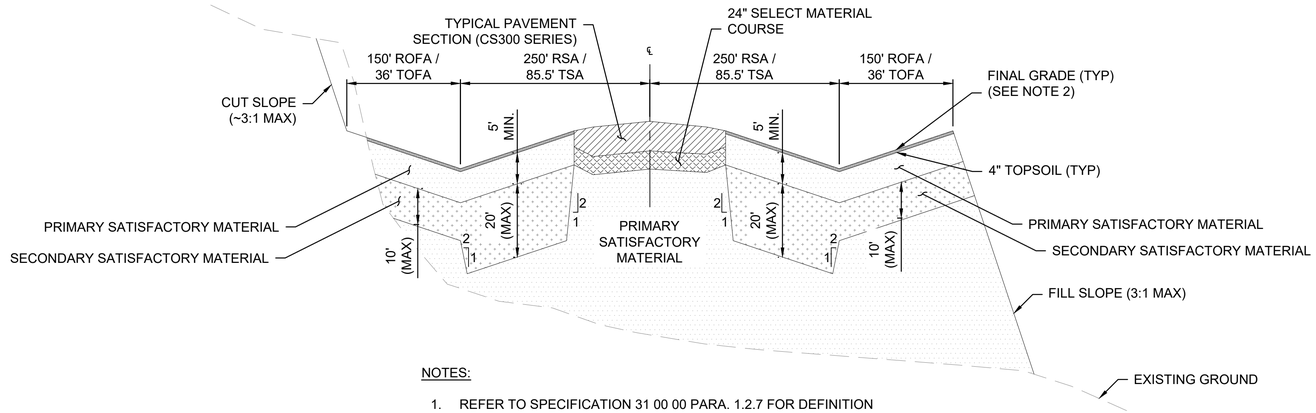
IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG501
PLOTTED: 10/30/2025 6:36:39 AM
USER: Morris, Tyler

NOTES:

1. CLEAR AND GRUB ALL AREAS BEYOND THE RUNWAY SAFETY AREA TO BE DISTURBED (AS SHOWN ON DRAWINGS CG101 THROUGH CG122) PRIOR TO TOPSOIL STRIPPING. REFER TO SPECIFICATION 31 11 00 FOR CLEARING AND GRUBBING REQUIREMENTS.
2. STRIP TOPSOIL TO A MINIMUM DEPTH OF 4" IN ALL AREAS TO BE DISTURBED (AS SHOWN ON DRAWINGS CG101 THROUGH CG122) PRIOR TO EARTHWORK OPERATIONS. STOCKPILE TOPSOIL IN CONTRACTING OFFICER APPROVED AREAS FOR LATER USE AS TOPSOIL PLACEMENT. REFER TO SPECIFICATION 31 00 00 FOR TOPSOIL STRIPPING AND STOCKPILING REQUIREMENTS.
3. AFTER EARTHWORK OPERATIONS ARE COMPLETE, APPLY TOPSOIL TO ALL UNPAVED AREAS, MINIMUM 4" DEPTH, WITHIN LIMITS OF DISTURBANCE (AS SHOWN ON DRAWINGS CG101 THROUGH CG122). REFER TO SPECIFICATION 31 00 00 FOR TOPSOIL PLACEMENT REQUIREMENTS.
4. APPLY SEED TO ALL TOPSOIL / DISTURBED AREAS (AS SHOWN ON DRAWINGS CG101 THROUGH CG122) AT THE END OF EACH PHASE AND PRIOR TO PROGRESSING TO THE NEXT PHASE OF WORK. REFER TO GC100 SERIES FOR PROJECT PHASING REQUIREMENTS AND TO SPECIFICATION 32 92 19 FOR SEEDING REQUIREMENTS.

C1 CLEARING, GRUBBING, TOPSOILING, AND SEEDING

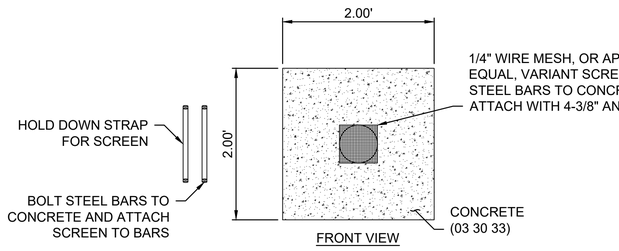


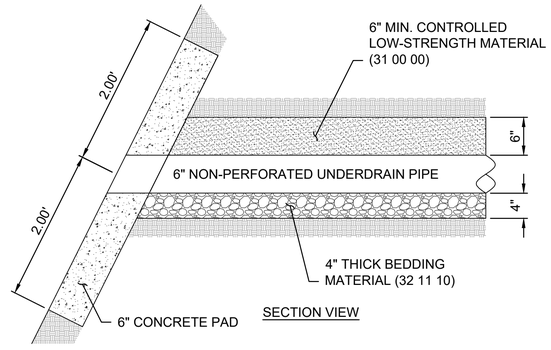
NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARA. 1.2.7 FOR DEFINITION OF PRIMARY AND SECONDARY SATISFACTORY MATERIAL.
2. REFER TO CG100 AND CG300 SERIES FOR CIVIL GRADING PLANS AND CROSS SECTIONS, RESPECTIVELY.

C3 EARTHWORK ZONING

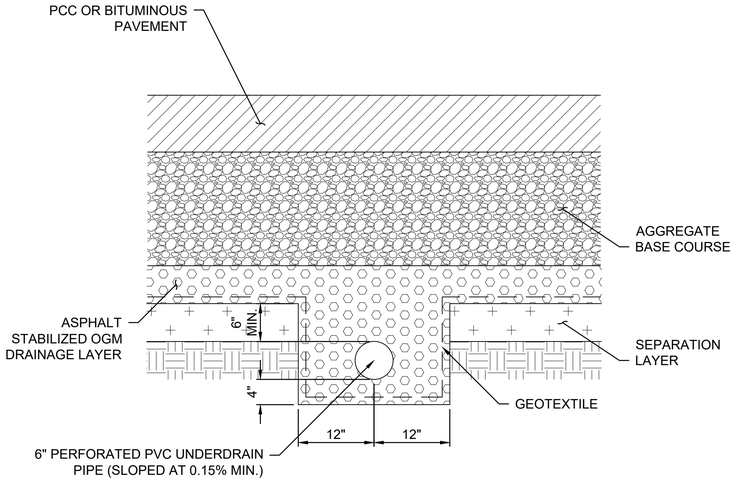
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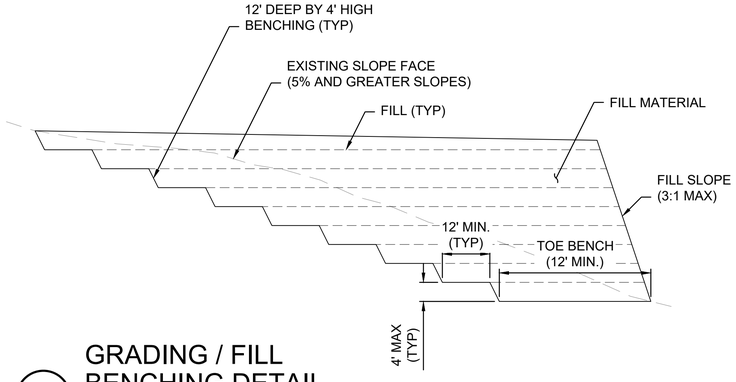
A1 UNDERDRAIN OUTFALL

SCALE: 1" = 1'-0"



A2 UNDERDRAIN INSTALLATION UNDER PAVEMENT

SCALE: NTS



A2 GRADING / FILL BENCHING DETAIL

SCALE: NTS

DATE | SYM | DESCRIPTION

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CO 29899 NOV 4, 2025
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SEAL

Jacobs / BURNS MCDONNELL

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ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: D3439015 A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
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MAKALAPA, HAWAII
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

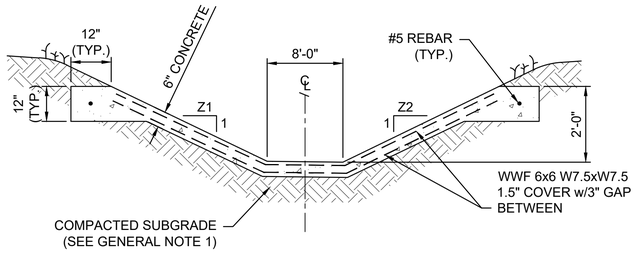
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EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF

CG502

PRE-FINAL SUBMITTAL

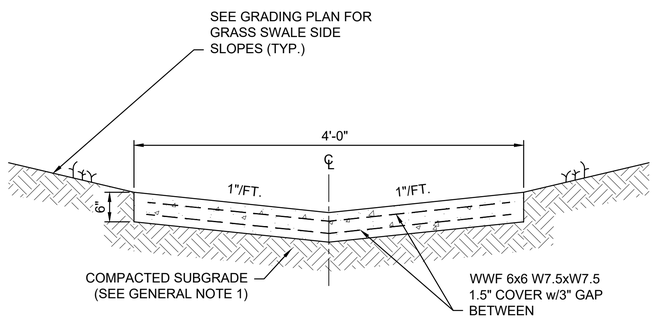
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FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG502
PLOTTED: 10/30/2025 6:36:44 AM
USER: Morris, Tyler



DITCH DATA			
LOCATION	Z1	Z2	NOTES
N/S TAXIWAY	4	4	--
NORTH SIDE APRON	4	10	FACING DOWNSTREAM
WEST SIDE APRON	10	4	FACING DOWNSTREAM

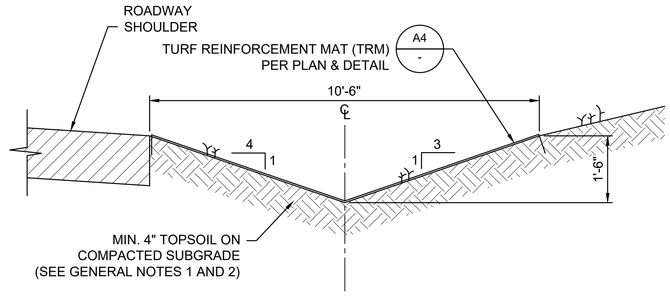
C1 CONCRETE-LINED TRAPEZOIDAL DITCH
SCALE: NTS



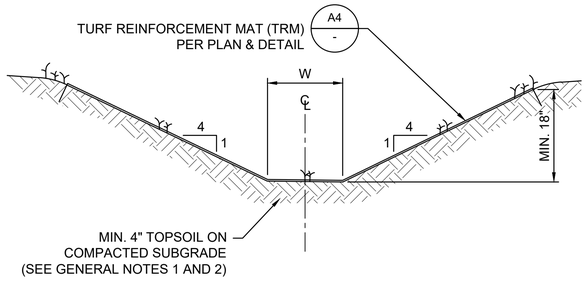
C2 GRASS SWALE WITH CONCRETE VALLEY GUTTER
SCALE: NTS

GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.9.4 FOR TOPSOIL AND SEEDING REQUIREMENTS.
3. REFER TO SPECIFICATION 03 30 00 FOR CAST-IN-PLACE CONCRETE AND JOINT REQUIREMENTS.

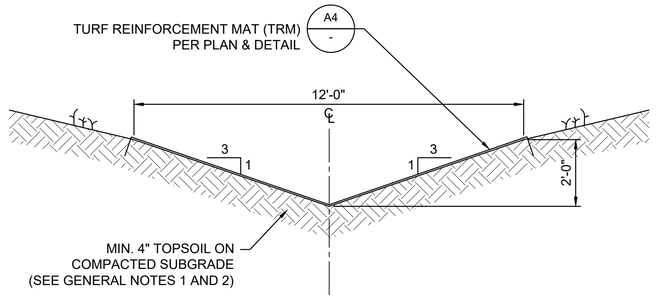


C4 ROADSIDE V-DITCH
SCALE: NTS

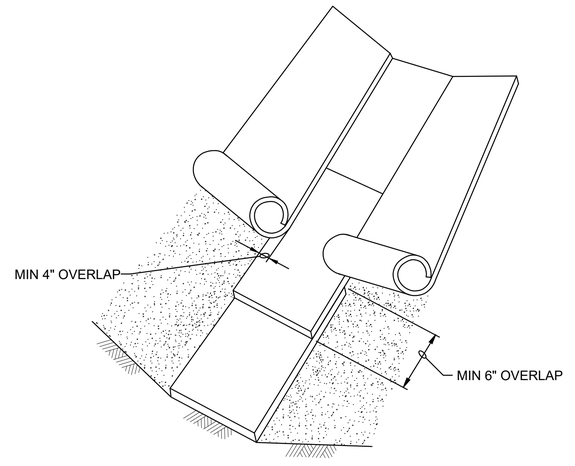


SWALE DATA	
LOCATION	W, ft.
WEST SIDE OF OUTFALL 6 POND	8
EAST SIDE OF OUTFALL 6 POND	4

A1 GRASS-LINED TRAPEZODAL SWALE WITH TRM
SCALE: NTS



A2 TRM-LINED DITCH
SCALE: NTS



NOTES:

1. SLOPE SURFACE SHALL BE SMOOTH BEFORE PLACEMENT FOR PROPER SOIL CONTACT.
2. DO NOT STRETCH BLANKETS/MATTINGS TIGHT, ALLOW THE ROLLS TO MOLD TO ANY IRREGULARITIES.
3. ANCHOR, STAPLE, AND INSTALL CHECK SLOTS AS PER MANUFACTURER'S RECOMMENDATIONS.
4. AVOID JOINING MATERIAL IN THE CENTER OF THE DITCH.
5. APPLY SOIL AMENDMENTS AND SEED BEFORE INSTALLATION. (SEE GENERAL NOTE 2)

A4 TURF REINFORCEMENT MAT
SCALE: N.T.S.

DATE | STM | DESCRIPTION

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JEG: D3A00615
A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	DPS	DRW:	MAK
REV:	VTO		
PM/DM			MAI/DRK
BRANCH MANAGER			SMK
CHIEF ENG			EAM
FIRE PROTECTION			JCC

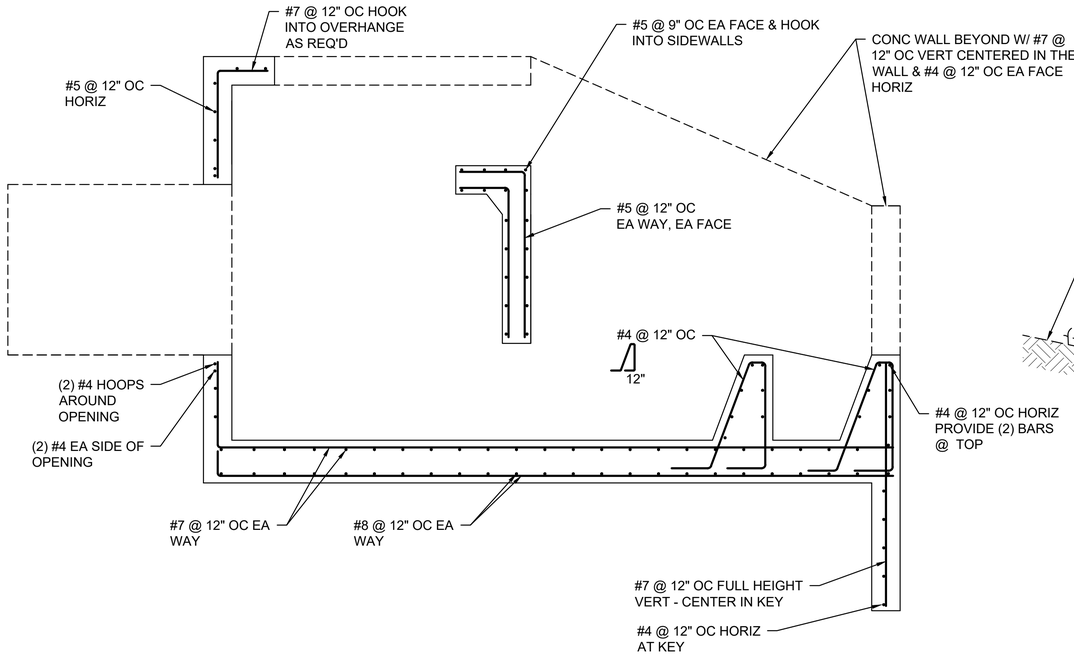
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG503

PRE-FINAL SUBMITTAL

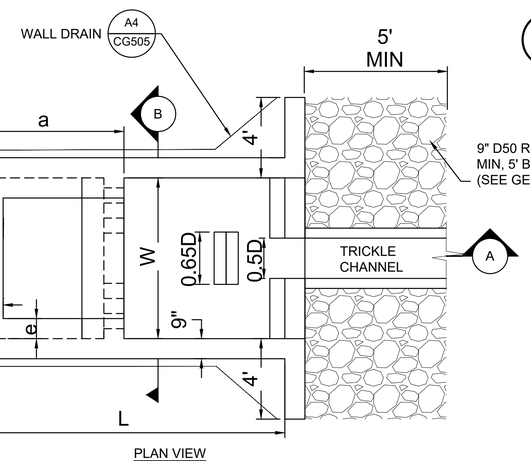
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LAYOUT NAME: CG503
PLOTTED: 10/30/2025 6:36:49 AM
USER: Morris, Tyler

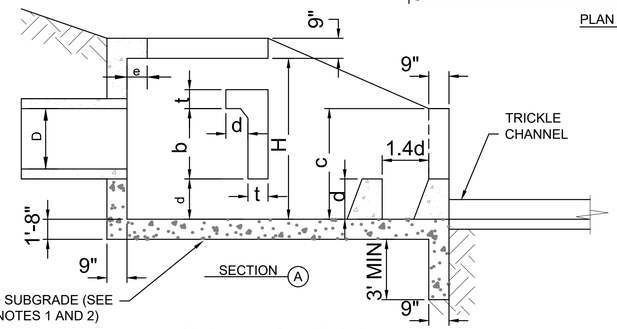


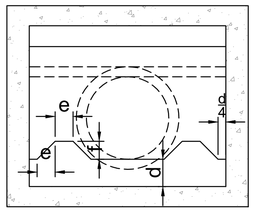
STILLING BASIN DIMENSIONS

	Basin 3	Basin 5
W =	10.81 ft	9.96 ft
H =	8.11 ft	7.41 ft
L =	14.41 ft	13.28 ft
a =	5.41 ft	4.98 ft
b =	4.05 ft	3.73 ft
c =	5.41 ft	4.98 ft
d =	1.80 ft	1.66 ft
e =	0.90 ft	0.83 ft
f =	1.35 ft	1.24 ft
t =	0.90 ft	0.83 ft



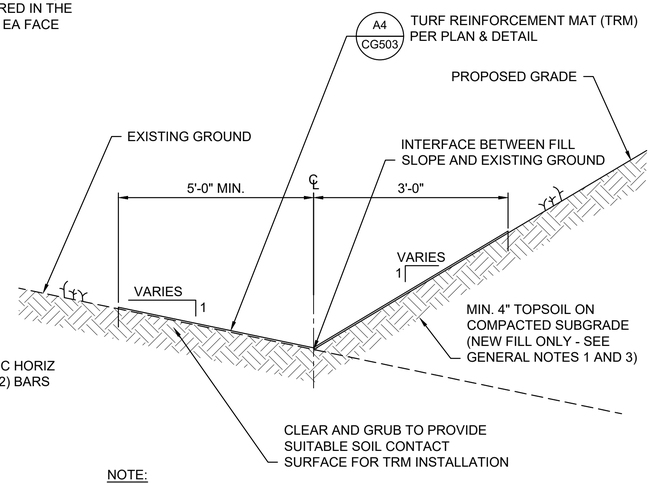
PLAN VIEW





A1 MODIFIED USBR TYPE VI IMPACT STILLING BASIN

SCALE: NTS

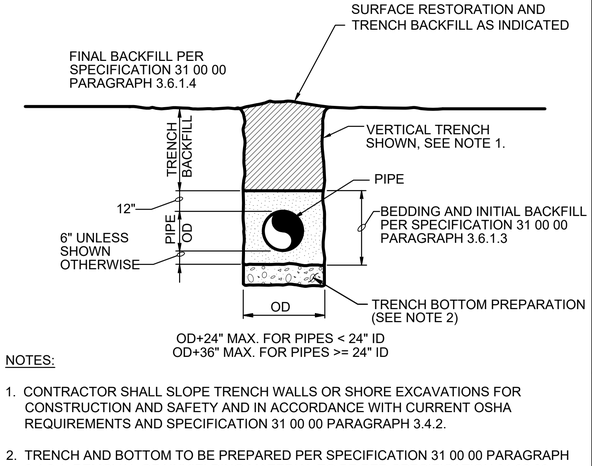


NOTE:

1. SEE PLAN FOR LOCATIONS OF TOE OF SLOPE DITCH PROTECTION.

C2 TRM-LINED TOE OF SLOPE PROTECTION

SCALE: NTS



NOTES:

1. CONTRACTOR SHALL SLOPE TRENCH WALLS OR SHORE EXCAVATIONS FOR CONSTRUCTION AND SAFETY AND IN ACCORDANCE WITH CURRENT OSHA REQUIREMENTS AND SPECIFICATION 31 00 00 PARAGRAPH 3.4.2.
2. TRENCH AND BOTTOM TO BE PREPARED PER SPECIFICATION 31 00 00 PARAGRAPH 3.4.2.1. REMOVAL OF UNYIELDING MATERIAL TO BE PER SPECIFICATION 31 00 00 PARAGRAPH 3.4.2.2.

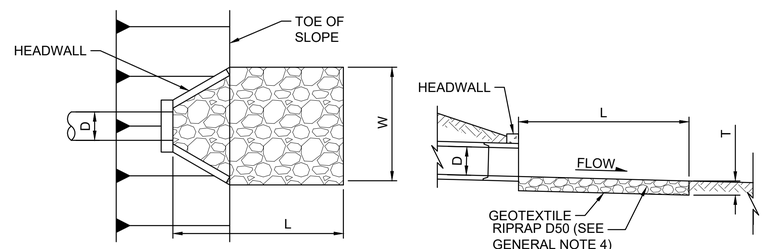
C4 TYPICAL STORM DRAIN PIPE TRENCH

SCALE: NTS

GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.9.4 FOR TOPSOIL AND SEEDING REQUIREMENTS.
4. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.8 FOR RIPRAP CONSTRUCTION.
5. REFER TO SPECIFICATION 03 30 00 FOR CAST-IN-PLACE CONCRETE AND JOINT REQUIREMENTS.

RIPRAP APRON DATA				
OUTFALL	L, ft.	W, ft.	D50, in.	T, ft.
1	21	11	9	1.5
2	35	18	24	4
6	45	22	18	3
7	23	11	9	1.5
POND INLET O3	15	8	9	1.5
OUTFALL TO POND 4	36	20.4	9	1.5
POND INLET O5A	7	4	9	1.5
POND INLET O5B	11	6	9	1.5
POND INLET O5C	5	3	9	1.5
POND 3 OUTLET	47	32.4	18	3
POND 4 OUTLET	46	35.2	18	3
POND 5 OUTLET	43	32.0	18	3



NOTES:

1. SPECIFIED WIDTH "W" IS THE MINIMUM PER CALCULATIONS. ADJUST AS NEEDED TO FILL SPACE BETWEEN WINGWALLS.

A4 PIPE OUTFALL RIPRAP APRON

SCALE: NTS

STM	DESCRIPTION	DATE

NAVFAC

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615
A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
CIVIL DETAILS - DRAINAGE

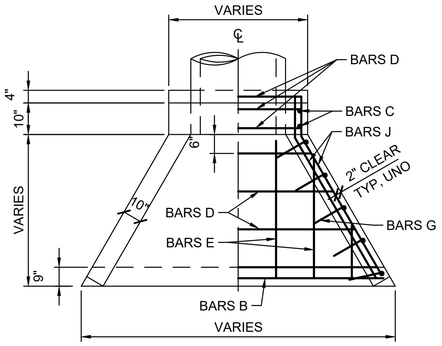
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CONSTR. CONTR. NO.	-
NAVFAC DRAWING NO.	
SHEET	OF

CG504

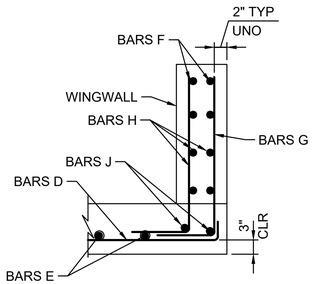
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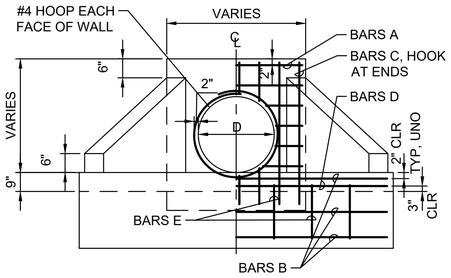
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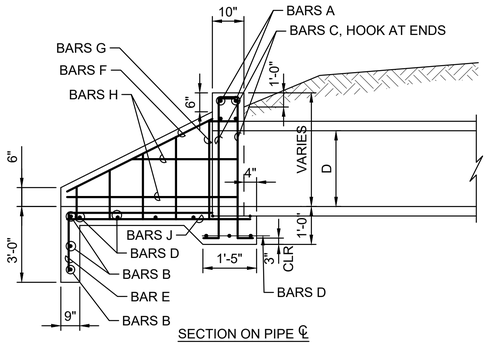
FOOTING PLAN VIEW



TYPICAL WINGWALL SECTION

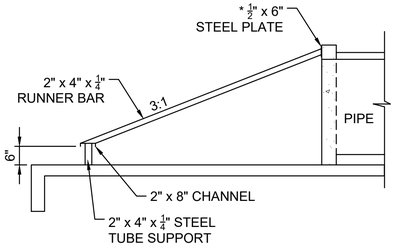


FRONT ELEVATION VIEW

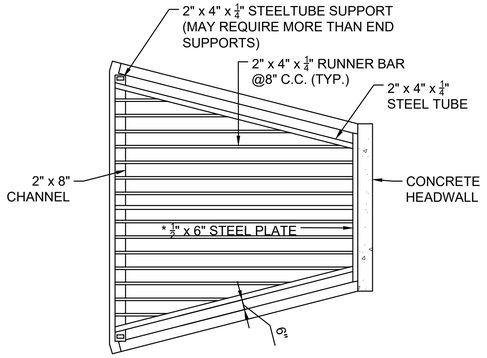


SECTION ON PIPE ℄

PIPE HEADWALL DETAILS



ELEVATION



* ATTACH WITH 5/8" RED HEAD WEDGE ANCHOR BOLTS. 4" MIN. DRIVEN EMBEDMENT

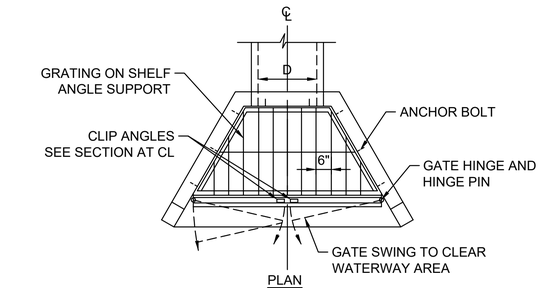
PLAN VIEW

NOTES:

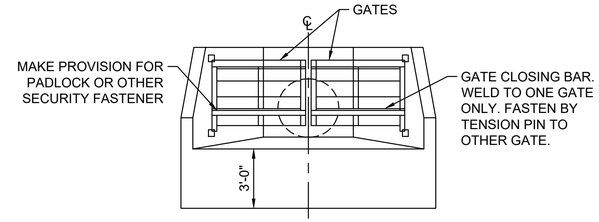
1. TRASH RACK TO INCLUDE PROVISIONS FOR MAINTENANCE ACCESS. INCLUDING LOCKABLE GATE, REMOVABLE SECTION(S), ECT.
2. SIZE AND NUMBER OF MEMBERS TO BE DETERMINED BY SPECIFIC DESIGN REQUIREMENTS.
3. MAXIMUM CLEAR OPENING IS 6".

B3 HEADWALL SECURITY GRATE AND TRASH RACK - TYPE A

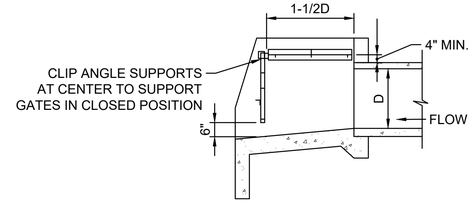
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PLAN



ELEVATION



SECTION AT CL

NOTES:

1. SIZE AND NUMBER OF MEMBERS TO BE DETERMINED BY SPECIFIC DESIGN REQUIREMENTS.
2. MAXIMUM CLEAR OPENING IS 6".

B4 HEADWALL SECURITY GRATE - TYPE B

SCALE: NTS

TABLE 1 - VARIABLE DIMENSIONS

PIPE SIZE	BARS A		BARS B		BARS C		BARS D		BARS E		BARS F		BARS G		BARS H		BARS J	
D	SPACING	SIZE	SPACING	SIZE	SPACING	SIZE	SPACING	SIZE	SPACING	SIZE	QTY	SIZE	SPACING PARALLEL TO WALL	SIZE	SPACING	SIZE	QTY	SIZE
24"	18"	#4	12"	#4	12"	#4	12"	#4	12"	#4	2	#4	12"	#4	12"	#4	2	#4
36"	18"	4	12"	4	12"	4	12"	4	12"	4	2	4	12"	4	12"	4	2	4
48"	18"	4	12"	4	12"	4	12"	4	12"	4	2	4	12"	4	12"	4	2	4
60"	18"	4	12"	4	12"	4	10"	4	12"	4	2	4	12"	4	12"	4	2	4
66"	18"	4	12"	4	12"	4	8"	4	12"	4	2	4	12"	4	12"	4	2	4
72"	18"	4	12"	4	12"	4	8"	4	10"	4	2	4	10"	4	12"	4	2	4
78"	18"	4	12"	4	12"	4	6"	4	8"	4	2	4	10"	4	12"	4	2	4

PIPE HEADWALL DETAIL NOTES:

** INCREASE CLEARANCE TO A MINIMUM OF 3" IF TRENCHED.

GENERAL NOTES:

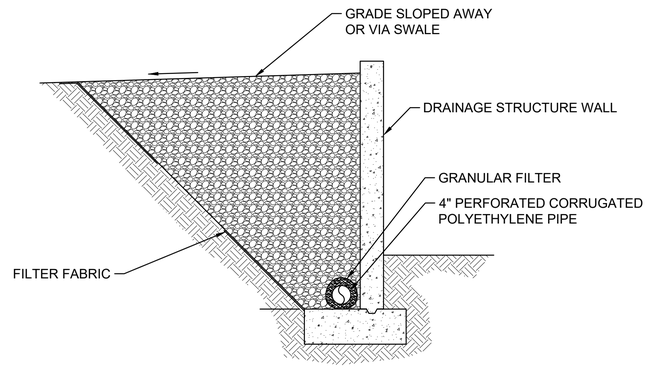
1. EPOXY COATED REINFORCING STEEL FY = 60 KSI.
2. CONCRETE COMPRESSIVE STRENGTH f'c = 5000 PSI.

PLAN VIEW NOTES:

1. EMBED BARS F AND H INTO HEADWALL 8".

A1 PIPE HEADWALL WITH APRON DETAILS

SCALE: NTS



A4 WALL DRAIN DETAIL

SCALE: NTS

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A/E INFO

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ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
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YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

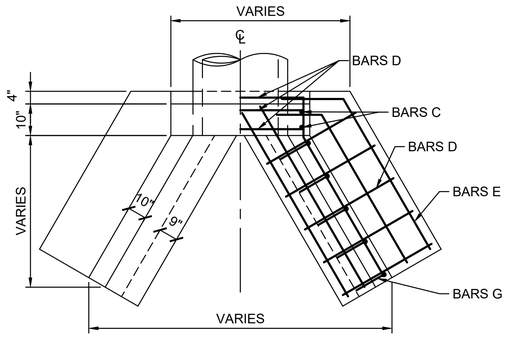
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SHEET OF
CG505

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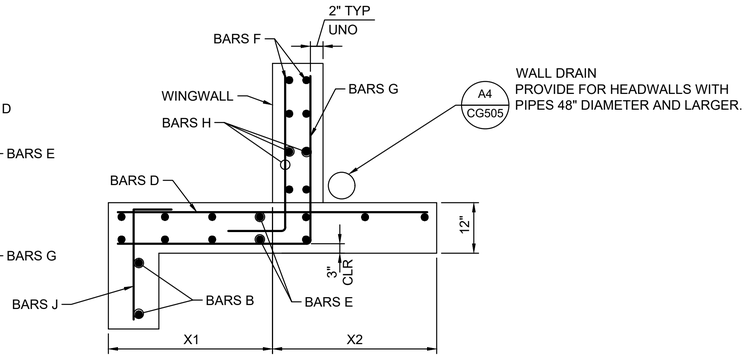
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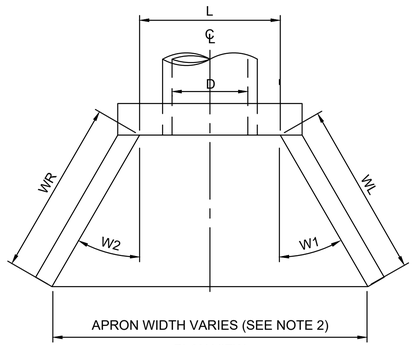
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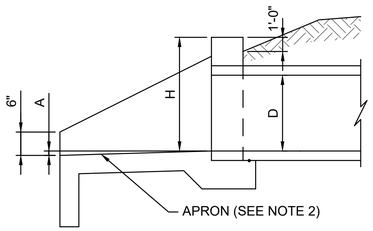
FOOTING PLAN VIEW



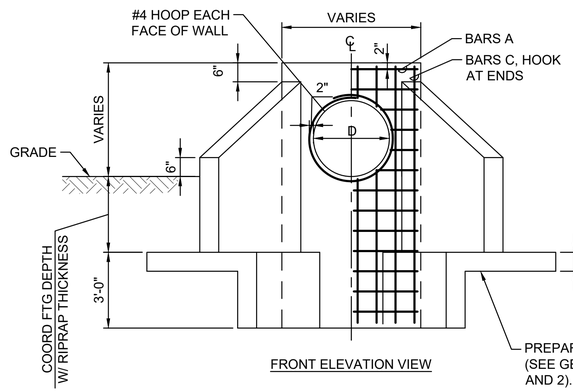
TYPICAL WINGWALL SECTION



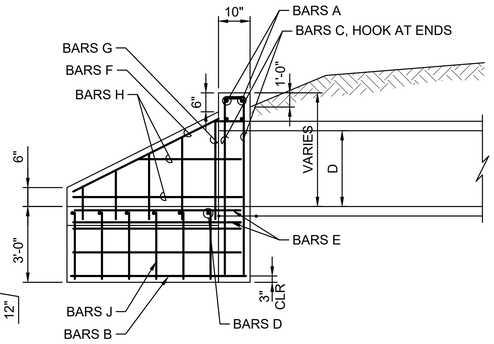
PLAN VIEW



SECTION ON PIPE ℄



FRONT ELEVATION VIEW



SECTION ON PIPE ℄

PIPE HEADWALL DETAILS

GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.

TABLE 2 - HEADWALL DIMENSIONS

ID	D, ft.	L, ft.	H, ft.	WL, ft	WR, ft.	W1,°	W2,°	A, ft. (DELTA PIPE INV. TO END APRON)	SECURITY GRATE TYPE	APRON TYPE
HW-1-3	2.0	6.00	3.67	6.00	6.00	45	45	-0.10	A	CONCRETE
OUTFALL 1	4.0	8.00	5.67	15.96	15.96	30	30	0.10	B	RIPRAP
HW-4-1	4.0	8.00	5.67	11.55	14.14	30	45	-0.10	A	CONCRETE
HW-4-2	3.0	7.00	4.67	10.00	11.00	30	60	-0.10	A	CONCRETE
HW-5-1	5.0	9.00	6.67	14.14	14.14	45	45	-0.10	A	CONCRETE
HW-5-2	5.0	9.00	6.67	14.14	14.14	45	45	-0.10	A	CONCRETE
HW-6-1	6.0	11.27	7.67	42.53	29.12	45	34.36	-0.10	A	CONCRETE
OUTFALL 6	6.0	10.00	7.67	10.13	10.13	30	30	0.10	B	RIPRAP
HW-7-1	3.0	12.00	4.67	14.14	14.14	45	45	-0.10	NONE	CONCRETE
OUTFALL 7	3.0	12.00	4.67	10.10	10.10	30	30	0.10	NONE	RIPRAP
POND INLET O3	2.0	6.00	3.67	10.41	15.86	30	30	0.10	NONE	RIPRAP
HW-O4P	6.5	10.50	8.17	20.21	17.93	15	15	0.10	B	RIPRAP
POND INLET O5A	2.0	6.00	3.67	9.23	8.65	30	30	0.10	NONE	RIPRAP
POND INLET O5B	2.0	6.00	3.67	9.14	8.82	30	30	0.10	NONE	RIPRAP
POND INLET O5C	2.0	6.00	3.67	12.48	10.54	30	30	0.10	NONE	RIPRAP
OUTFALL 3	5.5	9.57	7.17	21.24	21.23	30	30	0.10	NONE	RIPRAP
OUTFALL 4	6.0	10.00	7.67	26.09	26.09	30	30	1.04	NONE	RIPRAP
OUTFALL 5	5.5	9.50	7.17	21.24	21.24	30	30	0.10	NONE	RIPRAP

NOTES:
1. TYPE B SECURITY GRATE REQUIRED AT EXISTING OUTFALL 2 HEADWALL IF NOT PRESENT. ADD RIPRAP TO EXISTING OUTFALL 2 PER DETAIL A4 ON CG504.
2. HEADWALLS WITH RIPRAP APRONS ARE NOT SHOWN BUT ARE SIMILAR.

B4 HEADWALL DIMENSIONS
SCALE: NTS

TABLE 1 - VARIABLE DIMENSIONS

PIPE SIZE	BARS A				BARS B		BARS C		BARS D		BARS E		BARS F		BARS G		BARS H		BARS J	
D	X1	X2	SPACING	SIZE	SPACING	SIZE	SPACING	SIZE	SPACING	SIZE	SPACING	SIZE	QTY	SIZE	SPACING PARALLEL TO WALL	SIZE	SPACING	SIZE	SPACING	SIZE
24"	2'-0"	3'-8"	18"	#4	12"	#4	12"	#4	12"	#5	12"	#4	2	#4	12"	#5	12"	#4	10"	#4
36"	2'-0"	3'-8"	18"	4	12"	4	12"	4	12"	5	12"	4	2	4	12"	5	12"	4	10"	4
48"	2'-2"	4'-0"	18"	4	12"	4	12"	4	12"	5	12"	4	2	4	12"	5	12"	4	10"	4
60"	2'-4"	4'-4"	18"	4	12"	4	12"	4	10"	5	12"	4	2	4	10"	5	12"	4	10"	4
66"	2'-4"	4'-4"	18"	4	12"	4	12"	4	8"	5	12"	4	2	4	10"	5	12"	4	10"	4
72"	2'-6"	4'-8"	18"	4	12"	4	12"	4	8"	5	12"	4	2	4	8"	5	12"	4	9"	4
78"	2'-6"	4'-8"	18"	4	12"	4	12"	4	6"	5	12"	4	2	4	8"	5	12"	4	9"	4

PIPE HEADWALL DETAIL NOTES:

** INCREASE CLEARANCE TO A MINIMUM OF 3" IF TRENCHED.

GENERAL NOTES:

1. EPOXY COATED REINFORCING STEEL FY = 60 KSI.
2. CONCRETE COMPRESSIVE STRENGTH f'c = 5000 PSI.

PLAN VIEW NOTES:

1. EMBED BARS E, F AND H INTO HEADWALL 1'-9". HOOK AT EDGE AS REQUIRED.

A1 PIPE HEADWALL WITHOUT APRON DETAILS
SCALE: NTS

NAVFAC

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JEG: DIA00615 A/E INFO

APPROVED:
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ACTIVITY
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DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
HALAWA, HAWAII
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YAP INTERNATIONAL AIRPORT, FSM
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
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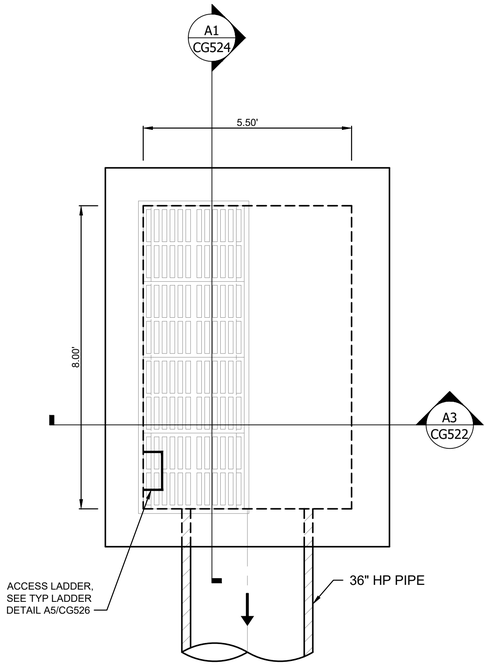
CIVIL DETAILS - DRAINAGE

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CG506

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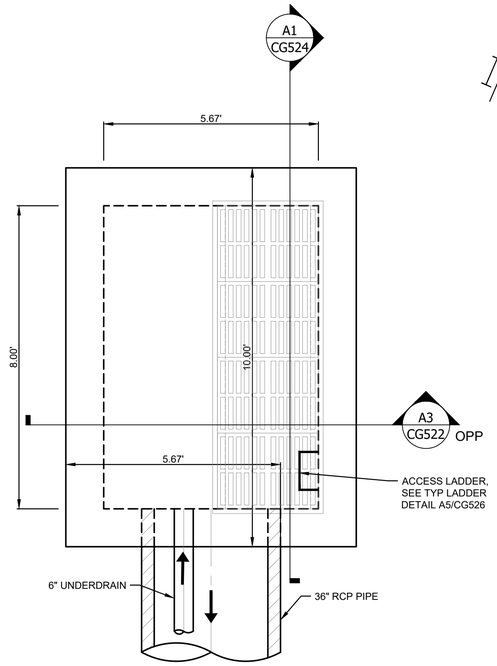
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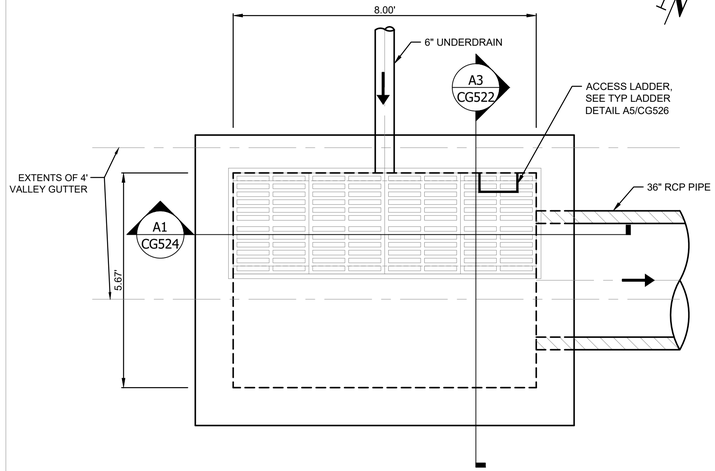
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NOTE:
STATION AND OFFSET
TO CENTER OF BOX



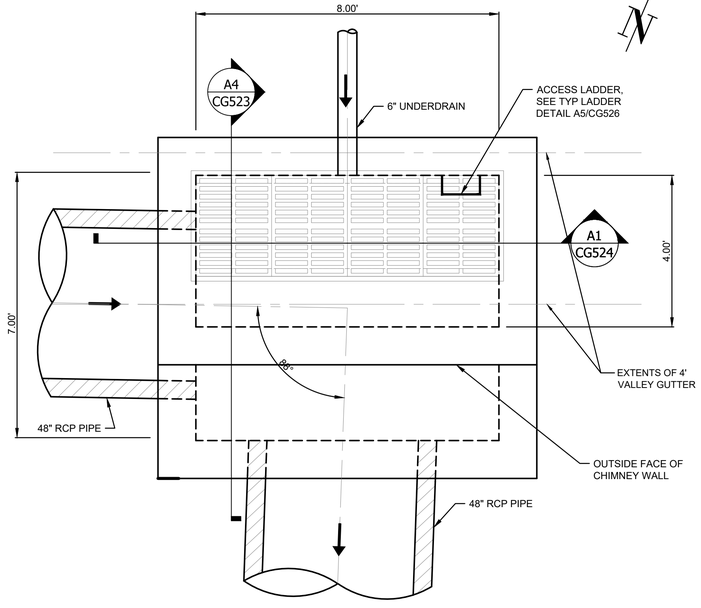
C2 IN-2-3
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



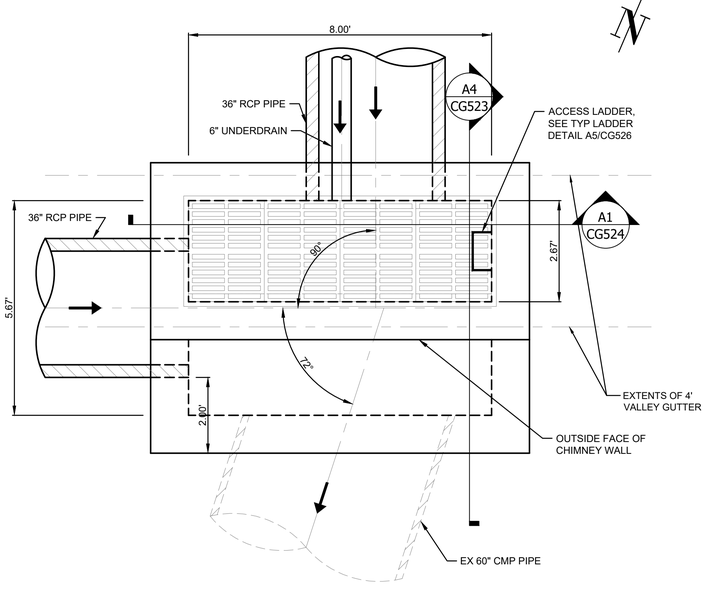
C4 IN-2-5
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



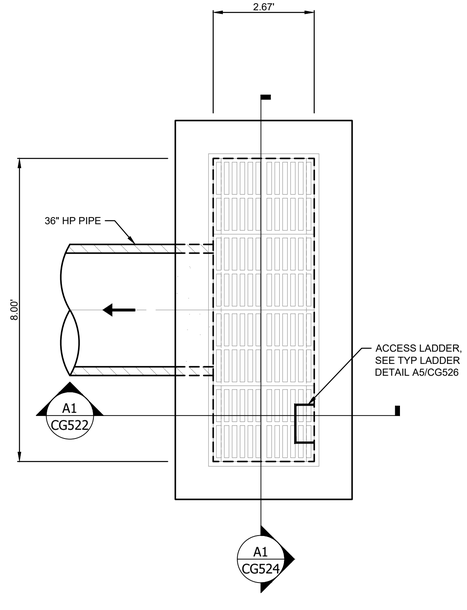
A1 IN-1-2
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A2 IN-2-4
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A4 IN-3-4
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX

NO.	DESCRIPTION	DATE

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAV/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

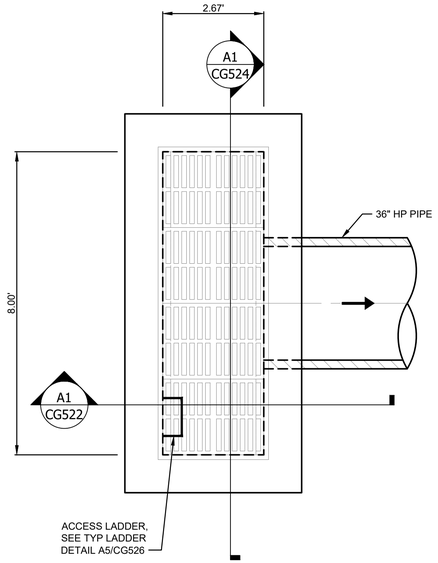
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG507

PRE-FINAL SUBMITTAL

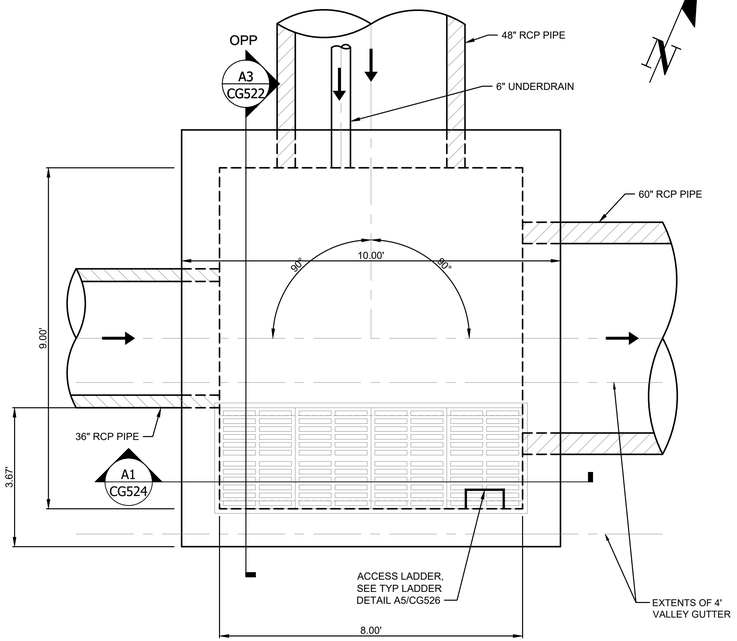
FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG507
PLOTTED: 10/30/2025 6:37:09 AM
USER: Morris, Tyler

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES



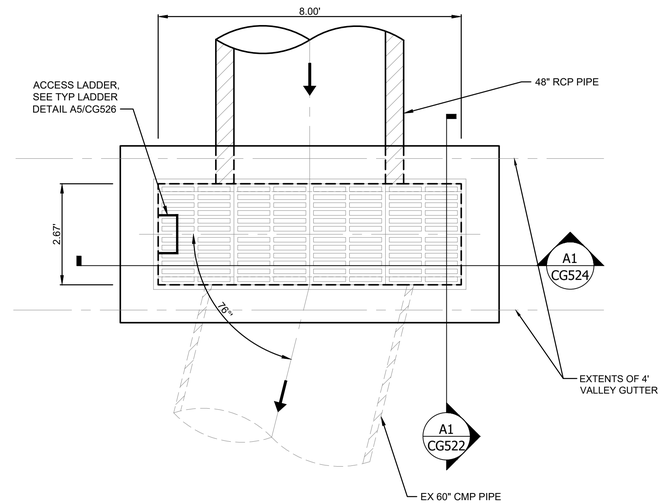
C1 IN-3-5
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



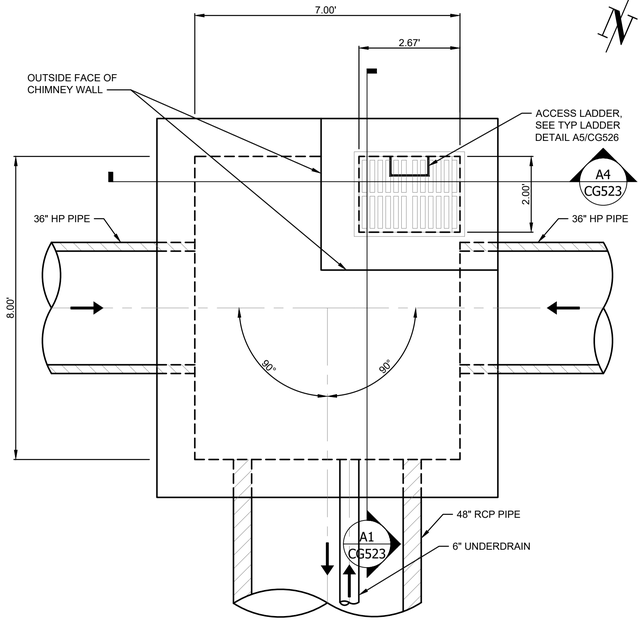
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SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



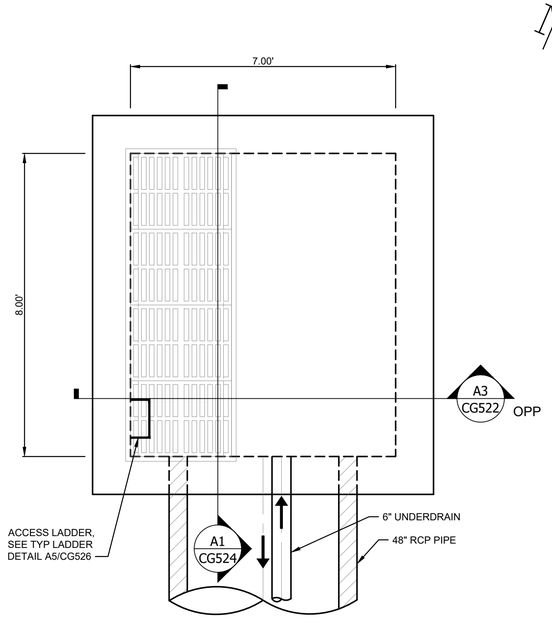
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SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



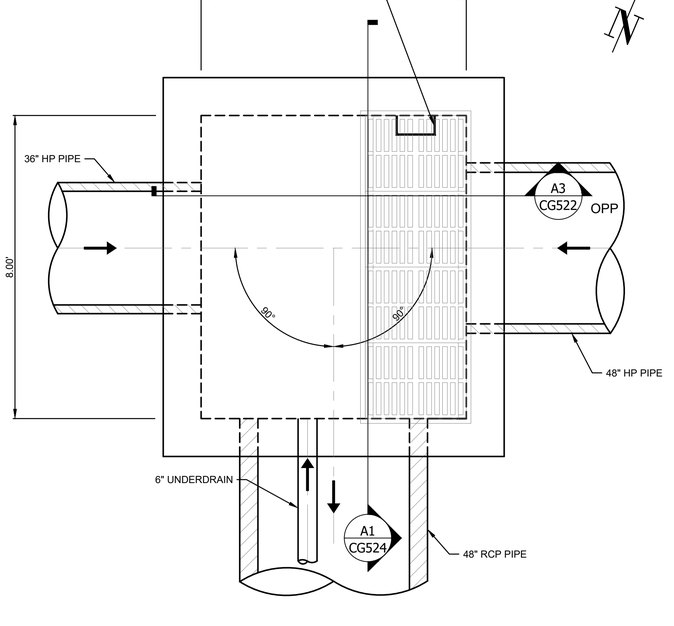
A1 IN-3-6
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A2 IN-3-8
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A4 IN-3-10
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX

DATE | SYM | DESCRIPTION

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JCG: D3430615 A/E INFO

APPROVED:
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ACTIVITY
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DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC MAKALAPA, HAWAII

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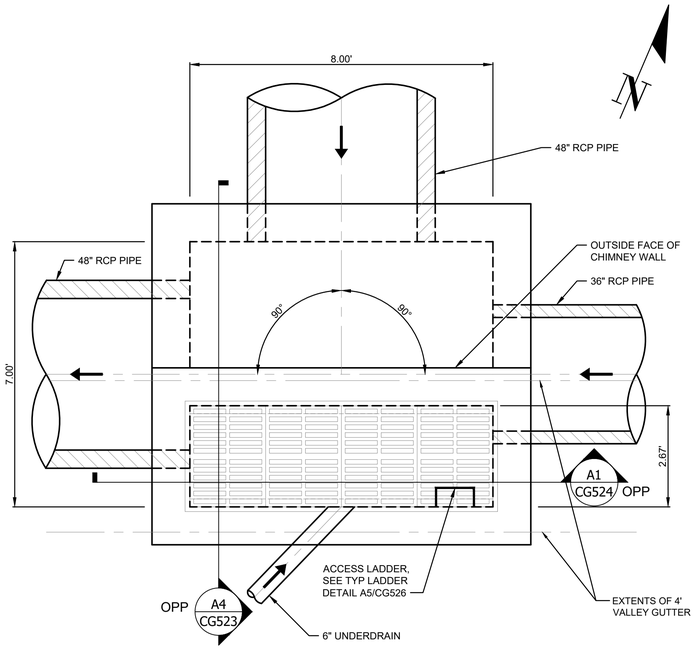
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG508

PRE-FINAL SUBMITTAL

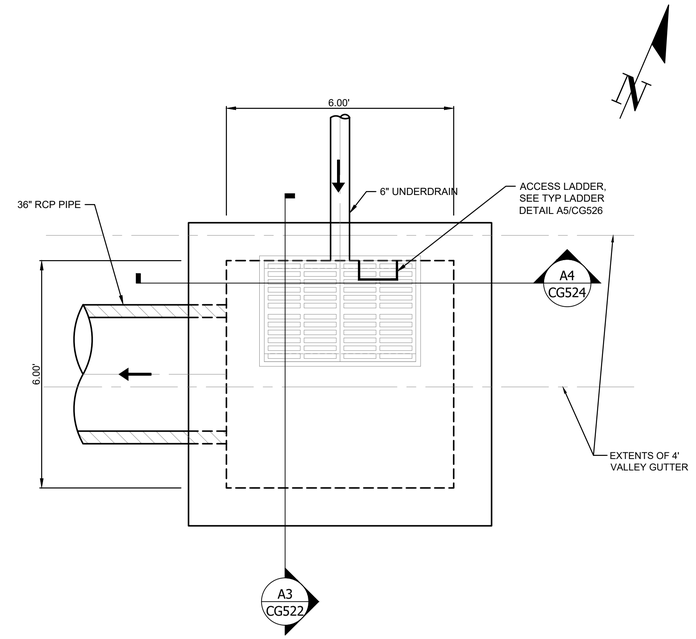
FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG508
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USER: Morris, Tyler

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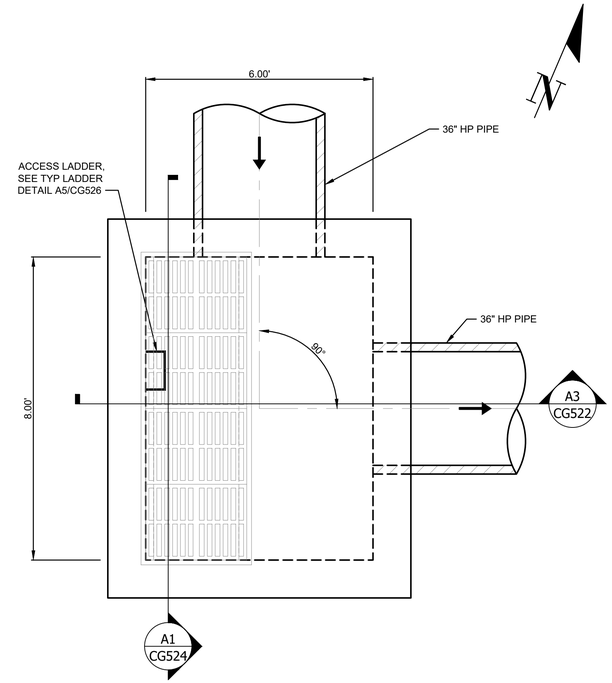
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SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



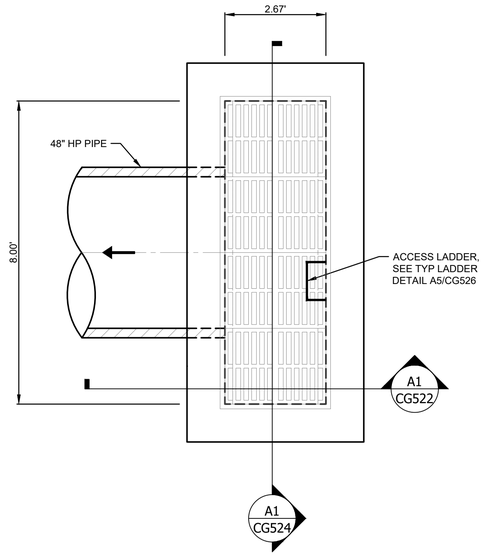
C2 IN-3-13
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



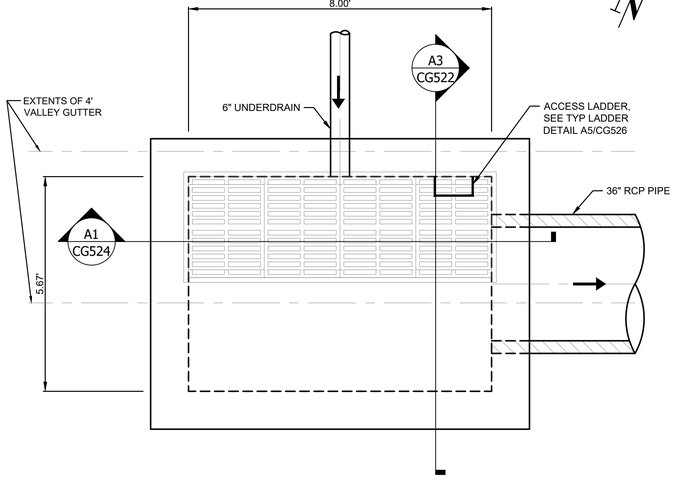
C4 IN-3-15
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



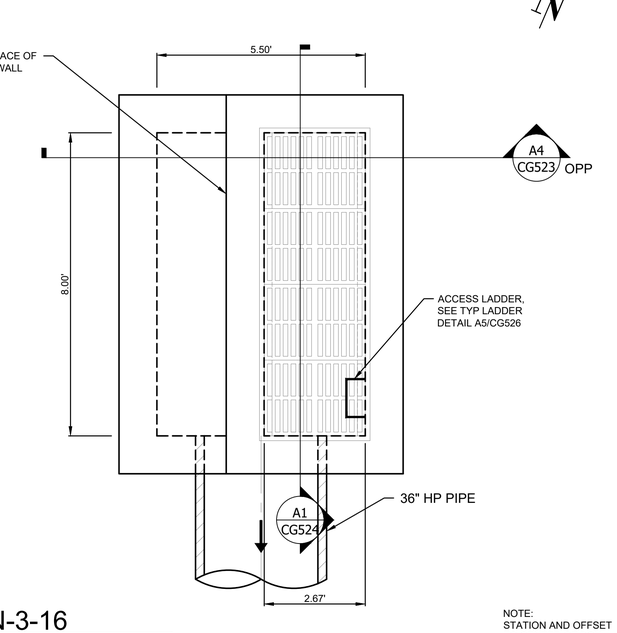
A1 IN-3-12
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A2 IN-3-14
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A4 IN-3-16
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX

DATE
SYM DESCRIPTION

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JCG: D3430615 A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

ACTIVITY

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DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

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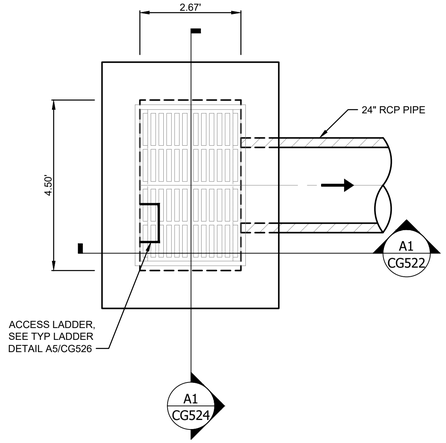
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG509

PRE-FINAL SUBMITTAL

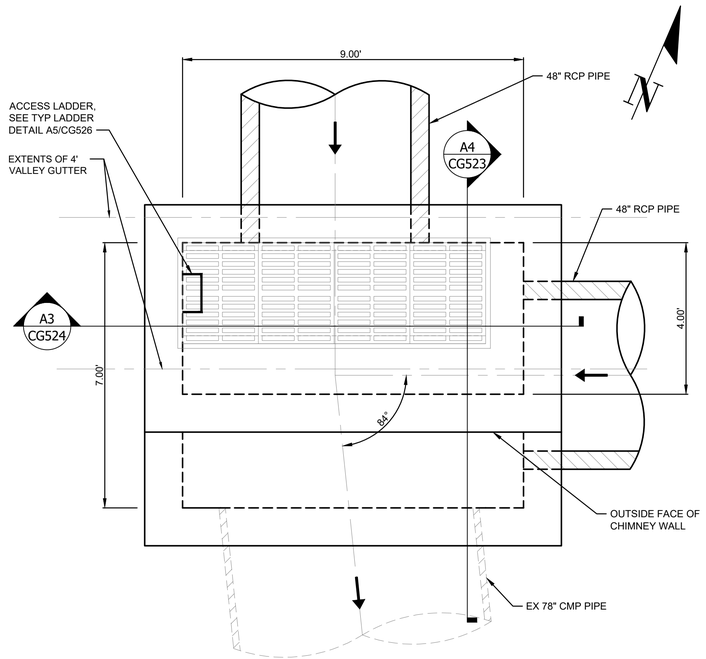
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LAYOUT NAME: CG509
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USER: Morris, Tyler

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES



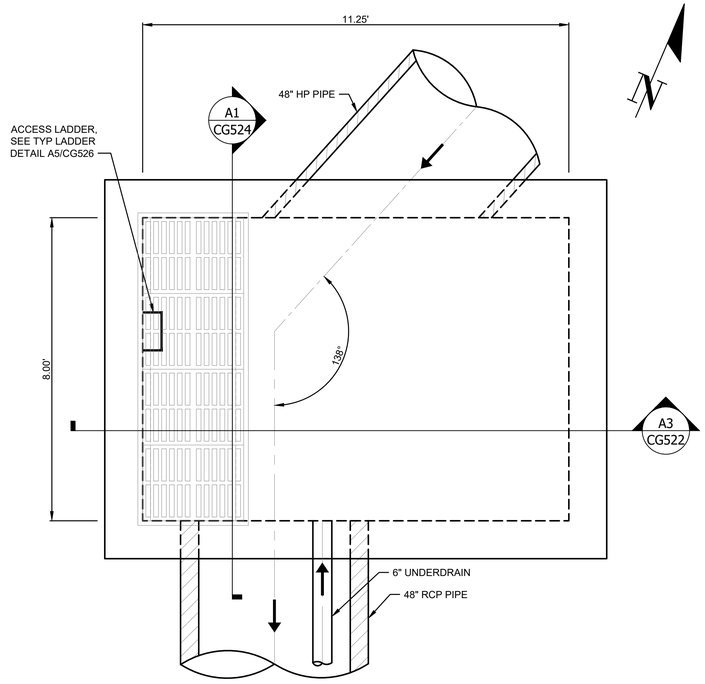
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SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



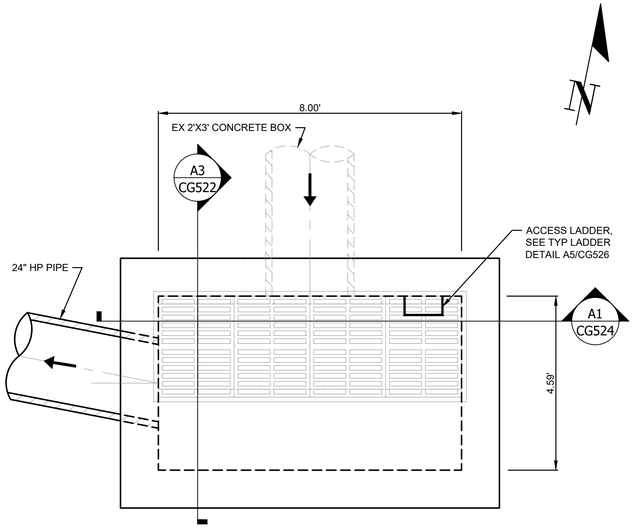
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SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



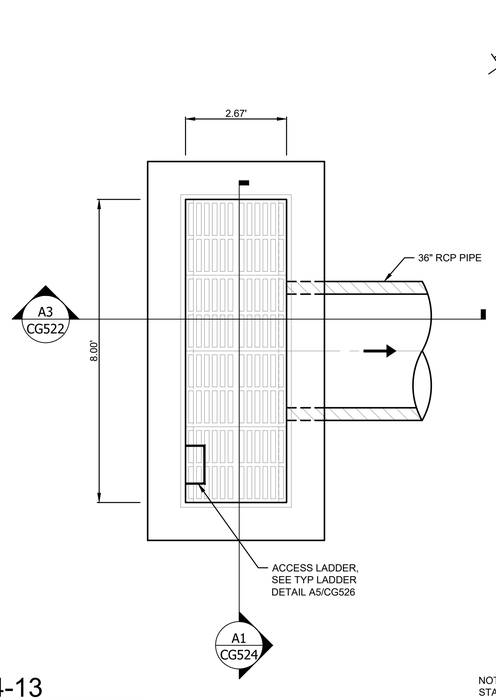
C4 IN-4-14
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



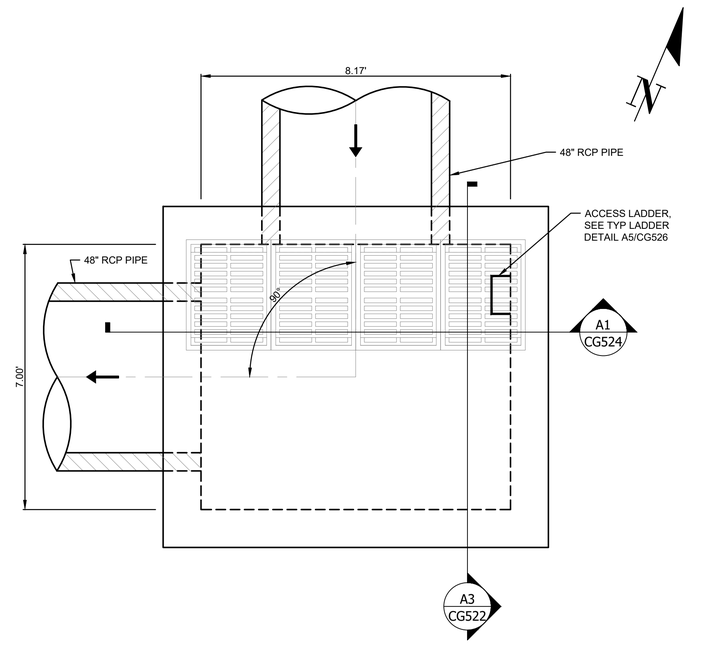
A1 IN-3-18
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A2 IN-4-13
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A4 IN-4-15
SCALE: NTS

NOTE:
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APPROVED:
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ACTIVITY
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DES:	DPS	DRW: MAK	REV: VTO
PM/DM			MAI/DRK
BRANCH MANAGER			SMK
CHIEF ENG			EAM
FIRE PROTECTION			JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
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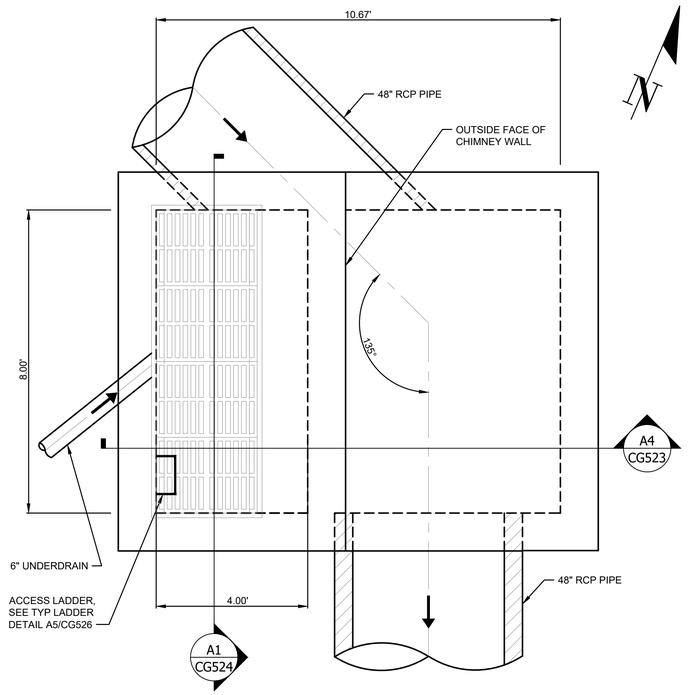
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.
-
NAVFAC DRAWING NO.
SHEET OF
CG510

PRE-FINAL SUBMITTAL

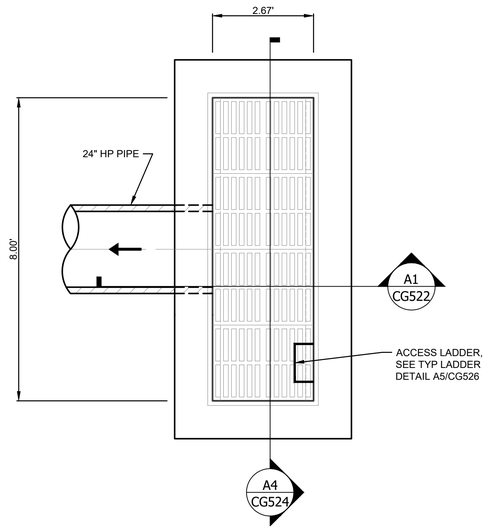
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USER: Morris, Tyler

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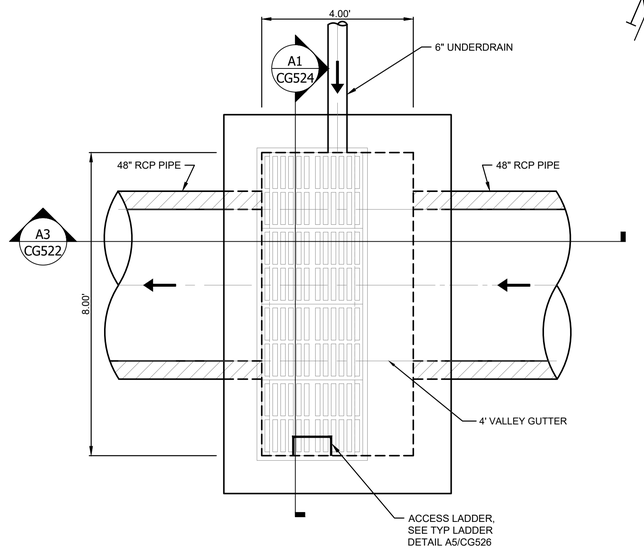
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SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



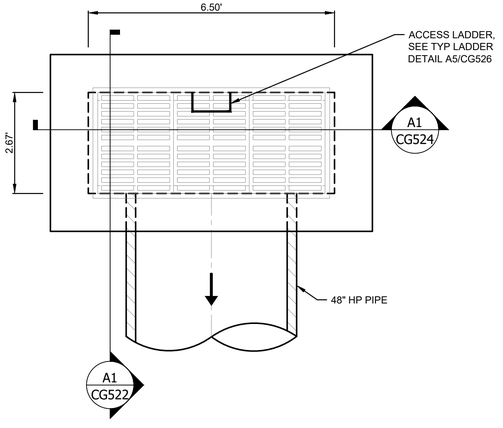
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SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



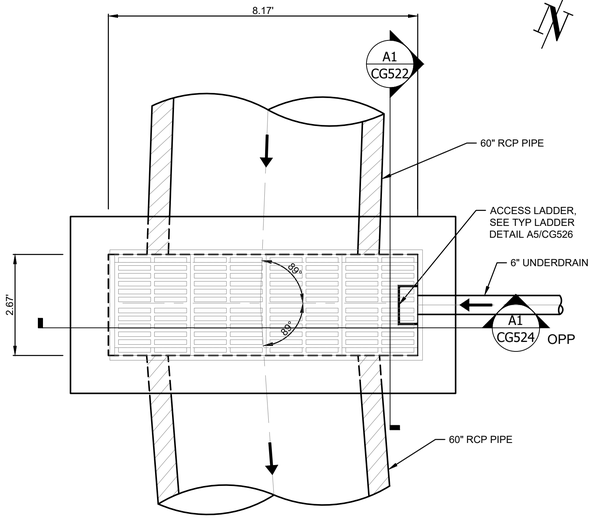
C4 IN-5-17
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



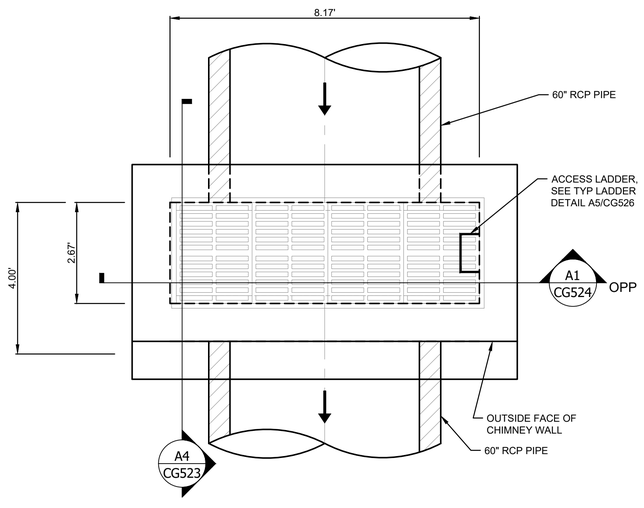
A1 IN-4-17
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A2 IN-5-16
SCALE: NTS

NOTE:
STATION AND OFFSET
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A4 IN-5-18
SCALE: NTS

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APPROVED:

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ACTIVITY

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DES:	DPS	DRW:	MAK	REV: VTO
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CHIEF ENG				EAM
FIRE PROTECTION				JCC

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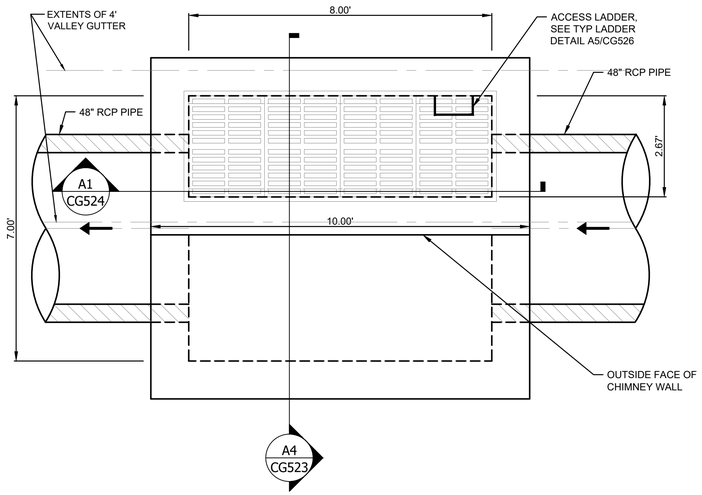
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.
-
NAVFAC DRAWING NO.
SHEET OF
CG511

PRE-FINAL SUBMITTAL

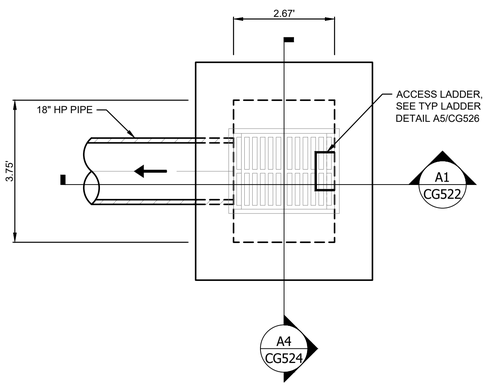
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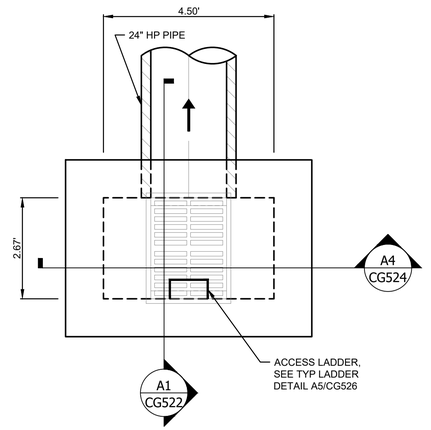
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NOTE:
STATION AND OFFSET
TO CENTER OF BOX



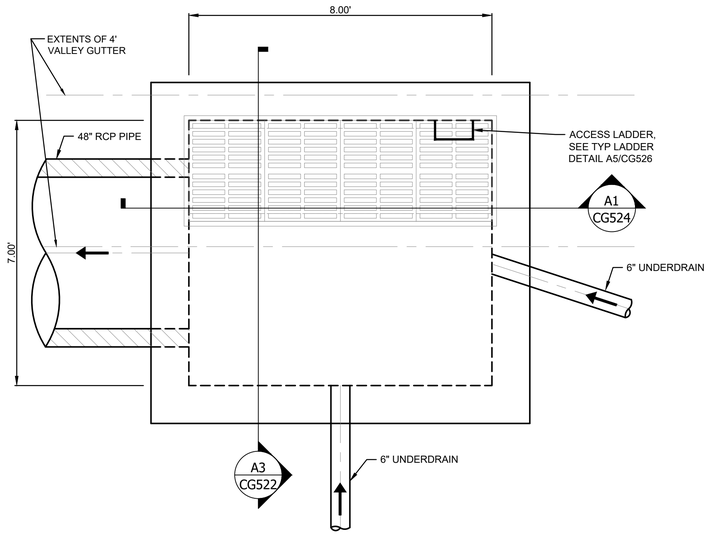
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SCALE: NTS

NOTE:
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TO CENTER OF BOX



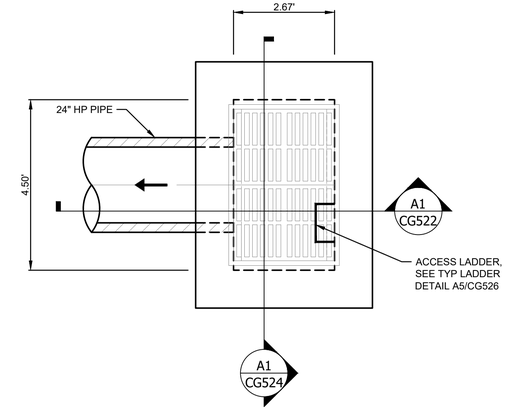
C4 IN-5-23
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



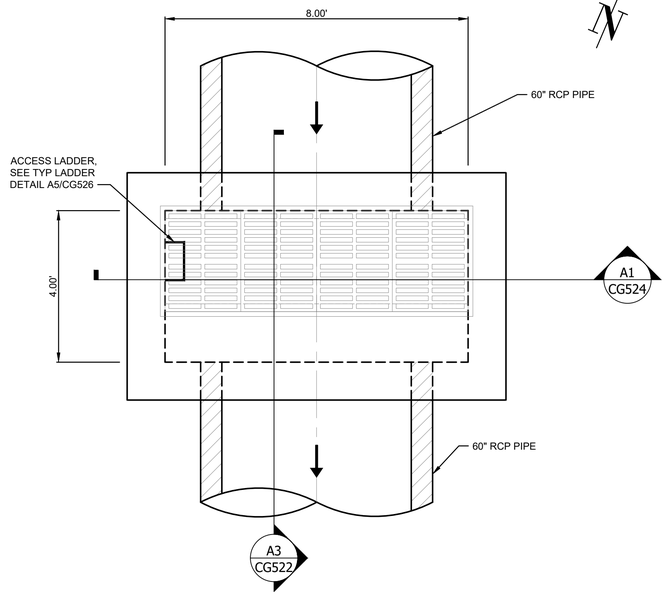
A1 IN-5-20
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A2 IN-5-22
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A4 IN-5-24
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX

(SEE SHEET CG525 FOR IN-5-25)

DATE
SYM DESCRIPTION

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: D3430615
A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	DPS	DRW	MAK	REV: VTO
PM/DM				MAV/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

DEPARTMENT OF THE NAVY
NAVFAC PACIFIC
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YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

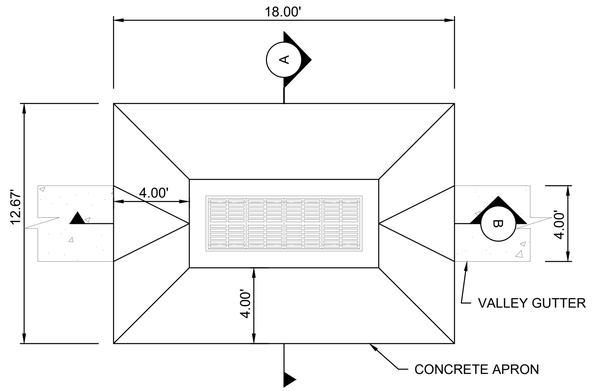
CIVIL DETAILS - DRAINAGE

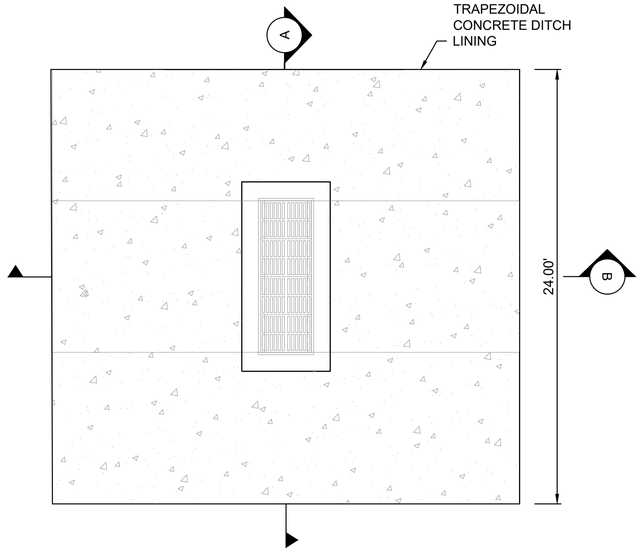
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EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG512

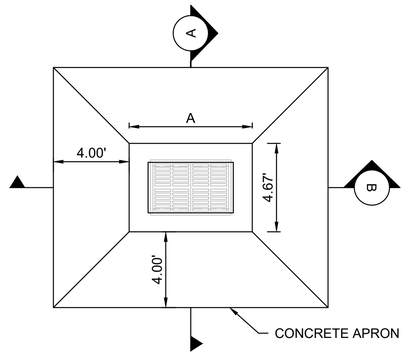
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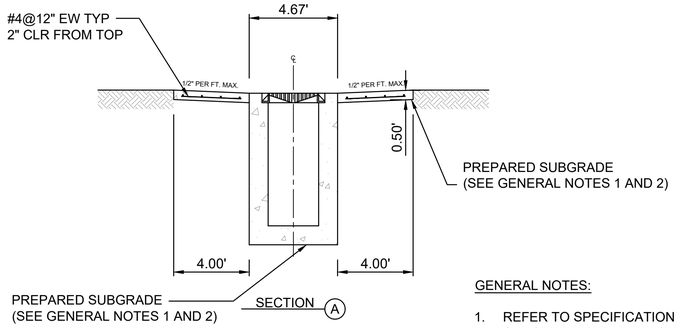
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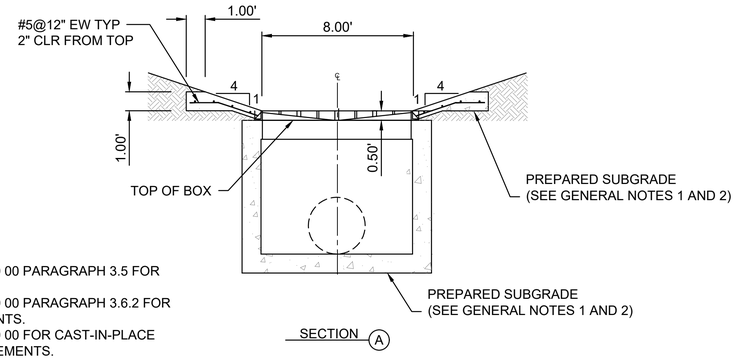
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LAYOUT NAME: CG512
PLOTTED: 10/30/2025 6:37:34 AM
USER: Morris, Tyler

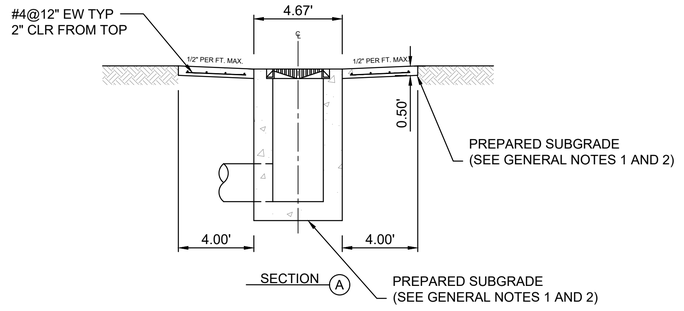








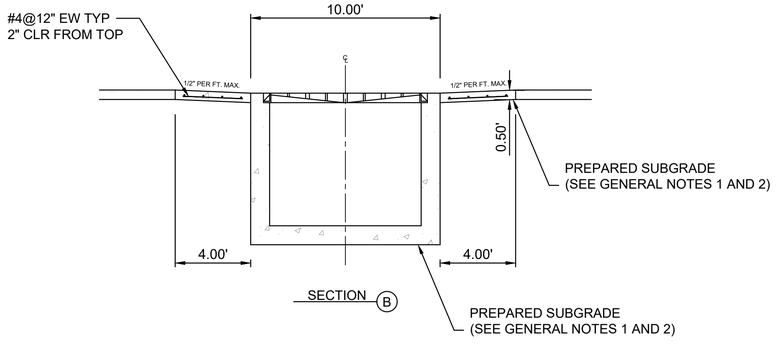


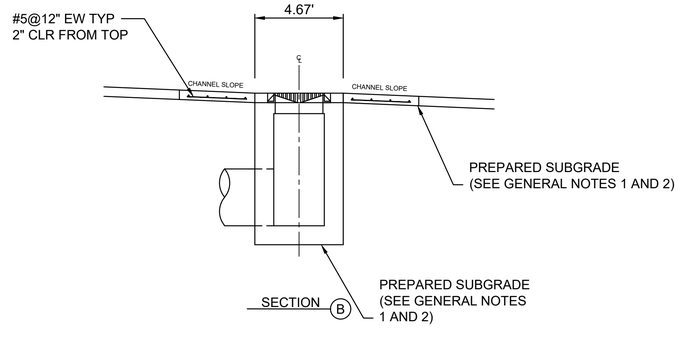


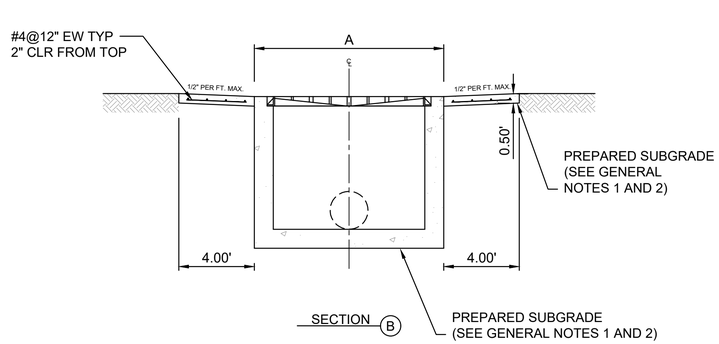
GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. REFER TO SPECIFICATION 03 30 00 FOR CAST-IN-PLACE CONCRETE AND JOINT REQUIREMENTS.
4. SEE INLET DETAILS FOR INLET DIMENSIONS.
5. USE NEENAH R-3475 SERIES INLET GRATES.
6. DETAILS ON THIS SHEET ARE FOR APRONS ONLY. INLET DEPTH AND PIPE DIAMETERS ARE SHOWN SCHEMATICALLY.

INLET	A	NUMBER OF GRATES
IN-3-17	6'-6"	2
IN-4-13	10'-0"	4
IN-4-18	10'-0"	4
IN-5-22	6'-6"	2
IN-5-23	6'-6"	1
IN-5-25	6'-6"	1







A1 4' CONCRETE VALLEY GUTTER INLET TRANSITION DETAIL

SCALE: NTS

A2 8' CONCRETE TRAPEZOIDAL CHANNEL INLET TRANSITION DETAIL

SCALE: NTS

A4 INLET CONCRETE APRON

SCALE: N.T.S.

DATE	SYM	DESCRIPTION

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Jacobs / BURNS MCDONNELL
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ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3A09615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
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DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

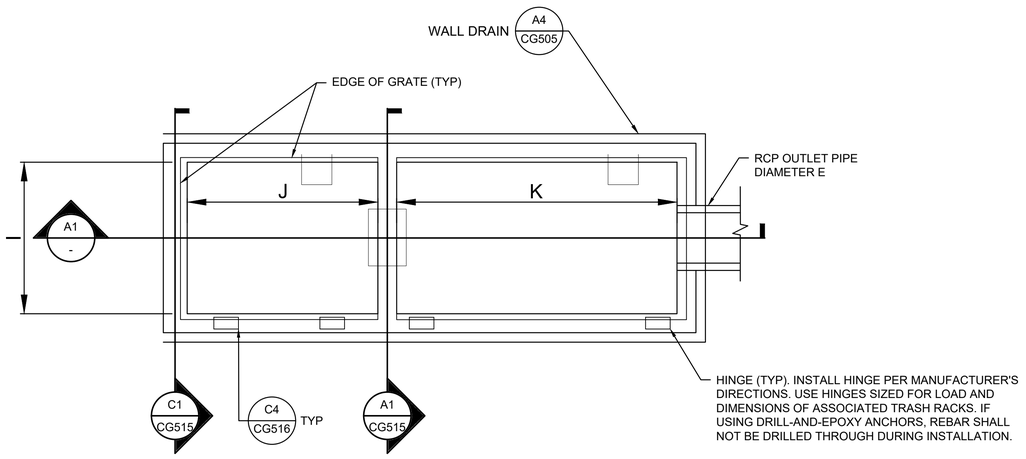
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EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF

CG513

PRE-FINAL SUBMITTAL

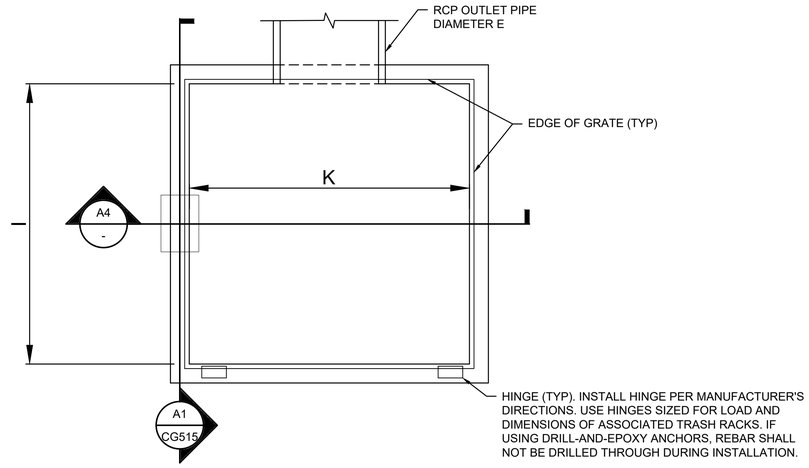
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LAYOUT NAME: CG513
PLOTTED: 10/30/2025 6:37:39 AM
USER: Morris, Tyler



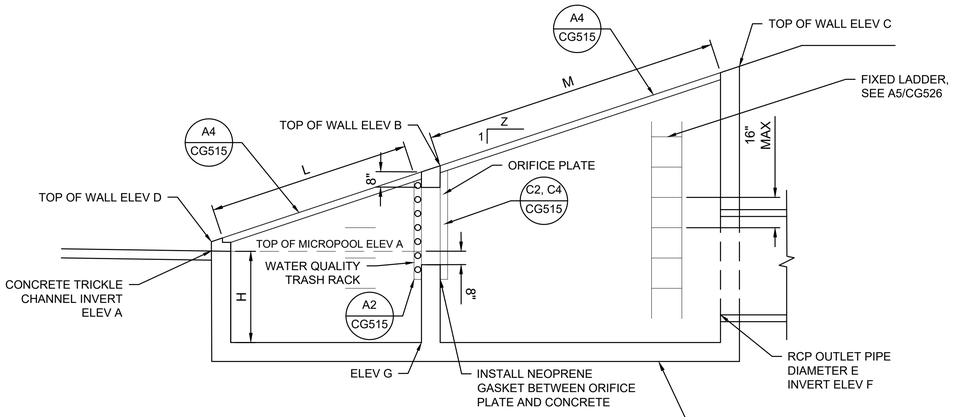
C1 OUTLET STRUCTURE PLAN

SCALE: NTS



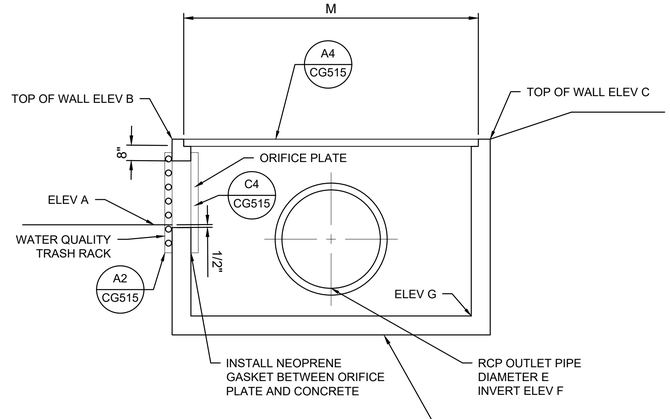
C4 OUTLET STRUCTURE 6A PLAN

SCALE: NTS



A1 OUTLET STRUCTURE PROFILE

SCALE: NTS



A4 OUTLET STRUCTURE 6A PROFILE

SCALE: NTS

NOTE: SEE THE TABLE ON CG516 FOR THE DIMENSIONS AND ELEVATIONS OF THE VARIABLES ON THE DETAILS.

SHEET NOTE:

1. SEE SHEET CG516 FOR A TABULATION OF LETTERED DIMENSIONS SHOWN HEREON.

GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. REFER TO SPECIFICATION 03 30 00 FOR CAST-IN-PLACE CONCRETE AND JOINT REQUIREMENTS.

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Jacobs / BURNS MCDONNELL
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ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: DAK0615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

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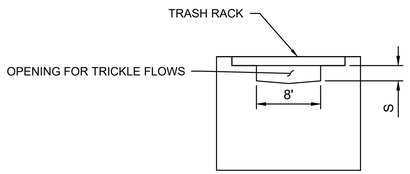
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG514

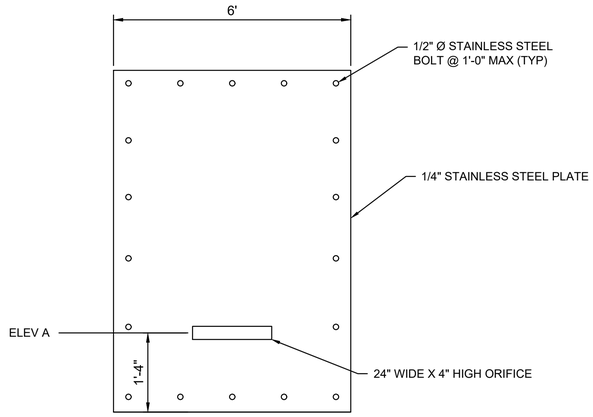
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USER: Morris, Tyler

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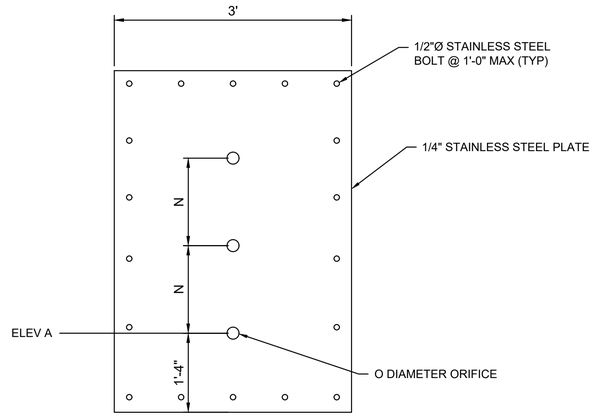


C1 SECTION
SCALE: NTS



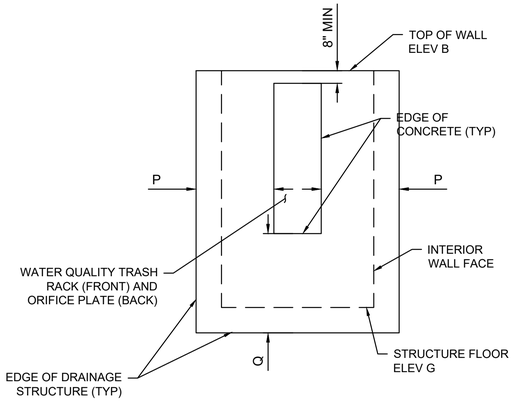
OUTFALL 3, 4, AND 5 PONDS

C2 ORIFICE PLATE
SCALE: NTS

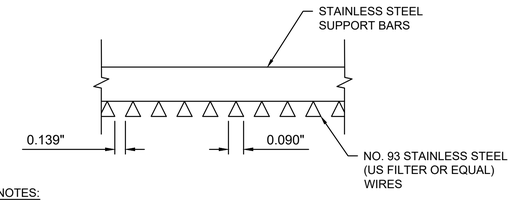


OUTFALL 6 AND 6A PONDS

C4 ORIFICE PLATE
SCALE: NTS



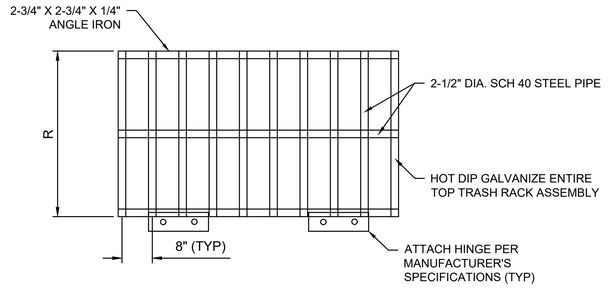
A1 SECTION
SCALE: NTS



NOTES:

1. WELL - SCREEN TRASH RACKS SHALL BE STAINLESS STEEL AND SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE. THEY SHALL BE ATTACHED BY 1/2" BOLTS EVERY FOOT ALONG THE EDGE OF THE MOUNTING FRAME.
2. THE SCREEN SHALL BE AN STAINLESS STEEL #93 VEE WIRE (US FILTER) TYPE SCREEN (OR APPROVED EQUAL) WITH A 0.139" (US FILTER) SCREEN OPENING SLOT DIMENSION. A TEE 0.074" X 0.50" SUPPORT RODS SHALL BE 1.0" O.C. THE HOLDING FRAME SHALL BE A 1" X 1.5" ANGLE BAR. THE WATER QUALITY TRASH RACK SHALL BE 5'-5" X 2'-0"
3. ATTACH WATER QUALITY TRASH RACK TO THE DRAINAGE STRUCTURE USING 1/2" BOLTS AT 1'-0" SPACING AROUND THE PERIMETER.

A2 WATER QUALITY TRASH RACK SECTION
SCALE: NTS



NOTES:

1. ALL TRASH RACKS SHALL BE MOUNTED USING GALVANIZED STEEL HARDWARE AND PROVIDED WITH HINGED ACCESS PANELS.
2. TRASH RACKS SHALL BE GALVANIZED STEEL AND SHALL BE HOT DIP GALVANIZED.

A4 COARSE BAR TRASH RACK
SCALE: NTS

NOTE: SEE THE TABLE ON CG516 FOR THE DIMENSIONS AND ELEVATIONS OF THE VARIABLES ON THE DETAILS.

SHEET NOTE:

1. SEE SHEET CG516 FOR A TABULATION OF LETTERED DIMENSIONS SHOWN HEREON.

NO.	DESCRIPTION	DATE
STM		

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3A09615
A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	DPS	DRW: MAK	REV: VTO
PM/DM			MAV/DRK
BRANCH MANAGER			SMK
CHIEF ENG			EAM
FIRE PROTECTION			JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG515

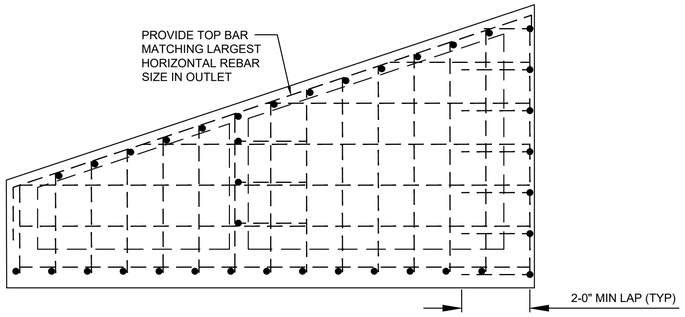
PRE-FINAL SUBMITTAL

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LAYOUT NAME: CG515
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USER: Morris, Tyler

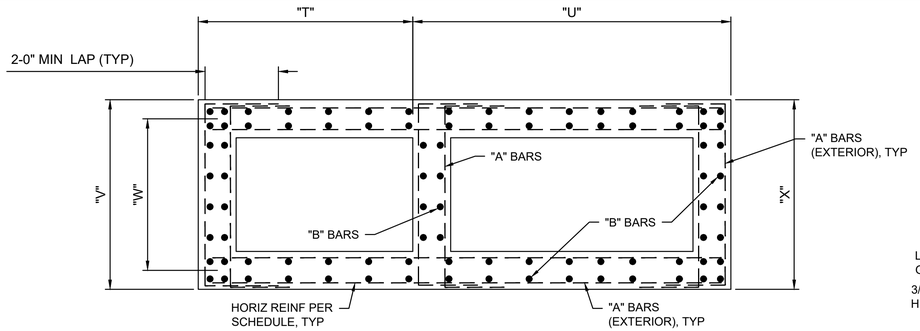
IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

STRUCTURAL NOTES:

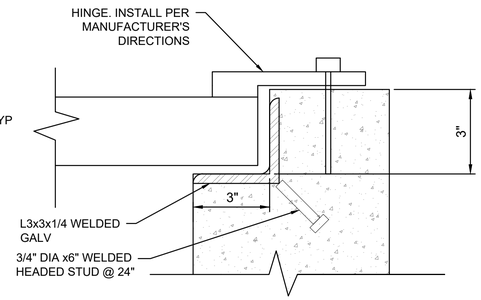
1. CONCRETE SHALL BE PER SPECIFICATIONS. (f'c = 5,000 PSI)
2. ALL REBAR SHALL BE GRADE 60 EPOXY COATED.
3. ALL GRATES, RACKS, PLATES, AND ATTACHMENT HARDWARE SHALL BE GALVANIZED OR STAINLESS STEEL AS NOTED ON THE PLANS.
4. BOTH TRASH RACKS ON TOP OF THE INLET STRUCTURE SHALL HAVE HINGES PLACED THAT ARE DESIGNED FOR THE FULL WEIGHT OF THE RACKS AND WILL ALLOW THE RACKS TO FULLY OPEN AND LAY ON THE SLOPE TO THE SIDE OF THE INLET. THE NUMBER AND TYPE OF HINGES IS DETERMINED BY THE CONTRACTOR.
5. THE INLET STRUCTURE MAY BE PRECAST OR CAST-IN-PLACE.
6. THE STRUCTURE SHALL NOT BE BACKFILLED AGAINST UNTIL THE CONCRETE HAS REACHED A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI.



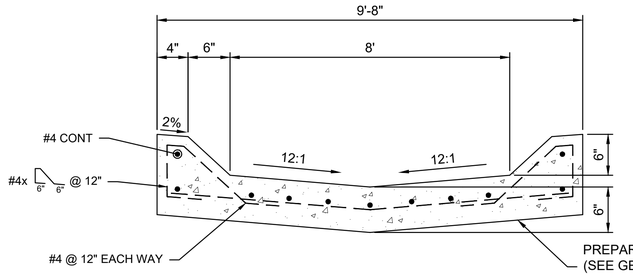
B1 OUTLET REINFORCING PROFILE
SCALE: NTS



C1 OUTLET REINFORCING PLAN
SCALE: NTS



C4 GRATE INSTALLATION DETAIL
SCALE: NTS



NOTES:

1. ALL REINFORCING STEEL SHALL BE ASTM GRADE 60.
2. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING ALL REINFORCING STEEL AND OTHER CONSTRUCTION DETAILS PRIOR TO FABRICATION.
3. WELDED WIRE FABRIC MAY BE USED AS A SUBSTITUTE FOR THE #5 BARS, IF THE AREA OF STEEL IS EQUAL TO OR GREATER THAN THE AREA PROVIDE BY THE #5 REBAR.

GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. REFER TO SPECIFICATION 03 30 00 FOR CAST-IN-PLACE CONCRETE AND JOINT REQUIREMENTS.

B4 TRICKLE CHANNEL SECTION
SCALE: NTS

WALL "T"				WALL "U"				WALL "V"				WALL "W"				WALL "X"				SLAB	
	VERT REINF			HORIZ REINF	VERT REINF			HORIZ REINF	VERT REINF			HORIZ REINF	VERT REINF			HORIZ REINF	VERT REINF			HORIZ REINF		
POND	THK	"A" BARS	"B" BARS		THK	"A" BARS	"B" BARS		THK	"A" BARS	"B" BARS		THK	"A" BARS	"B" BARS		THK	"A" BARS	"B" BARS		THK	REINF
OUTFALL 3	14"	#8 @ 12"	#4 @ 12"	#5 @ 12" EA FACE	14"	#8 @ 12"	#4 @ 12"	#5 @ 12" EA FACE	14"	#8 @ 12"	#4 @ 12"	#5 @ 12" EA FACE	9"	#8 @ 12"	#4 @ 16"	#4 @ 12" EA FACE	14"	#8 @ 12"	#4 @ 12"	#5 @ 12" EA FACE	18"	#8 @ 12" E.W.
OUTFALL 4	6"	#4 @ 12"	N/A	#4 @ 12"	9"	#5 @ 12"	#4 @ 16"	#4 @ 12" EA FACE	6"	#4 @ 12"	N/A	#4 @ 12" EA FACE	6"	#5 @ 12"	N/A	#4 @ 12"	9"	#5 @ 12"	#4 @ 16"	#4 @ 12" EA FACE	12"	#6 @ 12" E.W.
OUTFALL 5	12"	#6 @ 12"	#4 @ 16"	#5 @ 12" EA FACE	12"	#7 @ 12"	#4 @ 16"	#5 @ 12" EA FACE	12"	#6 @ 12"	#4 @ 16"	#5 @ 12" EA FACE	9"	#7 @ 12"	#4 @ 12" EA FACE	#4 @ 12" EA FACE	12"	#7 @ 12"	#4 @ 16"	#5 @ 12" EA FACE	16"	#7 @ 12" E.W.
OUTFALL 6	6"	#5 @ 12"	N/A	#4 @ 12"	9"	#5 @ 12"	#4 @ 16"	#4 @ 12" EA FACE	6"	#5 @ 12"	N/A	#4 @ 12"	6"	#5 @ 12"	N/A	#4 @ 12"	9"	#5 @ 12"	#4 @ 16"	#4 @ 12" EA FACE	12"	#5 @ 12" E.W.
OUTFALL 6A	-	-	-	-	6"	#4 @ 12"	N/A	#4 @ 12"	-	-	-	#4 @ 12"	6"	#5 @ 12"	N/A	#4 @ 12"	6"	#4 @ 12"	N/A	#4 @ 12"	9"	#5 @ 12" E.W.

POND OUTLET STRUCTURE DETAIL DIMENSIONS AND ELEVATIONS

POND	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	Z
OUTFALL 3	26.17	29.92	34.20	26.85	66"	21.28	20.67	5.50'	20.00'	7.54'	12.00'	8.21'	12.65'	N/A	N/A	8.50'	5.67'	20.50'	0.38'	3
OUTFALL 4	15.91	18.91	23.19	16.59	72"	15.41	14.41	1.50'	20.00'	5.29'	12.00'	5.84'	12.65'	N/A	N/A	8.50'	1.67'	20.50'	0.38'	3
OUTFALL 5	46.77	50.27	54.55	47.41	66"	43.24	42.27	4.50'	16.00'	6.91'	12.00'	7.54'	12.65'	N/A	N/A	6.50'	4.67'	16.50'	0.34'	3
OUTFALL 6	67.23	69.73	71.94	67.88	42"	64.73	64.23	3.00'	10.00'	5.73'	8.00'	6.16'	8.25'	10"	1 3/8"	5.00'	3.17'	10.50'	0.28'	4
OUTFALL 6A	49.00	52.25	52.25	N/A	36"	47.00	46.50	2.50'	7.00'	N/A	7.00'	N/A	7.50'	1'-1"	13/16"	3.50'	2.67'	7.50'	N/A	N/A

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: DIA09615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAU/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)
FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
CIVIL DETAILS - DRAINAGE

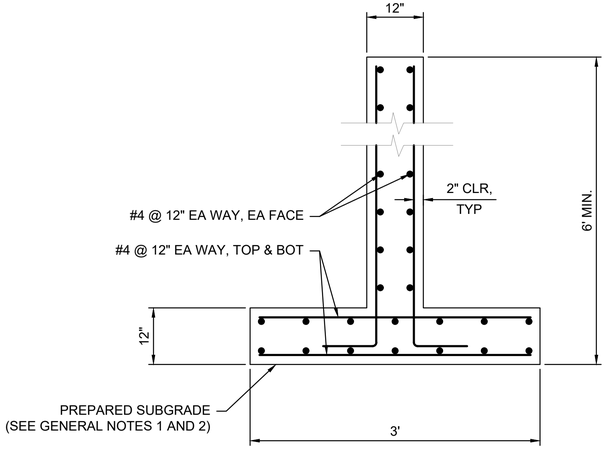
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EPROJECT NO.1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG516

PRE-FINAL SUBMITTAL

DATE | SYM | DESCRIPTION

FILE NAME: p-010_p-020-cg501-cg529.dwg
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USER: Morris, Tyler

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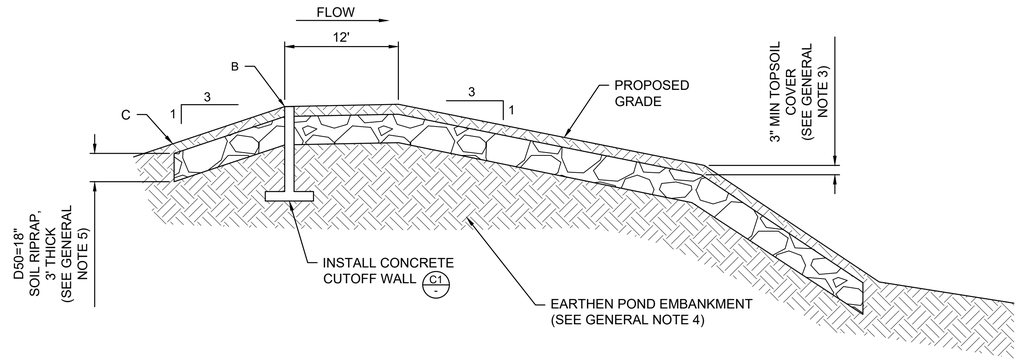


C1 POND EMERGENCY SPILLWAY CUTOFF WALL

SCALE: NTS

GENERAL NOTES:

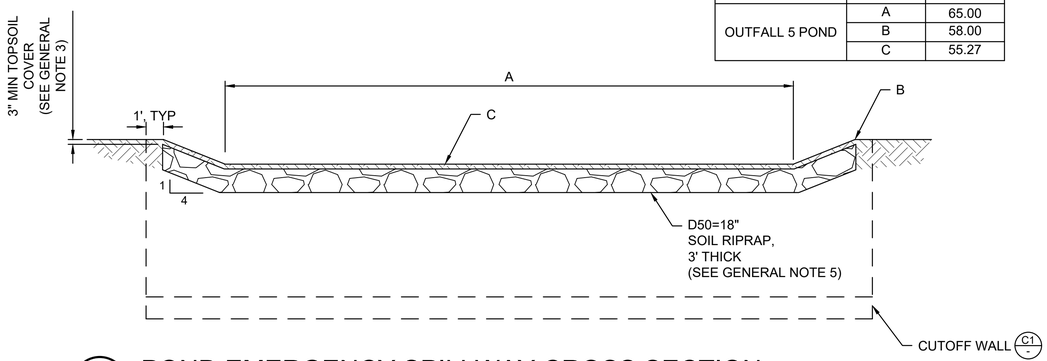
1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.9.4 FOR TOPSOIL AND SEEDING REQUIREMENTS.
4. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.7.1 FOR EARTHEN EMBANKMENT REQUIREMENTS.
5. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.8 FOR RIPRAP CONSTRUCTION.
6. REFER TO SPECIFICATION 32 11 23 FOR AGGREGATE BASE COURSE REQUIREMENTS.
7. REFER TO SPECIFICATION 33 46 16 FOR GEOTEXTILE REQUIREMENTS.
8. REFER TO SPECIFICATION 03 30 00 FOR CAST-IN-PLACE CONCRETE AND JOINT REQUIREMENTS.
9. ALL REINFORCING STEEL SHALL BE ASTM GRADE 60.
10. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING ALL REINFORCING STEEL AND OTHER CONSTRUCTION DETAILS PRIOR TO FABRICATION.
11. LENGTH OF SOIL RIPRAP VARIES AT EMERGENCY SPILLWAY, INSTALL TO TOE OF SLOPE.



B1 POND EMERGENCY SPILLWAY PROFILE

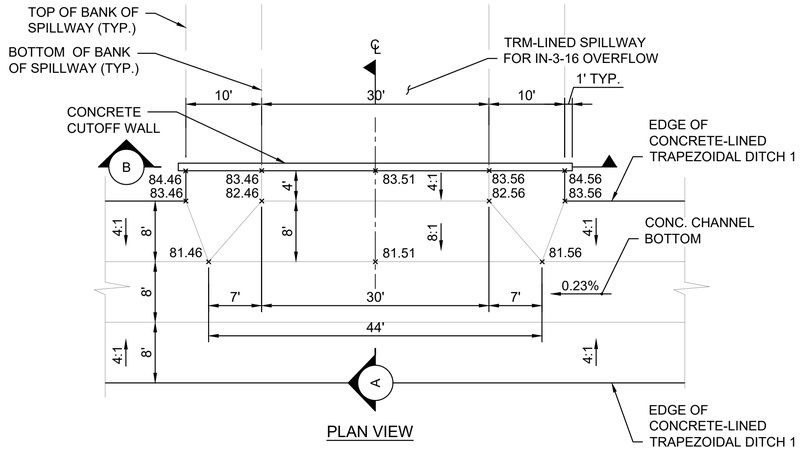
SCALE: NTS

EMERGENCY SPILLWAY DATA		
POND	DIM.	ELEV.
OUTFALL 3 POND	A	60.00
	B	38.00
	C	35.17
OUTFALL 4 POND	A	62.00
	B	29.00
	C	26.13
OUTFALL 5 POND	A	65.00
	B	58.00
	C	55.27

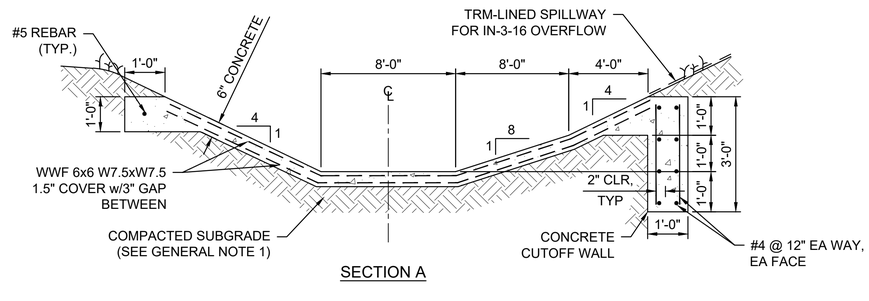


A1 POND EMERGENCY SPILLWAY CROSS SECTION

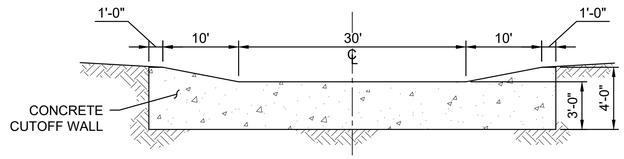
SCALE: NTS



PLAN VIEW



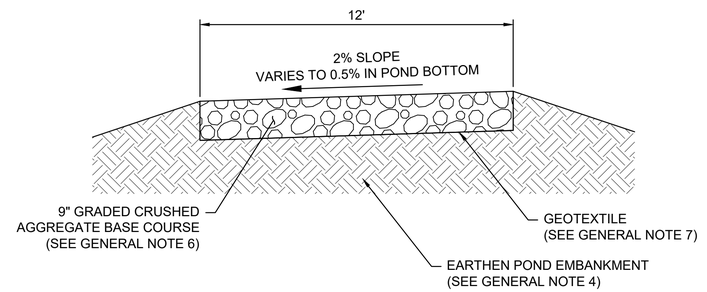
SECTION A



SECTION B

B4 DITCH 1 SIDE SLOPE AT IN-3-16 SPILLWAY

SCALE: NTS



A4 POND ACCESS ROAD

SCALE: NTS

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CO 29899 NOV 4, 2025
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SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA00615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
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MAKALAPA, HAWAII
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY
CIVIL DETAILS - DRAINAGE

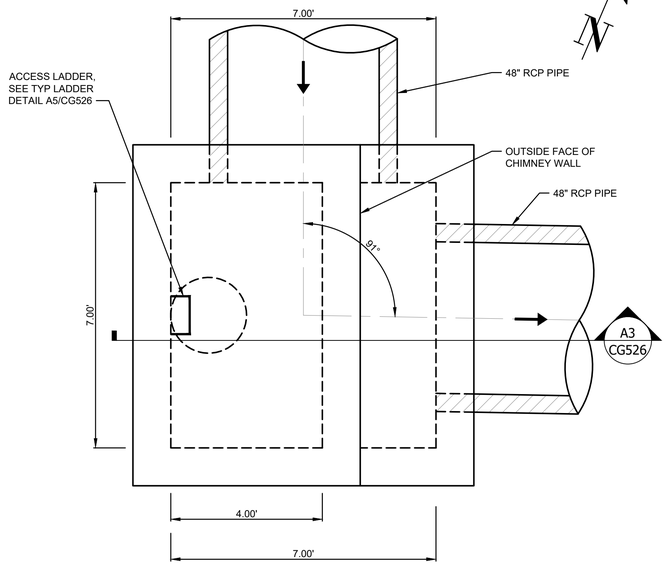
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CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG517

PRE-FINAL SUBMITTAL

DATE
SYM DESCRIPTION

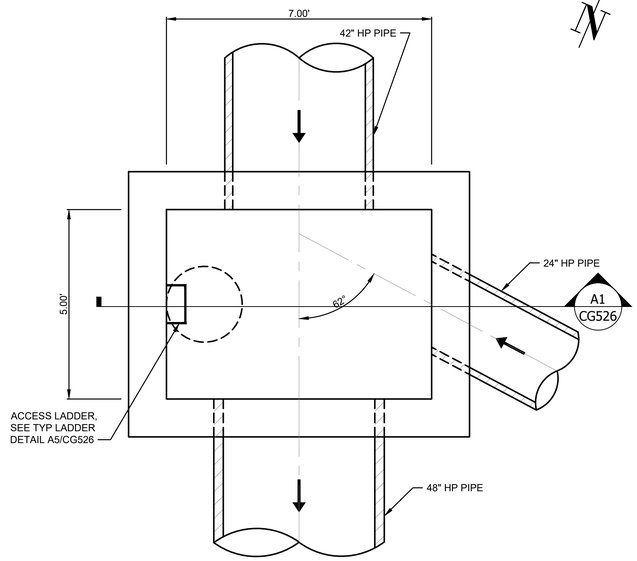
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USER: Morris, Tyler

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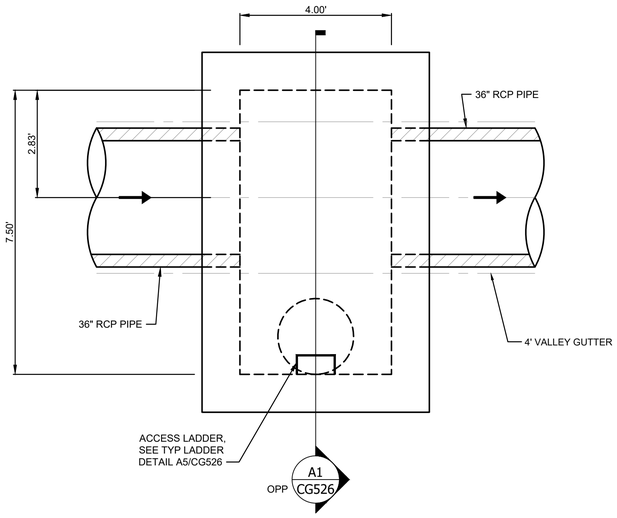
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STATION AND OFFSET
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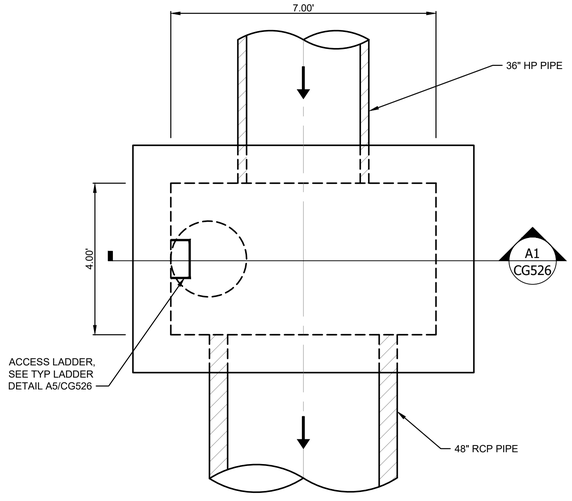
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NOTE:
STATION AND OFFSET
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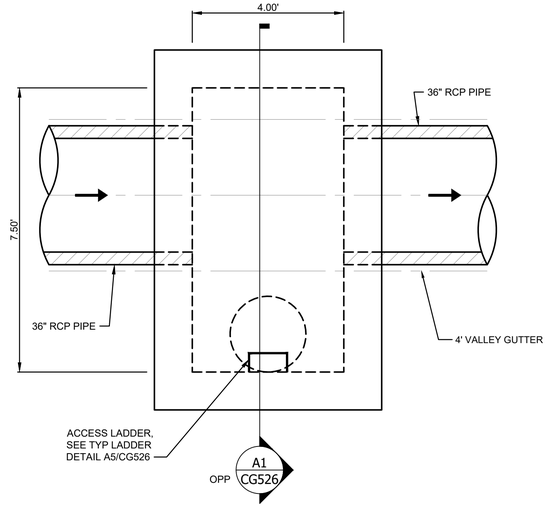
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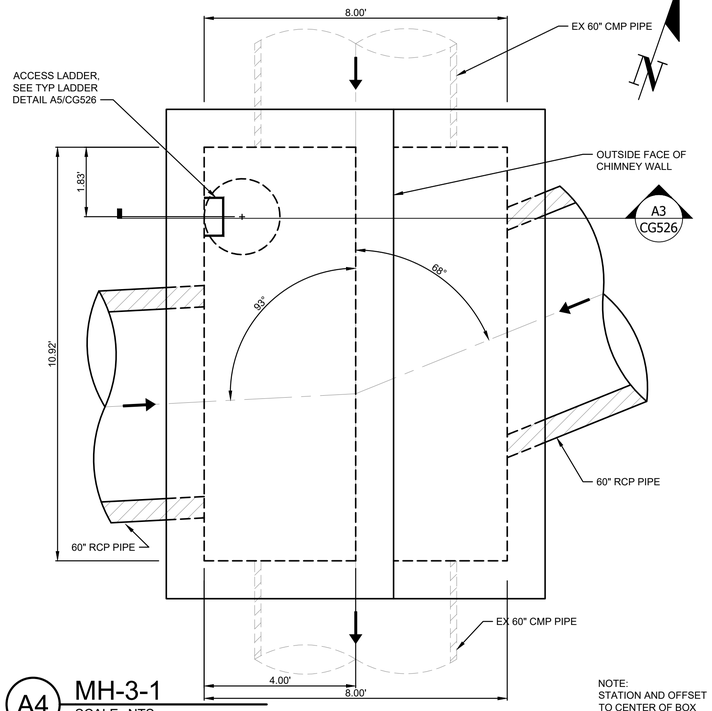
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NOTE:
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A2 MH-2-1
SCALE: NTS

NOTE:
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A4 MH-3-1
SCALE: NTS

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SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5765

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: D3430615 A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE
ACTIVITY

SATISFACTORY TO DATE

DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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MAKALAPA, HAWAII

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

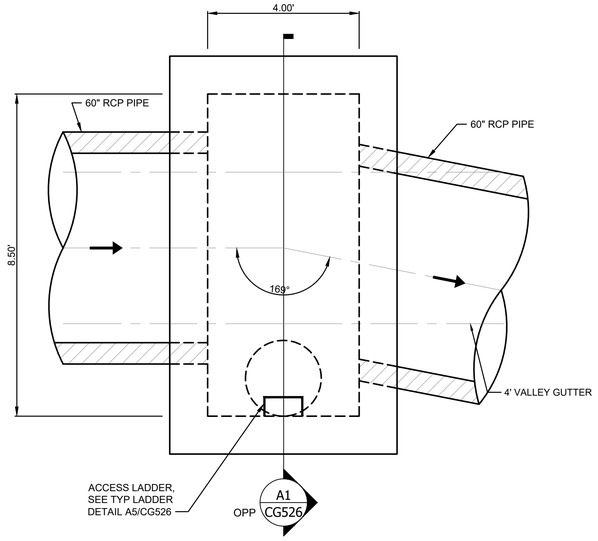
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CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG518

PRE-FINAL SUBMITTAL

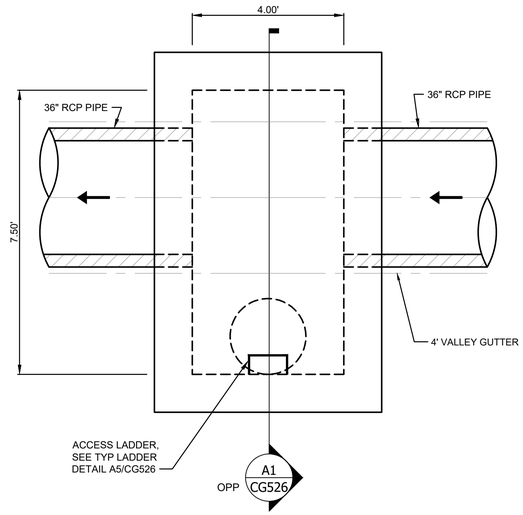
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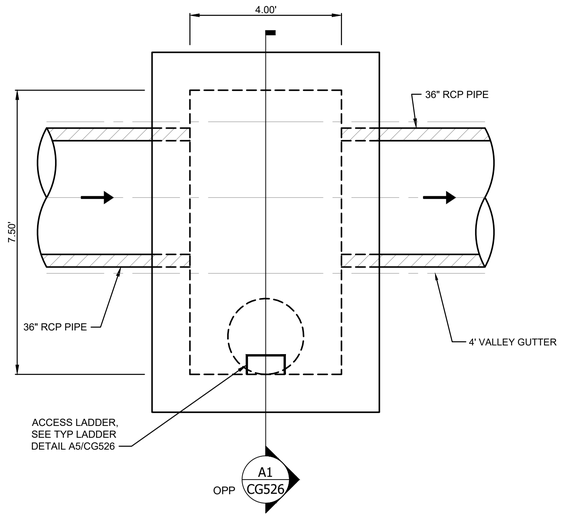
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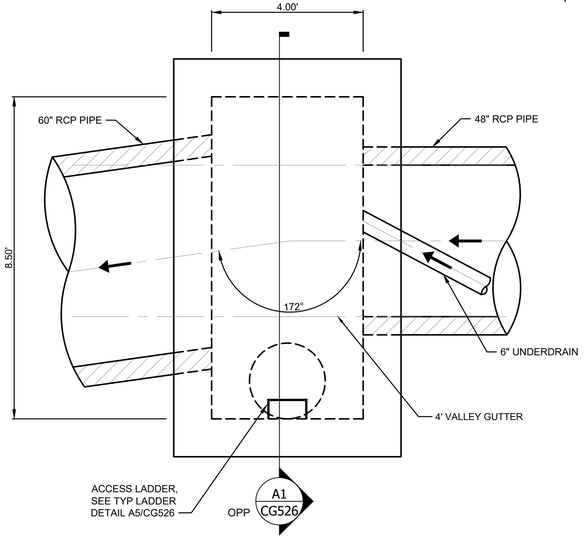
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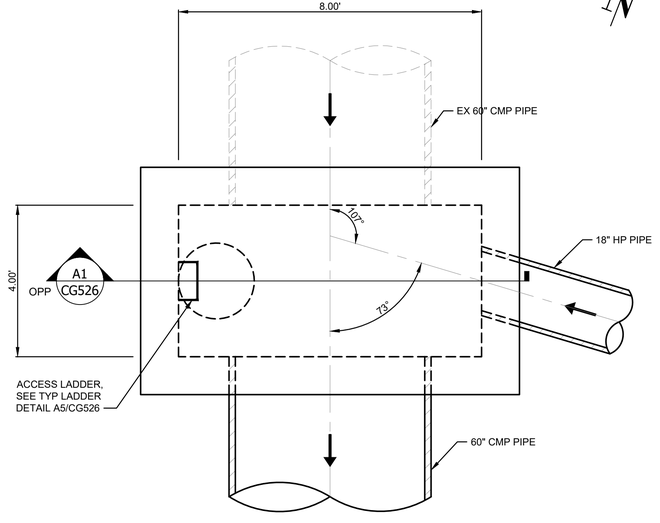
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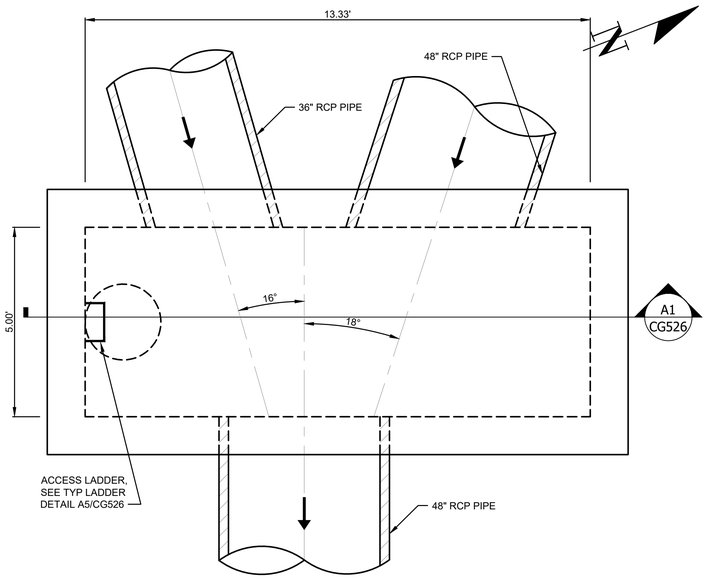
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A2 MH-3-5
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NOTE:
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A4 MH-4-1
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1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615 A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

ACTIVITY

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DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

DEPARTMENT OF THE NAVY
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
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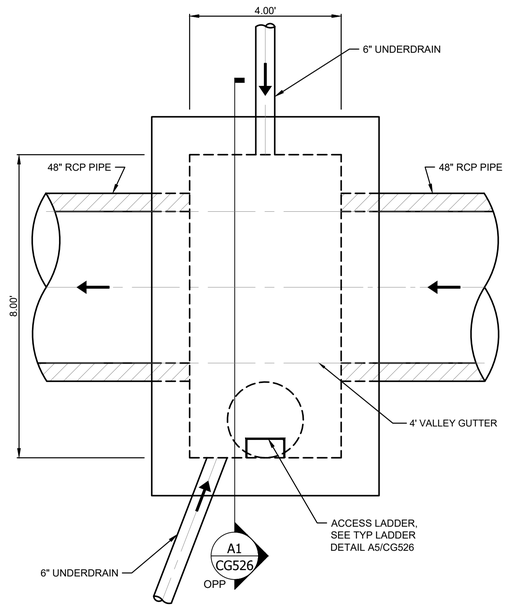
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SCALE: AS SHOWN
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CONSTR. CONTR. NO.
-
NAVFAC DRAWING NO.
SHEET OF
CG519

PRE-FINAL SUBMITTAL

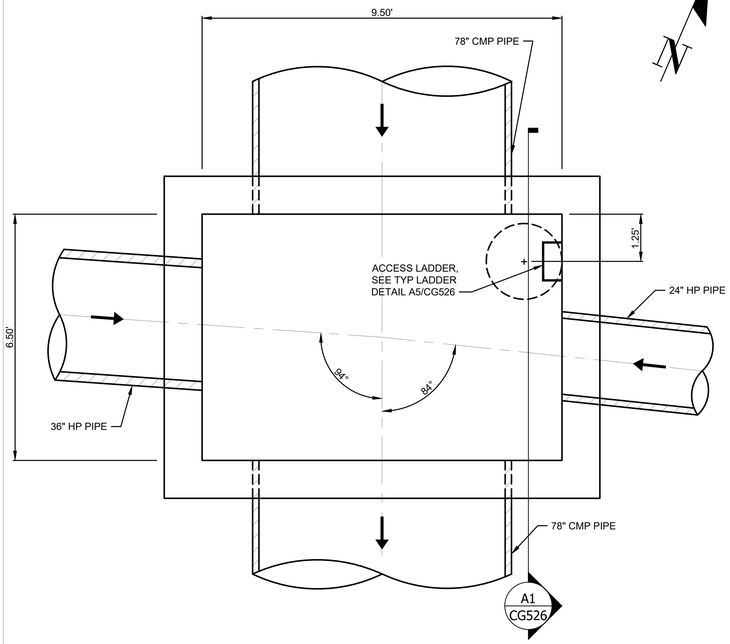
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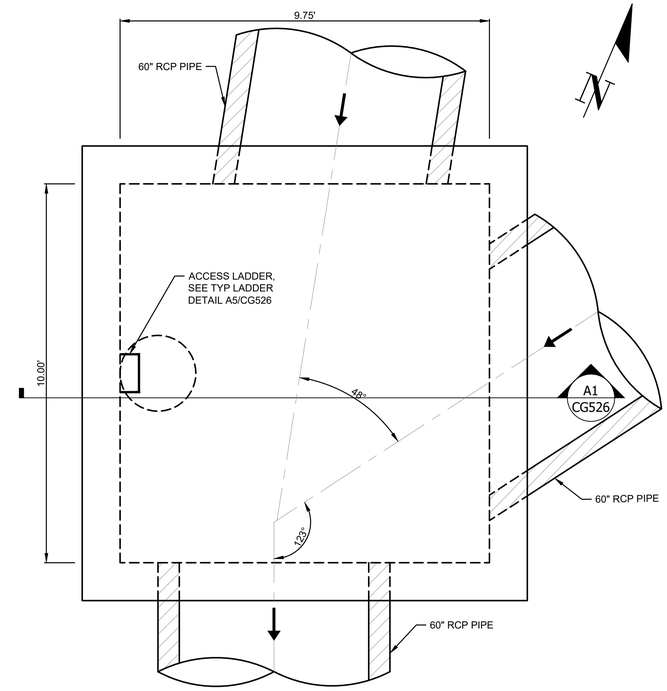
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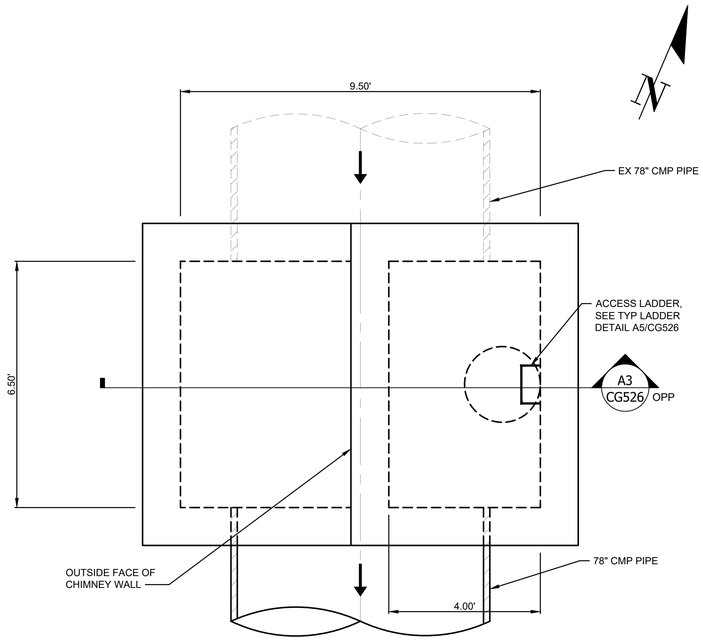
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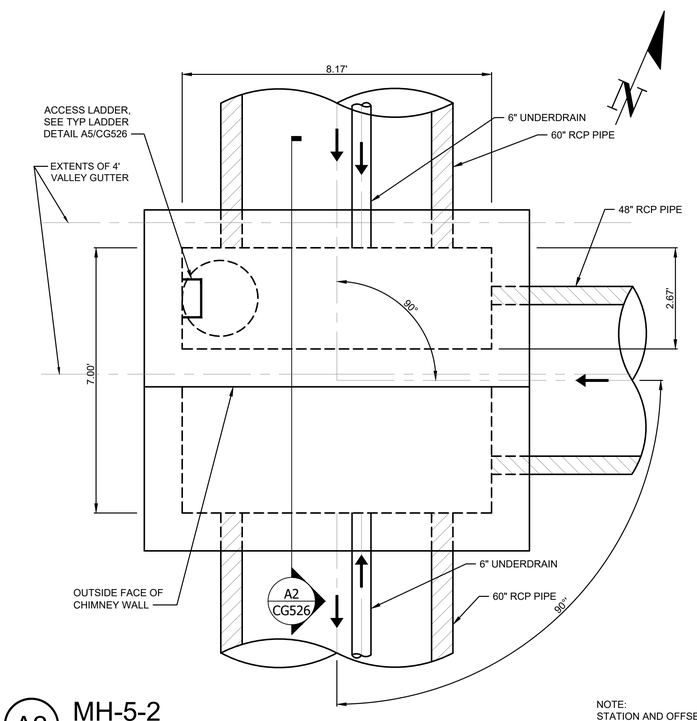
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TO CENTER OF BOX



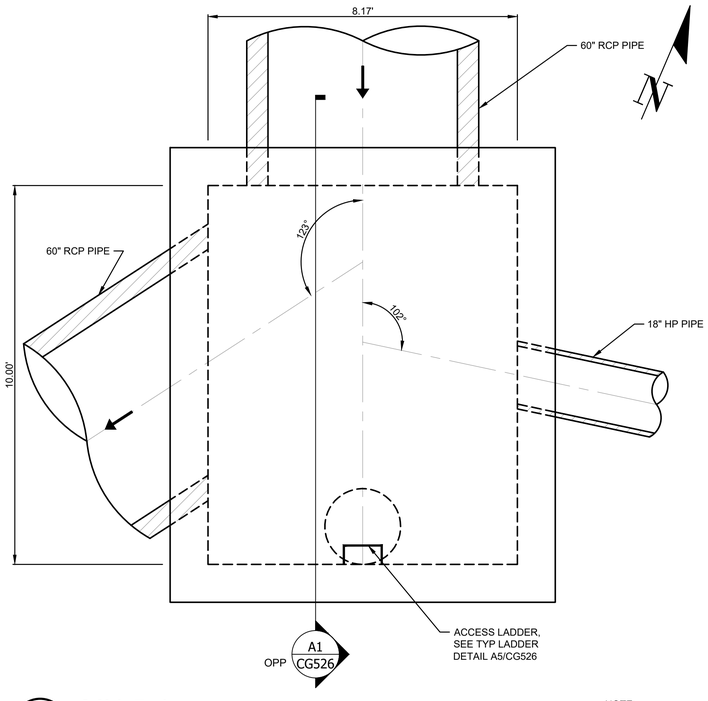
A1 MH-4-3
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A2 MH-5-2
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A4 MH-5-4
SCALE: NTS

NOTE:
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NO.	DESCRIPTION	DATE

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JEG: D3430615 A/E INFO

APPROVED:
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ACTIVITY
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PM/DM			MAI/DRK
BRANCH MANAGER			SMK
CHIEF ENG			EAM
FIRE PROTECTION			JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

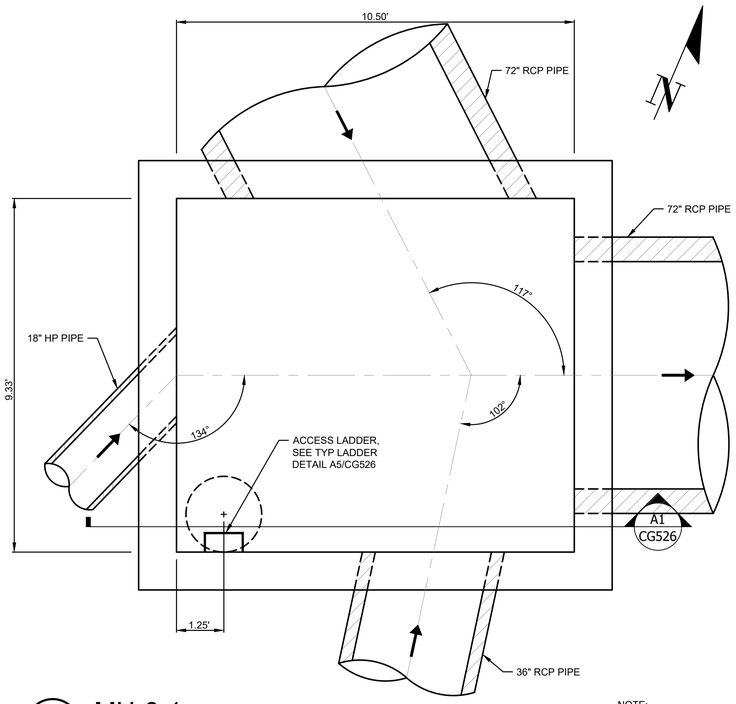
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO. 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG520

PRE-FINAL SUBMITTAL

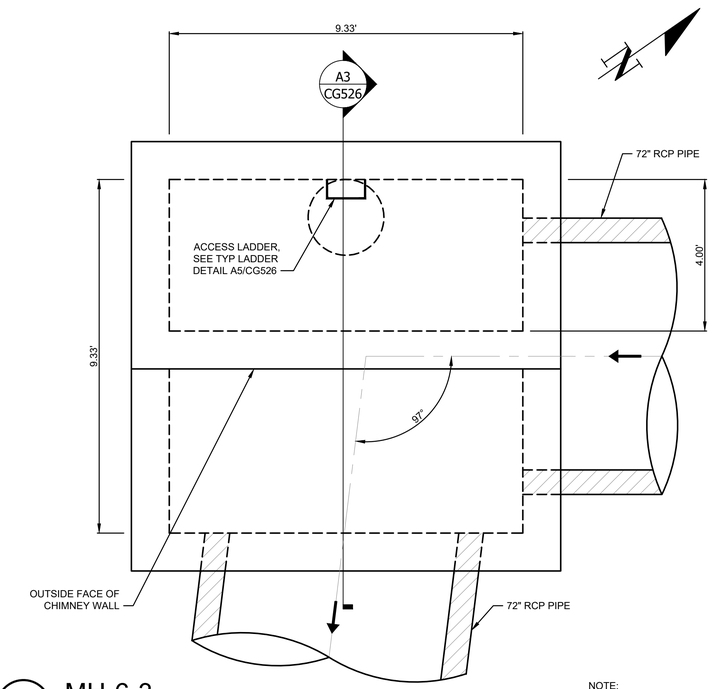
IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG520
PLOTTED: 10/30/2025 6:38:14 AM
USER: Morris, Tyler



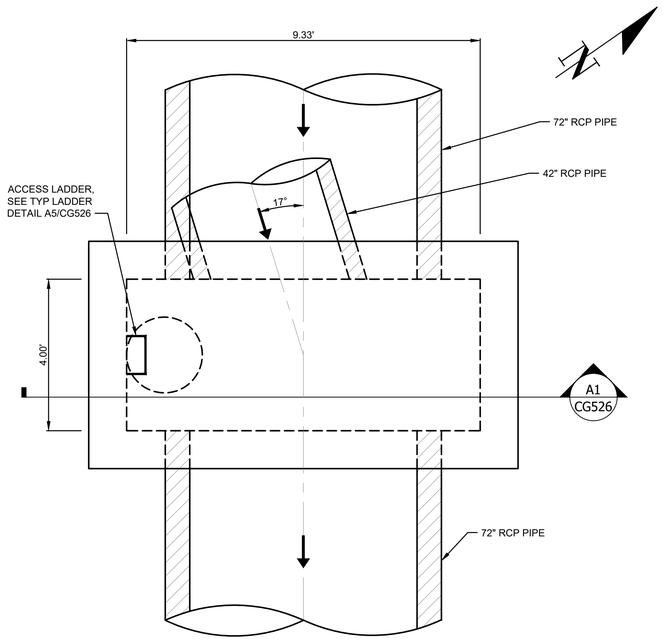
C1 MH-6-1
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



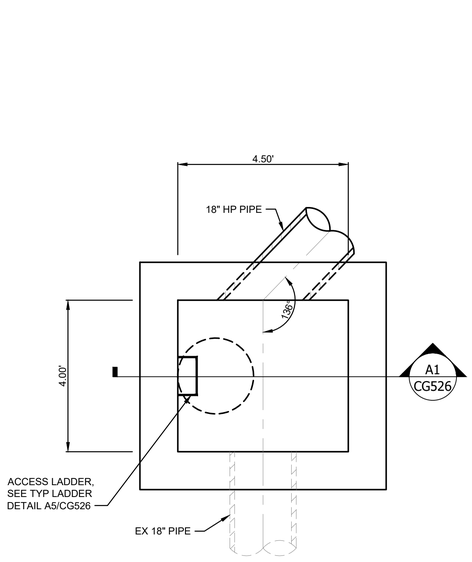
C2 MH-6-3
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A1 MH-6-2
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX



A2 MH-6-4
SCALE: NTS

NOTE:
STATION AND OFFSET
TO CENTER OF BOX

DATE
SYM DESCRIPTION

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: DAK0615 A/E INITS

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

DEPARTMENT OF THE NAVY
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

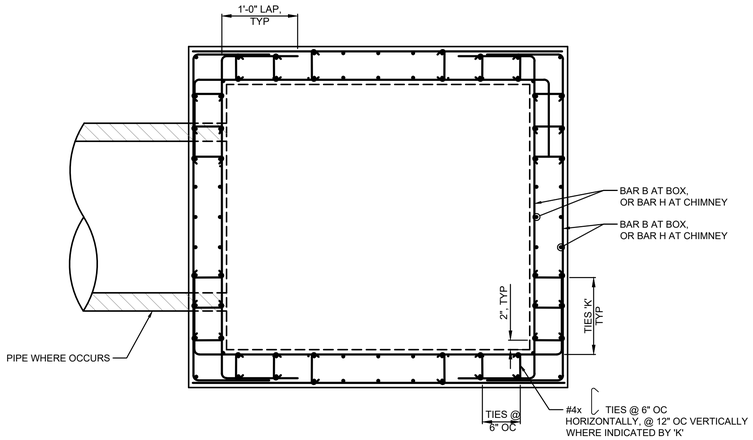
CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG521

PRE-FINAL SUBMITTAL

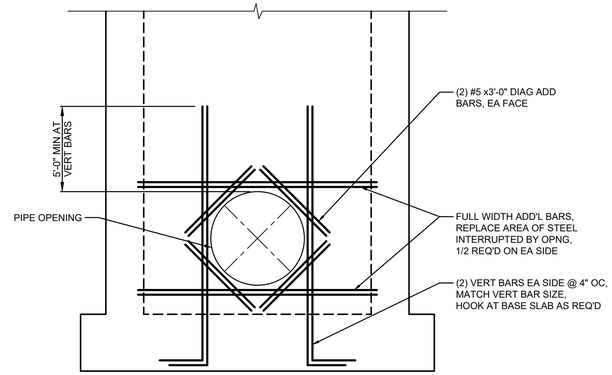
IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG521
PLOTTED: 10/30/2025 6:38:19 AM
USER: Morris, Tyler



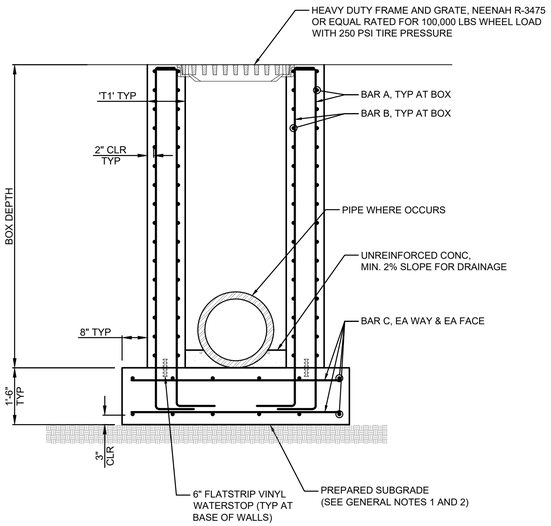
C2 TYP INLET AND MANHOLE WALL TIE BARS 'K'

SCALE: NTS



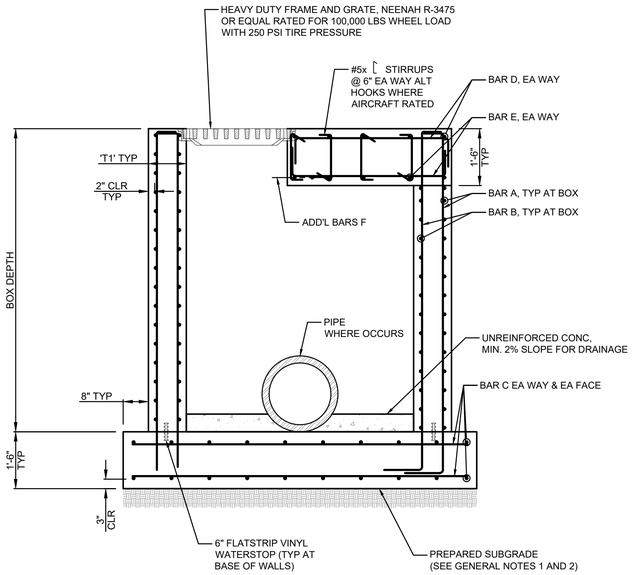
C4 TYP INLET AND MANHOLE PIPE PENETRATION

SCALE: NTS



A1 INLET SECTION

SCALE: NTS



A3 INLET SECTION

SCALE: NTS

GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. ALL REINFORCING SHALL BE ASTM A615 GRADE 60, EPOXY COATED PER ASTM A775.
4. CONCRETE COMPRESSIVE STRENGTH SHALL BE 5,000 PSI MINIMUM.
5. ALL GRATES SHALL BE BOLTED DOWN TO FRAME.
6. SEE "INLET REINFORCING SCHEDULE" DETAIL ON SHEET CG525 FOR SIZE AND SPACING OF BARS.
7. SEE "TYPICAL INLET AND MANHOLE PIPE PENETRATION" DETAIL ON SHEET CG522 FOR ADDITIONAL REINFORCING REQUIREMENTS.
8. FOR 'T1' THICKNESS, SEE "INLET STRUCTURE DIMENSION SCHEDULE" ON SHEET CG528.
9. SEE C2/CG522 FOR TYPICAL TIE REINFORCEMENT BAR 'K'.

A4 INLET STRUCTURE NOTES

SCALE: NTS

DATE	SYM	DESCRIPTION

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CO 29899 NOV 4, 2025
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SEAL

Jacobs / BURNS MCDONNELL

1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: DIA09615 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

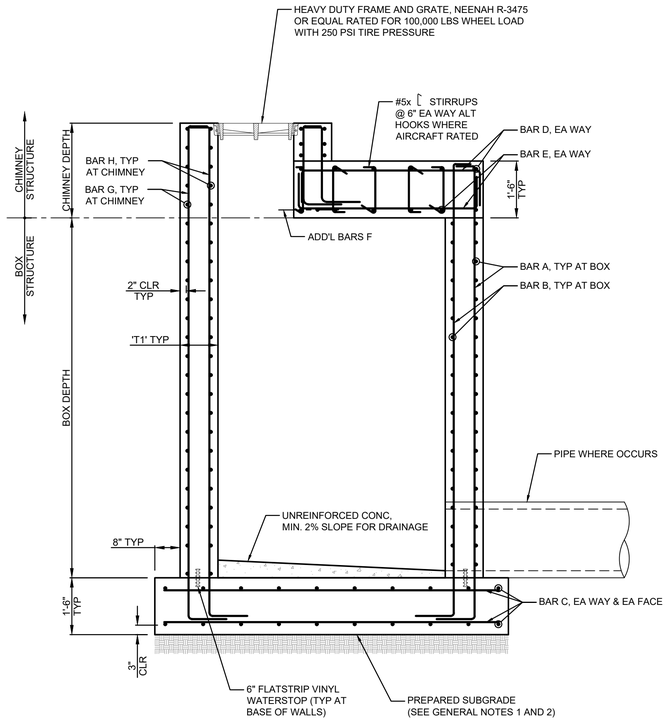
SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF

CG522

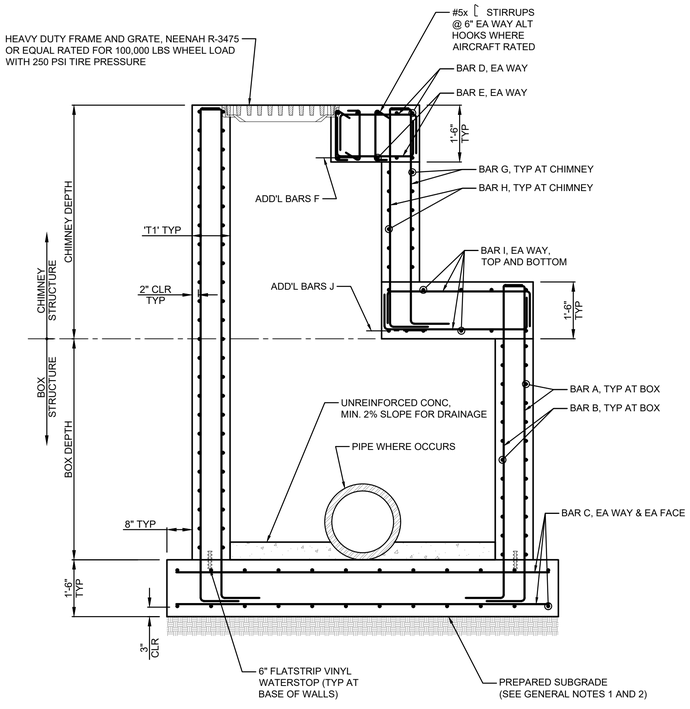
PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG522
PLOTTED: 10/30/2025 6:38:24 AM
USER: Morris, Tyler

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES



A1 INLET SECTION
SCALE: NTS



A4 INLET SECTION
SCALE: NTS

GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. ALL REINFORCING SHALL BE ASTM A615 GRADE 60, EPOXY COATED PER ASTM A775.
4. CONCRETE COMPRESSIVE STRENGTH SHALL BE 5,000 PSI MINIMUM.
5. ALL GRATES SHALL BE BOLTED DOWN TO FRAME.
6. SEE "INLET REINFORCING SCHEDULE" DETAIL ON SHEET CG525 FOR SIZE AND SPACING OF BARS.
7. SEE "TYPICAL INLET AND MANHOLE PIPE PENETRATION" DETAIL ON SHEET CG522 FOR ADDITIONAL REINFORCING REQUIREMENTS.
8. FOR 'T1' THICKNESS, SEE "INLET STRUCTURE DIMENSION SCHEDULE" ON SHEET CG528.
9. SEE C2/CG522 FOR TYPICAL TIE REINFORCEMENT BAR 'K'.

A5 INLET STRUCTURE NOTES
SCALE: NTS

NO.	DESCRIPTION	DATE

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1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615
A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

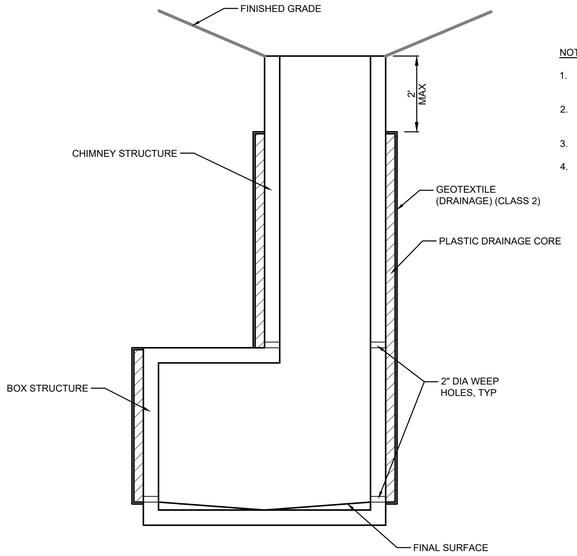
SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF

CG523

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG523
PLOTTED: 10/30/2025 6:38:29 AM
USER: Morris, Tyler

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES



NOTES:

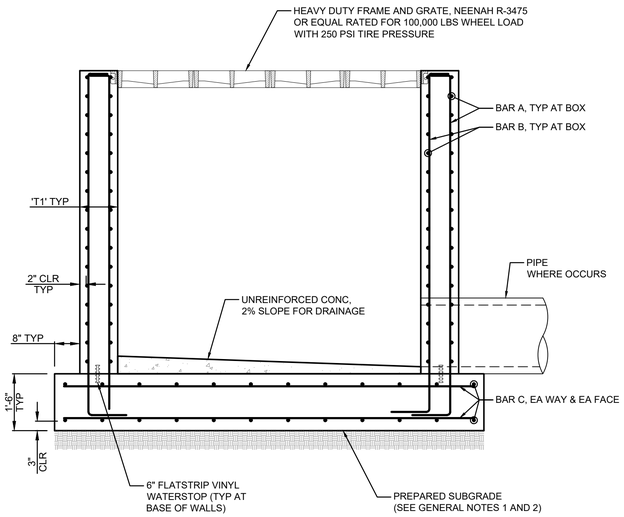
1. PROVIDE A MINIMUM OF TWO (2) WEEP HOLES PER WALL WITH MAXIMUM SPACING OF 4'-0" OC.
2. THE GEOTEXTILE AND PLASTIC DRAINAGE CORE SHALL BE SECURED TO THE WALL TO PREVENT MOVEMENT DURING BACKFILLING.
3. DRAINAGE TO BE PROVIDED ON ALL SIDES OF THE STRUCTURE.
4. WEEP HOLES TO BE PROVIDED AT BASE OF CHIMNEY AND BOX STRUCTURES.

C1 MANHOLE AND INLET EXTERIOR DRAINAGE
SCALE: NTS

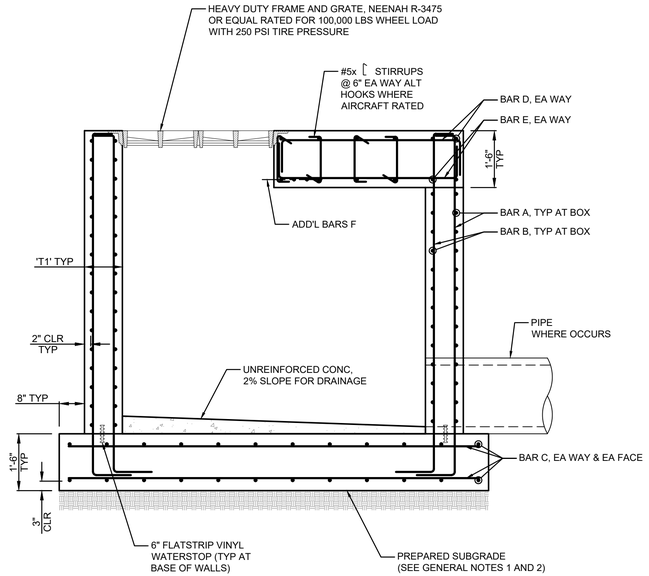
GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. ALL REINFORCING SHALL BE ASTM A615 GRADE 60, EPOXY COATED PER ASTM A775.
4. CONCRETE COMPRESSIVE STRENGTH SHALL BE 5,000 PSI MINIMUM.
5. ALL GRATES SHALL BE BOLTED DOWN TO FRAME.
6. SEE "INLET REINFORCING SCHEDULE" DETAIL ON SHEET CG525 FOR SIZE AND SPACING OF BARS.
7. SEE "TYPICAL INLET AND MANHOLE PIPE PENETRATION" DETAIL ON SHEET CG522 FOR ADDITIONAL REINFORCING REQUIREMENTS.
8. FOR 'T1' THICKNESS, SEE "INLET STRUCTURE DIMENSION SCHEDULE" ON SHEET CG528.
9. SEE C2/CG522 FOR TYPICAL TIE REINFORCEMENT BAR 'K'.

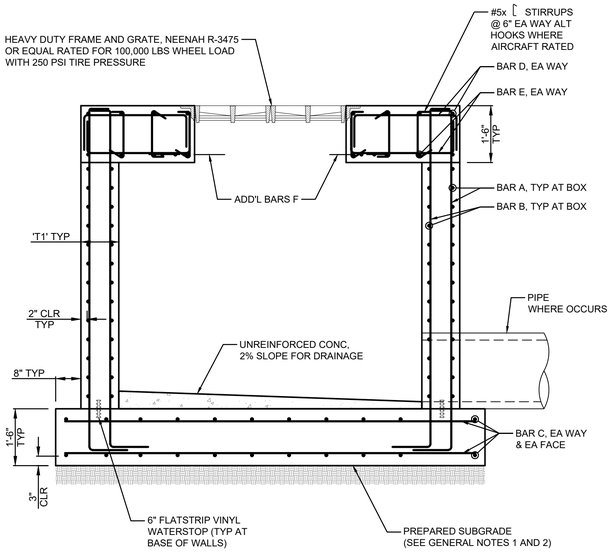
D5 INLET STRUCTURE NOTES
SCALE: NTS



A1 INLET SECTION
SCALE: NTS



A3 INLET SECTION
SCALE: NTS



A4 INLET SECTION
SCALE: NTS

NO.	DATE	SYM	DESCRIPTION

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615 A/E INFO

APPROVED:
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG524

PRE-FINAL SUBMITTAL

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG524
PLOTTED: 10/30/2025 6:38:34 AM
USER: Morris, Tyler

INLET ID	BAR A		BAR B		BAR C		BAR D		BAR E		BAR F		BAR G		BAR H		BAR I		BAR J		TIE BAR 'K' IN BOX WALLS			TIE BAR 'K' IN CHIMNEY WALLS		
	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	HORIZONTAL SPACE	VERTICAL SPACE	SIZE	HORIZONTAL SPACE	VERTICAL SPACE
IN-1-1	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-1-2	#6	6"	#8	6"	#7	6"	#6	12"	#6	6"	(2) #6	6"	#6	6"	#8	6"	#7	6"	(2) #7	6"	#4	6"	12"	#4	6"	12"
IN-2-3	#6	6"	#8	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-	#4	6"	12"	#4	6"	12"
IN-2-4	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	#6	12"	#6	6"	#6	6"	(2) #6	6"						
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IN-3-4	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-3-5	#6	6"	#8	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-	#4	6"	12"	#4	6"	12"
IN-3-6	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	#6	12"	#6	6"	#7	6"	(2) #7	6"						
IN-3-7	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
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IN-3-13	#6	6"	#6	6"	#7	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
IN-3-14	#6	6"	#8	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-	#4	6"	12"	#4	6"	12"
IN-3-15	#6	6"	#8	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-	#4	6"	12"	#4	6"	12"
IN-3-16	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	#6	12"	#6	6"	#6	6"	(2) #6	6"						
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IN-3-18	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-4-12	#6	6"	#8	6"	#7	6"	#6	6"	#8	6"	(2) #8	6"	#6	6"	#8	6"	#7	6"	(2) #7	6"	#4	6"	12"	#4	6"	12"
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IN-4-14	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-4-15	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
IN-4-16	#6	6"	#8	6"	#7	6"	#6	12"	#6	6"	(2) #6	6"	#6	6"	#8	6"	#7	6"	(2) #7	6"	#4	6"	12"	#4	6"	12"
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IN-5-16	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-5-18	#6	6"	#8	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	#6	6"	#8	6"	#7	6"	(2) #7	6"	#4	6"	12"	#4	6"	12"
IN-5-19	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	#6	12"	#6	6"	#6	6"	(2) #6	6"						
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IN-5-22	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-5-23	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-5-24	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-5-25	#6	12"	#6	6"	#6	6"	#6	6"	#6	6"	(2) #6	6"	-	-	-	-	-	-	-	-						
IN-5-26	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						

B1 INLET STRUCTURE - REINFORCING SCHEDULE

SCALE: NTS

DATE

SYM DESCRIPTION

NAVFAC

FOR REVIEW ONLY

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DOUGLAS PRESTON STEWART

Name

CO 29899 NOV 4, 2025

Registration Number # Date

SEAL

Jacobs / BURNS MCDONNELL

1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCG: D3439615 A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN

EPROJECT NO.: 1687159; 1719021

CONSTR. CONTR. NO.
-

NAVFAC DRAWING NO.

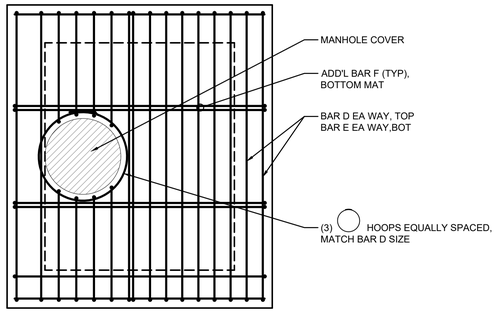
SHEET OF

CG525

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG525
PLOTTED: 10/30/2025 6:38:39 AM
USER: Morris, Tyler

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

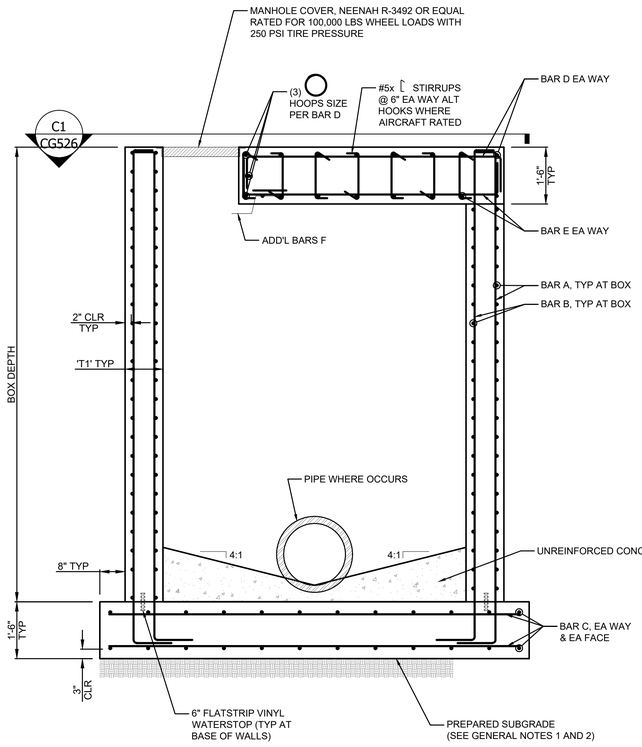


C1 MANHOLE TOP SLAB REINFORCING PLAN
SCALE: NTS

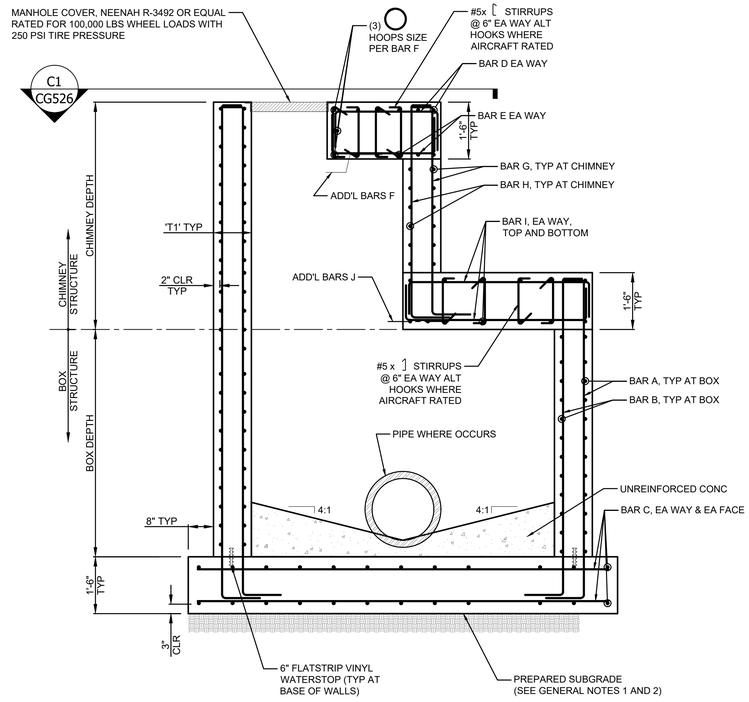
GENERAL NOTES:

1. REFER TO SPECIFICATION 31 00 00 PARAGRAPH 3.5 FOR SUBGRADE PREPARATION.
2. REFER TO SPRCIFICATION 31 00 00 PARAGRAPH 3.6.2 FOR STRUCTURAL FILL REQUIREMENTS.
3. ALL REINFORCING SHALL BE ASTM A615 GRADE 60, EPOXY COATED PER ASTM A775.
4. CONCRETE COMPRESSIVE STRENGTH SHALL BE 5,000 PSI MINIMUM.
5. SEE "INLET REINFORCING SCHEDULE" DETAIL ON SHEET CG525 FOR SIZE AND SPACING OF BARS.
6. SEE "TYPICAL INLET AND MANHOLE PIPE PENETRATION" DETAIL ON SHEET CG525 FOR ADDITIONAL REINFORCING REQUIREMENTS.
7. FOR 'T1' THICKNESS, SEE "INLET STRUCTURE DIMENSION SCHEDULE" ON SHEET CG529.
9. SEE C2/CG522 FOR TYPICAL TIE REINFORCEMENT BAR 'K'.

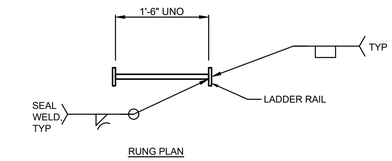
C3 MANHOLE STRUCTURE NOTES
SCALE: NTS



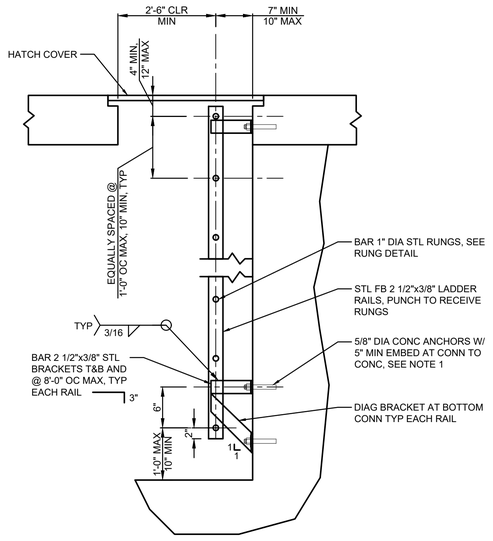
A1 MANHOLE SECTION
SCALE: NTS



A3 MANHOLE SECTION
SCALE: NTS



RUNG PLAN



NOTES:
1. PROVIDE SST CONCRETE ANCHORS LOCATED BELOW MAXIMUM WATER SURFACE.
2. HOT DIP GALVANIZE STEEL AFTER FABRICATION.
3. AT CONTRACTOR'S OPTION, PRE-ENGINEERED PIPE LADDER AS SPECIFIED MAY BE USED IN LIEU OF FLAT BAR LADDERS.

A5 TYPICAL LADDER DETAIL
SCALE: NTS

DATE | SYM | DESCRIPTION

NAVFAC

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DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
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SEAL

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615
A/E INFO

APPROVED

FOR COMMANDER NAVFAC DATE

ACTIVITY

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PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.: -
NAVFAC DRAWING NO.
SHEET OF
CG526

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG526
PLOTTED: 10/30/2025 6:38:44 AM
USER: Morris, Tyler

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MANHOLE ID	BAR A		BAR B		BAR C		BAR D		BAR E		BAR F		BAR G		BAR H		BAR I		BAR J		TIE BAR 'K' IN BOX WALLS			TIE BAR 'K' IN CHIMNEY WALLS		
	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	HORIZONTAL SPACE	VERTICAL SPACE	SIZE	HORIZONTAL SPACE	VERTICAL SPACE
MH-1-1	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	#6	12"	#6	6"	#6	6"	(2) #6	6"						
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MH-1-3	#6	12"	#7	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-2-1	#6	12"	#6	6"	#6	6"	#6	6"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-2-2	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-3-1	#6	12"	#7	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	#6	12"	#6	6"	#6	6"	(2) #6	6"						
MH-3-2	#6	12"	#6	6"	#6	6"	#6	6"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-3-3	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-3-4	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-3-5	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-3-13	#6	12"	#6	6"	#6	6"	#6	6"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-4-1	#6	6"	#8	6"	#7	6"	#6	12"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-	#4	6"	12"			
MH-4-2	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-4-3	#6	6"	#8	6"	#6	6"	#6	12"	#6	6"	(2) #8	6"	#6	6"	#8	6"	#6	6"	(2) #6	6"	#4	6"	12"	#4	6"	12"
MH-4-4	#6	12"	#7	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-5-1	#6	12"	#6	6"	#6	6"	#6	12"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-5-2	#6	12"	#7	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	#6	12"	#6	6"	#6	6"	(2) #6	6"						
MH-5-3	#6	6"	#8	6"	#6	6"	#6	12"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-	#4	6"	12"			
MH-5-4	#6	12"	#7	6"	#7	6"	#6	12"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-						
MH-6-1	#6	6"	#8	6"	#7	6"	#6	12"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-	#4	6"	12"			
MH-6-2	#6	6"	#8	6"	#6	6"	#6	12"	#6	6"	(2) #8	6"	-	-	-	-	-	-	-	-	#4	6"	12"			
MH-6-3	#6	6"	#8	6"	#6	6"	#6	12"	#6	6"	(2) #8	6"	#6	6"	#8	6"	#6	6"	(2) #6	6"	#4	6"	12"	#4	6"	12"
MH-6-4	#6	12"	#6	6"	#6	6"	#6	6"	#8	6"	(2) #8	6"	-	-	-	-	-	-	-	-						

C1 MANHOLE STRUCTURE - REINFORCING SCHEDULE

SCALE: NTS

DATE

SYM DESCRIPTION

NAVFAC

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Name

CO 29899 NOV 4, 2025

Registration Number # Date

SEAL

Jacobs / BURNS MCDONNELL

1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785

A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: D3430615

A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES:	DPS	DRW:	MAK	REV: VTO
PM/DM				MAI/DRK
BRANCH MANAGER				SMK
CHIEF ENG				EAM
FIRE PROTECTION				JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
NAVFAC PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
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FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN

EPROJECT NO.: 1687159; 1719021

CONSTR. CONTR. NO.
-

NAVFAC DRAWING NO.

SHEET OF

CG527

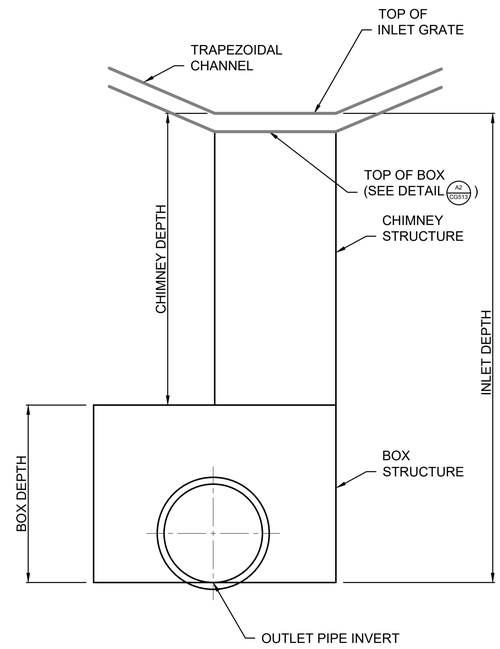
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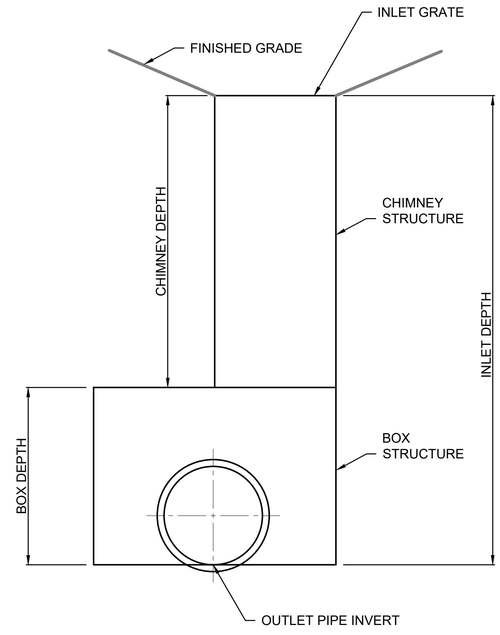
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Inlet ID	Basin ID	Number of Grates	Aircraft Rated	Inlet Depth (ft)	Box Depth (ft)	Inside Box Dimensions	Chimney Depth (ft)	Chimney Dimensions	T1	Pipe 1	Pipe 2	Pipe 3	Notes
IN-1-1	A-1-1	4	No	5.51		8'-0" x 5'-6"			18"	36" HP			
IN-1-2	A-1-2	4	No	43.00	6.00	7'-0" x 8'-0"	37.00	4'-0" x 8'-0"	36"	48" RCP	48" RCP		Deep Chimney
IN-2-3	A-2-3	4	No	5.51		8'-0" x 5'-8"			18"	36" RCP			
IN-2-4	A-2-4	4	Yes	10.40	6.00	5'-8" x 8'-0"	4.40	2'-8" x 8'-0"	12"	36" RCP	36" RCP	60" CMP (Ex)	
IN-2-5	A-2-5	4	Yes	6.19		5'-8" x 8'-0"			12"	36" RCP			
IN-3-4	A-3-4	4	No	5.51		8'-0" x 2'-8"			18"	36" HP			
IN-3-5	A-3-5	4	No	5.22		8'-0" x 2'-8"			18"	36" HP			
IN-3-6	N/A	1	No	7.25	6.25	8'-0" x 7'-0"	1.00	2'-8" x 2'-0"	12"	36" HP	48" RCP	36" HP	Junction structure, no tributary basin
IN-3-7	A-3-7	4	Yes	8.37		9'-0" x 8'-0"			12"	36" RCP	48" RCP	60" RCP	
IN-3-8	A-3-8	4	No	7.06		8'-0" x 7'-0"			12"	48" RCP			
IN-3-9	A-3-9	4	Yes	9.24		2'-8" x 8'-0"			12"	48" RCP	60" CMP EX		
IN-3-10	A-3-10	4	No	7.61		8'-0" x 7'-0"			12"	36" HP	48" HP	48" RCP	
IN-3-11	A-3-11	4	Yes	10.14	6.00	7'-0" x 8'-0"	4.14	2'-8" x 8'-0"	12"	36" RCP	48" RCP	48" RCP	
IN-3-12	A-3-12	4	No	6.25		8'-0" x 2'-8"			12"	48" HP			
IN-3-13	A-3-13	2	Yes	5.64		6'-0" x 6'-0"			15"	36" RCP			
IN-3-14	A-3-14	4	Yes	6.02		5'-8" x 8'-0"			12"	36" RCP			
IN-3-15	A-3-15	4	No	5.65		8'-0" x 6'-0"			12"	36" HP	36" HP		
IN-3-16	A-3-16	4	No	10.13	6.00	8'-0" x 5'-6"	4.13	8'-0" x 2'-8"	12"	36" HP			
IN-3-17	A-3-17	2	No	8.24		4'-6" x 2'-8"			12"	24" HP			
IN-3-18	A-3-18	4	No	8.22		8'-0" x 4'-7"			12"	EX 2'X3' RCP BOX	24" HP		Tie existing 2'x3' box culvert to new inlet
IN-4-12	A-4-12	4	Yes	44.20	16.00	7'-0" x 9'-0"	28.20	4'-0" x 9'-0"	36"	48" RCP	48" RCP	78" CMP (Ex)	Deep Chimney
IN-4-13	A-4-13	4	No	13.00		8'-0" x 2'- 8"			12"	36" RCP			
IN-4-14	A-4-14	4	No	9.20		8'-0" x 11'-3"			12"	48" HP	48" RCP		
IN-4-15	A-4-15	4	Yes	10.95		7'-0" x 8'-2"			12"	48" RCP	48" RCP		
IN-4-16	A-4-16	4	No	27.71	6.00	8'-0" x 10'-8"	21.71	8'-0" x 4'-0"	27"	48" HP	48" RCP		Deep Chimney
IN-4-17	A-4-17	3	No	7.25		2'-8" x 6'-6"			12"	48" HP			
IN-4-18	A-4-18	4	No	13.00		8'-0" x 2'-8"			12"	24" RCP			
IN-5-16	A-5-16	4	No	12.38		2'-8" x 8'-2"			12"	60" RCP	60" RCP		
IN-5-17	A-5-17	4	Yes	8.16		8'-0" x 4'-0"			12"	48" RCP	48" RCP		
IN-5-18	A-5-18	4	No	25.52	7.00	4'-0" x 8'-2"	18.52	2'-8" x 8'-2"	12"	60" RCP	60" RCP		
IN-5-19	A-5-19	4	Yes	10.20	6.00	7'-0" x 8'-0"	4.20	2'-8" x 8'-0"	12"	48" RCP	48" RCP		
IN-5-20	A-5-20	4	Yes	7.19		7'-0" x 8'-0"			12"	48" RCP			
IN-5-21	A-5-21	1	No	4.52		3'-9" x 2'-8"			12"	18" HP			
IN-5-22	A-5-22	2	No	9.00		4'-6" x 2'-8"			12"	24" HP			
IN-5-23	A-5-23	1	No	6.94		2'-8" x 4'-6"			12"	24" HP			
IN-5-24	A-5-24	4	No	7.71		4'-0" x 8'-0"			12"	60" RCP	60" RCP		
IN-5-25	A-5-25	1	No	5.70		4'-6" x 2'-8"			12"	24" HP			

A1 INLET STRUCTURE DIMENSION SCHEDULE
SCALE: NTS



B4 BOX AND CHIMNEY DEFINITION WITH TRAPEZOIDAL CHANNEL
SCALE: N.T.S.



A4 BOX AND CHIMNEY DEFINITION
SCALE: N.T.S.

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A/E Task Order No. N62742-22F-0338
JEG: EIA0061S
A/E INFO

APPROVED:
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ACTIVITY
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PM/DM					MAV/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

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NAVFAC PACIFIC
YAP INTERNATIONAL AIRPORT, FSM
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
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CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO. -
NAVFAC DRAWING NO.
SHEET OF
CG528

PRE-FINAL SUBMITTAL

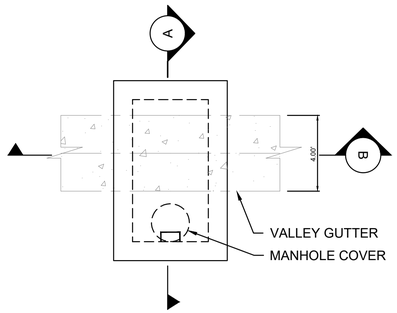
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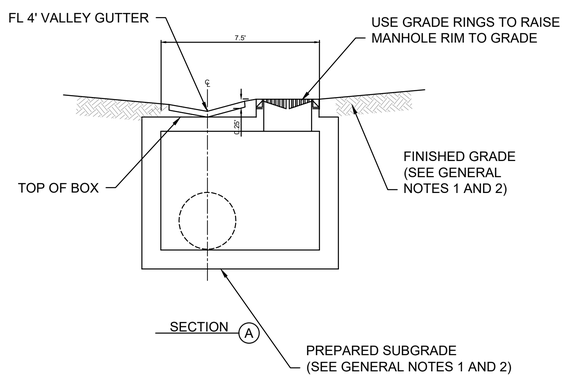
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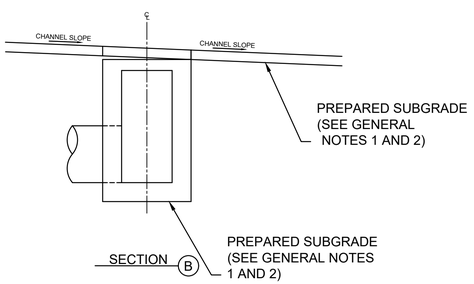
IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

NOTES:

1. SEE INLET DETAILS FOR INLET DIMENSIONS.
2. USE NEENAH R-3475 SERIES INLET GRATES.
3. DETAILS ON THIS SHEET ARE FOR VALLEY GUTTERS ONLY. INLET DEPTH AND PIPE DIAMETERS ARE SHOWN SCHEMATICALLY.

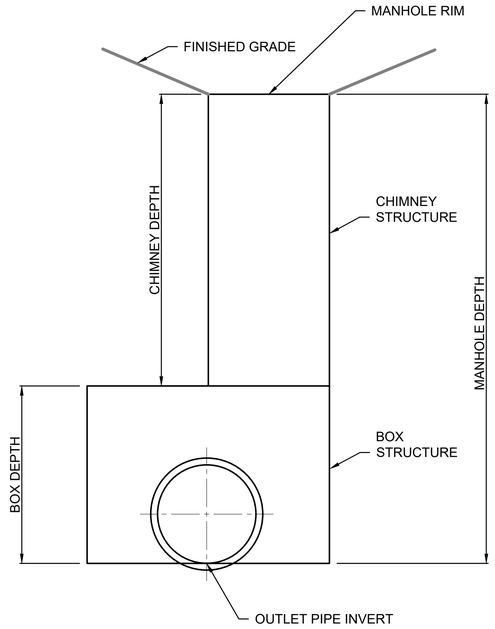






A1 4' CONCRETE VALLEY GUTTER MANHOLE DETAIL

SCALE: NTS



C2 BOX AND CHIMNEY DEFINITION

SCALE: N.T.S.

A2 MANHOLE STRUCTURE DIMENSION SCHEDULE

Manhole ID	*Aircraft Rated*	*Manhole Depth (ft)*	*Box Depth (ft)*	*Inside Box Dimensions*	*Chimney Depth (ft)*	*Chimney Dimensions*	*T1*	*Pipe 1*	*Pipe 2*	*Pipe 3*	*Pipe 4*	*Notes*
MH-1-1	Yes	12.35	6.00	7'-0" X 7'-0"	6.35	7'-0" X 4'-0"	12"	48" RCP	48" RCP			
MH-1-2	Yes	10.44		4'-0" X 7'-0"			12"	36" HP	48" RCP			
MH-1-3	No	17.74		5'-0" X 7'-0"			15"	42" HP	24" HP	48" HP		
MH-2-1	Yes	7.07		7'-6" X 4'-0"			12"	36" RCP	36" RCP			
MH-2-2	Yes	7.69		7'-6" X 4'-0"			12"	36" RCP	36" RCP			
MH-3-1	Yes	14.92	7.00	10-11" X 8'-0"	7.92	10'-11" X 4'-0"	15"	60" CMP (Ex)	60" RCP	60" RCP	60" CMP (Ex)	
MH-3-2	Yes	11.11		8'-6" X 4'-0"			12"	60" RCP	60" RCP			
MH-3-3	Yes	12.30		8'-6" X 4'-0"			12"	48" RCP	60"RCP			
MH-3-4	Yes	6.71		7'-6"X 4'-0"			12"	36" RCP	36" RCP			
MH-3-5	No	12.11		4'-0" X 8'-0"			12"	60" CMP (Ex)	60" CMP	18" HP		
MH-3-13	Yes	6.25		7'-6" X 4'-0"			12"	36" RCP	36" RCP			
MH-4-1	No	23.49		5'-0" X 13'-4"			24"	36" HP	48" HP	48" HP		
MH-4-2	Yes	12.02		8'-0" X 4'-0"			12"	48" RCP	48" RCP			
MH-4-3	No	42.21	9.00	6'-6" X 9'-6"	33.21	6'-6" X 4'-0"	24"	78" CMP (Ex)	78" CMP			
MH-4-4	No	17.25		6'-6" X 9'-6"			18"	36" HP	78" CMP	24" HP	78" CMP	
MH-5-2	Yes	15.29	6.00	7'-0" X 8'-2"	9.29	2'-8" X 8'-2"	12"	48" RCP	60" RCP	60" RCP		
MH-5-3	No	24.26		10'-0" X 9'-9"			24"	60" RCP	60" RCP	60" RCP		
MH-5-4	No	15.23		10'-0" X 8'-2"			18"	60" RCP	18" HP	60" RCP		
MH-6-1	No	36.00		9'-4" X 10'-6"			24"	72" RCP	36" RCP	18" HP	72" RCP	
MH-6-2	No	38.81		4'-0" X 9'-4"			24"	72" RCP	42" RCP	72" RCP		
MH-6-3	No	29.47	8.00	9'-4" X 9'-4"	21.47	4'-0" X 9'-4"	24"	72" RCP	72" RCP			
MH-6-4	No	8.72		4'-0" X 4'-6"			12"	18" HP	18" (Ex)			

DATE | SYM | DESCRIPTION

NAVFAC

FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

DOUGLAS PRESTON STEWART
Name
CO 29899 NOV 4, 2025
Registration Number # Date
SEAL

Jacobs / BURNS MCDONNELL
1100 N GLEBE RD STE 500
ARLINGTON, VA 22201-5785
A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JCC: D3439615
A/E INFO

APPROVED
FOR COMMANDER NAVFAC DATE
ACTIVITY
SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
NAVFAC PACIFIC
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII
YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

CIVIL DETAILS - DRAINAGE

SCALE: AS SHOWN
EPROJECT NO.: 1687159; 1719021
CONSTR. CONTR. NO.
-
NAVFAC DRAWING NO.
SHEET OF
CG529

PRE-FINAL SUBMITTAL

FILE NAME: p-010_p-020-cg501-cg529.dwg
LAYOUT NAME: CG529
PLOTTED: 10/30/2025 6:38:59 AM
USER: Morris, Tyler

IF SHEET IS LESS THAN 22" X 34" REDUCED PRINT. USE GRAPHIC SCALES

STRUCTURE TABLE: UNDERDRAIN NETWORK - A

STRUCTURE	RIM ELEV.	STATION	OFFSET	NORTHING	EASTING	INV. IN	INV. OUT
STRU (98)	89.02'	187+41.42	348.01' L	3450808.06	592833.31		85.25' (6" PERFORATED PVC) E 85.25' (6" PERFORATED PVC) SW
STRU (100)	88.60'	186+06.40	314.50' L	3450734.77	592715.07	84.85' (6" PERFORATED PVC) NE	84.85' (6" PERFORATED PVC) S
UCO-2-1	92.11'	310+23.90	85.50' R	3448409.88	585497.78		88.36' (6" PERFORATED PVC) S 88.36' (6" PERFORATED PVC) NE
UCO-2-2	91.94'	311+58.92	52.00' R	3448483.17	585616.03	88.19' (6" PERFORATED PVC) SW	88.19' (6" PERFORATED PVC) E
UCO-2-3	90.96'	315+00	40.50' R	3448598.69	585937.16	87.21' (6" PERFORATED PVC) W	87.21' (6" PERFORATED PVC) E
UCO-2-4	93.20'	310+35.50	40.50' L	3448533.37	585470.19		89.45' (6" PERFORATED PVC) E
UCO-2-5	90.96'	315+00	40.50' L	3448675.79	585912.32	87.21' (6" PERFORATED PVC) W	87.21' (6" PERFORATED PVC) E
UCO-3-3	87.75'	325+00	40.50' R	3448905.30	586888.99	84.00' (6" PERFORATED PVC) W	84.00' (6" PERFORATED PVC) E
UCO-3-4	87.75'	325+00	40.50' L	3448982.40	586864.15	84.00' (6" PERFORATED PVC) W	84.00' (6" PERFORATED PVC) E
UCO-4-1	84.54'	335+00	40.50' R	3449211.91	587840.82	80.79' (6" PERFORATED PVC) W	80.79' (6" PERFORATED PVC) E
UCO-4-2	84.54'	335+00	40.50' L	3449289.01	587815.99	80.79' (6" PERFORATED PVC) W	80.79' (6" PERFORATED PVC) E
UCO-5-3	82.65'	348+50	40.50' R	3449625.84	589125.80	78.90' (6" PERFORATED PVC) E	78.90' (6" PERFORATED PVC) W
UCO-5-4	82.65'	348+50	40.50' L	3449702.94	589100.97	78.90' (6" PERFORATED PVC) E	78.90' (6" PERFORATED PVC) W
UCO-6-1	84.17'	355+27.94	40.50' R	3449833.70	589771.09	80.25' (6" PERFORATED PVC) E	80.25' (6" PERFORATED PVC) W
UCO-6-2	84.73'	358+28.58	52.00' R	3449914.94	590060.77	80.75' (6" PERFORATED PVC) E	80.75' (6" PERFORATED PVC) W
UCO-6-3	84.77'	359+63.60	85.50' R	3449924.45	590199.56		81.00' (6" PERFORATED PVC) W 81.00' (6" PERFORATED PVC) SE
UCO-6-5	85.41'	159+63.60	85.50' L	3449706.48	590269.78	81.25' (6" PERFORATED PVC) SW	81.25' (6" PERFORATED PVC) N
UCO-6-6	85.36'	159+03	78.00' L	3449680.76	590214.39		81.60' (6" PERFORATED PVC) NE
UCO-6-7	85.95'	161+97	78.00' L	3449770.90	590494.23		82.20' (6" PERFORATED PVC) W
UCO-6-8	85.72'	161+36.40	85.50' L	3449759.46	590434.25	81.97' (6" PERFORATED PVC) E	81.97' (6" PERFORATED PVC) NW
UCO-6-10	85.10'	361+36.40	85.50' R	3449977.44	590364.04	81.34' (6" PERFORATED PVC) NE	81.34' (6" PERFORATED PVC) S
UCO-6-11	85.71'	362+71.42	52.00' R	3450050.72	590482.29	81.96' (6" PERFORATED PVC) E	81.96' (6" PERFORATED PVC) SW
UCO-6-12	84.62'	357+25.50	40.50' L	3449971.38	589934.30	80.87' (6" PERFORATED PVC) E	80.87' (6" PERFORATED PVC) W
UCO-7-2	87.16'	372+44.50	40.50' R	3450360.02	591404.97	83.40' (6" PERFORATED PVC) E	83.40' (6" PERFORATED PVC) W
UCO-7-4	86.49'	367+43.96	40.50' L	3450283.65	590903.71	82.74' (6" PERFORATED PVC) E	82.74' (6" PERFORATED PVC) W
UCO-7-6	87.82'	177+45	440.50' L	3450590.58	591856.53	84.07' (6" PERFORATED PVC) E	84.07' (6" PERFORATED PVC) W
UCO-8-2	88.15'	379+97.94	40.50' R	3450591.04	592122.12	84.30' (6" PERFORATED PVC) E	84.30' (6" PERFORATED PVC) W
UCO-8-3	89.58'	385+10	40.50' L	3450825.14	592584.68	85.83' (6" PERFORATED PVC) NE	85.83' (6" PERFORATED PVC) W
UCO-8-7	93.43'	186+86.50	798.50' L	3451220.01	592642.91		90.18' (6" PERFORATED PVC) S
UCO-8-8	90.15'	387+64.50	51.50' L	3450913.64	592823.55	86.90' (6" PERFORATED PVC) E	86.90' (6" PERFORATED PVC) NW
UCO-8-9	88.27'	184+33.60	314.50' L	3450681.79	592550.59	84.50' (6" PERFORATED PVC) W	84.50' (6" PERFORATED PVC) SE
UCO-8-10	88.44'	182+98.58	348.01' L	3450672.28	592411.80		84.70' (6" PERFORATED PVC) E 84.70' (6" PERFORATED PVC) W
UCO-9-1	90.72'	391+94.50	51.50' L	3451045.48	593232.84	87.47' (6" PERFORATED PVC) E	87.47' (6" PERFORATED PVC) W
UCO-9-3	91.30'	396+34.50	51.50' L	3451180.39	593651.65		88.05' (6" PERFORATED PVC) W
UCO-9-4	90.34'	397+41.08	52.00' R	3451114.56	593784.82		86.59' (6" PERFORATED PVC) W 86.59' (6" PERFORATED PVC) E
UCO-9-5	90.23'	398+76.10	85.50' R	3451124.07	593923.61	86.30' (6" PERFORATED PVC) W	86.30' (6" PERFORATED PVC) SE
UCO-9-6	94.00'	396+34.50	321.50' L	3451437.39	593568.86		90.75' (6" PERFORATED PVC) W
UCO-9-7	93.42'	391+94.50	321.50' L	3451302.48	593150.06	90.17' (6" PERFORATED PVC) E	90.17' (6" PERFORATED PVC) W
UCO-12-1	93.13'	109+03	78.00' R	3447999.21	585503.05		89.38' (6" PERFORATED PVC) E
UCO-12-3	90.95'	115+80.50	78.00' R	3448206.94	586147.92	87.20' (6" PERFORATED PVC) W	87.20' (6" PERFORATED PVC) E
UCO-12-5	92.31'	111+56	78.00' L	3448225.27	585696.04		88.56' (6" PERFORATED PVC) E 88.56' (6" PERFORATED PVC) W
UCO-13-3	89.93'	119+00	78.00' L	3448453.39	586404.20	86.18' (6" PERFORATED PVC) W	86.18' (6" PERFORATED PVC) E
UCO-18-1	88.94'	184+03.40	78.00' L	3450447.41	592594.36		85.20' (6" PERFORATED PVC) W 85.20' (6" PERFORATED PVC) NE
UCO-18-2	88.48'	180+54.70	78.00' L	3450340.50	592262.46	84.73' (6" PERFORATED PVC) E	84.73' (6" PERFORATED PVC) W
UCO-18-3	89.07'	185+00	78.00' R	3450328.55	592734.14	85.32' (6" PERFORATED PVC) E	85.32' (6" PERFORATED PVC) W
UCO-18-5	88.86'	184+33.60	85.50' L	3450463.81	592620.81	85.10' (6" PERFORATED PVC) SW	85.10' (6" PERFORATED PVC) N
UCO-18-9	89.16'	186+06.40	85.50' L	3450516.79	592785.28	85.40' (6" PERFORATED PVC) E	85.40' (6" PERFORATED PVC) NW
UCO-18-10	89.25'	186+36.60	78.00' L	3450518.92	592816.33	85.50' (6" PERFORATED PVC) E	85.50' (6" PERFORATED PVC) W
UCO-19-1	91.05'	199+97	78.00' R	3450787.54	594159.04		87.30' (6" PERFORATED PVC) W
UCO-19-3	90.39'	195+00	78.00' R	3450635.16	593685.97	86.64' (6" PERFORATED PVC) E	86.64' (6" PERFORATED PVC) W

STRUCTURE TABLE: UNDERDRAIN NETWORK - A

STRUCTURE	RIM ELEV.	STATION	OFFSET	NORTHING	EASTING	INV. IN	INV. OUT
UCO-19-6	90.73'	197+44	78.00' L	3450858.46	593870.39		87.00' (6" PERFORATED PVC) NE 86.60' (6" PERFORATED PVC) W
UHW-12-7	87.51'	115+00	251.00' L	3448495.41	585970.42	86.76' (6" NON-PERFORATED PVC) S 86.76' (6" NON-PERFORATED PVC) SW	86.76' (6" PERFORATED PVC) N
UHW-18-6	83.81'	180+08.67	251.00' R	3450013.23	592319.52	82.80' (6" NON-PERFORATED PVC) N	82.80' (6" PERFORATED PVC) S
UHW-18-7	86.48'	190+00	251.00' R	3450317.18	593263.10	85.00' (6" NON-PERFORATED PVC) N	85.00' (6" PERFORATED PVC) S
UMH-3-1	89.35'	320+00	40.50' R	3448751.99	586413.07	84.70' (6" NON-PERFORATED PVC) N 84.70' (6" PERFORATED PVC) W	84.70' (6" NON-PERFORATED PVC) S 85.60' (6" PERFORATED PVC) E
UMH-3-2	89.35'	320+00	40.50' L	3448829.09	586388.24	85.50' (6" PERFORATED PVC) W	85.60' (6" PERFORATED PVC) E 85.50' (6" NON-PERFORATED PVC) S
UMH-3-5	86.14'	330+00	40.50' R	3449058.61	587364.91	82.29' (6" PERFORATED PVC) W	82.39' (6" PERFORATED PVC) E 82.29' (6" NON-PERFORATED PVC) S
UMH-3-6	86.14'	330+00	40.50' L	3449135.71	587340.07	82.29' (6" PERFORATED PVC) W	82.39' (6" PERFORATED PVC) E 82.29' (6" NON-PERFORATED PVC) N
UMH-4-3	82.99'	339+80	40.50' R	3449359.09	588297.71	78.30' (6" PERFORATED PVC) W 78.30' (6" NON-PERFORATED PVC) N	79.24' (6" PERFORATED PVC) E 78.30' (6" NON-PERFORATED PVC) S
UMH-4-4	82.99'	339+80	40.50' L	3449436.19	588272.87	79.14' (6" PERFORATED PVC) W	79.24' (6" PERFORATED PVC) E 79.14' (6" NON-PERFORATED PVC) S
UMH-5-1	82.04'	344+50	40.50' R	3449503.19	588745.07	78.29' (6" PERFORATED PVC) E 78.29' (6" PERFORATED PVC) W	78.19' (6" NON-PERFORATED PVC) S
UMH-5-2	82.04'	344+50	40.50' L	3449580.29	588720.23	78.29' (6" PERFORATED PVC) E 78.29' (6" PERFORATED PVC) W	78.19' (6" NON-PERFORATED PVC) N
UMH-5-5	83.54'	352+46	40.50' R	3449747.26	589502.73	79.69' (6" PERFORATED PVC) E	79.79' (6" PERFORATED PVC) W 79.69' (6" NON-PERFORATED PVC) S
UMH-5-6	83.54'	352+46	40.50' L	3449824.36	589477.89	79.69' (6" PERFORATED PVC) E	79.79' (6" PERFORATED PVC) W 79.69' (6" NON-PERFORATED PVC) N
UMH-6-4	84.03'	602+00	53.00' L	3449825.71	590266.46	80.00' (6" PERFORATED PVC) NW 80.00' (6" PERFORATED PVC) S	80.00' (6" NON-PERFORATED PVC) W
UMH-6-9	84.03'	602+00	53.00' R	3449858.21	590367.35	79.45' (6" PERFORATED PVC) SE 79.45' (6" PERFORATED PVC) N	79.45' (6" NON-PERFORATED PVC) NE
UMH-6-13	85.69'	362+05	40.50' L	3450118.40	590390.70	81.84' (6" PERFORATED PVC) E	81.94' (6" PERFORATED PVC) W 81.84' (6" NON-PERFORATED PVC) N
UMH-7-1	86.49'	367+44	40.50' R	3450206.56	590928.58	82.64' (6" PERFORATED PVC) E	82.74' (6" PERFORATED PVC) W 82.64' (6" NON-PERFORATED PVC) S
UMH-7-3	87.82'	377+45	40.50' R	3450513.48	591881.36	84.00' (6" PERFORATED PVC) E	84.00' (6" PERFORATED PVC) W 83.90' (6" NON-PERFORATED PVC) S
UMH-7-5	87.16'	372+44.50	40.50' L	3450437.12	591380.13	83.40' (6" PERFORATED PVC) E	83.40' (6" PERFORATED PVC) W 83.40' (6" NON-PERFORATED PVC) NE
UMH-8-1	88.17'	380+10	40.50' L	3450671.83	592108.76	84.42' (6" PERFORATED PVC) E	84.42' (6" PERFORATED PVC) W 84.42' (6" NON-PERFORATED PVC) N
UMH-8-4	89.58'	390+79.22	40.50' R	3450922.57	593151.32	84.80' (6" PERFORATED PVC) E 84.80' (6" PERFORATED PVC) W	84.70' (6" NON-PERFORATED PVC) S
UMH-8-5	91.32'	386+86.50	187.50' L	3451019.17	592707.61	88.07' (6" PERFORATED PVC) N 86.50' (6" PERFORATED PVC) SE	88.07' (6" PERFORATED PVC) SW 86.50' (6" PERFORATED PVC) W
UMH-8-6	92.66'	386+86.50	321.50' L	3451146.72	592666.52	89.41' (6" PERFORATED PVC) N 89.41' (6" PERFORATED PVC) E	89.41' (6" PERFORATED PVC) S
UMH-9-2	90.06'	394+40.44	40.50' R	3451033.32	593495.14	86.00' (6" PERFORATED PVC) E	86.00' (6" PERFORATED PVC) W
UMH-12-2	92.29'	111+64	78.00' R	3448079.24	585751.48	88.54' (6" PERFORATED PVC) W	88.54' (6" PERFORATED PVC) E 88.54' (6" NON-PERFORATED PVC) S
UMH-12-4	91.50'	502+00	53.00' R	3448290.65	585501.10	87.74' (6" PERFORATED PVC) E 87.74' (6" PERFORATED PVC) N	87.74' (6" NON-PERFORATED PVC) NE
UMH-12-6	91.21'	115+00	78.00' L	3448330.75	586023.47	87.46' (6" PERFORATED PVC) W	87.49' (6" PERFORATED PVC) E 87.46' (6" NON-PERFORATED PVC) N
UMH-13-1	89.60'	120+02	78.00' R	3448336.18	586549.12	85.85' (6" PERFORATED PVC) W	85.85' (6" NON-PERFORATED PVC) S
UMH-13-4	88.51'	123+22	78.00' L	3448582.78	586805.87	84.76' (6" PERFORATED PVC) W	84.76' (6" NON-PERFORATED PVC) N
UMH-17-1	88.15'	177+03	78.00' L	3450232.66	591927.70	84.10' (6" PERFORATED PVC) E	84.00' (6" NON-PERFORATED PVC) N
UMH-18-1	88.42'	180+08.67	78.00' R	3450177.90	592266.47	84.67' (6" PERFORATED PVC) E	84.67' (6" NON-PERFORATED PVC) S
UMH-18-4	87.50'	185+73	200.00' L	3450615.54	592718.39	83.75' (6" PERFORATED PVC) SE 83.75' (6" PERFORATED PVC) N	83.65' (6" NON-PERFORATED PVC) NE
UMH-18-5	89.73'	190+00	78.00' R	3450481.85	593210.06	85.98' (6" PERFORATED PVC) E	85.98' (6" PERFORATED PVC) W 85.98' (6" NON-PERFORATED PVC) S
UMH-18-8	87.50'	184+66.88	200.00' L	3450583.00	592617.37	83.75' (6" PERFORATED PVC) S 83.75' (6" PERFORATED PVC) NW	83.65' (6" NON-PERFORATED PVC) W
UMH-19-2	89.83'	190+79.20	78.00' L	3450654.62	593237.61	86.10' (6" PERFORATED PVC) E	86.10' (6" PERFORATED PVC) W 86.00' (6" NON-PERFORATED PVC) N
UMH-19-4	90.37'	194+84	78.00' L	3450778.74	593622.91	86.10' (6" PERFORATED PVC) E	86.50' (6" NON-PERFORATED PVC) N 86.60' (6" PERFORATED PVC) W
UMH-19-5	89.48'	702+01.16	53.46' L	3451026.29	593989.72	85.73' (6" PERFORATED PVC) NW 85.73' (6" PERFORATED PVC) SW	85.73' (6" NON-PERFORATED PVC) W

DATE

SYM DESCRIPTION

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These documents are for Design Review and not intended for Construction Bidding or Permit Purposes. They were prepared by, or under the supervision of:

DOUGLAS PRESTON STEWART

Name

CO 29899 NOV 4, 2025

Registration Number # Date

SEAL

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A/E Contract No. N62742-20-D-0002
A/E Task Order No. N62742-22F-0338
JEG: EIA90615 A/E INFO

APPROVED:

FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DPS	DRW	MAK	REV	VTO
PM/DM					MAI/DRK
BRANCH MANAGER					SMK
CHIEF ENG					EAM
FIRE PROTECTION					JCC

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM

YAP, FEDERATED STATES OF MICRONESIA (FSM

FY26 MILCON YAAD229010, RUNWAY EXTENSION AND
FY26 MILCON YAAD229020, AIRCRAFT PARKING APRON AND TAXIWAY

DRAINAGE STRUCTURE SCHEDULES

SCALE: AS SHOWN

EPROJECT NO.: 1687159; 1719021

CONSTR. CONTR. NO.: -

NAVFAC DRAWING NO.

SHEET OF

CG601

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FILE NAME: p-010_p-020-cg601.dwg
LAYOUT NAME: CG601
PLOTTED: 10/29/2025 12:11:46 PM
USER: Morris, Tyler

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STRUCTURE TABLE: UNDERDRAIN NETWORK

STRUCTURE	RIM ELEV.	STATION	OFFSET	NORTHING	EASTING	INV. IN	INV. OUT
UCO-2-1	91.33'	310+04.28	153.00' R	3448339.61	585499.81		87.55' (6" PERFORATED PVC) S
UCO-8-2	88.43'	183+02	347.16' L	3450672.52	592415.32		84.68' (6" PERFORATED PVC) E
UCO-8-3	89.58'	385+10	40.50' L	3450825.14	592584.68	84.50' (6" PERFORATED PVC) W	84.50' (6" PERFORATED PVC) NE
UCO-8-4	88.27'	184+33.60	314.50' L	3450681.79	592550.59	84.50' (6" PERFORATED PVC) W	84.50' (6" PERFORATED PVC) SE
UCO-8-7	93.43'	186+86.50	798.50' L	3451220.01	592642.91		90.18' (6" PERFORATED PVC) S
UCO-8-8	90.15'	387+64.50	51.50' L	3450913.64	592823.55	86.90' (6" PERFORATED PVC) E	86.90' (6" PERFORATED PVC) NW
UCO-8-9	88.60'	186+06.40	314.50' L	3450734.77	592715.07	84.85' (6" PERFORATED PVC) NE	84.85' (6" PERFORATED PVC) S
UCO-8-10	89.02'	187+41.42	348.01' L	3450808.06	592833.31	85.25' (6" PERFORATED PVC) E	85.25' (6" PERFORATED PVC) SW
UCO-8-11	89.53'	190+42.06	359.50' L	3450911.17	593115.95	85.75' (3.6 inch PVC Pipe) E	85.75' (6" PERFORATED PVC) W
UCO-9-1	90.72'	391+94.50	51.50' L	3451045.48	593232.84	87.47' (6" PERFORATED PVC) E	87.47' (6" PERFORATED PVC) W
UCO-9-2	90.06'	194+40.44	359.50' L	3451033.32	593495.14	86.30' (6" PERFORATED PVC) E	86.30' (6" PERFORATED PVC) W
UCO-9-3	91.30'	396+34.50	51.50' L	3451180.39	593651.65		88.05' (6" PERFORATED PVC) W
UCO-9-4	90.34'	397+41.08	52.00' R	3451114.56	593784.82		86.59' (6" PERFORATED PVC) W 86.59' (6" PERFORATED PVC) E
UCO-9-5	90.23'	398+76.10	85.50' R	3451124.07	593923.61	86.30' (6" PERFORATED PVC) W	86.30' (6" PERFORATED PVC) SE
UCO-9-6	94.00'	396+34.50	321.50' L	3451437.39	593568.86		90.75' (6" PERFORATED PVC) W
UCO-9-7	93.42'	391+94.50	321.50' L	3451302.48	593150.06	90.17' (6" PERFORATED PVC) E	90.17' (6" PERFORATED PVC) W
UCO-12-1	93.13'	109+03	78.00' R	3447999.21	585503.05		89.38' (6" PERFORATED PVC) E
UCO-12-3	90.95'	115+80.50	78.00' R	3448206.94	586147.92	87.20' (6" PERFORATED PVC) W	87.20' (6" PERFORATED PVC) E
UCO-12-5	92.31'	111+56	78.00' L	3448225.27	585696.04		88.56' (6" PERFORATED PVC) E 88.56' (6" PERFORATED PVC) W
UCO-13-3	89.93'	119+00	78.00' L	3448453.39	586404.20	86.18' (6" PERFORATED PVC) W	86.18' (6" PERFORATED PVC) E
UCO-18-2	88.48'	180+54.70	78.00' L	3450340.50	592262.46	84.70' (6" PERFORATED PVC) E	84.70' (6" PERFORATED PVC) W
UCO-18-3	89.07'	185+00	78.00' R	3450328.55	592734.14	85.32' (6" PERFORATED PVC) E	85.32' (6" PERFORATED PVC) W
UCO-18-4	89.25'	186+36.60	78.00' L	3450518.92	592816.33	85.50' (6" PERFORATED PVC) E	85.50' (6" PERFORATED PVC) W
UCO-18-5	88.94'	184+03.40	78.00' L	3450447.41	592594.36		85.20' (6" PERFORATED PVC) NE 85.20' (6" PERFORATED PVC) W
UCO-18-6	89.16'	186+06.40	85.50' L	3450516.79	592785.28	85.40' (6" PERFORATED PVC) E	85.40' (6" PERFORATED PVC) NW
UCO-18-7	88.86'	184+33.60	85.50' L	3450463.81	592620.81	85.00' (6" PERFORATED PVC) SW	85.00' (6" PERFORATED PVC) N
UCO-19-3	90.39'	195+00	78.00' R	3450635.16	593685.97	86.64' (6" PERFORATED PVC) E	86.64' (6" PERFORATED PVC) W
UCO-19-4	91.05'	199+97	78.00' R	3450787.54	594159.04		87.30' (6" PERFORATED PVC) W
UCO-19-7	90.73'	197+44	78.00' L	3450858.46	593870.39		86.98' (6" PERFORATED PVC) W 86.98' (6" PERFORATED PVC) NE
UHW-12-7	87.51'	115+00	251.00' L	3448495.41	585970.42	86.76' (6" NON-PERFORATED PVC) S 86.76' (6" NON-PERFORATED PVC) SW	86.76' (6" PERFORATED PVC) N

STRUCTURE TABLE: UNDERDRAIN NETWORK

STRUCTURE	RIM ELEV.	STATION	OFFSET	NORTHING	EASTING	INV. IN	INV. OUT
UHW-18-6	83.81'	180+08.67	251.00' R	3450013.23	592319.52	82.80' (6" NON-PERFORATED PVC) N	82.80' (6" PERFORATED PVC) S
UHW-18-7	86.48'	190+00	251.00' R	3450317.18	593263.10	85.00' (6" NON-PERFORATED PVC) N	85.00' (6" PERFORATED PVC) S
UMH-8-1	88.56'	383+02	40.50' L	3450761.36	592386.70		84.80' (6" PERFORATED PVC) E
UMH-8-5	91.32'	386+86.50	187.50' L	3451019.17	592707.61	84.00' (6" PERFORATED PVC) SW 87.00' (6" PERFORATED PVC) N 84.50' (6" PERFORATED PVC) SE	83.90' (6" PERFORATED PVC) W
UMH-8-6	92.66'	386+86.50	321.50' L	3451146.72	592666.52	89.41' (6" PERFORATED PVC) N 89.41' (6" PERFORATED PVC) E	89.41' (6" PERFORATED PVC) S
UMH-9-2	89.58'	390+79.20	40.50' R	3450922.56	593151.30	85.83' (6" PERFORATED PVC) E	85.83' (3.6 inch PVC Pipe) W 85.73' (6" NON-PERFORATED PVC) S
UMH-12-2	92.29'	111+64	78.00' R	3448079.24	585751.48	88.54' (6" PERFORATED PVC) W	88.54' (6" PERFORATED PVC) E 88.54' (6" NON-PERFORATED PVC) S
UMH-12-4	91.49'	502+01.16	53.46' R	3448291.90	585501.18	87.40' (6" PERFORATED PVC) E 87.40' (6" PERFORATED PVC) N	87.30' (6" NON-PERFORATED PVC) NE
UMH-12-6	91.21'	115+00	78.00' L	3448330.75	586023.47	87.46' (6" PERFORATED PVC) W	87.49' (6" PERFORATED PVC) E 87.46' (6" NON-PERFORATED PVC) N
UMH-13-1	89.60'	120+02	78.00' R	3448336.18	586549.12	85.85' (6" PERFORATED PVC) W	85.85' (6" NON-PERFORATED PVC) S
UMH-13-4	88.51'	123+22	78.00' L	3448582.78	586805.87	84.76' (6" PERFORATED PVC) W	84.76' (6" NON-PERFORATED PVC) N
UMH-17-1	88.15'	177+03	78.00' L	3450232.66	591927.70	84.40' (6" PERFORATED PVC) E	84.30' (6" NON-PERFORATED PVC) W
UMH-18-1	88.42'	180+08.67	78.00' R	3450177.90	592266.47	84.67' (6" PERFORATED PVC) E	84.67' (6" NON-PERFORATED PVC) S
UMH-18-5	89.73'	190+00	78.00' R	3450481.85	593210.06	85.98' (6" PERFORATED PVC) E	85.98' (6" PERFORATED PVC) W 85.98' (6" NON-PERFORATED PVC) S
UMH-18-8	87.50'	385+73.12	200.00' R	3450615.58	592718.50	83.75' (6" PERFORATED PVC) SE 83.75' (6" PERFORATED PVC) N	83.65' (6" NON-PERFORATED PVC) NE
UMH-18-9	87.50'	184+66.88	200.00' L	3450583.00	592617.37	83.75' (6" PERFORATED PVC) NW 83.75' (6" PERFORATED PVC) S	83.75' (6" NON-PERFORATED PVC) W
UMH-19-4	90.37'	194+84	78.00' L	3450778.74	593622.91	86.62' (6" PERFORATED PVC) E	86.62' (6" NON-PERFORATED PVC) N 86.62' (6" PERFORATED PVC) W
UMH-19-5	89.48'	702+01.16	53.46' L	3451026.29	593989.72	85.73' (6" PERFORATED PVC) NW 85.73' (6" PERFORATED PVC) SW	85.73' (6" NON-PERFORATED PVC) W
UMH-19-6	89.83'	190+79.20	78.00' L	3450654.62	593237.61	86.08' (6" PERFORATED PVC) E	86.08' (6" PERFORATED PVC) W 85.98' (6" NON-PERFORATED PVC) N

DATE

SYM DESCRIPTION

NAVFAC

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DOUGLAS PRESTON STEWART

Name

CO 29899 NOV 4, 2025

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SEAL

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FOR COMMANDER NAVFAC DATE

ACTIVITY

SATISFACTORY TO DATE

DES	DRW	REV.

PM/DM	MAI/DRK
BRANCH MANAGER	SMK
CHIEF ENG	EAM
FIRE PROTECTION	JCC

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NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND
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YAP INTERNATIONAL AIRPORT, FSM
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SCALE: AS SHOWN

EPROJECT NO.: 1687159; 1719021

CONSTR. CONTR. NO.
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LAYOUT NAME: CG601A
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Appendix C. Storm Drainage Narrative

1.0 Storm Drainage

1.1 Hydrologic and Hydraulic Criteria

The design of the storm drainage system is based on guidance and criteria in the following documents:

a) AC 150/5320-5D, Airport Drainage Design, FAA (15 August 2013)

b) Marianas Navy and Marine Corps Design and Construction Standards (MDACS), with Amendments 001 (22 October 2019) and 002 (30 December 2020)

c) UFC 3-201-01, Civil Engineering, DoD (20 December 2022)

d) UFC 3-210-10 Low Impact Development (LID), DoD (01 March 2020)

e) Yap State EPA, Regulations for Earthmoving and Sedimentation Control, Title X, Chapter 1 (09 November 1994)

1.1.1 AC 150/5320-5D Criteria

The design storm frequency used for the storm drainage design follows FAA AC 150/5320-5D guidance for airport drainage design, using the 5-year storm event with no encroachment of runoff on taxiway and runway pavements (including paved shoulders) and no encroachment the 10-year storm onto the center 50% of runways or taxiways. The 50-year storm event was used to analyze the existing outfall culverts beneath the runway, including the low point in the grading. The 100-year storm event was also used for the design of all drainage collection, conveyance, and detention facilities as a check-scenario. Precipitation frequency estimates of depth and intensity were determined for the site using National Oceanic and Atmospheric Administration (NOAA) Atlas 14 data at the airport site. The Rational Method was used to compute peak runoff discharges from drainage basins. A spreadsheet incorporating locally calibrated unit hydrograph methodology was used to generate hydrographs for detention and water quality pond routing.

Drainage basins were delineated to determine flow patterns across the airport, including the runway extensions, the addition of the taxiway, and the addition of the aircraft parking apron area. There are three existing corrugated steel pipe (CSP) culverts crossing under the airport runway that will not be replaced. See Section 1.2.1 for a description of culvert conditions. These culverts were analyzed with design and check storm flows and were determined to have sufficient capacity.

Hydraulic criteria also follow FAA AC 150/5320-5D guidance. Inlet structures are concrete drop inlet (area inlet) type with single or multiple steel grates provided in sufficient quantity to meet the above design storm criteria. Inlet capacities are computed using weir and orifice equations associated with the slot size and spacing within the grates. Inlet structures are reinforced based on their location relative to loading capacity and depth. Some of the inlets are deep, requiring special structural design consideration. Inlet structures are aircraft-rated where they fall within safety zones in the airfield. See also Section 1.6.

Manholes are used to facilitate junctions and bends in the storm drainage pipe network. Manhole spacing is also limited to certain distances based on pipe size, in accordance with the AC 150/5320-5D guidance, so that maintenance can be readily performed. Manhole structures are reinforced based on their location relative to loading capacity and depth. Some of the manholes are deep, requiring special structural design consideration. Manhole structures are aircraft-rated where they fall within safety zones in the airfield. For the purposes of the design, the term “manhole” includes junction chambers, which are specially designed structures that are used for large storm drains.

The project includes several headwall structures that are used at upper and lower ends of storm drain systems. Headwalls provide retainage of embankments at storm drain inlets and outlets. Inlet headwalls provide means to gather incoming flow, usually from intermittent or perennial flow sources, guiding flow safely into the storm drain and improving hydraulics. Inlet headwalls are provided with steel grated structures having the dual purpose of providing a security barrier and protection against debris potentially clogging the storm drain. Outlet headwalls guide discharge into energy dissipating devices, which help to reduce the potential for erosion. Energy dissipators include rock riprap aprons and concrete stilling basins; the latter are used for pipes discharging into detention basins. Energy dissipator design is via spreadsheets incorporating HEC No. 14 and U.S. Bureau of Reclamation (USBR) procedures.

Pipe and culvert design is based on the storm frequencies described above, using Bentley Systems' StormCAD and Autodesk's Civil 3D software. All pipes used for the project are smooth-lined, either reinforced concrete (RCP) or dual-wall high-performance polypropylene (HP). Pipe usage and class is dependent upon several factors including loading capacity, depth of bury, diameter, and location within the airport property. Minimum and maximum pipe cover is as dictated by the AC 150/5320-5D guidance and manufacturers' requirements. Maximum spacing between manholes and inlet structures are based on the AC 150/5320-5D guidance as well. Minimum pipe slopes are based on pipe size and discharge to limit the minimum velocity within the pipe to 3 feet per second (fps). Pipe design is based on hydraulic grade line (HGL). For the most part, pipes have been upsized to allow for better maintenance accessibility. This results in the HGL being maintained within the pipe itself. In no case is the HGL above the grate or cover of inlet or manhole structures for the 100-year storm event.

Ditches and swales are designed by spreadsheets incorporating Manning's Equation, and capacities are based on linings, slopes, and cross-sectional configuration. Ditches and swales intercept and convey runoff to inlets and headwalls within the storm drain system or directly to detention ponds. Ditches and swales are lined either with grass, vegetated turf reinforcement mat (TRM), or concrete, depending upon factors including slope and discharge. See also Section 1.5.

Detention and water quality ponds are designed using inflow hydrographs generated by a spreadsheet incorporating locally-calibrated unit hydrograph methodology. Stage-storage data is developed for each pond and routing through an outlet structure is performed using Modified Puls methodology to develop outflow hydrographs. Emergency spillways are provided for the ponds that have earthen embankments and are designed to provide one (1) foot of freeboard above the elevation of the peak 100-year inflow, assuming the pond is already full and all other pond outlets are blocked. Emergency spillways are stabilized with a concrete cutoff wall and riprap through their weir section to the bottom of the exterior embankment. See also Section 1.7.

1.1.2 UFC 3-201-01 Criteria

The requirements of UFC 3-201-01 are complementary to the AC 150/5320-5D criteria described above and were used to establish this Basis of Design as it relates to drainage and stormwater management.

1.1.3 MDACS Criteria

The storm drainage design was also based on the MDACS guidelines; in particular, G10, Site Preparations. The design was conducted with the intent of meeting the following sustainable design strategies:

- *Grade to encourage stormwater sheet flow and lengthen flow paths.* A significant quantity of runoff enters the property from the hills north of the airfield. This runoff is captured where it concentrates above cut slopes and is conveyed beneath the airfield to storm drain outfalls to the south. Upslope sheet flow will run down the stabilized cut slopes into the airfield conveyance system. Nearly all airfield surface runoff conveyance is east-west, which effectively lengthens flow paths by conveying across slopes, rather than directly downslope to the outfalls.

- *Maintain natural drainage divides to keep flow paths dispersed.* Six outfalls have been delineated to align existing drainage divides with the design. Minor cross-watershed drainage will occur, but this will be managed by attenuation of peak discharges within the detention ponds.
- *Preserve the naturally vegetated areas and soil types that slow runoff, filter out pollutants, and facilitate infiltration.* Disturbed areas are to be revegetated with in-kind vegetation. Runoff from over 100 acres of airfield will be directed to grass-lined swales which can filter pollutants and enable infiltration. These swales are equipped with a narrow concrete valley gutter to facilitate conveyance of low flows, but larger flows will spread across the permeable grass portions of the swales.
- *Strip and stockpile existing topsoil wherever possible where soil is viable for planting beds. Limit the height of the stockpile to preserve micro-organisms.* A complete plan for erosion and sediment control is part of the design documents. This will provide the Contractor with guidance for stripping and stockpiling topsoil for reuse onsite, as well as dust control and minimizing sedimentation of downstream waters.

1.1.4 UFC 3-210-10 Criteria

The MDACS guidelines reference UFC 3-210-10, LID criteria, which were also considered in the project design. Note that the March 2020 UFC 3-210-10 Change 3 version is used because the most current version of this UFC is 28 August 2023, which is more recent than the Effective Code Date of the project (July 21, 2023). The UFC 3-210-10 LID criteria aim to restore pre-development infiltration rates to mitigate reduction of infiltrative surfaces due to the addition of impervious area. For this project, the percent change in runoff volume due to additional impervious area is 4.5%. Because this is an already developed airport and the site presents several constraints toward implementing LID BMPs, the AC 150/5320-5D guidance was selected for design criteria pertaining to hydrology and hydraulics. Certain elements of the UFC 3-210-10 design objective are met when implementing the AC 150/5320-5D guidance; however, there remain several technical constraints for implementing LID BMPs to meet the design objective (e.g., infiltration and storage). Section 2-1.4 of UFC 3-210-10 provides examples of technical constraints that are applicable to the subject site and project, including prevention of stormwater retention onsite, shallow bedrock, contaminated soils, and limited infiltration capacity. Stormwater retention is not provided on this site because the resulting ponding can be considered a wildlife attractant. AC 150/5200-33C cites retention ponds and poorly drained locations as potentially ideal locations for wildlife. Furthermore, the GDR for the project indicates that schist bedrock is relatively shallow, and permeability is likely very low. Finally, Section 2.3.9 of this Basis of Design Report indicates that soils, rocks, and sediments on Yap Island are known to have elevated levels of heavy metals and minerals that, although naturally occurring, have concentrations that are considered hazardous to humans.

1.1.5 Yap State Code Title X, Chapter 1 Criteria

The final resource for design criteria used for this project is the Yap State EPA Regulations for Earthmoving and Sedimentation Control Title X, Chapter 1. A complete plan for erosion and sedimentation control is part of the design documents, and this plan was developed based on guidance in Title X, Chapter 1. The plan includes BMPs for minimizing erosion and limiting sedimentation of waters downstream. Erosion control BMPs include erosion control blankets, check dams, and slope surface roughening. Permanent BMPs include TRMs and rock riprap. Sediment controls include tire scrubbers at site intersections with roadways, sediment logs, inlet protection, and sediment basins. The plan also provides guidance for dust control. This plan should provide the Contractor with a complete framework for managing erosion, sediment, and dust throughout all phases of the project.

To inform the Contractor and assist them in summarizing the project for the Yap State EPA to obtain requirement permits, a separate Stormwater Protection Report has been prepared. This report appears in Appendix R.

1.2 Existing Drainage Patterns

Within the vicinity of the airport, stormwater runoff generally flows from north to south. The low elevation of the runway is approximately 83 feet above mean sea level. Contributing drainage areas to the north extend up to an approximate elevation of 275 feet and the areas immediately to the south of the airport drain to as low as 15 feet.

Although the airfield drainage systems are interconnected, further discussion is split into offsite and onsite drainage systems.

1.2.1 Offsite Drainage Systems

Offsite drainage areas contributing to the airport area consist primarily of undeveloped, dense tropical vegetation classified with the categories "Upland Forest" and "Savanna or Other Shrub/Grass" with hydraulically moderate-to-steep slopes.

There are multiple drainage-ways that cross the airfield. The original airport design, which created a fill-condition with respect to historical drainage, accommodates drainage via CSP culverts to convey runoff from the north side to the south side of the airfield. Two of these culverts were retrofitted with a tack-welded wire mesh-reinforced concrete bottom of 3-inch thickness and 50-inch length along the bottom circumference as part of the 1997 improvements. The culverts were installed circa 1980. The existing culverts, in order of west-to-east, are described as follows (see also Appendix A.2 for mapping depicting the culvert locations):

- Existing Culvert #1 (Outfall 2) is the western-most existing culvert and is a 60-inch CSP, according to as-built drawings. The inlet receives inflow from a heavily vegetated trapezoidal channel parallel to the runway, as well as a small concrete chute north of the inlet headwall. The inlet and outlet headwalls consist of grouted rock with a flat, mostly smooth surface.
- Existing Culvert #2 (Outfall 3) is the central existing culvert and is a 60-inch CSP, according to as-built drawings. The inlet receives inflow from a heavily vegetated trapezoidal channel parallel to the runway as well as a small concrete chute north of the inlet headwall. The inlet and outlet headwalls consist of grouted rock with a flat, mostly smooth surface.
- Existing Culvert #3 (Outfall 4) is the eastern-most existing culvert and is a 78-inch CSP, according to as-built drawings. The inlet receives inflow from a heavily vegetated trapezoidal channel parallel to the runway. A 36-inch CSP drop-shaft was observed approximately 80 feet from the inlet headwall to connect the surface to the top of pipe as an inflow for the concrete ditch directly above. The outlet was observed to be partially submerged at an approximate depth of two feet. The inlet headwall consisted of grouted rock with a flat, mostly smooth surface.

In the area downstream of the Existing Culvert #3, the land is known to be part of a system of taro patches. The extents of taro patches were identified as part of a topographical field survey in 2024. According to the survey, approximately 1,200 square feet (0.028 acre) of a taro patch that extends into the airport property will be destroyed by construction of a stormwater detention pond. Coordination is suggested with the local population on creating the same size taro patch elsewhere for the community. The remainder of the taro patch network on private property will not be disturbed by the project. Further downstream, beyond the main island road, mangrove areas include endangered fruit bat habitat.

West of the runway, the area consists of tropical brush that drains to the south toward the Public Access Road.

East of the runway, the drainage basin consists of dense tropical brush that contributes runoff to a small stream that ultimately crosses underneath the main island roadway through a large box culvert. This culvert is overgrown with vegetation and is not believed to have been surveyed or measured.

The drainage and stormwater management systems were designed without the benefit of federal or local jurisdictional determinations pertaining to the existence of regulated waters and wetlands. For the purposes of this Basis of Design, it has been assumed that watercourses, streams, marshes and/or swamps affected by earthmoving activities associated with this project are non-jurisdictional waters and as such are not subject to buffering, avoidance, or permitting. Similarly, based on field observations, it is believed that earthmoving activities will not impact nearby mangrove communities. However, this belief is based on lay-person observations and not on a provided plant community assessment. It is noted that the design intent was to maximize avoidance of these sensitive waters and plants, regardless of their jurisdictional status.

1.2.2 Onsite Drainage Systems

Onsite drainage consists of the runway, airfield, and ARFF area, and terminal apron drainage facilities. The runway is crowned with an approximate cross slope at or exceeding 1% and includes 6-inch PVC pipe subdrains parallel to the runway with accessible vault-junctions where flow turns perpendicular to the runway and outlets into ditches parallel to the runway approximately 150 feet or more beyond the edge of pavement.

The ditches parallel to the runway consist of multiple sections and materials including concrete U-shape channels of depths between 1 and 4 feet and widths varying between 2 and 4 feet as well as grass/earthen trapezoidal and V-ditches. Some of the earthen V-ditches have a grouted rock low flow section.

A Reinforced Concrete Box Culvert (RCBC) of 48-inch width and varying depth of 31 to 41 inches was observed crossing the driveway to the ARFF building. The culvert drains ditch flow from west to east with the east outlet side consisting of a trapezoidal grass channel and the west inlet side transitioning from the concrete U-shape channel.

The drainage ditches parallel to the runway along the north side drain into the respective CSP culverts. The drainage ditches along the south side were observed to drain into hydraulically steep concrete chutes that drain towards the CSP culvert outlet channels.

1.3 Proposed Drainage Patterns

The presence of sensitive environments, particularly those downstream of the airport including the endangered fruit bat habitat and mangrove areas, dictate that the drainage design must minimize the hydrologic impact. Two primary objectives for the design of stormwater detention are to maintain or reduce peak discharge rates and to drain as quickly as possible to avoid creating habitat for wildlife that may be hazardous to airfield operations.

The proposed drainage patterns are intended to mimic existing flow patterns as closely as possible.

1.4 Proposed Storm Drainage Outfall Systems

At the west end of the runway extension, inlets and a pipe system will be constructed to collect and convey stormwater runoff from the west end of the runway. This system is labeled as Outfall 1.

Existing Culvert #1 will be extended under the proposed taxiway north of the runway. Inlets will be added on each side of the taxiway to collect and convey runoff into Existing Culvert #1. This system is labeled as Outfall 2.

Existing Culvert #2 will be extended under the proposed taxiway north of the runway. Inlets will be added on each side of the taxiway to collect and convey runoff into Existing Culvert #2. This system is labeled as Outfall 3.

Existing Culvert #3 will be extended under the proposed taxiway north of the runway. Headwalls will be added at the upstream end of the extended pipe and inlets will be added south of the proposed taxiway to collect and convey offsite and infield flows, respectively. This system is labeled as Outfall 4.

The Outfall 5 system will be placed just west of the proposed apron to collect and convey offsite flows from north of the apron and infield flows on both sides of the extended runway.

The Public Access Road will be constructed at the east end of the runway. The main drainageway in that area will cross the roadway alignment twice. A pipe system will be constructed along this drainageway to collect and convey offsite flows and infield flows between the taxiway and roadway. This system is labeled as Outfall 6.

Outfall 7 is located within a sub-basin of the basin to Outfall 6 and consists of a double culvert under the Connector Road on the north side of the apron. It collects runoff from the directly connected area north of the apron and discharges to Outfall 6 Pond, which discharges to the Outfall 6 system.

1.5 Drainage Ditches and Swales

In this Basis of Design and on the Project plans, the terms “ditches” and “swales” are both used to identify designed channels that are used for conveyance of runoff. “Ditches” are generally located parallel to paved surfaces including taxiways and roads, as well as along the toes of fill slopes. “Swales” are located within grass areas, including infields and sloping areas leading to the Outfall 6 Pond. The plans and construction details distinguish between these channels; however, for the purposes of the calculations in Appendix A.2, all designed channels are identified as ditches.

The ditch along the north side of the proposed taxiway is concrete-lined with an 8-foot bottom, 4H:1V side slope and is trapezoidal in shape. The concrete lining, ditch width, and the trapezoidal shape are for maintenance vehicle use as well as for conveyance.

A concrete lining is also provided for the trapezoidal ditches along the north and west sides of the apron. These ditches have an 8-foot bottom with varying side slopes.

The ditches along the Public Access Road at the east end of the project are V-ditches with varying side slopes and will be lined with a TRM. V-ditches are narrower and deeper and are typically found on the steeper slopes in the project area. The TRM lining provides erosion control that cannot be provided with a grass lining alone.

TRM lining is also provided for the V-ditches along the Connector Road north of the apron and for the trapezoidal ditches leading to Outfall 6 Pond.

The ditches conveying offsite flows from the north into the drainage system are TRM-lined V-ditches with 3H:1V side slope. Similar TRM-lined ditches are proposed throughout the project area where fill is placed at an acute angle to existing slopes, creating a concentrated flow path needing erosion protection.

The swales at the southern edge of the infield area south of the runway will be grass lined with a concrete valley gutter section along the flow line. The concrete lining provides a maintenance benefit due to the shallow slope of the swales. The minimum slope for ditches and swales with concrete linings is 0.2%.

Maintenance of the concrete-lined ditches can be accomplished with a small skid loader or equivalent machine that can fit within the 8-foot channel width. Maintenance of the grass swales with concrete flow-line gutters will typically be by mowing, with hand tool spot cleanup being provided along the concrete gutter section. TRM-lined ditches can be mowed after establishment of grass.

1.6 Inlets

Inlets are the drop inlet (area inlet) type, having single and multiple grate configurations as dictated by tributary runoff rates. Inlets are either on-grade or in sumps. Inlet grate capacity was evaluated using Neenah Foundry grates R-3475 E, F, G, and H for single, double, triple, and quadruple inlet layouts, respectively. First, calculations were performed for the 5-year flows, choosing the number of grates that accommodated weir flow for a maximum 0.4-foot depth in accordance with FAA inlet guidelines at aprons. Then an evaluation was made to determine if a 100-year storm event would spill out of the basin for the 5-year inlets grates chosen. If there was a 100-year spill in a certain basin, then the number of inlet grates per basin were increased (up to 4) to see if the basin spill would be eliminated for the 100-year flow. Because the pipe system has the capacity to convey the 100-year flow, the increased number of inlet grates per inlet structure could be considered to better convey less frequent (larger) storm events and reduce the amount of potential surface flooding. In all cases, inlet capacities are based on a clogging factor of 50%. Inlet calculations and output are included in Appendix A.2.

1.7 Detention and Water Quality Ponds

Five stormwater ponds are proposed for the project to provide varying degrees of peak discharge attenuation and improvements to water quality. The ponds are identified by the site outfalls with which they are associated and include, from west to east, Outfall 3 Pond, Outfall 4 Pond, Outfall 5 Pond, Outfall 6 Pond, and Outfall 6A Pond. All ponds function as detention ponds and have been designed to accommodate and attenuate runoff from the improvements to pre-developed conditions based on the 2-, 10-, 50-, and 100-year storm events.

Outfall 3 Pond, Outfall 4 Pond, and Outfall 5 Pond will also provide limited water quality treatment with flow reduction and pond storage to allow some suspended sediments to settle out. Outfall 6 Pond and Outfall 6A Pond will provide added water quality treatment by attenuating the Water Quality Capture Volume (WQCV), which reflects the volume of runoff from a rainfall event of 0.6 inch over the drainage basin area. Outfall 6 Pond and Outfall 6A Pond are located within the project areas that have the highest anticipated sediment loadings, where water quality treatment is most effective.

Within Outfall 6 Pond and Outfall 6A Pond, the WQCV is detained for 42 and 41 hours, respectively, for optimum settling of suspended solids, while limiting duration of ponded water to less than that at which mosquito breeding could take place (typically, around 120 hours). The 41 – 42-hour duration is also compliant with the FAA guidance for hazardous wildlife attractants in AC 150-5200-33C, Section 2.3.1.2, which limits detention periods to 48 hours.

Emergency spillways are provided for Outfall 3 Pond, Outfall 4 Pond, and Outfall 5 Pond. Emergency spillways are designed to safely discharge the peak 100-year inflow with 1 foot of freeboard to the top of berm, assuming the pond is full and all other pond outlets are blocked. Outfall 6 Pond and Outfall 6A Pond do not have embankments and as such do not have emergency spillways. Outfall 6 Pond will overflow into the roadside ditch along the reconstructed Public Access Road in an emergency. Outfall 6A Pond will overflow the road surface and rejoin the stream channel to the east in an emergency.

Incoming flows to Outfall 3 Pond, Outfall 4 Pond, and Outfall 5 Pond are substantial, as they include not only airfield runoff but offsite upstream areas as well. Due to high incoming discharge rates, Outfall 3 Pond and Outfall 5 Pond are equipped with USBR Type VI stilling basins at the pipe outfalls into the ponds. The stilling basins consist of a concrete structure with a series of baffles and weirs to dissipate energy from high discharges more effectively than conventional energy dissipators such as riprap or forebays.

In addition to high incoming discharge rates at Outfall 3 Pond, Outfall 4 Pond, and Outfall 5 Pond, field investigations revealed that these ponds are likely to have year-round base flows originating in the hills north of the airfield. The base flows are estimated to be 2 cubic feet per second, based on field observations of flow area, depth, and velocity. For this reason, water quality capture is limited, as the ponds must maintain an undetained low-flow discharge so that they do not have permanent pools, which can be wildlife attractants. Low-flow discharge replicates the streamflow downstream of the outfalls, with the added benefit that the ponds will temporarily impound large flows and meter them out at lower rates than without the ponds. Onsite areas upstream of these ponds include paved runway and taxiway, and grass infield and hillsides. As such, suspended sediment loading should be minimized once the site is fully revegetated. With the ponds replicating natural low-flow stream characteristics, normal sediment loads will continue downstream, but in a more manageable manner.

The areas tributary to Ponds 6 and 6A include proportionately larger expanses of paved and gravel surfaces, with more intensive amounts of site activity. These areas are expected to produce larger amounts of suspended sediments, even after site revegetation. Therefore, these ponds include the extra measure of water quality treatment through WQCV attenuation.

During construction Outfall 6 Pond and Outfall 6A Pond will function as sediment basins, to trap and settle sediments associated with construction activity.

Maintenance of the ponds throughout their temporary and permanent configurations is vital to their performance. Therefore, all ponds are designed with maintenance access to the pond bottoms.

See Appendix A.2 for pond design calculations. General pond characteristics are tabulated in Table 2-17.

Table 1. General Stormwater Pond Characteristics

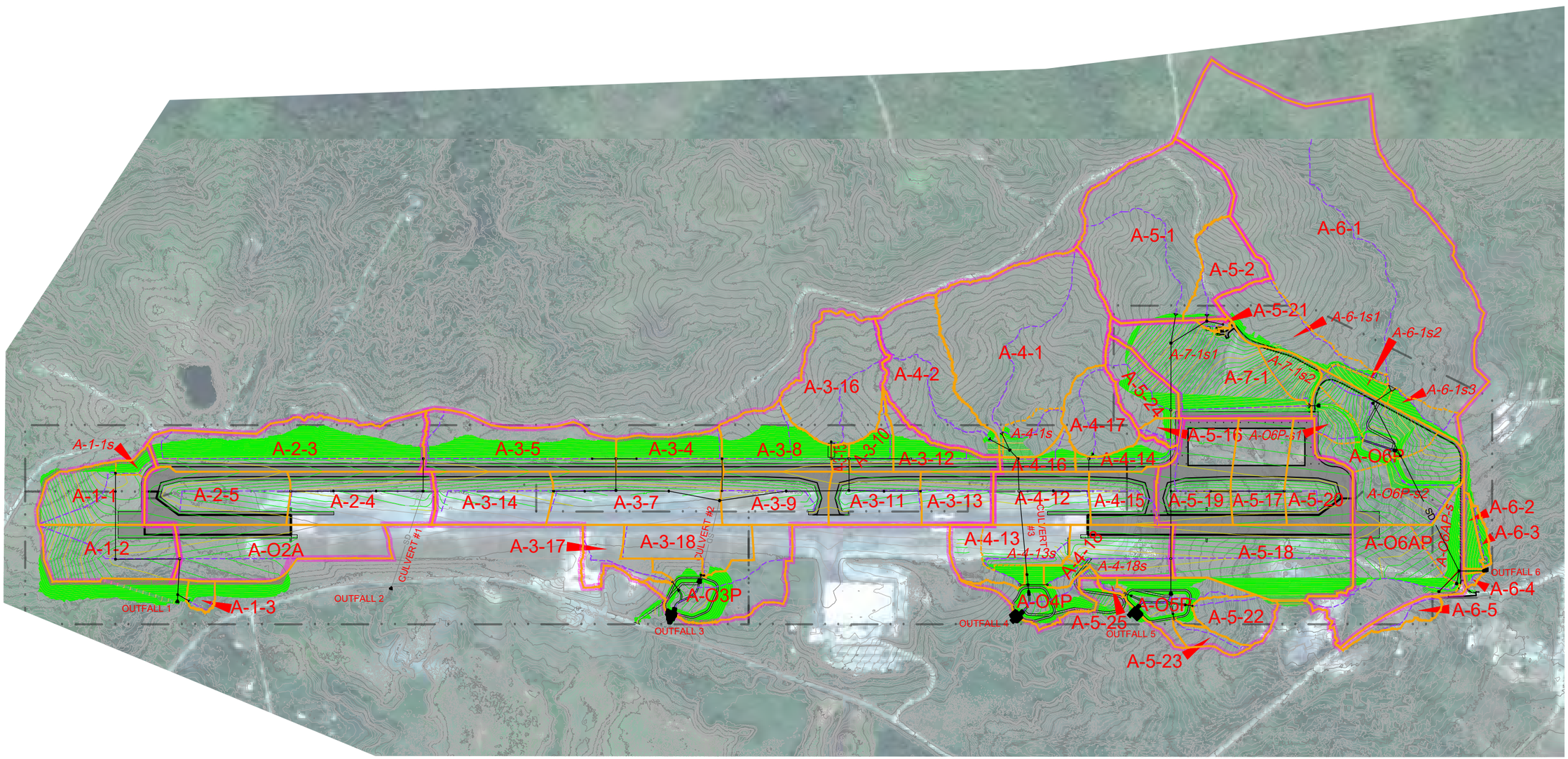
Pond ID	Pond Location	Detention Provided?	Water Quality Treatment Method
Outfall 3 Pond	Site Outfall 3	Yes	None
Outfall 4 Pond	Site Outfall 4	Yes	None
Outfall 5 Pond	Site Outfall 5	Yes	None
Outfall 6 Pond	East of Aircraft Apron	Yes	WQCV Attenuation
Outfall 6A Pond	Southwest Public Access Road	Yes	WQCV Attenuation

Site Outfalls 1 and 2 do not have stormwater ponds, due to limited increases in impervious area within their drainage basins. Outfall 1 discharges to an existing waterway and Outfall 2 discharges into the area identified for equipment and materials staging. The plan includes provisions for enabling Outfall 2 discharge to traverse the staging area without pollutant impacts.

Appendix D. Storm Drainage Calculations

Hydrology

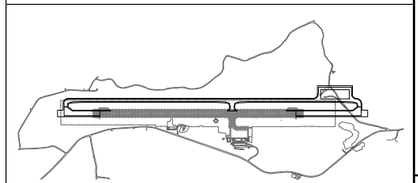
PROPOSED DRAINAGE BASIN MAPS



LEGEND

- OUTFALL BASIN BOUNDARY
- CONVEYANCE BASIN BOUNDARY
- Tc FLOWPATH
- DRAINAGE SYSTEM ELEMENT

KEY PLAN



GRAPHIC SCALE

0 400 800

SCALE: 1:400

NORTH ARROW

TRUE N

B PROPOSED DRAINAGE BASINS - CLIN BA01 AWARDED

SCALE: 1:400

FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction Bidding or Permit Purposes.

NAVFAC

Jacobs

JACOBS GOVERNMENT SERVICES COMPANY
777 MAIN STREET
FORT WORTH, TEXAS 76102

A/E Contract No. N62742-17-D-0003
A/E Task Order No. N62742-22F-0338
JGS: WFOK3Z3

A/E INFO

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND PACIFIC
NAVFAC PACIFIC

NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND ~ PACIFIC
MAKALAPA, HAWAII

YAP INTERNATIONAL AIRPORT, FSM
YAP, FEDERATED STATES OF MICRONESIA (FSM)

FY25/FY26 MCAF/MCON PROJECTS
PROPOSED DRAINAGE BASIN MAP - CLIN BA01 AWARDED

SCALE: AS SHOWN

PR-1

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USER: KITZMIMA

RAINFALL DATA

NOAA Atlas 14, Volume 5, Version 3
Location name: Yap, FSM*
Latitude: 9.4833°, Longitude: 138.0833°
Elevation: 43 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Bingzhang Lin, Deborah Martin, Fenglin Yan, Daniel Brewer, Carl Trypaluk, Michael Yekta, Lillian Hiner, Sarah Heim, Sarah Dietz, Tye Parzybok, Li-Chuan Chen, Kazungu Maitaria, Ruiming Chen, Ishani Roy, Dale Unruh, Tan Zhao, John Yarchoan, G. M. Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.358 (0.261-0.476)	0.482 (0.351-0.642)	0.648 (0.469-0.867)	0.775 (0.558-1.04)	0.945 (0.673-1.28)	1.08 (0.757-1.47)	1.21 (0.838-1.66)	1.34 (0.916-1.87)	1.52 (1.01-2.16)	1.65 (1.08-2.38)
10-min	0.558 (0.407-0.743)	0.752 (0.547-1.00)	1.01 (0.732-1.35)	1.21 (0.870-1.62)	1.47 (1.05-2.00)	1.68 (1.18-2.29)	1.88 (1.31-2.60)	2.09 (1.43-2.92)	2.37 (1.58-3.36)	2.58 (1.68-3.72)
15-min	0.716 (0.522-0.953)	0.964 (0.701-1.28)	1.30 (0.939-1.73)	1.55 (1.12-2.08)	1.89 (1.35-2.56)	2.15 (1.51-2.94)	2.41 (1.68-3.33)	2.68 (1.83-3.74)	3.04 (2.02-4.31)	3.31 (2.16-4.77)
30-min	1.06 (0.772-1.41)	1.43 (1.04-1.90)	1.92 (1.39-2.57)	2.29 (1.65-3.08)	2.80 (1.99-3.79)	3.18 (2.24-4.35)	3.57 (2.48-4.92)	3.96 (2.71-5.53)	4.49 (2.99-6.38)	4.90 (3.19-7.06)
60-min	1.43 (1.04-1.90)	1.93 (1.40-2.57)	2.59 (1.88-3.47)	3.10 (2.23-4.16)	3.78 (2.69-5.12)	4.30 (3.03-5.88)	4.82 (3.35-6.66)	5.36 (3.66-7.48)	6.07 (4.05-8.62)	6.62 (4.31-9.54)
2-hr	1.73 (1.26-2.30)	2.28 (1.66-3.04)	3.03 (2.19-4.05)	3.60 (2.59-4.84)	4.36 (3.11-5.91)	4.95 (3.48-6.76)	5.53 (3.84-7.64)	6.13 (4.19-8.56)	6.94 (4.62-9.85)	7.55 (4.92-10.9)
3-hr	2.00 (1.46-2.67)	2.62 (1.90-3.49)	3.44 (2.49-4.60)	4.06 (2.93-5.46)	4.90 (3.49-6.65)	5.55 (3.90-7.58)	6.19 (4.30-8.55)	6.85 (4.68-9.57)	7.74 (5.16-11.0)	8.41 (5.48-12.1)
6-hr	2.72 (1.98-3.62)	3.48 (2.53-4.63)	4.49 (3.25-6.00)	5.26 (3.78-7.06)	6.29 (4.48-8.53)	7.08 (4.99-9.68)	7.88 (5.47-10.9)	8.69 (5.94-12.1)	9.77 (6.51-13.9)	10.6 (6.91-15.3)
12-hr	3.75 (2.73-5.00)	4.69 (3.41-6.25)	5.94 (4.31-7.95)	6.90 (4.97-9.28)	8.19 (5.83-11.1)	9.18 (6.46-12.5)	10.2 (7.06-14.0)	11.2 (7.64-15.6)	12.5 (8.34-17.8)	13.6 (8.83-19.5)
24-hr	4.86 (3.67-6.26)	5.96 (4.49-7.68)	7.42 (5.57-9.59)	8.53 (6.37-11.1)	10.0 (7.42-13.1)	11.2 (8.20-14.7)	12.3 (8.94-16.4)	13.5 (9.67-18.1)	15.1 (10.6-20.5)	16.3 (11.2-22.4)
2-day	6.21 (4.68-8.00)	7.51 (5.66-9.68)	9.26 (6.95-12.0)	10.6 (7.91-13.7)	12.4 (9.16-16.2)	13.7 (10.1-18.1)	15.1 (11.0-20.0)	16.5 (11.8-22.1)	18.4 (12.9-25.0)	19.8 (13.7-27.3)
3-day	6.97 (5.26-8.98)	8.43 (6.35-10.9)	10.4 (7.79-13.4)	11.9 (8.87-15.4)	13.9 (10.3-18.1)	15.4 (11.3-20.3)	16.9 (12.3-22.5)	18.5 (13.3-24.8)	20.6 (14.5-28.0)	22.2 (15.3-30.5)
4-day	7.73 (5.83-9.96)	9.35 (7.04-12.0)	11.5 (8.64-14.9)	13.2 (9.83-17.1)	15.4 (11.4-20.1)	17.1 (12.5-22.4)	18.8 (13.6-24.9)	20.5 (14.7-27.4)	22.8 (16.0-31.0)	24.6 (17.0-33.8)
7-day	9.73 (7.34-12.5)	11.6 (8.76-15.0)	14.2 (10.6-18.3)	16.1 (12.0-20.9)	18.7 (13.8-24.4)	20.7 (15.2-27.2)	22.7 (16.4-30.1)	24.7 (17.7-33.1)	27.4 (19.3-37.3)	29.5 (20.4-40.6)
10-day	11.4 (8.60-14.7)	13.5 (10.2-17.4)	16.3 (12.2-21.0)	18.4 (13.8-23.9)	21.3 (15.7-27.8)	23.5 (17.2-30.9)	25.7 (18.6-34.0)	27.9 (20.0-37.4)	30.9 (21.7-42.0)	33.2 (22.9-45.7)
20-day	16.4 (12.4-21.1)	19.1 (14.4-24.6)	22.7 (17.0-29.4)	25.5 (19.0-33.1)	29.2 (21.6-38.2)	32.0 (23.5-42.2)	34.9 (25.3-46.3)	37.8 (27.1-50.6)	41.7 (29.3-56.7)	44.7 (30.8-61.5)
30-day	20.8 (15.7-26.8)	24.1 (18.1-31.0)	28.4 (21.4-36.8)	31.8 (23.7-41.2)	36.2 (26.8-47.3)	39.6 (29.1-52.2)	43.1 (31.3-57.1)	46.6 (33.4-62.4)	51.3 (36.0-69.7)	54.8 (37.8-75.5)
45-day	27.4 (20.7-35.3)	31.3 (23.6-40.3)	36.4 (27.4-47.1)	40.4 (30.2-52.4)	45.6 (33.8-59.6)	49.7 (36.4-65.4)	53.7 (39.0-71.3)	57.9 (41.5-77.5)	63.4 (44.5-86.2)	67.6 (46.6-93.1)
60-day	33.8 (25.5-43.6)	37.9 (28.6-48.9)	43.4 (32.5-56.0)	47.5 (35.5-61.7)	53.1 (39.3-69.4)	57.4 (42.1-75.5)	61.7 (44.7-81.8)	66.0 (47.3-88.4)	71.9 (50.5-97.7)	76.4 (52.7-105)

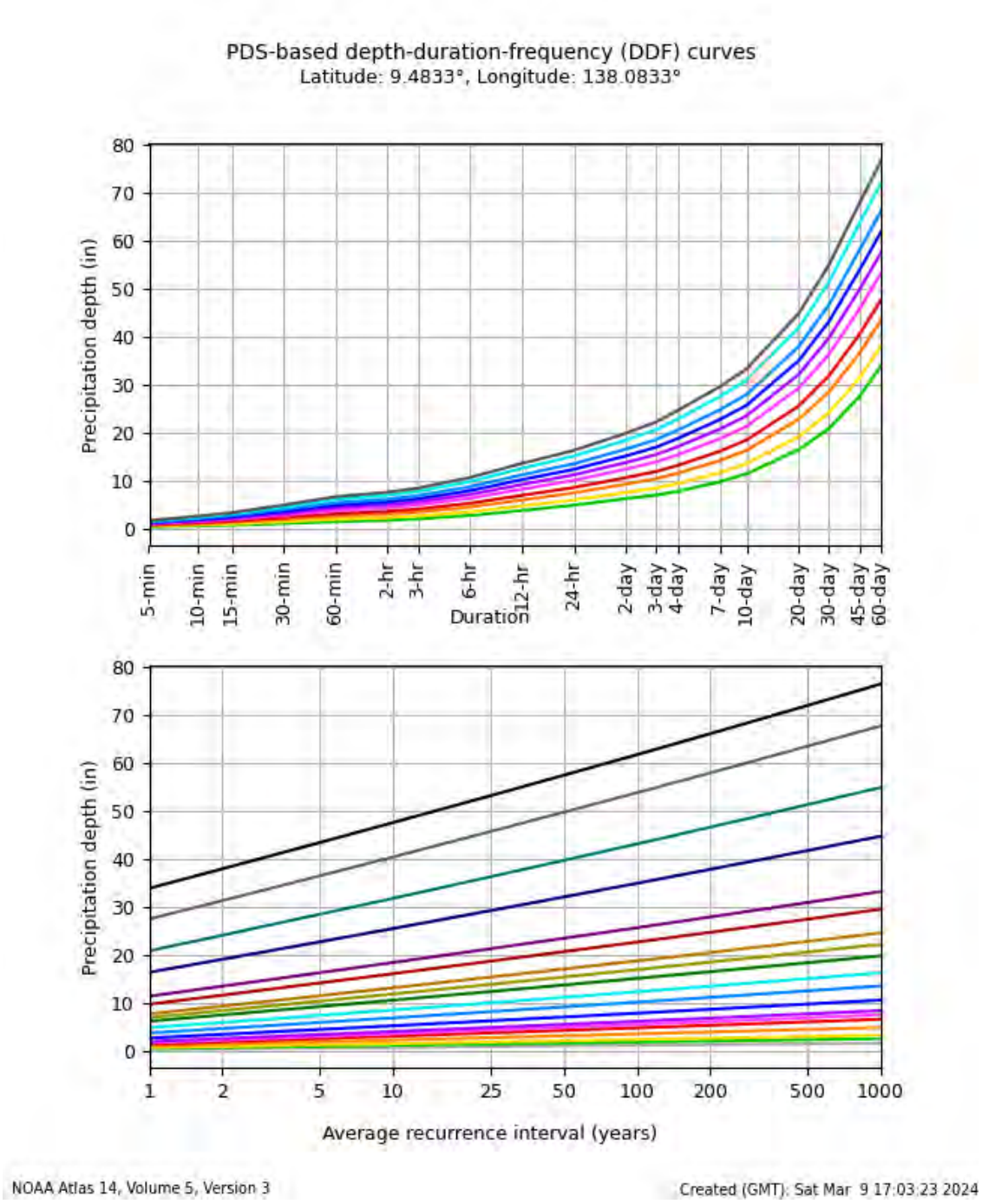
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



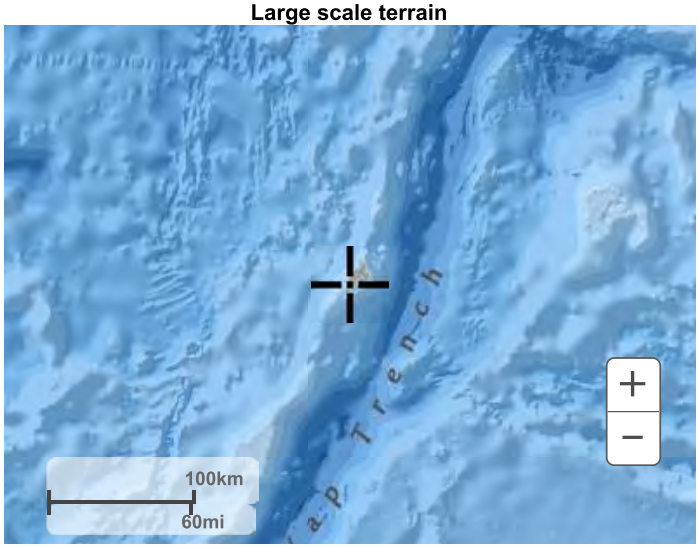
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Maps & aerials

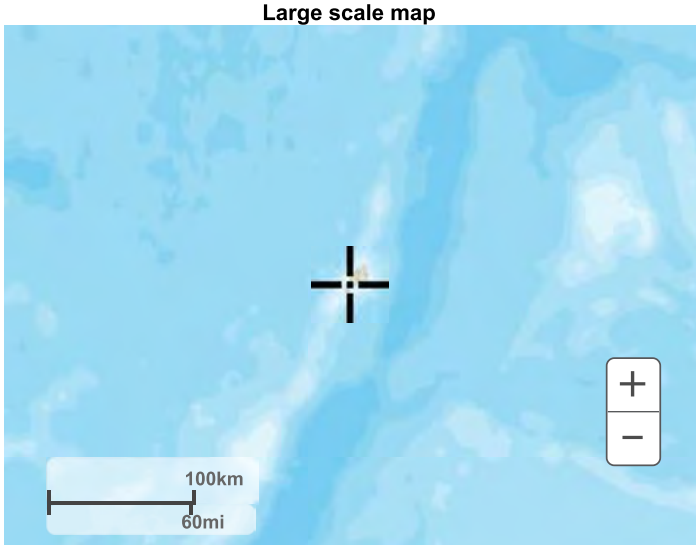
Small scale terrain



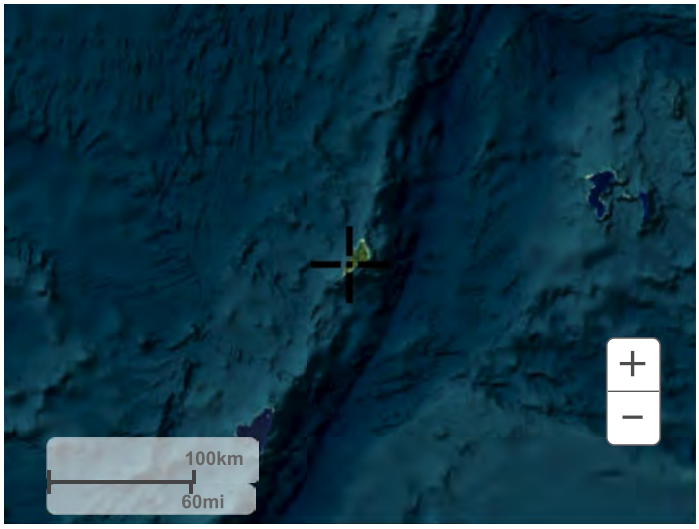
Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Atlas 14, Volume 5, Version 3
Location name: Yap, FSM*
Latitude: 9.4833°, Longitude: 138.0833°
Elevation: 43 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Bingzhang Lin, Deborah Martin, Fenglin Yan, Daniel Brewer, Carl Trypaluk, Michael Yekta, Lillian Hiner, Sarah Heim, Sarah Dietz, Tye Parzybok, Li-Chuan Chen, Kazungu Maitaria, Ruiming Chen, Ishani Roy, Dale Unruh, Tan Zhao, John Yarchoan, G. M. Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.30** (3.13-5.71)	**5.78** (4.21-7.70)	**7.78** (5.63-10.4)	**9.30** (6.70-12.5)	**11.3** (8.08-15.4)	**12.9** (9.08-17.6)	**14.5** (10.1-20.0)	**16.1** (11.0-22.4)	**18.2** (12.1-25.9)	**19.8** (12.9-28.6)
10-min	**3.35** (2.44-4.46)	**4.51** (3.28-6.01)	**6.06** (4.39-8.11)	**7.25** (5.22-9.74)	**8.84** (6.29-12.0)	**10.1** (7.09-13.8)	**11.3** (7.84-15.6)	**12.5** (8.57-17.5)	**14.2** (9.47-20.2)	**15.5** (10.1-22.3)
15-min	**2.86** (2.09-3.81)	**3.86** (2.80-5.14)	**5.18** (3.76-6.94)	**6.20** (4.46-8.33)	**7.56** (5.38-10.2)	**8.60** (6.06-11.8)	**9.65** (6.70-13.3)	**10.7** (7.32-15.0)	**12.1** (8.09-17.2)	**13.2** (8.62-19.1)
30-min	**2.12** (1.54-2.82)	**2.85** (2.07-3.80)	**3.83** (2.78-5.13)	**4.59** (3.30-6.16)	**5.59** (3.98-7.58)	**6.36** (4.48-8.70)	**7.14** (4.96-9.85)	**7.93** (5.42-11.1)	**8.99** (5.99-12.8)	**9.79** (6.38-14.1)
60-min	**1.43** (1.04-1.90)	**1.93** (1.40-2.57)	**2.59** (1.88-3.47)	**3.10** (2.23-4.16)	**3.78** (2.69-5.12)	**4.30** (3.03-5.88)	**4.82** (3.35-6.66)	**5.36** (3.66-7.48)	**6.07** (4.05-8.62)	**6.62** (4.31-9.54)
2-hr	**0.863** (0.629-1.15)	**1.14** (0.831-1.52)	**1.51** (1.10-2.03)	**1.80** (1.30-2.42)	**2.18** (1.55-2.96)	**2.47** (1.74-3.38)	**2.77** (1.92-3.82)	**3.07** (2.10-4.28)	**3.47** (2.31-4.92)	**3.77** (2.46-5.44)
3-hr	**0.666** (0.485-0.887)	**0.871** (0.633-1.16)	**1.14** (0.828-1.53)	**1.35** (0.974-1.82)	**1.63** (1.16-2.21)	**1.85** (1.30-2.52)	**2.06** (1.43-2.85)	**2.28** (1.56-3.18)	**2.58** (1.72-3.66)	**2.80** (1.82-4.04)
6-hr	**0.454** (0.331-0.605)	**0.580** (0.422-0.773)	**0.749** (0.542-1.00)	**0.877** (0.632-1.18)	**1.05** (0.747-1.42)	**1.18** (0.832-1.62)	**1.32** (0.913-1.82)	**1.45** (0.991-2.02)	**1.63** (1.09-2.32)	**1.77** (1.15-2.55)
12-hr	**0.311** (0.226-0.414)	**0.389** (0.283-0.518)	**0.493** (0.357-0.660)	**0.573** (0.412-0.770)	**0.679** (0.483-0.921)	**0.761** (0.536-1.04)	**0.843** (0.585-1.16)	**0.927** (0.633-1.29)	**1.04** (0.692-1.48)	**1.12** (0.733-1.62)
24-hr	**0.202** (0.152-0.260)	**0.248** (0.186-0.319)	**0.309** (0.231-0.399)	**0.355** (0.265-0.461)	**0.417** (0.309-0.546)	**0.465** (0.341-0.612)	**0.513** (0.372-0.681)	**0.562** (0.402-0.753)	**0.628** (0.440-0.853)	**0.678** (0.467-0.932)
2-day	**0.129** (0.097-0.166)	**0.156** (0.117-0.201)	**0.192** (0.144-0.249)	**0.220** (0.164-0.286)	**0.257** (0.190-0.336)	**0.286** (0.209-0.376)	**0.314** (0.228-0.417)	**0.343** (0.246-0.460)	**0.382** (0.268-0.520)	**0.412** (0.284-0.567)
3-day	**0.096** (0.073-0.124)	**0.117** (0.088-0.150)	**0.144** (0.108-0.186)	**0.164** (0.123-0.213)	**0.192** (0.142-0.251)	**0.213** (0.156-0.281)	**0.235** (0.170-0.311)	**0.256** (0.184-0.344)	**0.286** (0.200-0.388)	**0.308** (0.212-0.424)
4-day	**0.080** (0.060-0.103)	**0.097** (0.073-0.125)	**0.119** (0.089-0.154)	**0.137** (0.102-0.177)	**0.160** (0.118-0.209)	**0.177** (0.130-0.233)	**0.195** (0.141-0.259)	**0.213** (0.152-0.285)	**0.237** (0.166-0.322)	**0.256** (0.176-0.352)
7-day	**0.057** (0.043-0.074)	**0.069** (0.052-0.089)	**0.084** (0.063-0.108)	**0.095** (0.071-0.124)	**0.111** (0.082-0.145)	**0.123** (0.090-0.161)	**0.134** (0.097-0.178)	**0.147** (0.105-0.196)	**0.163** (0.114-0.221)	**0.175** (0.121-0.241)
10-day	**0.047** (0.035-0.061)	**0.056** (0.042-0.072)	**0.067** (0.050-0.087)	**0.076** (0.057-0.099)	**0.088** (0.065-0.115)	**0.097** (0.071-0.128)	**0.106** (0.077-0.141)	**0.116** (0.083-0.155)	**0.128** (0.090-0.174)	**0.138** (0.095-0.190)
20-day	**0.034** (0.025-0.043)	**0.039** (0.029-0.051)	**0.047** (0.035-0.061)	**0.053** (0.039-0.068)	**0.060** (0.045-0.079)	**0.066** (0.048-0.087)	**0.072** (0.052-0.096)	**0.078** (0.056-0.105)	**0.086** (0.060-0.118)	**0.093** (0.064-0.128)
30-day	**0.028** (0.021-0.037)	**0.033** (0.025-0.043)	**0.039** (0.029-0.051)	**0.044** (0.032-0.057)	**0.050** (0.037-0.065)	**0.055** (0.040-0.072)	**0.059** (0.043-0.079)	**0.064** (0.046-0.086)	**0.071** (0.049-0.096)	**0.076** (0.052-0.104)
45-day	**0.025** (0.019-0.032)	**0.028** (0.021-0.037)	**0.033** (0.025-0.043)	**0.037** (0.027-0.048)	**0.042** (0.031-0.055)	**0.046** (0.033-0.060)	**0.049** (0.036-0.066)	**0.053** (0.038-0.071)	**0.058** (0.041-0.079)	**0.062** (0.043-0.086)
60-day	**0.023** (0.017-0.030)	**0.026** (0.019-0.033)	**0.030** (0.022-0.038)	**0.033** (0.024-0.042)	**0.036** (0.027-0.048)	**0.039** (0.029-0.052)	**0.042** (0.031-0.056)	**0.045** (0.032-0.061)	**0.049** (0.035-0.067)	**0.053** (0.036-0.072)

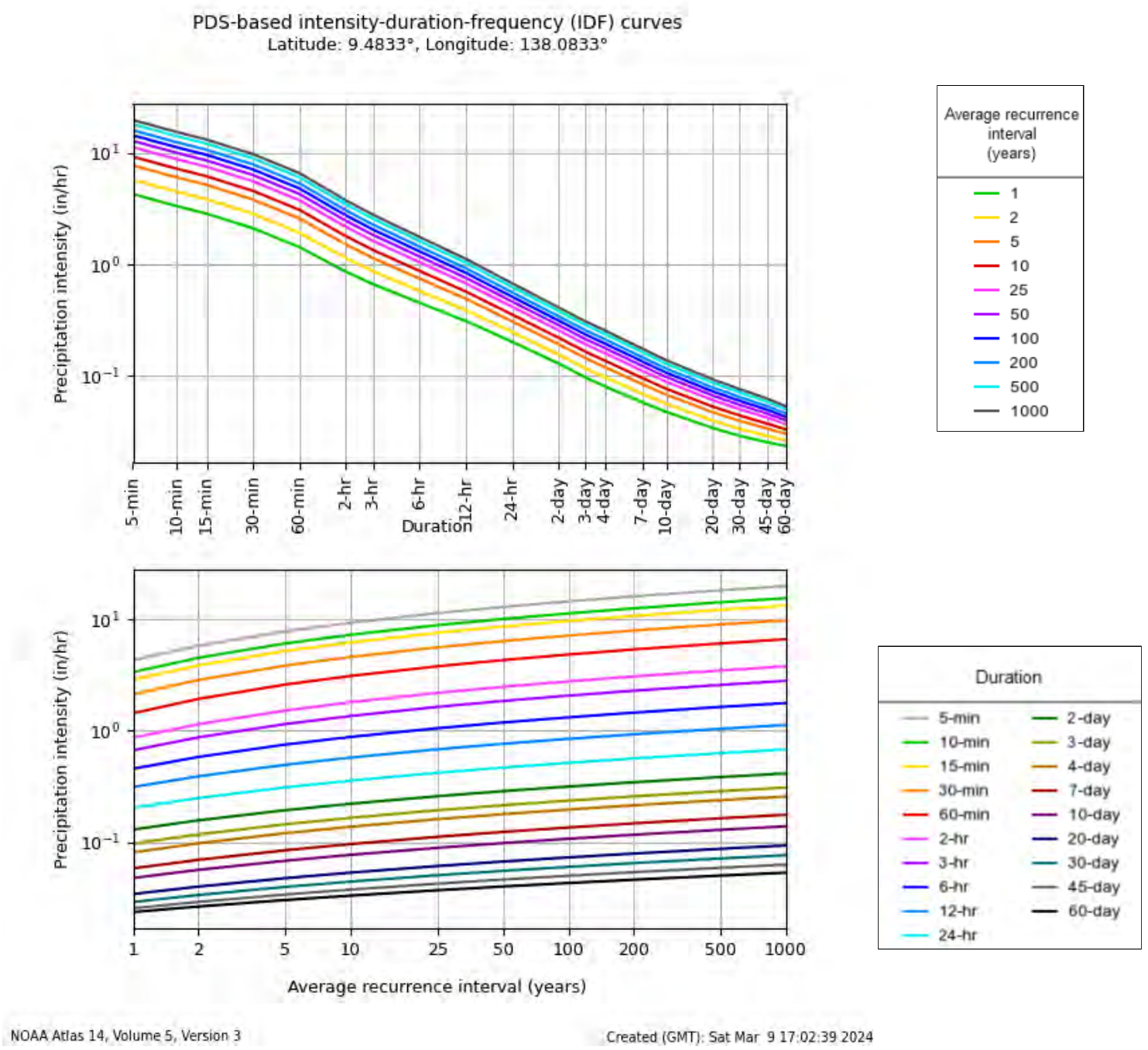
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



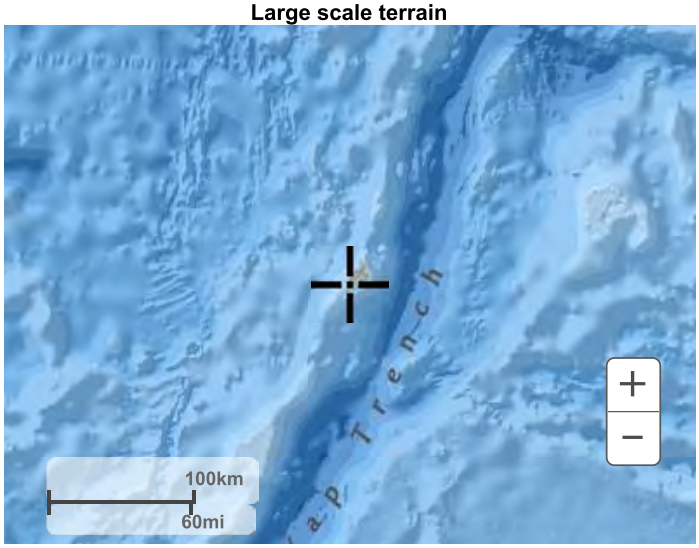
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Maps & aerials

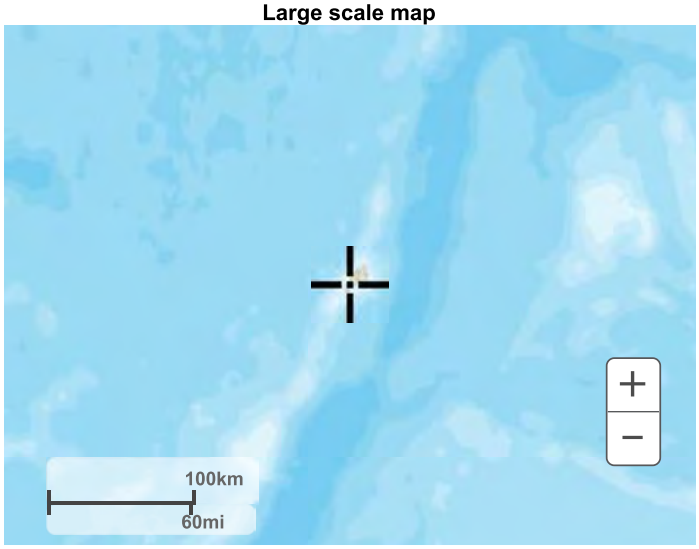
Small scale terrain



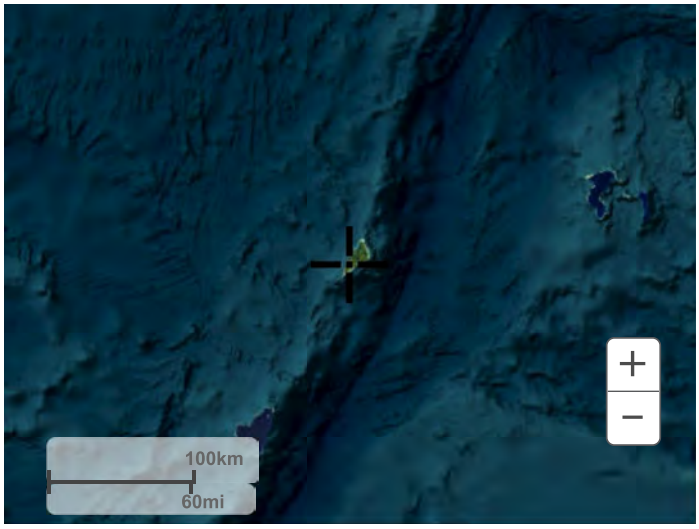
Large scale terrain



Large scale map



Large scale aerial



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Disclaimer

SOILS REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Islands of Yap, Federated States of Micronesia

Yap International Airport



June 26, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

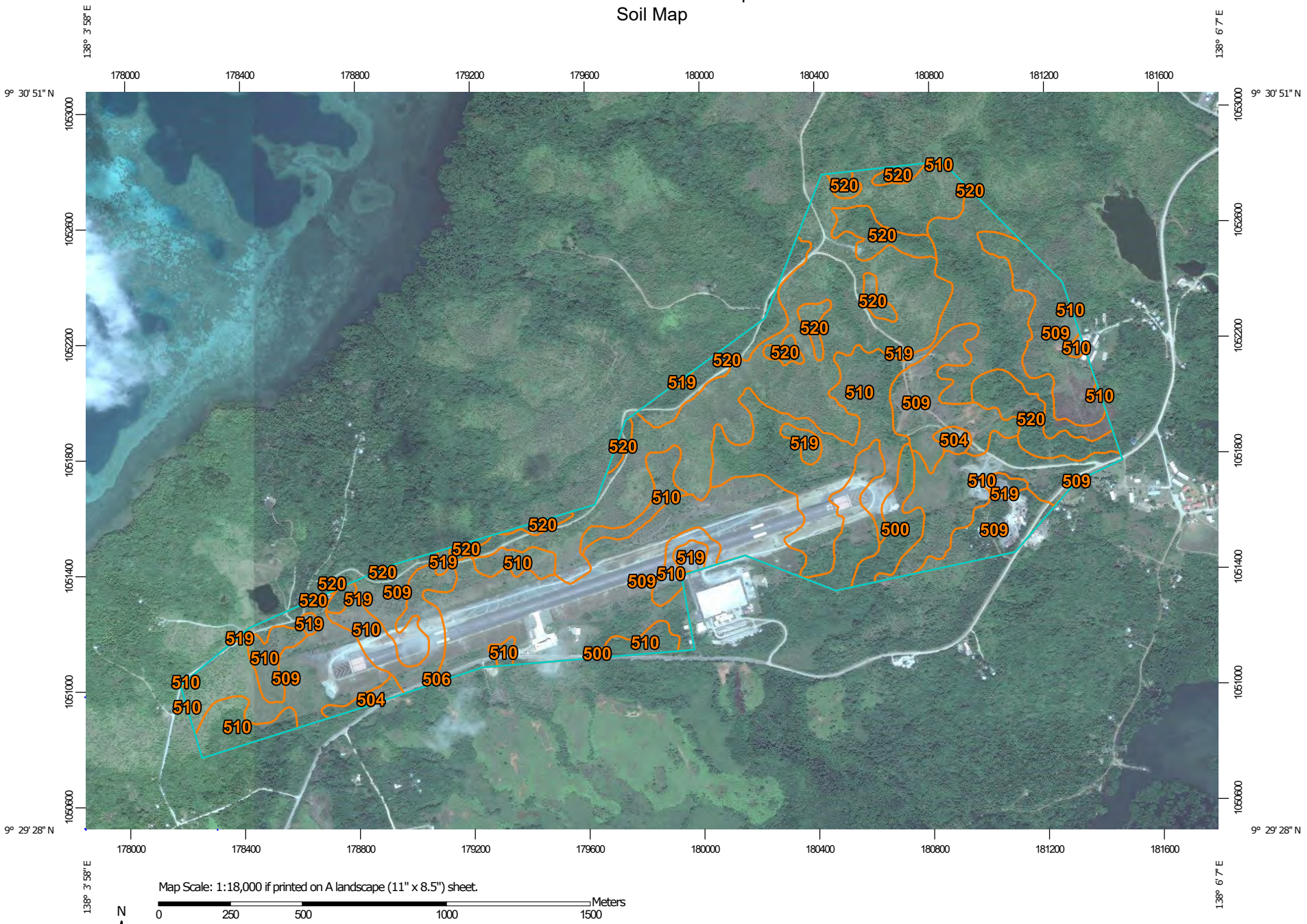
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:18,000 if printed on A landscape (11" x 8.5") sheet.

N

0 250 500 1000 1500 Meters

0 500 1000 2000 3000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 54N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:10,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Islands of Yap, Federated States of Micronesia
Survey Area Data: Version 8, Sep 8, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
500	Dechel mucky silt loam, 0 to 2 percent slopes	11.5	1.9%
504	Gagil silty clay loam, 2 to 6 percent slopes	5.2	0.9%
506	Gagil silty clay loam, 12 to 30 percent slopes	0.2	0.0%
509	Gitam very gravelly silty clay loam, 2 to 6 percent slopes	217.7	35.9%
510	Gitam very gravelly silty clay loam, 6 to 12 percent slopes	186.9	30.8%
519	Rumung-Weloy complex, 12 to 30 percent slopes	134.2	22.1%
520	Rumung-Weloy complex, 30 to 50 percent slopes	51.3	8.5%
Totals for Area of Interest		**607.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit

descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Islands of Yap, Federated States of Micronesia

500—Dechel mucky silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hmcw
Elevation: 0 feet
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Dechel and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dechel

Setting

Landform: Shores
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium

Typical profile

H1 - 0 to 4 inches: mucky silt loam
H2 - 4 to 40 inches: silty clay loam
H3 - 40 to 43 inches: very gravelly silty clay loam
H4 - 43 to 66 inches: silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Frequent
Frequency of ponding: Rare
Available water supply, 0 to 60 inches: High (about 10.2 inches)

504—Gagil silty clay loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: hmd0
Elevation: 0 to 200 feet
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Gagil and similar soils: 95 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gagil

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Tuff breccia

Typical profile

H1 - 0 to 4 inches: silty clay loam
H2 - 4 to 18 inches: silty clay
H3 - 18 to 60 inches: silty clay loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

506—Gagil silty clay loam, 12 to 30 percent slopes

Map Unit Setting

National map unit symbol: hmd2
Elevation: 0 to 200 feet
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Gagil and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gagil

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Tuff breccia

Typical profile

H1 - 0 to 4 inches: silty clay loam
H2 - 4 to 18 inches: silty clay

H3 - 18 to 60 inches: silty clay loam

Properties and qualities

Slope: 12 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

509—Gitam very gravelly silty clay loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: hmd5
Elevation: 20 to 160 feet
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Gitam and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gitam

Setting

Landform: Plains
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Schist

Typical profile

H1 - 0 to 6 inches: very gravelly silty clay loam
H2 - 6 to 14 inches: silty clay
H3 - 14 to 35 inches: silty clay
H4 - 35 to 39 inches: bedrock

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 35 to 35 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None

Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

510—Gitam very gravelly silty clay loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: hmd6
Elevation: 20 to 160 feet
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Gitam and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gitam

Setting

Landform: Plains
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Schist

Typical profile

H1 - 0 to 6 inches: very gravelly silty clay loam
H2 - 6 to 14 inches: silty clay
H3 - 14 to 35 inches: silty clay
H4 - 35 to 39 inches: bedrock

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 35 to 35 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

519—Rumung-Weloy complex, 12 to 30 percent slopes

Map Unit Setting

National map unit symbol: hmdh
Elevation: 0 to 570 feet

Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Rumung and similar soils: 45 percent
Weloy and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rumung

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum from chlorite + talk schist

Typical profile

H1 - 0 to 4 inches: gravelly silt loam
H2 - 4 to 19 inches: extremely gravelly clay
H3 - 19 to 23 inches: bedrock

Properties and qualities

Slope: 12 to 30 percent
Depth to restrictive feature: 19 to 19 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Description of Weloy

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Chlorite and talc schist

Typical profile

H1 - 0 to 13 inches: gravelly silty clay loam
H2 - 13 to 22 inches: very gravelly clay
H3 - 22 to 31 inches: bedrock

Properties and qualities

Slope: 12 to 30 percent
Depth to restrictive feature: 22 to 22 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

520—Rumung-Weloy complex, 30 to 50 percent slopes

Map Unit Setting

National map unit symbol: hmdj
Elevation: 0 to 570 feet
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Rumung and similar soils: 45 percent
Weloy and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rumung

Setting

Landform position (two-dimensional): Summit
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum from chlorite + talk schist

Typical profile

H1 - 0 to 4 inches: gravelly silt loam
H2 - 4 to 19 inches: extremely gravelly clay
H3 - 19 to 23 inches: bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 19 to 19 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Description of Weloy

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, rise
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Chlorite and talc schist

Typical profile

H1 - 0 to 13 inches: gravelly silty clay loam
H2 - 13 to 22 inches: very gravelly clay
H3 - 22 to 31 inches: bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 22 to 22 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (Yap International Airport)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

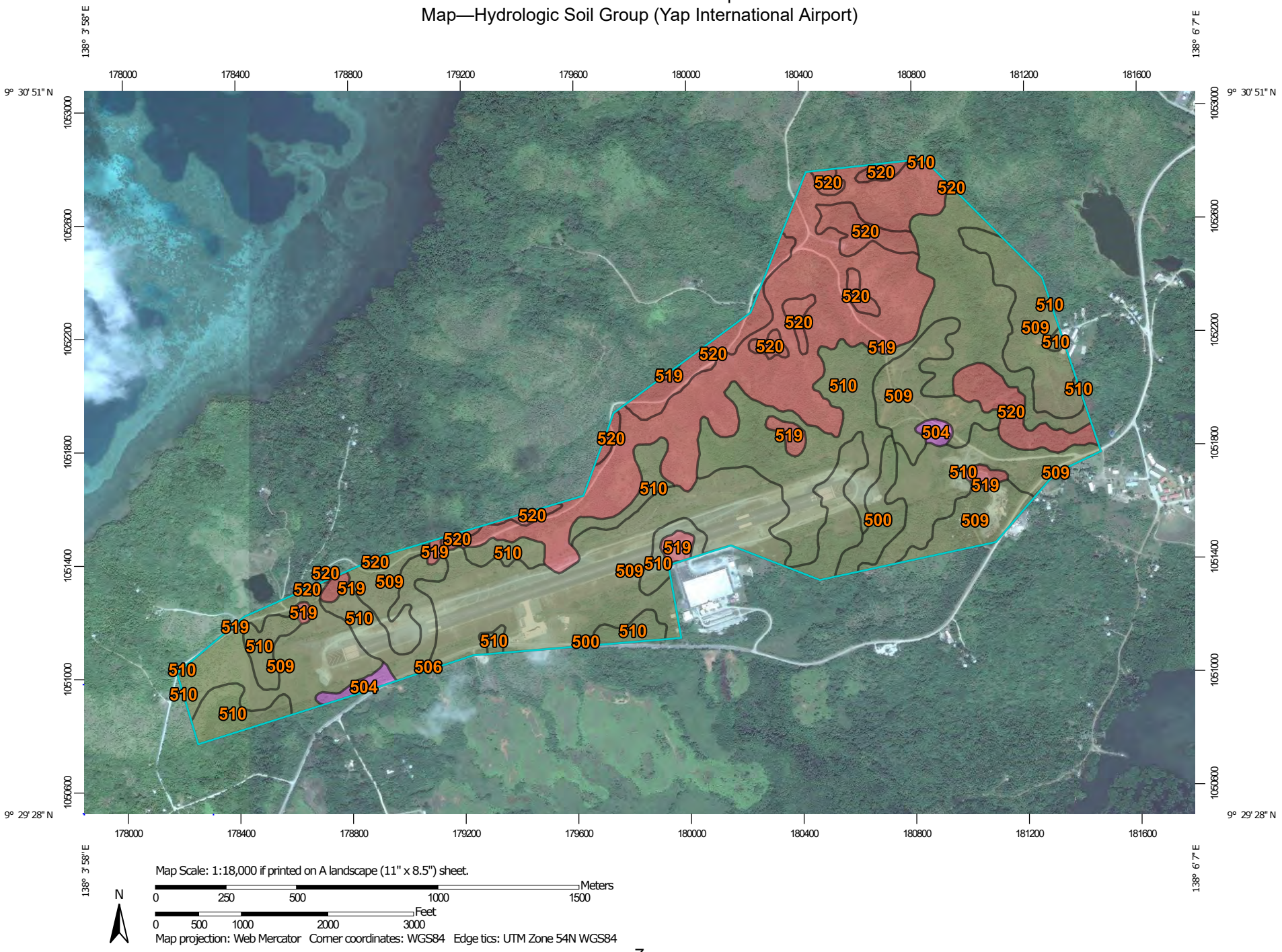
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report
Map—Hydrologic Soil Group (Yap International Airport)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:10,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Islands of Yap, Federated States of Micronesia
Survey Area Data: Version 8, Sep 8, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group (Yap International Airport)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
500	Dechel mucky silt loam, 0 to 2 percent slopes	C/D	11.5	1.9%
504	Gagil silty clay loam, 2 to 6 percent slopes	A	5.2	0.9%
506	Gagil silty clay loam, 12 to 30 percent slopes	A	0.2	0.0%
509	Gitam very gravelly silty clay loam, 2 to 6 percent slopes	C/D	217.7	35.9%
510	Gitam very gravelly silty clay loam, 6 to 12 percent slopes	C/D	186.9	30.8%
519	Rumung-Weloy complex, 12 to 30 percent slopes	D	134.2	22.1%
520	Rumung-Weloy complex, 30 to 50 percent slopes	D	51.3	8.5%
Totals for Area of Interest			**607.0**	**100.0%**

Rating Options—Hydrologic Soil Group (Yap International Airport)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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RATIONAL METHOD CALCULATIONS

CLIN BA01 AWARDED

Composite C Calculations

Project Name	**Yap International Airport - CLIN BA01 Awarded**				Project No.	**D3430615**
Revised Date	**10/20/2025**				Calculated by	**MK/JD**

	C2	C5	C10	C25	C50	C100	Impervious
$C_{Undeveloped}$	**0.01**	**0.05**	**0.15**	**0.33**	**0.40**	**0.49**	2%
C_{Paved}	**0.83**	**0.86**	**0.87**	**0.88**	**0.88**	**0.89**	100%
C_{Gravel}	**0.30**	**0.36**	**0.43**	**0.54**	**0.59**	**0.65**	40%

Basin Designation	$A_{Undeveloped}$ (ft^2)	A_{Paved} (ft^2)	A_{Gravel} (ft^2)	A_{total} (ft^2)	A_{total} (acres)	Impervious %	C_{Ave} 02 yr	C_{Ave} 05 yr	C_{Ave} 10 yr	C_{Ave} 25 yr	C_{Ave} 50 yr	C_{Ave} 100 yr
A-1-1	328364	29520	0	357884	8.22	10.08%	0.08	0.12	0.21	0.38	0.44	0.53
A-1-2	371521	43024	0	414545	9.52	12.17%	0.10	0.13	0.22	0.39	0.45	0.53
A-1-3	43071	0	0	43071	0.99	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-2-3	596437	120059	0	716496	16.45	18.42%	0.15	0.19	0.27	0.42	0.48	0.56
A-2-4	244311	192929	0	437240	10.04	45.24%	0.37	0.41	0.47	0.57	0.61	0.67
A-2-5	216812	221532	0	438344	10.06	51.53%	0.42	0.46	0.51	0.61	0.65	0.70
A-3-4	170172	50154	0	220326	5.06	24.31%	0.20	0.23	0.31	0.46	0.51	0.58
A-3-5	430948	90846	0	521794	11.98	19.06%	0.15	0.19	0.27	0.43	0.49	0.56
A-3-7	299045	216465	0	515510	11.83	43.15%	0.35	0.39	0.45	0.56	0.60	0.66
A-3-8	264619	51894	0	316513	7.27	18.07%	0.14	0.18	0.27	0.42	0.48	0.56
A-3-9	163844	160673	0	324517	7.45	50.52%	0.42	0.45	0.51	0.60	0.64	0.69
A-3-10	87326	20448	0	107774	2.47	20.59%	0.17	0.20	0.28	0.43	0.49	0.57
A-3-11	138902	137662	0	276564	6.35	50.78%	0.42	0.45	0.51	0.60	0.64	0.69
A-3-12	141539	48235	0	189774	4.36	26.91%	0.22	0.26	0.33	0.47	0.52	0.59
A-3-13	129383	88065	0	217448	4.99	41.69%	0.34	0.38	0.44	0.55	0.60	0.65
A-3-14	205637	144986	0	350623	8.05	42.52%	0.35	0.38	0.45	0.56	0.60	0.66
A-3-15	19092	8349	0	27441	0.63	31.82%	0.26	0.30	0.37	0.50	0.55	0.61
A-3-16	572697	0	0	572697	13.15	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-3-17	107811	54077	0	161888	3.72	34.74%	0.28	0.32	0.39	0.51	0.56	0.63
A-3-18	177408	96593	0	274001	6.29	36.55%	0.30	0.33	0.40	0.52	0.57	0.63
A-4-1	1370081	0	0	1370081	31.45	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-4-2	565721	0	0	565721	12.99	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-4-12	160103	130487	0	290590	6.67	46.01%	0.38	0.41	0.47	0.58	0.62	0.67
A-4-13	249366	90746	0	340112	7.81	28.15%	0.23	0.27	0.34	0.48	0.53	0.60
A-4-14	66008	59956	0	125964	2.89	48.65%	0.40	0.43	0.49	0.59	0.63	0.68
A-4-15	92794	113006	0	205800	4.72	55.81%	0.46	0.49	0.55	0.63	0.67	0.71
A-4-16	57734	34938	0	92672	2.13	38.95%	0.32	0.35	0.42	0.54	0.58	0.64
A-4-17	267726	0	0	267726	6.15	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-4-18	258074	77256	0	335330	7.70	24.58%	0.20	0.24	0.31	0.46	0.51	0.58
A-5-1	1055237	16832	0	1072069	24.61	3.54%	0.02	0.06	0.16	0.34	0.41	0.50
A-5-2	257751	6544	0	264295	6.07	4.43%	0.03	0.07	0.16	0.34	0.41	0.50
A-5-16	36433	12841	0	49274	1.13	27.54%	0.22	0.26	0.34	0.47	0.53	0.60
A-5-17	96848	231297	0	328145	7.53	71.08%	0.59	0.62	0.66	0.72	0.74	0.78
A-5-18	537831	136998	0	674829	15.49	21.90%	0.18	0.21	0.29	0.44	0.50	0.57
A-5-19	107193	296756	0	403949	9.27	73.99%	0.61	0.64	0.68	0.73	0.76	0.79
A-5-20	80780	217679	0	298459	6.85	73.48%	0.61	0.64	0.68	0.73	0.75	0.79
A-5-21	8466	8471	0	16937	0.39	51.01%	0.42	0.45	0.51	0.60	0.64	0.69
A-5-22	174776	0	0	174776	4.01	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-5-23	65047	0	0	65047	1.49	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-5-24	179523	29009	0	208532	4.79	15.63%	0.12	0.16	0.25	0.41	0.47	0.55
A-5-25	16565	0	0	16565	0.38	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-6-1	3488119	19605	0	3507724	80.53	2.55%	0.01	0.06	0.15	0.33	0.41	0.49
A-6-2	53058	0	0	53058	1.22	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-6-3	21968	7856	0	29824	0.68	27.81%	0.23	0.26	0.34	0.47	0.53	0.60
A-6-4	10237	0	0	10237	0.24	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-6-5	68404	10857	0	79261	1.82	15.42%	0.12	0.16	0.25	0.41	0.47	0.55
A-7-1	424736	349809	0	774545	17.78	46.26%	0.38	0.41	0.47	0.58	0.62	0.67
A-O2A	388199	158346	0	546545	12.55	30.39%	0.25	0.28	0.36	0.49	0.54	0.61
A-O3P	417111	39723	0	456834	10.49	10.52%	0.08	0.12	0.21	0.38	0.44	0.53
A-O4P	197069	0	0	197069	4.52	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-O5P	235411	0	0	235411	5.40	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-O6P	743992	86878	0	830870	19.07	12.25%	0.10	0.14	0.22	0.39	0.45	0.53
A-O6AP	565830	79616	0	645446	14.82	14.09%	0.11	0.15	0.24	0.40	0.46	0.54
A-1-1s	33144	7912	0	41056	0.94	20.89%	0.17	0.21	0.29	0.44	0.50	0.57
A-4-1s	125114	0	0	125114	2.87	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-4-13s	131701	68523	0	200224	4.60	35.54%	0.29	0.33	0.39	0.52	0.57	0.63
A-4-18s	211622	77256	0	288878	6.63	28.21%	0.23	0.27	0.34	0.48	0.53	0.60
A-6-1s1	305522	18170	0	323692	7.43	7.50%	0.06	0.10	0.19	0.36	0.43	0.51
A-6-1s2	45106	484	0	45590	1.05	3.04%	0.02	0.06	0.15	0.34	0.41	0.50
A-6-1s3	87112	0	0	87112	2.00	2.00%	0.01	0.05	0.15	0.33	0.40	0.49
A-7-1s1	348347	316154	0	664501	15.25	48.63%	0.40	0.43	0.49	0.59	0.63	0.68
A-7-1s2	82494	27548	0	110042	2.53	26.53%	0.22	0.25	0.33	0.47	0.52	0.59
A-O6P-s1	88029	10284	0	98313	2.26	12.25%	0.10	0.14	0.22	0.39	0.45	0.53
A-O6P-s2	365947	38697	0	404644	9.29	11.37%	0.09	0.13	0.22	0.38	0.45	0.53
A-O6AP-s	135631	26254	0	161885	3.72	17.89%	0.14	0.18	0.26	0.42	0.48	0.56

Note: Basins with the suffix "s" are sub-basins of the basin identified in their prefix.

Time of Concentration

Project Name **Yap International Airport - CLIN BA01 Awarded**
Revised Date **10/20/2025**

Project No. **D3430615**
Calculated by **MK/JD**

$t_i = 0.395(1.1 - C_5)L_i^{1/2} / S_i^{1/3}$

$t_t = Lt/(60Vt)$

Regional $t_c = (26\text{-}17i) + Lt / (60*(14i + 9)*St^{1/2})$

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

SUB-BASIN DATA			OVERLAND (INITIAL) FLOW TIME (t_i)					CHANNELIZED (TRAVEL) FLOW TIME (t_t)								$t_i + t_t$	First Design Point t_c in Urban Catchments	FINAL t_c USED
Basin Designation	Area	C_{Ave}	Overland Flow Length, Li	U/S Elevation (Optional)	D/S Elevation (Optional)	Overland Flow Slope, Si	Overland Flow Time, t_i	Channelized Flow Length, Lt	U/S Elevation (Optional)	D/S Elevation (Optional)	Channelized Flow Slope, St	Type of Land Surface	NRCS Conveyance Factor K	Channelized Flow Velocity, Vt	Channelized Flow Time, t_t	Computed t_c	Regional t_c	t_c
	(acres)	05 yr	(ft)	(ft)	(ft)	(ft/ft)	(min)	(ft)	(ft)	(ft)	(ft/ft)			(ft/sec)	(min)	(min)	(min)	(min)
A-1-1	8.22	0.12	300	111.0	98.0	0.043	19.13	445	98.0	87.1	0.024	Short pastures and lawns	7	1.10	6.77	25.90	28.84	**25.9**
A-1-2	9.52	0.13	300	111.0	98.0	0.043	18.80	817	*	*	0.008	Grassed waterway	15	1.37	9.96	28.76	37.89	**28.8**
A-1-3	0.99	0.05	240	89.0	49.5	0.165	11.71	160	49.5	38.0	0.072	Short pastures and lawns	7	1.88	1.42	13.13	26.73	**13.1**
A-2-3	16.45	0.19	132	135.2	123.7	0.087	9.36	2074	*	*	0.006	Paved areas and shallow paved swales	20	1.50	23.10	32.45	62.76	**32.5**
A-2-4	10.04	0.41	109	87.5	85.0	0.023	10.07	990	85.0	81.8	0.003	Grassed waterway	15	0.85	19.35	29.42	37.24	**29.4**
A-2-5	10.06	0.46	154	91.4	87.6	0.025	10.82	816	87.6	85.0	0.003	Grassed waterway	15	0.85	16.06	26.88	32.10	**26.9**
A-3-4	5.06	0.23	81	137.4	128.4	0.111	6.40	778	*	*	0.011	Paved areas and shallow paved swales	20	2.11	6.15	12.56	31.79	**12.6**
A-3-5	11.98	0.19	300	132.5	108.9	0.079	14.51	1333	*	*	0.006	Paved areas and shallow paved swales	20	1.48	14.98	29.49	48.43	**29.5**
A-3-7	11.83	0.39	160	81.9	78.6	0.021	12.96	438	78.6	77.1	0.003	Grassed waterway	15	0.88	8.32	21.27	26.96	**21.3**
A-3-8	7.27	0.18	212	198.0	162.0	0.170	9.52	770	*	*	0.023	Paved areas and shallow paved swales	20	3.01	4.26	13.78	30.32	**13.8**
A-3-9	7.45	0.45	177	84.5	80.0	0.025	11.63	621	80.0	79.0	0.002	Grassed waterway	15	0.60	17.19	28.82	33.46	**28.8**
A-3-10	2.47	0.20	321	178.5	141.5	0.115	13.03	487	*	*	0.033	Paved areas and shallow paved swales	20	3.61	2.25	15.28	26.29	**15.3**
A-3-11	6.35	0.45	160	86.1	82.8	0.021	11.82	503	82.8	81.6	0.002	Grassed waterway	15	0.73	11.44	23.26	28.02	**23.3**
A-3-12	4.36	0.26	59	102.7	83.3	0.329	3.71	421	83.3	82.5	0.002	Paved areas and shallow paved swales	20	0.87	8.05	11.76	34.03	**11.8**
A-3-13	4.99	0.38	155	86.7	83.7	0.019	13.25	523	83.7	82.8	0.002	Grassed waterway	15	0.62	14.01	27.25	33.08	**27.3**
A-3-14	8.05	0.38	160	84.8	81.2	0.023	12.68	792	81.2	78.7	0.003	Grassed waterway	15	0.84	15.66	28.34	34.48	**28.3**
A-3-15	0.63	0.30	106	115.0	81.8	0.313	4.82	134	81.8	81.5	0.002	Paved areas and shallow paved swales	20	0.95	2.36	7.18	24.10	**7.2**
A-3-16	13.15	0.05	300	208.7	177.9	0.103	15.32	932	177.9	112.0	0.071	Heavy Meadow	3	0.66	23.37	38.69	31.95	**32.0**
A-3-17	3.72	0.32	277	83.4	73.8	0.035	15.73	654	73.8	38.0	0.055	Grassed waterway	15	3.51	3.11	18.84	23.46	**18.8**
A-3-18	6.29	0.33	251	83.7	76.2	0.030	15.43	742	76.2	38.0	0.051	Short pastures and lawns	7	1.59	7.79	23.22	23.65	**23.2**
A-4-1	31.45	0.05	300	264.2	192.8	0.238	11.58	1480	192.8	60.0	0.090	Heavy Meadow	3	0.75	32.94	44.51	34.53	**34.5**
A-4-2	12.99	0.05	300	208.3	177.2	0.104	15.27	1358	177.2	67.2	0.081	Heavy Meadow	3	0.71	31.81	47.08	34.23	**34.2**
A-4-12	6.67	0.41	110	86.4	84.5	0.017	11.02	517	84.5	83.4	0.002	Grassed waterway	15	0.69	12.45	23.48	30.28	**23.5**
A-4-13	7.81	0.27	300	89.4	82.4	0.023	19.97	853	*	*	0.021	Grassed waterway	15	2.18	6.52	26.50	28.78	**26.5**
A-4-14	2.89	0.43	290	93.6	87.5	0.021	16.23	646	87.5	84.3	0.005	Paved areas and shallow paved swales	20	1.41	7.65	23.88	27.41	**23.9**
A-4-15	4.72	0.49	225	90.3	87.1	0.014	14.85	464	87.1	84.4	0.006	Paved areas and shallow paved swales	20	1.53	5.07	19.92	22.54	**19.9**
A-4-16	2.13	0.35	189	136.9	101.0	0.190	7.04	335	*	*	0.009	Paved areas and shallow paved swales	20	1.85	3.01	10.05	23.54	**10.1**
A-4-17	6.15	0.05	300	170.0	134.0	0.120	14.54	534	134.0	84.0	0.094	Heavy Meadow	3	0.76	11.63	26.18	28.79	**26.2**
A-4-18	7.70	0.24	248	90.4	84.0	0.026	18.18	988	*	*	0.019	Grassed waterway	15	2.06	7.99	26.16	31.45	**26.2**
A-5-1	24.61	0.06	300	258.0	207.7	0.168	12.85	1119	207.7	118.4	0.080	Heavy Meadow	3	0.71	26.41	39.26	32.35	**32.4**
A-5-2	6.07	0.07	300	260.0	181.0	0.263	10.98	613	181.0	113.0	0.111	Heavy Meadow	3	0.83	12.27	23.25	28.44	**23.3**
A-5-16	1.13	0.26	260	126.0	88.3	0.145	10.17	55	88.3	87.8	0.009	Paved areas and shallow paved swales	20	1.91	0.48	10.65	22.07	**10.7**
A-5-17	7.53	0.62	154	89.5	85.7	0.025	8.12	398	85.7	84.8	0.002	Grassed waterway	15	0.71	9.30	17.42	21.28	**17.4**
A-5-18	15.49	0.21	149	88.4	86.9	0.010	19.77	1352	86.9	85.2	0.001	Grassed waterway	15	0.53	42.36	62.14	74.95	**62.1**
A-5-19	9.27	0.64	300	93.6	90.6	0.010	14.55	503	90.6	84.5	0.012	Grassed waterway	15	1.65	5.08	19.63	17.35	**17.4**
A-5-20	6.85	0.64	154	89.8	86.2	0.023	7.93	237	86.2	85.7	0.002	Grassed waterway	15	0.69	5.73	13.66	17.97	**13.7**
A-5-21	0.39	0.45	80	132.2	127.9	0.054	6.05	138	127.9	123.8	0.030	Paved areas and shallow paved swales	20	3.45	0.67	6.72	18.15	**6.7**
A-5-22	4.01	0.05	300	133.2	96.0	0.124	14.39	215	96.0	62.5	0.156	Heavy Meadow	3	0.99	3.63	18.02	26.64	**18.0**
A-5-23	1.49	0.05	300	124.1	97.4	0.089	16.07	349	97.4	61.0	0.104	Heavy Meadow	3	0.81	7.20	23.27	27.60	**23.3**
A-5-24	4.79	0.16	165	164.0	141.0	0.139	9.17	508	*	*	0.085	Grassed waterway	15	4.37	1.94	11.10	25.94	**11.1**
A-5-25	0.38	0.05	114	85.5	68.0	0.154	8.26	138	68.0	56.0	0.087	Grassed waterway	15	4.42	0.52	8.78	26.50	**8.8**
A-6-1	80.53	0.06	300	186.3	120.8	0.218	11.86	1893	120.8	49.0	0.038	Heavy Meadow	3	0.49	64.80	76.66	42.88	**42.9**
A-6-2	1.22	0.05	37	76.3	70.0	0.170	4.55	552	70.0	22.1	0.087	Grassed waterway	15	4.42	2.08	6.63	29.03	**6.6**
A-6-3	0.68	0.26	24	62.4	61.8	0.025	5.54	478	61.8	21.6	0.084	Grassed waterway	15	4.35	1.83	7.37	23.40	**7.4**
A-6-4	0.24	0.05	109	53.5	36.5	0.156	8.03	67	36.5	19.8	0.249	Short pastures and lawns	7	3.49	0.32	8.35	25.90	**8.4**
A-6-5	1.82	0.16	276	116.0	92.0	0.087	13.90	303	92.0	63.0	0.096	Short pastures and lawns	7	2.17	2.33	16.23	24.84	**16.2**
A-7-1	17.78	0.41	300	187.3	139.7	0.159	8.67	1475	*	*	0.010	Paved areas and shallow paved swales	20	1.99	12.35	21.02	34.10	**21.0**
A-O2A	12.55	0.28	156	91.5	88.3	0.021	14.70	1586	88.3	81.5	0.004	Grassed waterway	15	0.98	26.91	41.62	51.29	**41.6**
A-O3P	10.49	0.12	259	86.1	77.2	0.034	19.14	997	77.2	26.2	0.051	Short pastures and lawns	7	1.58	10.50	29.63	31.23	**29.6**
A-O4P	4.52	0.05	300	84.9	61.2	0.079	16.72	370	61.2	16.0	0.122	Short pastures and lawns	7	2.45	2.52	19.24	27.56	**19.2**
A-O5P	5.40	0.05	300	127.9	93.7	0.114	14.80	627	93.7	47.0	0.075	Heavy Meadow	3	0.68	15.31	30.11	29.78	**29.8**
A-O6P	19.07	0.14	300	99.3	83.8	0.052	17.72	702	83.8	67.9	0.023	Short pastures and lawns	7	1.05	11.11	28.82	31.17	**28.8**
A-O6AP	14.82	0.15	300	141.8	133.5	0.028	21.48	958	133.5	48.2	0.089	Short pastures and lawns	7	2.09	7.64	29.12	28.48	**28.5**
A-1-1s	0.94	0.21	121	123.9	89.8	0.282	5.92	324	89.8	87.1	0.008	Paved areas and shallow paved swales	20	1.83	2.95	8.87	27.39	**8.9**
A-4-1s	2.87	0.05	300	134.0	92.0	0.140	13.82	286	92.0	59.1	0.115	Heavy Meadow	3	0.85	5.62	19.44	27.17	**19.4**
A-4-13s	4.60	0.33	300	89.4	82.4	0.023	18.52	627	82.4	70.7	0.019	Paved areas and shallow paved swales	20	2.73	3.82	22.35	25.43	**22.3**
A-4-18s	6.63	0.27	248	90.4	84.0	0.026	17.55	704	84.0	80.4	0.005	Grassed waterway	15	1.07	10.94	28.49	33.88	**28.5**
A-6-1s1	7.43	0.10	300	213.4	153.7	0.199	11.76	1024	153.7	50.0	0.101	Heavy Meadow	3	0.80	21.45	33.21	30.06	**30.1**
A-6-1s2	1.05	0.06	88	95.0	84.0	0.125	7.71	407	84.0	49.6	0.085	Grassed waterway	15	4.36	1.56	9.26	27.96	**9.3**
A-6-1s3	2.00	0.05	161	105.0	90.8	0.088	11.81	498	90.8	51.0	0.080	Heavy Meadow	3	0.71	11.74	23.55	28.82	**23.6**
A-7-1s1	15.25	0.43	300	187.3	139.7	0.159	8.42	1475	*	*	0.010	Paved areas and shallow paved swales	20	2.00	12.29	20.71	33.29	**20.7**
A-7-1s2	2.53	0.25	300	122.0	106.0	0.053	15.40	356	106.0	87.0	0.053	Paved areas and shallow paved swales	20	4.62	1.28	16.69	23.51	**16.7**
A-O6P-s1	2.26	0.14	300	93.9	85.3	0.029	21.56	90	85.3	68.5	0.187	Grassed waterway	15	6.48	0.23	21.79	24.24	**21.8**
A-O6P-s2	9.29	0.13	300	86.3	80.0	0.021	24.10	582	80.0	68.6	0.020	Grassed waterway	15	2.10	4.62	28.72	30.61	**28.7**
A-O6AP-s	3.72	0.18	300	87.7	82.3	0.018	23.97	269	82.3	48.5	0.126	Short pastures and lawns	7	2.48	1.81	25.78	24.06	**24.1**

Notes:

1. "*" Denotes rows where channelized flow lengths and slopes are computed in the Basin Tc Slope Weighting spreadsheet to average the slope along multiple channelized flow segments.

2. Basins with the suffix "s" are sub-basins of the basin identified in their prefix.

Runoff Calculations

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No. **D3430615**
Revised Date **10/20/2025** Calculated by **MK/JD**

Basin	Area (ac.)	C	t_c (min)	intensity (in/hr)	Q (cfs)	Storm Event
A-1-1	8.22	0.08	25.9	3.13	2.00	2-Year
		0.12		4.20	4.06	5-Year
		0.21		5.03	8.54	10-year
		0.44		6.97	25.34	50-Year
		0.53		7.83	33.78	100-Year
A-1-2	9.52	0.10	28.8	2.93	2.66	2-Year
		0.13		3.94	5.06	5-Year
		0.22		4.72	9.98	10-year
		0.45		6.54	28.19	50-Year
		0.53		7.35	37.33	100-Year
A-1-3	0.99	0.01	13.1	4.10	0.04	2-Year
		0.05		5.51	0.28	5-Year
		0.15		6.59	0.96	10-year
		0.40		9.16	3.65	50-Year
		0.49		10.27	5.00	100-Year
A-2-3	16.45	0.15	32.5	2.77	6.74	2-Year
		0.19		3.73	11.41	5-Year
		0.27		4.47	19.72	10-year
		0.48		6.19	49.22	50-Year
		0.56		6.95	63.97	100-Year
A-2-4	10.04	0.37	29.4	2.89	10.79	2-Year
		0.41		3.88	15.82	5-Year
		0.47		4.65	21.80	10-year
		0.61		6.45	39.77	50-Year
		0.67		7.24	48.63	100-Year
A-2-5	10.06	0.42	26.9	3.06	13.07	2-Year
		0.46		4.11	18.93	5-Year
		0.51		4.92	25.44	10-year
		0.65		6.83	44.34	50-Year
		0.70		7.66	53.61	100-Year
A-3-4	5.06	0.20	12.6	4.18	4.16	2-Year
		0.23		5.61	6.65	5-Year
		0.31		6.71	10.59	10-year
		0.51		9.33	24.18	50-Year
		0.58		10.46	30.87	100-Year
A-3-5	11.98	0.15	29.5	2.88	5.29	2-Year
		0.19		3.88	8.88	5-Year
		0.27		4.64	15.19	10-year
		0.49		6.44	37.50	50-Year
		0.56		7.23	48.66	100-Year
A-3-7	11.83	0.35	21.3	3.44	14.42	2-Year
		0.39		4.62	21.24	5-Year
		0.45		5.53	29.52	10-year
		0.60		7.66	54.82	50-Year
		0.66		8.60	67.27	100-Year

Runoff Calculations

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No. **D3430615**
Revised Date **10/20/2025** Calculated by **MK/JD**

Basin	Area (ac.)	C	t_c (min)	intensity (in/hr)	Q (cfs)	Storm Event
A-3-8	7.27	0.14	13.8	4.02	4.22	2-Year
		0.18		5.39	7.18	5-Year
		0.27		6.46	12.46	10-year
		0.48		8.97	31.37	50-Year
		0.56		10.05	40.76	100-Year
A-3-9	7.45	0.42	28.8	2.93	9.08	2-Year
		0.45		3.94	13.17	5-Year
		0.51		4.72	17.77	10-year
		0.64		6.54	31.19	50-Year
		0.69		7.34	37.78	100-Year
A-3-10	2.47	0.17	15.3	3.84	1.58	2-Year
		0.20		5.15	2.60	5-Year
		0.28		6.17	4.34	10-year
		0.49		8.56	10.46	50-Year
		0.57		9.60	13.51	100-Year
A-3-11	6.35	0.42	23.3	3.30	8.77	2-Year
		0.45		4.44	12.72	5-Year
		0.51		5.31	17.13	10-year
		0.64		7.37	30.02	50-Year
		0.69		8.27	36.34	100-Year
A-3-12	4.36	0.22	11.8	4.28	4.08	2-Year
		0.26		5.75	6.40	5-Year
		0.33		6.88	9.93	10-year
		0.52		9.57	21.89	50-Year
		0.59		10.72	27.75	100-Year
A-3-13	4.99	0.34	27.3	3.03	5.19	2-Year
		0.38		4.08	7.67	5-Year
		0.44		4.88	10.74	10-year
		0.60		6.77	20.19	50-Year
		0.65		7.60	24.85	100-Year
A-3-14	8.05	0.35	28.3	2.96	8.33	2-Year
		0.38		3.98	12.29	5-Year
		0.45		4.77	17.14	10-year
		0.60		6.61	31.99	50-Year
		0.66		7.42	39.31	100-Year
A-3-15	0.63	0.26	7.2	5.23	0.86	2-Year
		0.30		7.03	1.31	5-Year
		0.37		8.41	1.95	10-year
		0.55		11.68	4.04	50-Year
		0.61		13.11	5.07	100-Year
A-3-16	13.15	0.01	32.0	2.79	0.38	2-Year
		0.05		3.75	2.53	5-Year
		0.15		4.49	8.67	10-year
		0.40		6.23	32.97	50-Year
		0.49		6.99	45.23	100-Year

Runoff Calculations

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No. **D3430615**
Revised Date **10/20/2025** Calculated by **MK/JD**

Basin	Area (ac.)	C	t_c (min)	intensity (in/hr)	Q (cfs)	Storm Event
A-3-17	3.72	0.28	18.8	3.60	3.80	2-Year
		0.32		4.83	5.75	5-Year
		0.39		5.79	8.37	10-year
		0.56		8.03	16.80	50-Year
		0.63		9.01	20.97	100-Year
A-3-18	6.29	0.30	23.2	3.31	6.22	2-Year
		0.33		4.44	9.35	5-Year
		0.40		5.32	13.46	10-year
		0.57		7.37	26.53	50-Year
		0.63		8.27	32.99	100-Year
A-4-1	31.45	0.01	34.5	2.71	0.88	2-Year
		0.05		3.64	5.89	5-Year
		0.15		4.36	20.15	10-year
		0.40		6.05	76.63	50-Year
		0.49		6.79	105.11	100-Year
A-4-2	12.99	0.01	34.2	2.72	0.36	2-Year
		0.05		3.66	2.44	5-Year
		0.15		4.38	8.35	10-year
		0.40		6.07	31.75	50-Year
		0.49		6.81	43.55	100-Year
A-4-12	6.67	0.38	23.5	3.29	8.30	2-Year
		0.41		4.42	12.15	5-Year
		0.47		5.29	16.67	10-year
		0.62		7.33	30.26	50-Year
		0.67		8.23	36.94	100-Year
A-4-13	7.81	0.23	26.5	3.09	5.52	2-Year
		0.27		4.15	8.60	5-Year
		0.34		4.97	13.19	10-year
		0.53		6.88	28.53	50-Year
		0.60		7.73	36.16	100-Year
A-4-14	2.89	0.40	23.9	3.26	3.78	2-Year
		0.43		4.38	5.50	5-Year
		0.49		5.25	7.46	10-year
		0.63		7.27	13.28	50-Year
		0.68		8.16	16.13	100-Year
A-4-15	4.72	0.46	19.9	3.53	7.68	2-Year
		0.49		4.74	11.03	5-Year
		0.55		5.67	14.60	10-year
		0.67		7.87	24.77	50-Year
		0.71		8.83	29.73	100-Year
A-4-16	2.13	0.32	10.1	4.50	3.06	2-Year
		0.35		6.05	4.56	5-Year
		0.42		7.24	6.47	10-year
		0.58		10.08	12.52	50-Year
		0.64		11.28	15.45	100-Year

Runoff Calculations

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No. **D3430615**
Revised Date **10/20/2025** Calculated by **MK/JD**

Basin	Area (ac.)	C	t_c (min)	intensity (in/hr)	Q (cfs)	Storm Event
A-4-17	6.15	0.01	26.2	3.11	0.20	2-Year
		0.05		4.17	1.32	5-Year
		0.15		5.00	4.51	10-year
		0.40		6.93	17.16	50-Year
		0.49		7.78	23.53	100-Year
A-4-18	7.70	0.20	26.2	3.11	4.77	2-Year
		0.24		4.18	7.60	5-Year
		0.31		5.00	12.09	10-year
		0.51		6.93	27.40	50-Year
		0.58		7.78	35.03	100-Year
A-5-1	24.61	0.02	32.4	2.78	1.58	2-Year
		0.06		3.73	5.88	5-Year
		0.16		4.47	17.42	10-year
		0.41		6.20	62.60	50-Year
		0.50		6.96	85.37	100-Year
A-5-2	6.07	0.03	23.3	3.30	0.61	2-Year
		0.07		4.44	1.92	5-Year
		0.16		5.31	5.31	10-year
		0.41		7.37	18.54	50-Year
		0.50		8.27	25.19	100-Year
A-5-16	1.13	0.22	10.7	4.42	1.12	2-Year
		0.26		5.94	1.75	5-Year
		0.34		7.11	2.70	10-year
		0.53		9.90	5.91	50-Year
		0.60		11.08	7.48	100-Year
A-5-17	7.53	0.59	17.4	3.70	16.38	2-Year
		0.62		4.96	23.10	5-Year
		0.66		5.94	29.44	10-year
		0.74		8.24	46.01	50-Year
		0.78		9.25	54.01	100-Year
A-5-18	15.49	0.18	62.1	1.90	5.21	2-Year
		0.21		2.55	8.48	5-Year
		0.29		3.05	13.91	10-year
		0.50		4.23	32.82	50-Year
		0.57		4.75	42.20	100-Year
A-5-19	9.27	0.61	17.4	3.70	21.02	2-Year
		0.64		4.97	29.57	5-Year
		0.68		5.95	37.48	10-year
		0.76		8.25	57.80	50-Year
		0.79		9.26	67.59	100-Year
A-5-20	6.85	0.61	13.7	4.03	16.81	2-Year
		0.64		5.42	23.65	5-Year
		0.68		6.48	30.01	10-year
		0.75		9.00	46.44	50-Year
		0.79		10.09	54.30	100-Year

Runoff Calculations

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No. **D3430615**
Revised Date **10/20/2025** Calculated by **MK/JD**

Basin	Area (ac.)	C	t_c (min)	intensity (in/hr)	Q (cfs)	Storm Event
A-5-21	0.39	0.42	6.7	5.34	0.87	2-Year
		0.45		7.19	1.27	5-Year
		0.51		8.59	1.70	10-year
		0.64		11.94	2.98	50-Year
		0.69		13.40	3.61	100-Year
A-5-22	4.01	0.01	18.0	3.66	0.15	2-Year
		0.05		4.91	1.01	5-Year
		0.15		5.88	3.46	10-year
		0.40		8.15	13.17	50-Year
		0.49		9.15	18.06	100-Year
A-5-23	1.49	0.01	23.3	3.30	0.05	2-Year
		0.05		4.44	0.34	5-Year
		0.15		5.31	1.16	10-year
		0.40		7.36	4.43	50-Year
		0.49		8.27	6.08	100-Year
A-5-24	4.79	0.12	11.1	4.37	2.60	2-Year
		0.16		5.87	4.58	5-Year
		0.25		7.02	8.32	10-year
		0.47		9.77	21.96	50-Year
		0.55		10.94	28.69	100-Year
A-5-25	0.38	0.01	8.8	4.82	0.02	2-Year
		0.05		6.48	0.13	5-Year
		0.15		7.75	0.43	10-year
		0.40		10.78	1.65	50-Year
		0.49		12.08	2.26	100-Year
A-6-1	80.53	0.01	42.9	2.45	2.94	2-Year
		0.06		3.30	14.84	5-Year
		0.15		3.95	47.99	10-year
		0.41		5.48	178.79	50-Year
		0.49		6.14	244.62	100-Year
A-6-2	1.22	0.01	6.6	5.37	0.07	2-Year
		0.05		7.22	0.45	5-Year
		0.15		8.63	1.54	10-year
		0.40		11.99	5.88	50-Year
		0.49		13.46	8.07	100-Year
A-6-3	0.68	0.23	7.4	5.18	0.80	2-Year
		0.26		6.96	1.25	5-Year
		0.34		8.33	1.93	10-year
		0.53		11.57	4.19	50-Year
		0.60		12.98	5.32	100-Year
A-6-4	0.24	0.01	8.4	4.93	0.01	2-Year
		0.05		6.63	0.08	5-Year
		0.15		7.93	0.27	10-year
		0.40		11.02	1.04	50-Year
		0.49		12.35	1.43	100-Year

Runoff Calculations

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No. **D3430615**
Revised Date **10/20/2025** Calculated by **MK/JD**

Basin	Area (ac.)	C	t_c (min)	intensity (in/hr)	Q (cfs)	Storm Event
A-6-5	1.82	0.12	16.2	3.78	0.84	2-Year
		0.16		5.07	1.49	5-Year
		0.25		6.07	2.72	10-year
		0.47		8.42	7.18	50-Year
		0.55		9.44	9.40	100-Year
A-7-1	17.78	0.38	21.0	3.45	23.37	2-Year
		0.41		4.64	34.17	5-Year
		0.47		5.55	46.84	10-year
		0.62		7.70	84.86	50-Year
		0.67		8.64	103.53	100-Year
A-O2A	12.55	0.25	41.6	2.49	7.75	2-Year
		0.28		3.35	11.95	5-Year
		0.36		4.01	17.97	10-year
		0.54		5.56	37.82	50-Year
		0.61		6.24	47.66	100-Year
A-O3P	10.49	0.08	29.6	2.87	2.46	2-Year
		0.12		3.86	4.91	5-Year
		0.21		4.63	10.19	10-year
		0.44		6.41	29.91	50-Year
		0.53		7.20	39.81	100-Year
A-O4P	4.52	0.01	19.2	3.57	0.17	2-Year
		0.05		4.80	1.12	5-Year
		0.15		5.74	3.82	10-year
		0.40		7.97	14.52	50-Year
		0.49		8.94	19.91	100-Year
A-O5P	5.40	0.01	29.8	2.86	0.16	2-Year
		0.05		3.85	1.07	5-Year
		0.15		4.61	3.66	10-year
		0.40		6.39	13.91	50-Year
		0.49		7.18	19.09	100-Year
A-O6P	19.07	0.10	28.8	2.93	5.36	2-Year
		0.14		3.94	10.17	5-Year
		0.22		4.72	20.03	10-year
		0.45		6.54	56.47	50-Year
		0.53		7.34	74.76	100-Year
A-O6AP	14.82	0.11	28.5	2.95	4.87	2-Year
		0.15		3.97	8.85	5-Year
		0.24		4.75	16.64	10-year
		0.46		6.59	45.09	50-Year
		0.54		7.39	59.36	100-Year
A-1-1s	0.94	0.17	8.9	4.80	0.76	2-Year
		0.21		6.45	1.25	5-Year
		0.29		7.71	2.08	10-year
		0.50		10.73	5.01	50-Year
		0.57		12.02	6.46	100-Year

Runoff Calculations

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No. **D3430615**
Revised Date **10/20/2025** Calculated by **MK/JD**

Basin	Area (ac.)	C	t_c (min)	intensity (in/hr)	Q (cfs)	Storm Event
A-4-1s	2.87	0.01	19.4	3.56	0.11	2-Year
		0.05		4.78	0.71	5-Year
		0.15		5.72	2.41	10-year
		0.40		7.94	9.18	50-Year
		0.49		8.91	12.59	100-Year
A-4-13s	4.60	0.29	22.3	3.37	4.50	2-Year
		0.33		4.52	6.78	5-Year
		0.39		5.41	9.82	10-year
		0.57		7.50	19.56	50-Year
		0.63		8.42	24.37	100-Year
A-4-18s	6.63	0.23	28.5	2.95	4.49	2-Year
		0.27		3.97	7.00	5-Year
		0.34		4.75	10.74	10-year
		0.53		6.59	23.20	50-Year
		0.60		7.39	29.40	100-Year
A-6-1s1	7.43	0.06	30.1	2.85	1.19	2-Year
		0.10		3.83	2.74	5-Year
		0.19		4.59	6.39	10-year
		0.43		6.36	20.30	50-Year
		0.51		7.14	27.29	100-Year
A-6-1s2	1.05	0.02	9.3	4.70	0.09	2-Year
		0.06		6.31	0.40	5-Year
		0.15		7.55	1.22	10-year
		0.41		10.51	4.49	50-Year
		0.50		11.77	6.12	100-Year
A-6-1s3	2.00	0.01	23.6	3.28	0.07	2-Year
		0.05		4.41	0.45	5-Year
		0.15		5.28	1.55	10-year
		0.40		7.32	5.90	50-Year
		0.49		8.22	8.09	100-Year
A-7-1s1	15.25	0.40	20.7	3.48	21.22	2-Year
		0.43		4.67	30.87	5-Year
		0.49		5.59	41.92	10-year
		0.63		7.75	74.60	50-Year
		0.68		8.69	90.63	100-Year
A-7-1s2	2.53	0.22	16.7	3.75	2.04	2-Year
		0.25		5.03	3.21	5-Year
		0.33		6.02	4.99	10-year
		0.52		8.35	11.03	50-Year
		0.59		9.37	14.03	100-Year
A-O6P-s1	2.26	0.10	21.8	3.40	0.74	2-Year
		0.14		4.57	1.40	5-Year
		0.22		5.47	2.75	10-year
		0.45		7.59	7.76	50-Year
		0.53		8.51	10.26	100-Year

Runoff Calculations

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No. **D3430615**
Revised Date **10/20/2025** Calculated by **MK/JD**

Basin	Area (ac.)	C	t_c (min)	intensity (in/hr)	Q (cfs)	Storm Event
A-O6P-s2	9.29	0.09	28.7	2.94	2.42	2-Year
		0.13		3.95	4.70	5-Year
		0.22		4.73	9.49	10-year
		0.45		6.55	27.31	50-Year
		0.53		7.35	36.25	100-Year
A-O6AP-s	3.72	0.14	24.1	3.25	1.73	2-Year
		0.18		4.36	2.95	5-Year
		0.26		5.23	5.14	10-year
		0.48		7.25	12.95	50-Year
		0.56		8.13	16.85	100-Year

Note: Basins with the suffix "s" are sub-basins of the basin identified in their prefix.

Project Name	**Yap Intl Airport - BA01 Awarded**	Project No.	D3430615
Revised Date	**9/25/2024**	Calculated by	**MK**

CHANNELIZED SEGMENT SLOPE WEIGHTING FOR Tcs

Select basins have multiple channelized flow paths. This table computes weighted slopes since the Rational spreadsheet only provides one row for channelized data entry.

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-1-2	260	98.0	90.5	0.0288	111.02
	557	90.5	88.3	0.0039	147.58
	817		**Wt'd Slope**	**0.0083**	258.60

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-2-3	113	125.0	90.0	0.3097	85.29
	1961	90.0	82.7	0.0037	512.25
	2074		**Wt'd Slope**	**0.0056**	597.54

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-3-4	156	128.4	79.7	0.3122	117.97
	622	79.7	78.2	0.0024	146.40
	778		**Wt'd Slope**	**0.0111**	264.37

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-3-5	82	108.9	82.5	0.3220	62.47
	1251	82.5	78.2	0.0034	320.59
	1333		**Wt'd Slope**	**0.0055**	383.06

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-3-8	247	162.0	80.8	0.3287	189.12
	523	80.8	79.6	0.0023	121.64
	770		**Wt'd Slope**	**0.0227**	310.76

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-3-10	182	141.5	82.7	0.3231	138.77
	305	82.7	81.8	0.0030	75.35
	487		**Wt'd Slope**	**0.0325**	214.12

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-4-13	501	82.4	81.0	0.0028	122.17
	352	81.0	35.0	0.1307	215.99
	853		**Wt'd Slope**	**0.0211**	338.16

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-4-16	59	101.0	84.1	0.2864	43.71
	276	84.1	83.5	0.0022	63.36
	335		**Wt'd Slope**	**0.0086**	107.07

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-4-18	704	84.0	80.4	0.0051	198.46
	284	80.4	35.0	0.1599	182.90
	988		**Wt'd Slope**	**0.0189**	381.36

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-5-24	280	141.0	129.0	0.0429	131.48
	228	129.0	89.0	0.1754	150.15
	508		**Wt'd Slope**	**0.0854**	281.62

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-7-1	412	139.7	122.4	0.0420	192.60
	116	122.4	91.0	0.2707	84.77
	946.62	91.0	89.2	0.0019	210.45
	1474.88		**Wt'd Slope**	**0.0099**	487.83

Basin	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
A-7-1s1	412	139.7	122.4	0.0420	192.60
	116	122.4	91.0	0.2707	84.77
	946.62	91.0	89.2	0.0019	210.45
	1474.88		**Wt'd Slope**	**0.0099**	487.83

Note:

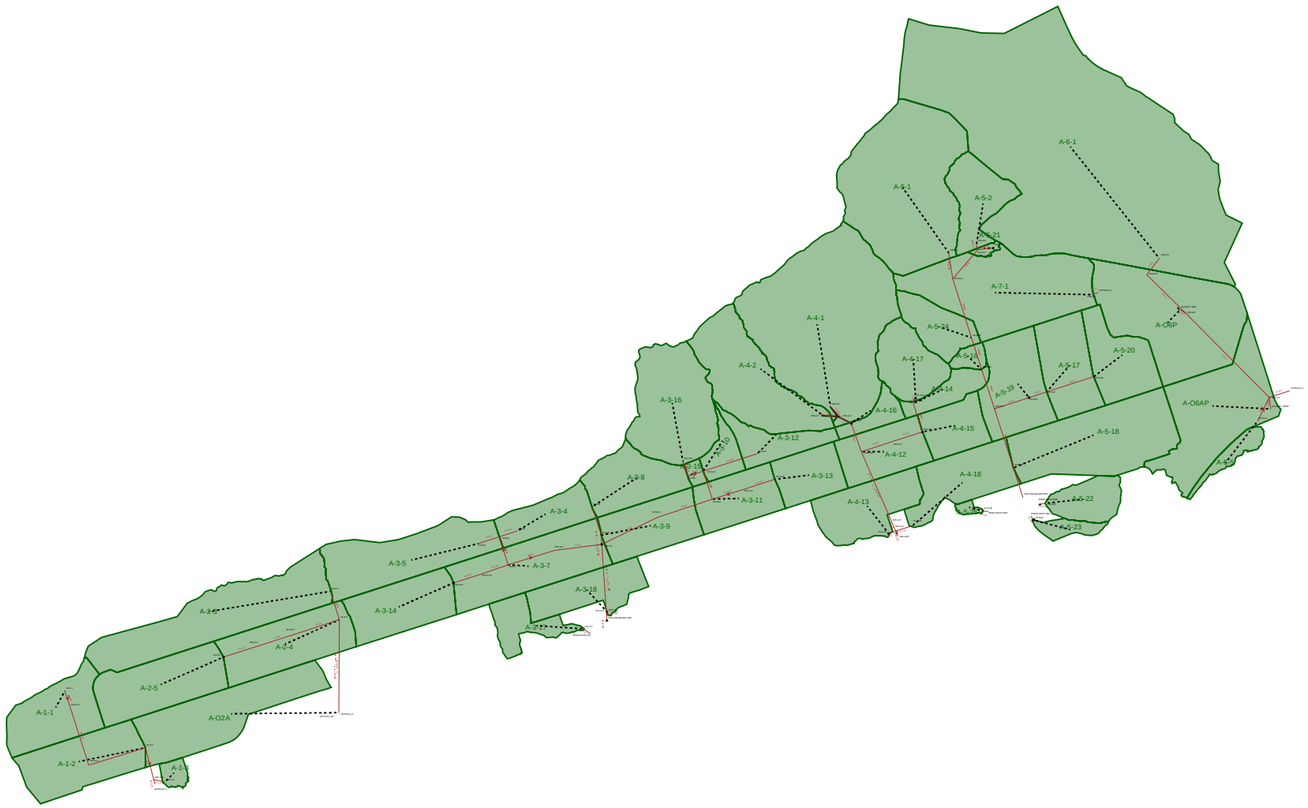
1. Basins with the suffix "s" are sub-basins of the basin identified in their prefix.

Hydraulics

5-YEAR STORMCAD OUTPUT FILES

CLIN BA01 AWARDED

Scenario: Scenario - 5 Yr



5-Yr Storm Catchment					
Label	Outflow Element	Area (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
A-1-1	IN-1-1	8.22	0.12	25.9	4.18
A-1-2	IN-1-2	9.52	0.13	28.8	4.91
A-1-3	HW-1-3	0.99	0.05	13.1	0.28
A-2-3	IN-2-3	16.45	0.19	32.5	11.74
A-2-4	IN-2-4	10.04	0.41	29.4	16.12
A-2-5	IN-2-5	10.06	0.46	26.9	19.17
A-3-10	IN-3-10	2.47	0.20	15.3	2.57
A-3-11	IN-3-11	6.35	0.45	23.3	12.77
A-3-12	IN-3-12	4.36	0.26	11.8	6.56
A-3-13	IN-3-13	4.99	0.38	27.3	7.79
A-3-14	IN-3-14	8.05	0.38	28.3	12.28
A-3-15	IN-3-15	0.63	0.30	7.2	1.34
A-3-16	IN-3-16	13.15	0.05	32.0	2.48
A-3-17	IN-3-17	3.72	0.32	18.8	5.81
A-3-18	IN-3-18	6.29	0.33	23.2	9.29
A-3-4	IN-3-4	5.06	0.23	12.6	6.57
A-3-5	IN-3-5	11.98	0.19	29.5	8.89
A-3-7	IN-3-7	11.83	0.39	21.3	21.45
A-3-8	IN-3-8	7.27	0.18	13.8	7.11
A-3-9	IN-3-9	7.45	0.45	28.8	13.31
A-4-1	HW-4-1	31.45	0.05	34.5	5.78
A-4-12	IN-4-12	6.67	0.41	23.5	12.17
A-4-13	IN-4-13	7.81	0.27	26.5	8.81
A-4-14	IN-4-14	2.89	0.32	16.9	4.67
A-4-15	IN-4-15	1.71	0.38	18.6	3.18
A-4-16	IN-4-16	2.13	0.35	10.1	4.54
A-4-17	IN-4-17	6.15	0.05	26.2	1.29
A-4-18	IN-4-18	7.70	0.24	26.2	7.77
A-4-2	HW-4-2	12.99	0.05	34.2	2.39
A-5-1	HW-5-1	24.61	0.06	32.4	5.55
A-5-16	IN-5-16	1.09	0.14	12.3	0.87
A-5-17	IN-5-17	7.53	0.62	17.4	23.36
A-5-18	IN-5-18	15.49	0.21	62.1	8.37
A-5-19	IN-5-19	9.29	0.64	15.8	30.61
A-5-2	HW-5-2	6.07	0.07	23.3	1.90
A-5-20	IN-5-20	6.85	0.64	13.7	23.90
A-5-21	IN-5-21	0.39	0.45	6.7	1.27
A-5-22	IN-5-22	4.01	0.05	18.0	0.99
A-5-23	IN-5-23	1.49	0.05	23.3	0.33
A-5-24	IN-5-24	4.79	0.16	11.1	4.53
A-5-25	IN-5-25	0.38	0.05	8.8	0.12
A-6-1	HW-6-1	80.53	0.06	42.9	16.06
A-6-5	MH-6-4	1.82	0.16	16.2	1.49
A-7-1	HW-7-1	17.78	0.41	21.0	34.10
A-O2A	OUTFALL 2A	12.55	0.28	41.6	11.87
A-O6AP	OUTLET - O6AP	14.82	0.15	28.5	8.88
A-O6P	OUTLET - O6P	19.07	0.14	28.8	10.60

5-Yr Storm Pipes									
Label	Start Node	Invert Start (ft)	Stop Node	Invert Stop (ft)	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Catalog Class
EX-P-2-1 (CULVERT #1)	IN-2-4	71.50	OUTFALL 2	30.84	60	760.4	0.053	0.024	CMP Pipe
EX-P-3-1 (CULVERT #2)(1)	MH-3-1	65.40	MH-3-5	35.25	60	577.1	0.052	0.024	CMP Pipe
EX-P-3-2 (CULVERT #2)	IN-3-9	69.80	MH-3-1	65.60	60	75.7	0.055	0.024	CMP Pipe
EX-P-4-2 (CULVERT #3)	IN-4-12	39.34	MH-4-3	17.88	78	630.9	0.034	0.024	CMP Pipe
P-1-1	IN-1-2	45.00	MH-1-3	39.00	48	269.8	0.022	0.013	Concrete Pipe
P-1-2	MH-1-1	77.19	IN-1-2	56.00	48	483.9	0.044	0.013	Concrete Pipe
P-1-3	MH-1-2	79.89	MH-1-1	77.39	48	509.7	0.005	0.013	Concrete Pipe
P-1-4	IN-1-1	81.58	MH-1-2	80.89	36	138.0	0.005	0.013	HP Pipe
P-1-5	MH-1-3	32.42	OUTFALL 1	32.00	48	40.0	0.011	0.013	Concrete Pipe
P-1-6	HW-1-3	42.00	MH-1-3	39.00	24	93.8	0.032	0.013	HP Pipe
P-2-1	IN-2-3	77.16	IN-2-4	73.50	36	243.9	0.015	0.013	Concrete Pipe
P-2-2	IN-2-5	78.89	MH-2-1	77.21	36	322.0	0.005	0.013	Concrete Pipe
P-2-3	MH-2-1	77.01	MH-2-2	75.56	36	322.0	0.005	0.013	Concrete Pipe
P-2-4	MH-2-2	75.36	IN-2-4	73.50	36	353.4	0.005	0.013	Concrete Pipe
P-3-1	MH-3-2	67.10	MH-3-1	65.60	60	389.6	0.004	0.013	Concrete Pipe
P-3-10	IN-3-12	76.21	IN-3-10	74.20	48	465.0	0.004	0.013	HP Pipe
P-3-11	IN-3-5	72.98	IN-3-6	72.30	36	179.2	0.004	0.013	HP Pipe
P-3-12	IN-3-4	72.75	IN-3-6	72.30	36	155.0	0.003	0.013	HP Pipe
P-3-13	MH-3-4	75.56	IN-3-11	72.60	36	264.0	0.011	0.013	Concrete Pipe
P-3-14	IN-3-13	77.14	MH-3-4	75.76	36	275.0	0.005	0.013	Concrete Pipe
P-3-15	IN-3-14	72.75	MH-3-13	72.01	36	235.0	0.003	0.013	Concrete Pipe
P-3-16	MH-3-13	71.81	IN-3-7	71.00	36	235.1	0.003	0.013	Concrete Pipe
P-3-17	IN-3-16	102.12	IN-3-15	76.06	36	126.5	0.206	0.013	HP Pipe
P-3-18	MH-3-5	30.39	STILLING BASIN-03P	29.39	60	45.6	0.022	0.024	CMP Pipe
P-3-19	IN-3-17	29.00	POND INLET 03	28.00	24	70.4	0.014	0.013	HP Pipe
P-3-2	IN-3-7	69.00	MH-3-2	67.30	60	398.0	0.004	0.013	Concrete Pipe
P-3-20	IN-3-18	33.35	MH-3-5	33.15	24	22.1	0.009	0.013	HP Pipe
P-3-3	IN-3-6	71.30	IN-3-7	70.29	48	239.4	0.004	0.013	Concrete Pipe
P-3-4	IN-3-8	72.56	IN-3-9	70.80	48	242.6	0.007	0.013	Concrete Pipe
P-3-5	MH-3-3	68.05	MH-3-1	65.60	60	507.2	0.005	0.013	Concrete Pipe
P-3-6	IN-3-11	71.60	MH-3-3	69.05	48	472.0	0.005	0.013	Concrete Pipe
P-3-8	IN-3-10	74.20	IN-3-11	71.60	48	240.3	0.011	0.013	Concrete Pipe
P-3-9	IN-3-15	75.86	IN-3-10	75.20	36	133.5	0.005	0.013	HP Pipe
P-4-1	IN-4-16	55.87	IN-4-12	53.42	48	244.8	0.010	0.013	Concrete Pipe
P-4-10	IN-4-13	22.00	MH-4-4	21.00	36	61.1	0.016	0.013	HP Pipe
P-4-11	IN-4-18	22.00	MH-4-4	21.00	24	146.6	0.007	0.013	HP Pipe
P-4-12	MH-4-4	17.02	HW-04P	16.77	78	43.2	0.006	0.024	CMP Pipe
P-4-2	MH-4-1	56.95	IN-4-16	56.07	48	88.4	0.010	0.013	Concrete Pipe
P-4-3	MH-4-2	72.12	IN-4-12	70.80	48	258.7	0.005	0.013	Concrete Pipe
P-4-4	IN-4-15	73.64	MH-4-2	72.32	48	265.0	0.005	0.013	Concrete Pipe
P-4-5	IN-4-14	75.06	IN-4-15	73.84	48	244.6	0.005	0.013	Concrete Pipe
P-4-6	HW-4-1	58.50	MH-4-1	57.15	48	135.4	0.010	0.013	Concrete Pipe
P-4-7	HW-4-2	66.50	MH-4-1	62.00	36	169.6	0.027	0.013	Concrete Pipe
P-4-8	IN-4-17	75.50	IN-4-14	75.26	48	47.1	0.005	0.013	HP Pipe
P-4-9	MH-4-3	17.68	MH-4-4	17.22	78	77.3	0.006	0.024	CMP Pipe
P-5-1	IN-5-18	58.50	STILLING BASIN-05P	49.81	60	256.7	0.034	0.013	Concrete Pipe
P-5-10	HW-5-1	117.50	MH-5-3	111.08	60	214.7	0.030	0.013	Concrete Pipe
P-5-11	HW-5-2	114.50	MH-5-4	114.20	60	40.4	0.007	0.013	Concrete Pipe
P-5-12	MH-5-4	114.00	MH-5-3	111.08	60	317.1	0.009	0.013	Concrete Pipe
P-5-13	IN-5-21	119.39	MH-5-4	118.74	18	124.3	0.005	0.013	HP Pipe
P-5-14	IN-5-23	50.30	POND INLET 05A	49.30	24	35.5	0.028	0.013	HP Pipe
P-5-15	IN-5-22	51.00	POND INLET 05B	49.50	24	47.9	0.031	0.013	HP Pipe
P-5-16	IN-5-25	50.30	POND INLET 05C	48.30	24	45.7	0.044	0.013	HP Pipe
P-5-2	MH-5-2	71.05	IN-5-18	58.70	60	507.8	0.024	0.013	Concrete Pipe
P-5-3	IN-5-16	75.40	MH-5-2	71.25	60	334.7	0.012	0.013	Concrete Pipe
P-5-4	IN-5-24	81.70	IN-5-16	75.60	60	276.5	0.022	0.013	Concrete Pipe
P-5-5	MH-5-3	110.88	IN-5-24	81.90	60	503.8	0.058	0.013	Concrete Pipe
P-5-6	IN-5-20	78.62	IN-5-17	77.00	48	404.8	0.004	0.013	Concrete Pipe
P-5-7	IN-5-17	76.80	IN-5-19	74.70	48	152.2	0.014	0.013	Concrete Pipe
P-5-8	IN-5-19	74.50	MH-5-2	71.25	48	297.0	0.011	0.013	Concrete Pipe
P-6-1	MH-6-1	16.30	OUTFALL 6	15.00	72	175.1	0.007	0.013	Concrete Pipe
P-6-2	MH-6-2	46.43	MH-6-1	21.20	72	971.9	0.026	0.013	Concrete Pipe
P-6-3	MH-6-3	48.35	MH-6-2	46.63	72	448.4	0.004	0.013	Concrete Pipe
P-6-4	HW-6-1	49.40	MH-6-3	48.55	72	168.2	0.005	0.013	Concrete Pipe
P-6-6	OUTLET - 06AP	47.00	MH-6-1	46.46	36	93.0	0.006	0.013	Concrete Pipe
P-6-7	OUTLET - 06P	64.73	MH-6-2	64.11	42	56.3	0.011	0.013	Concrete Pipe
P-6-8	MH-6-4	53.66	MH-6-1	45.00	18	217.3	0.040	0.013	HP Pipe
P-7-1	HW-7-1	86.50	OUTFALL 7	86.00	36	53.4	0.009	0.013	Concrete Pipe

5-Yr Storm Inlets		
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)
IN-1-1	87.09	81.58
IN-1-2	88.00	45.00
IN-2-3	82.67	77.16
IN-2-4	81.90	71.50
IN-2-5	85.08	78.89
IN-3-10	81.81	74.20
IN-3-11	81.74	71.60
IN-3-12	82.46	76.21
IN-3-13	82.78	77.14
IN-3-14	78.77	72.75
IN-3-15	81.51	75.86
IN-3-16	112.25	102.12
IN-3-17	37.24	29.00
IN-3-18	41.57	33.35
IN-3-4	78.26	72.75
IN-3-5	78.20	72.98
IN-3-6	78.55	71.30
IN-3-7	77.37	69.00
IN-3-8	79.62	72.56
IN-3-9	79.04	69.80
IN-4-12	83.54	39.34
IN-4-13	35.00	22.00
IN-4-14	84.26	75.06
IN-4-15	84.59	73.64
IN-4-16	83.58	55.87
IN-4-17	82.75	75.50
IN-4-18	35.00	22.00
IN-5-16	87.78	75.40
IN-5-17	84.96	76.80
IN-5-18	84.02	58.50
IN-5-19	84.70	74.50
IN-5-20	0.00	78.62
IN-5-21	123.91	119.39
IN-5-22	60.00	51.00
IN-5-23	57.24	50.30
IN-5-24	89.41	81.70
IN-5-25	56.00	50.30
OUTLET - O6AP	50.83	47.00
OUTLET - O6P	70.63	64.73

5-Yr Storm Manholes		
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)
MH-1-1	89.54	77.19
MH-1-2	90.33	79.89
MH-1-3	50.16	32.42
MH-2-1	84.08	77.01
MH-2-2	83.05	75.36
MH-3-1	80.32	65.40
MH-3-13	78.06	71.81
MH-3-2	78.21	67.10
MH-3-3	80.35	68.05
MH-3-4	82.27	75.56
MH-3-5	42.50	30.39
MH-4-1	80.44	56.95
MH-4-2	84.14	72.12
MH-4-3	59.89	17.68
MH-4-4	34.27	17.02
MH-5-2	86.34	71.05
MH-5-3	135.14	110.88
MH-5-4	129.23	114.00
MH-6-1	52.30	16.30
MH-6-2	85.24	46.43
MH-6-3	77.82	48.35
MH-6-4	62.38	53.66

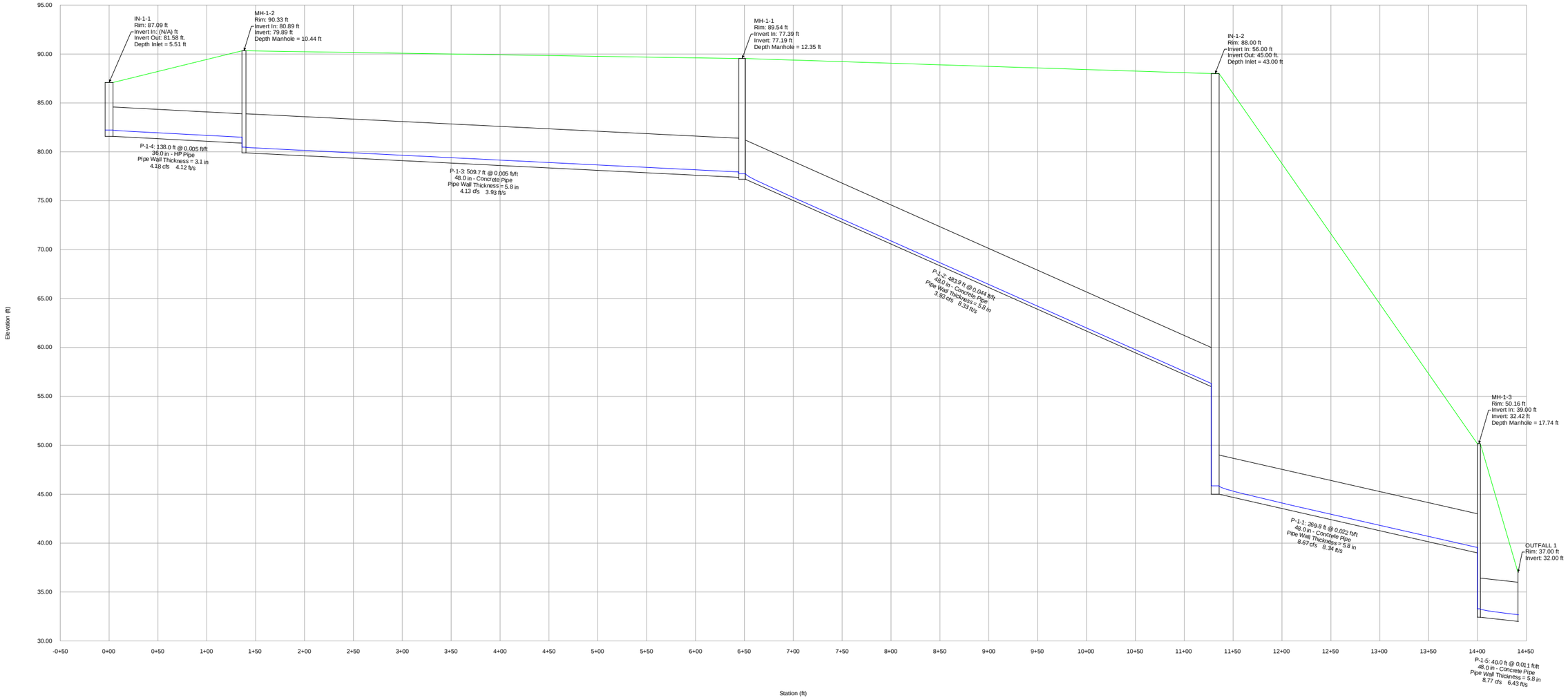
5-Yr Storm Outfall	
Label	Elevation (Invert) (ft)
OUTFALL 1	32.00
OUTFALL 2	30.84
STILLING BASIN-O3P	29.38
STILLING BASIN-O5P	49.81
OUTFALL 6	15.00
OUTFALL 2A	30.00
OUTFALL 7	86.00
POND INLET O3	28.00
POND INLET O5A	49.30
POND INLET O5B	49.50
POND INLET O5C	48.30

5-Yr Storm Headwall	
Label	Elevation (Invert) (ft)
HW-1-3	42.00
HW-4-1	58.50
HW-4-2	66.50
HW-5-1	117.50
HW-5-2	114.50
HW-6-1	49.40
HW-7-1	86.50
HW-O4P	16.77

5-Yr

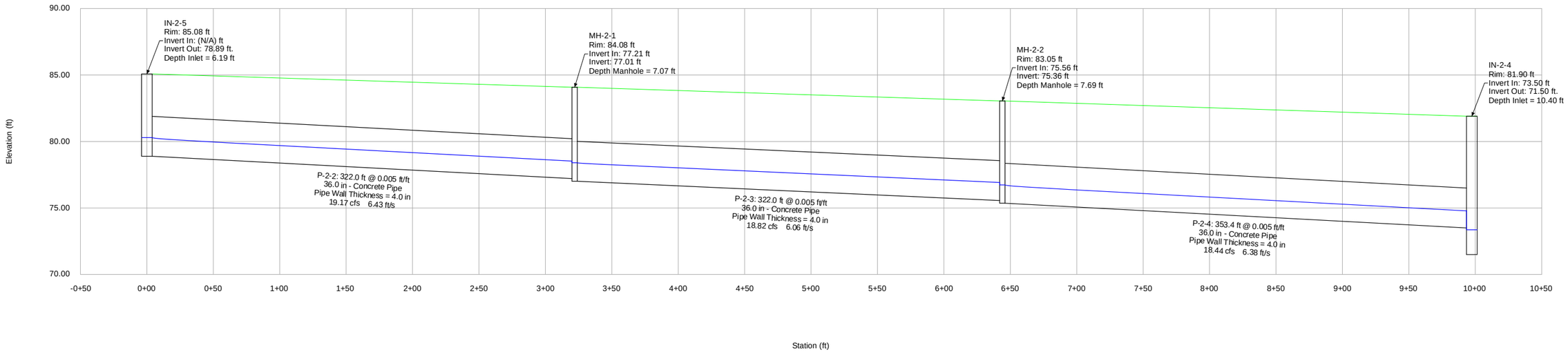
Profile Report

Engineering Profile - Profile - 1 - IN-1-1 TO OUTFALL 1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

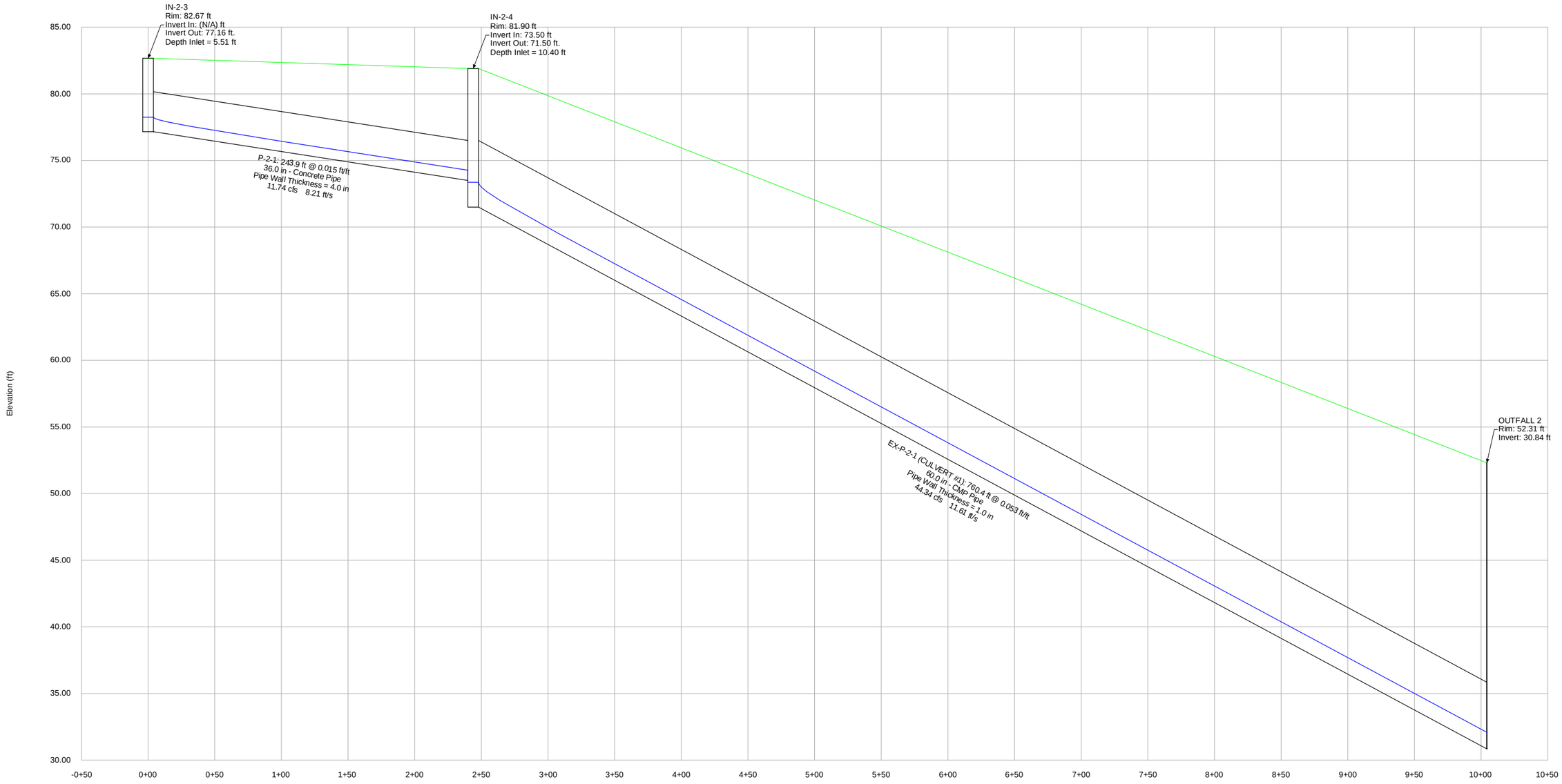
Profile Report
Engineering Profile - Profile - 2 - IN-2-5 TO IN-2-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

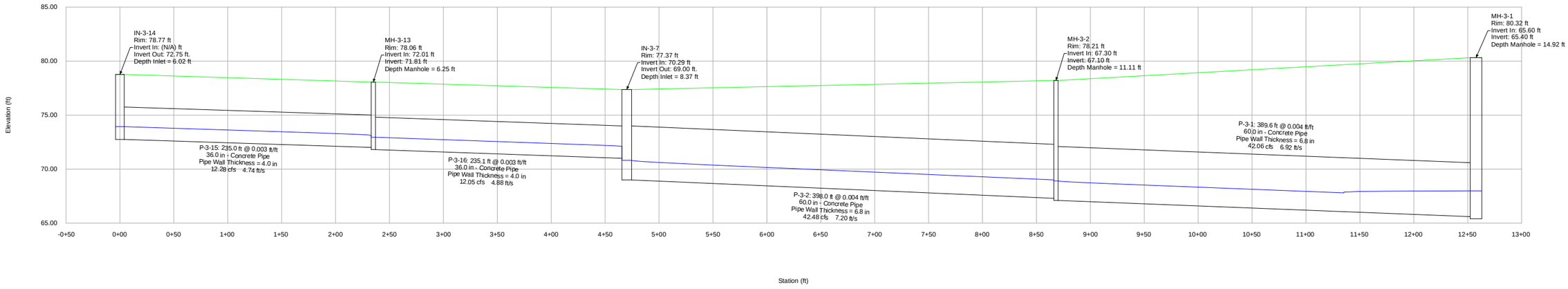
Profile Report

Engineering Profile - Profile - 2 - IN-2-3 TO OUTFALL 2 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

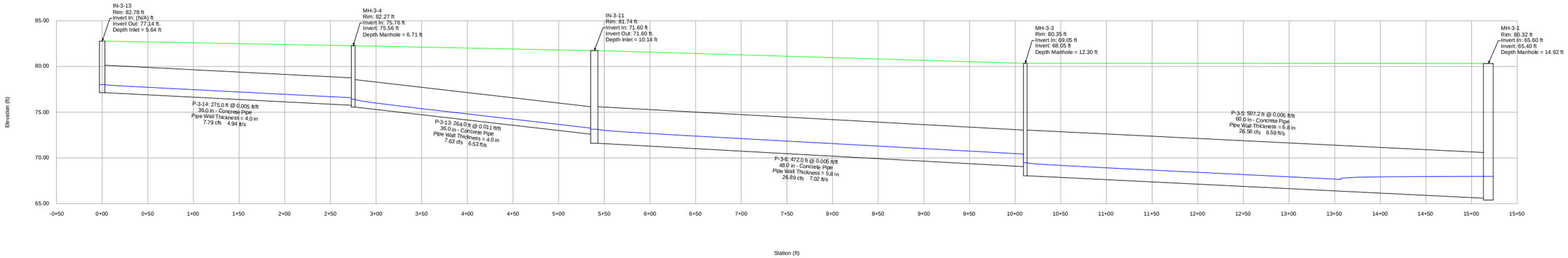
Profile Report
Engineering Profile - Profile - 3 - IN-3-14 TO MH-3-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

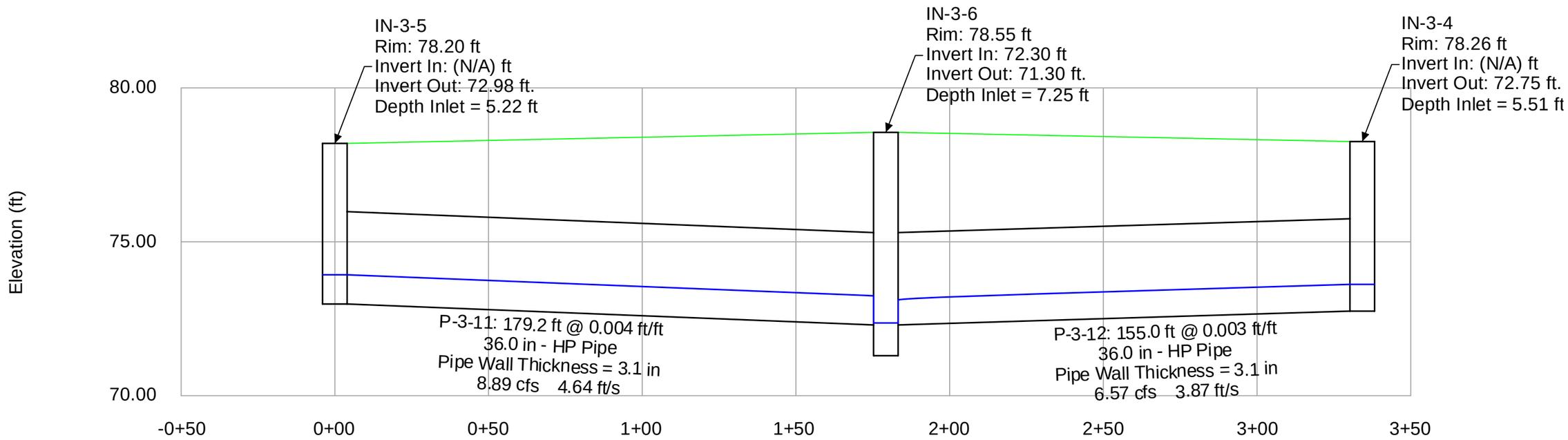
Engineering Profile - Profile - 3 - IN-3-13 TO MH-3-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

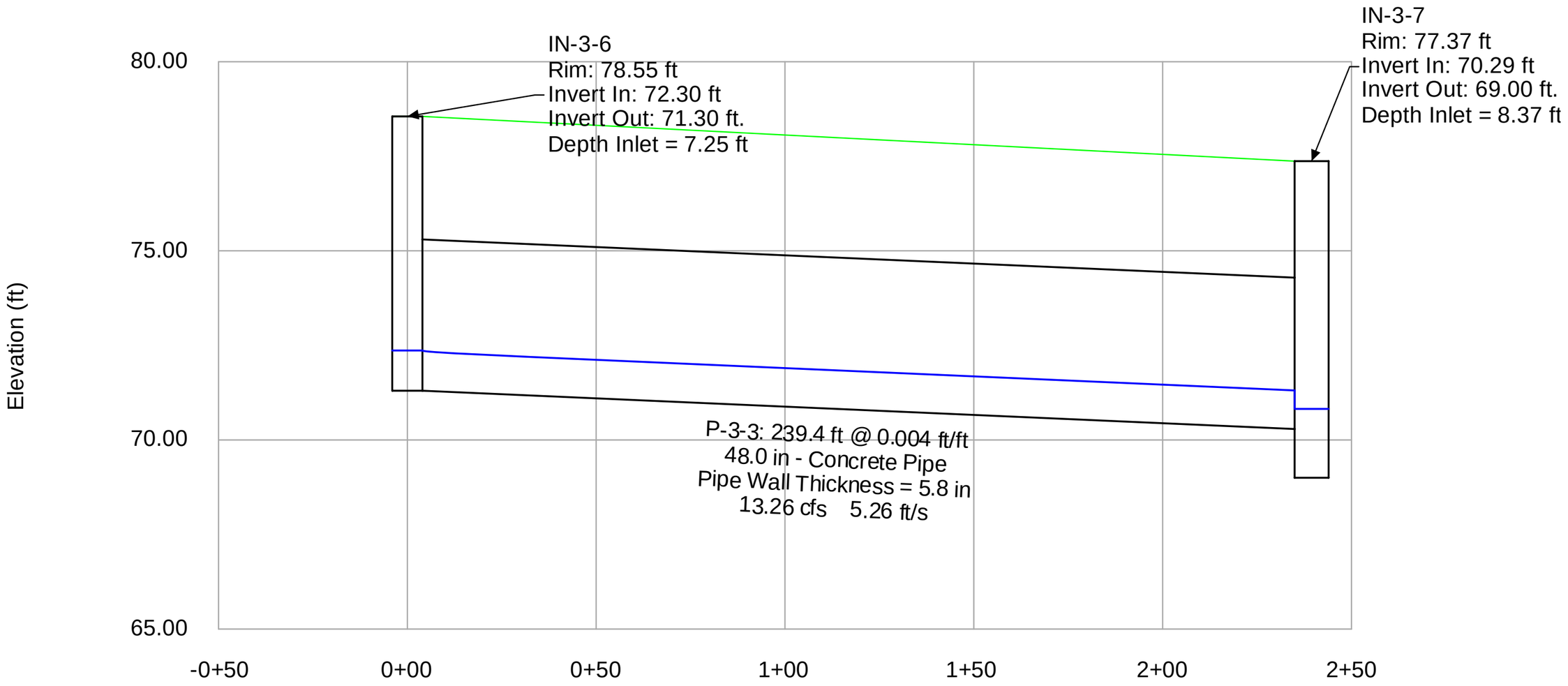
Engineering Profile - Profile - 3 - IN-3-5 TO IN-3-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

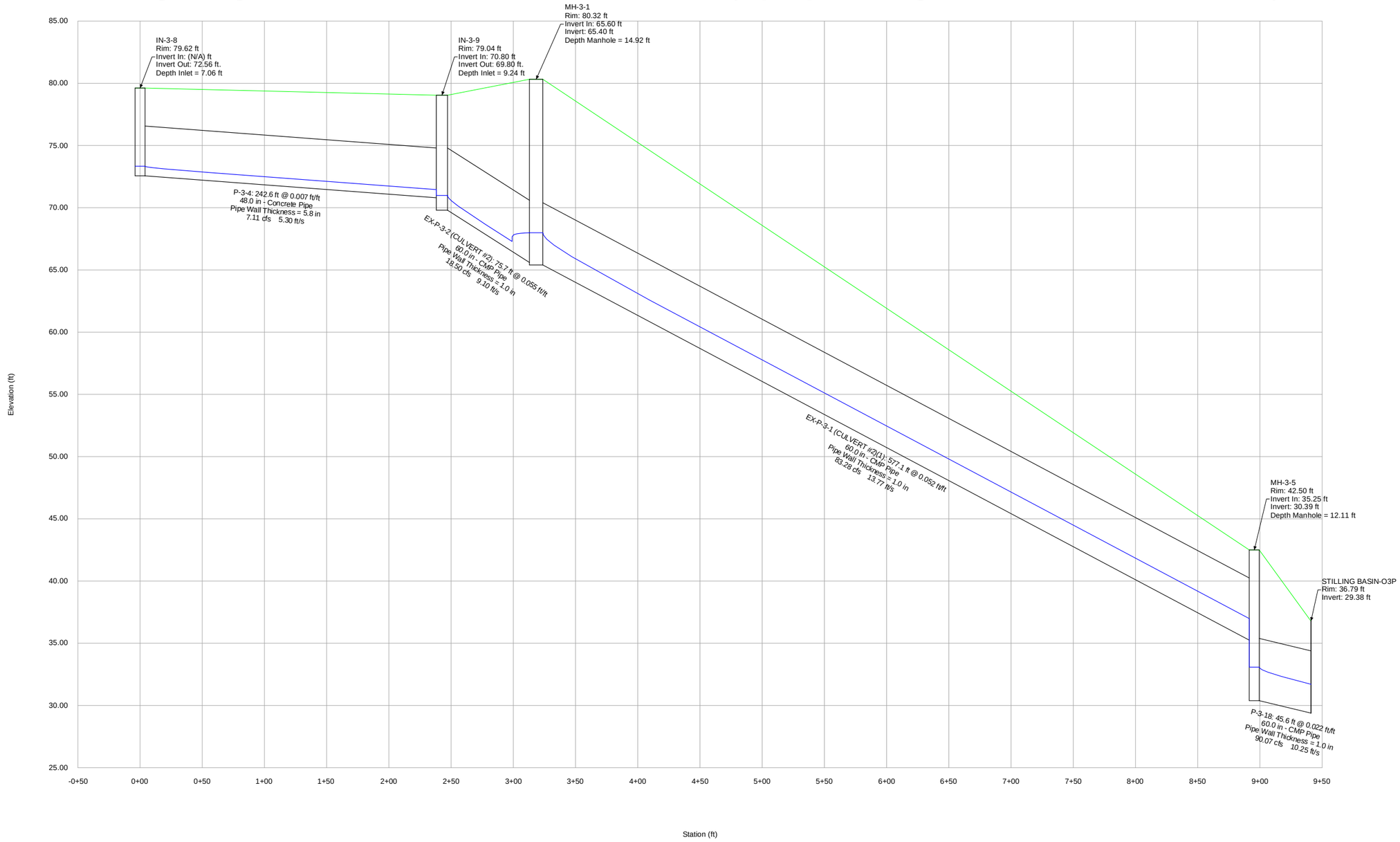
Engineering Profile - Profile - 3 - IN-3-6 TO IN-3-7 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

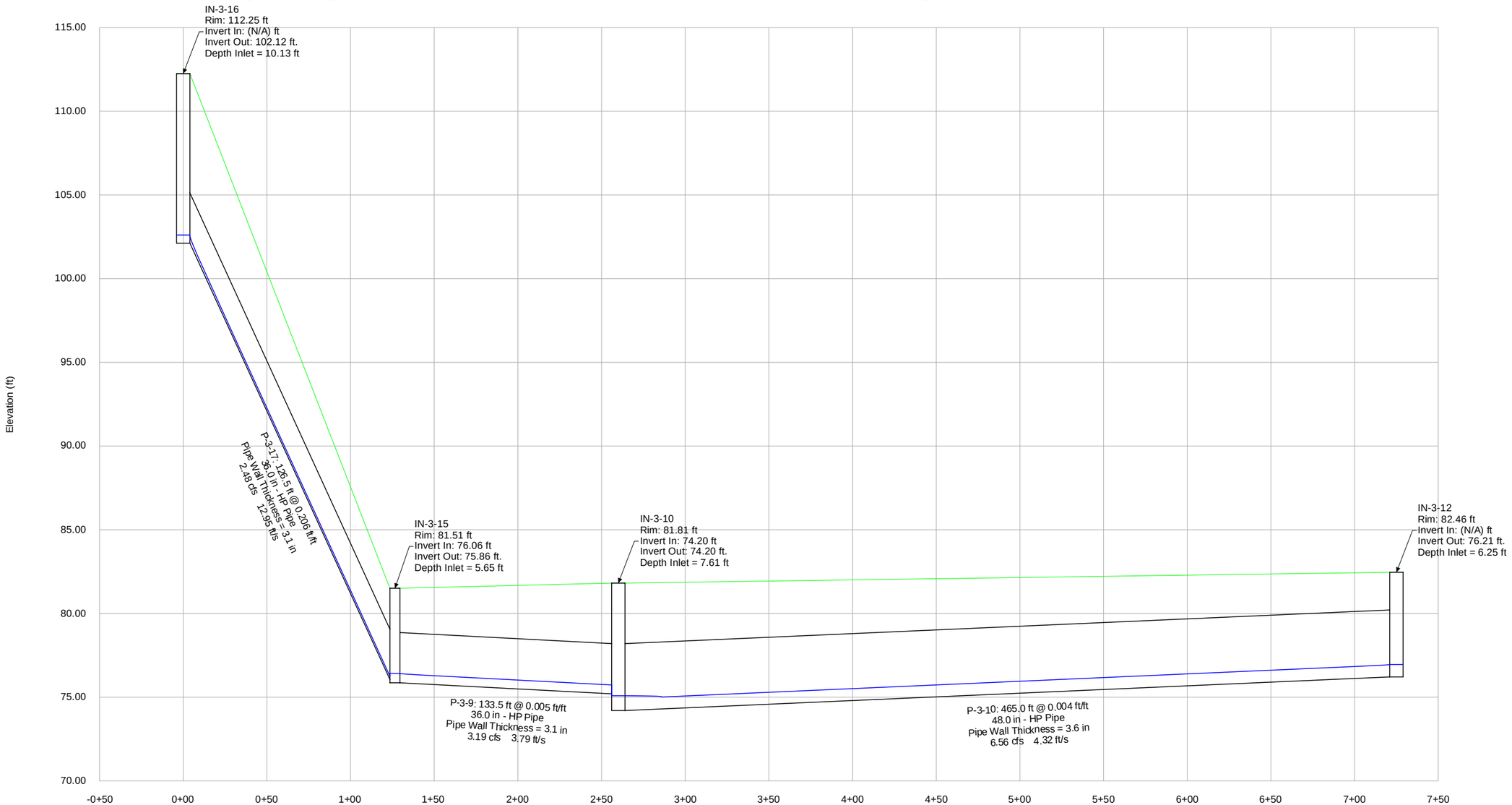
Engineering Profile - Profile - 3 - IN-3-8 TO STILING BASIN-O3P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

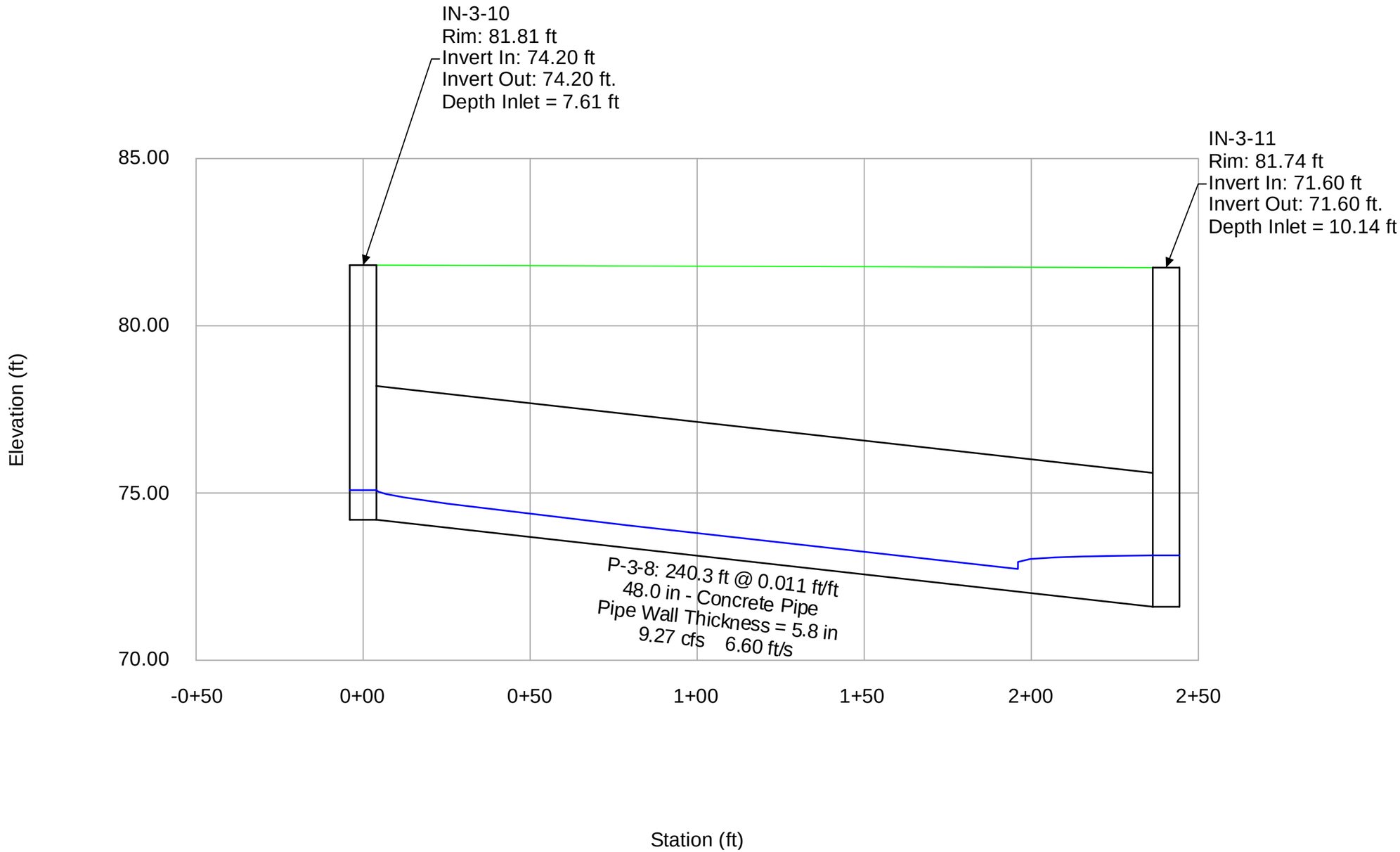
Engineering Profile - Profile - 3 - IN-3-16 TO IN-3-12 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

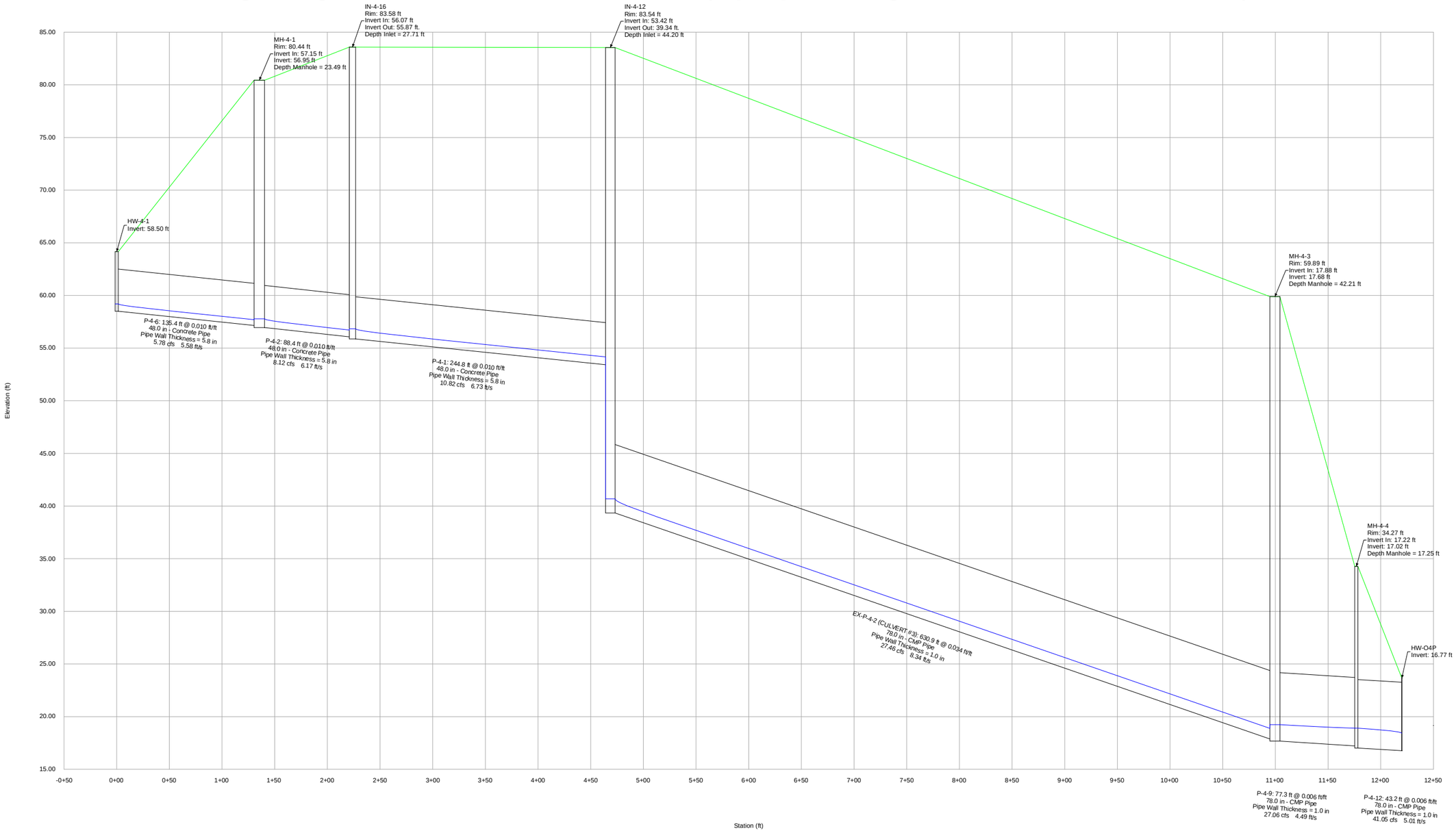
Engineering Profile - Profile - 3 - IN-3-10 TO IN-3-11 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

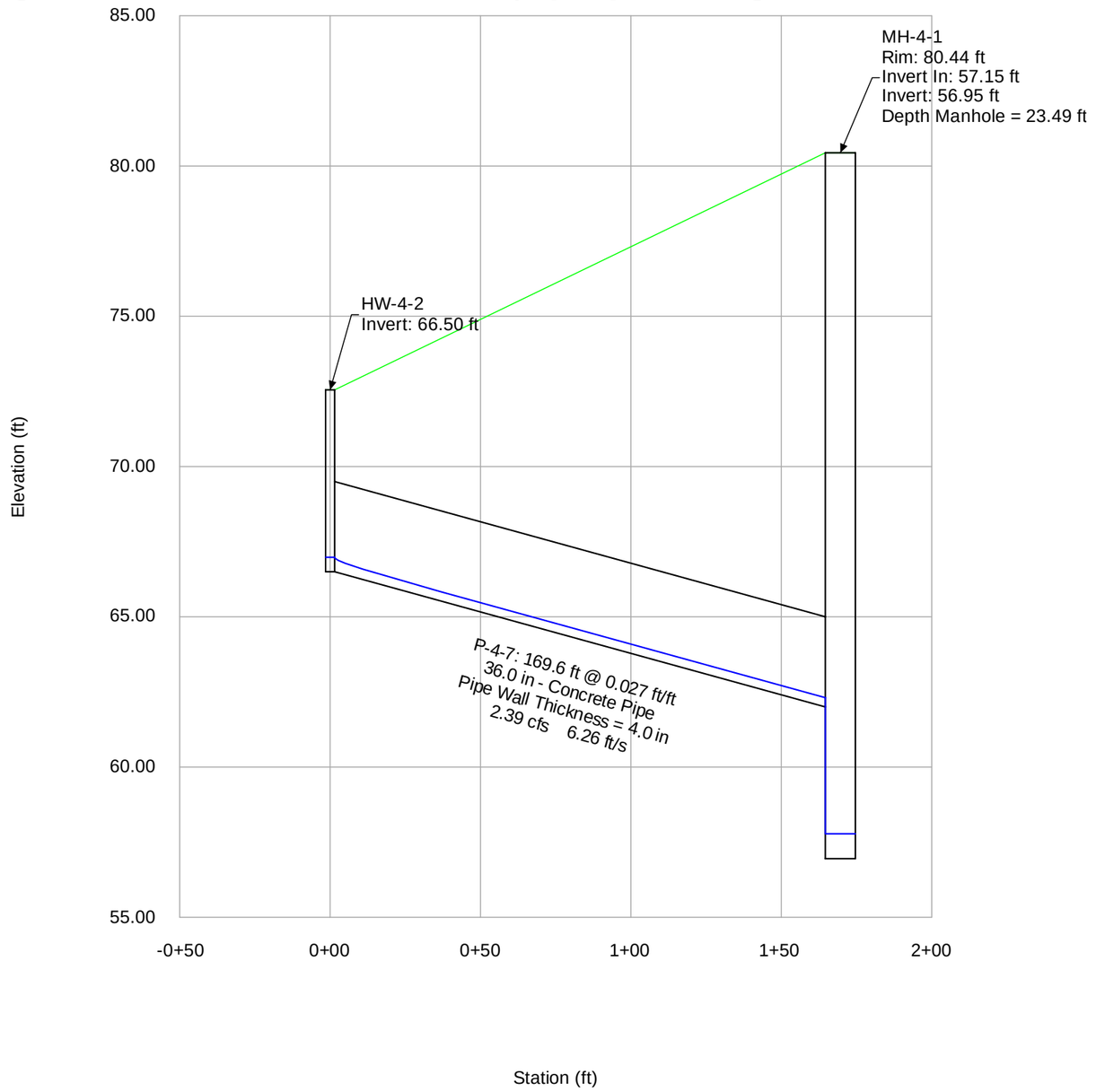
Engineering Profile - Profile - 4 - HW-4-1 TO HW-O4P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

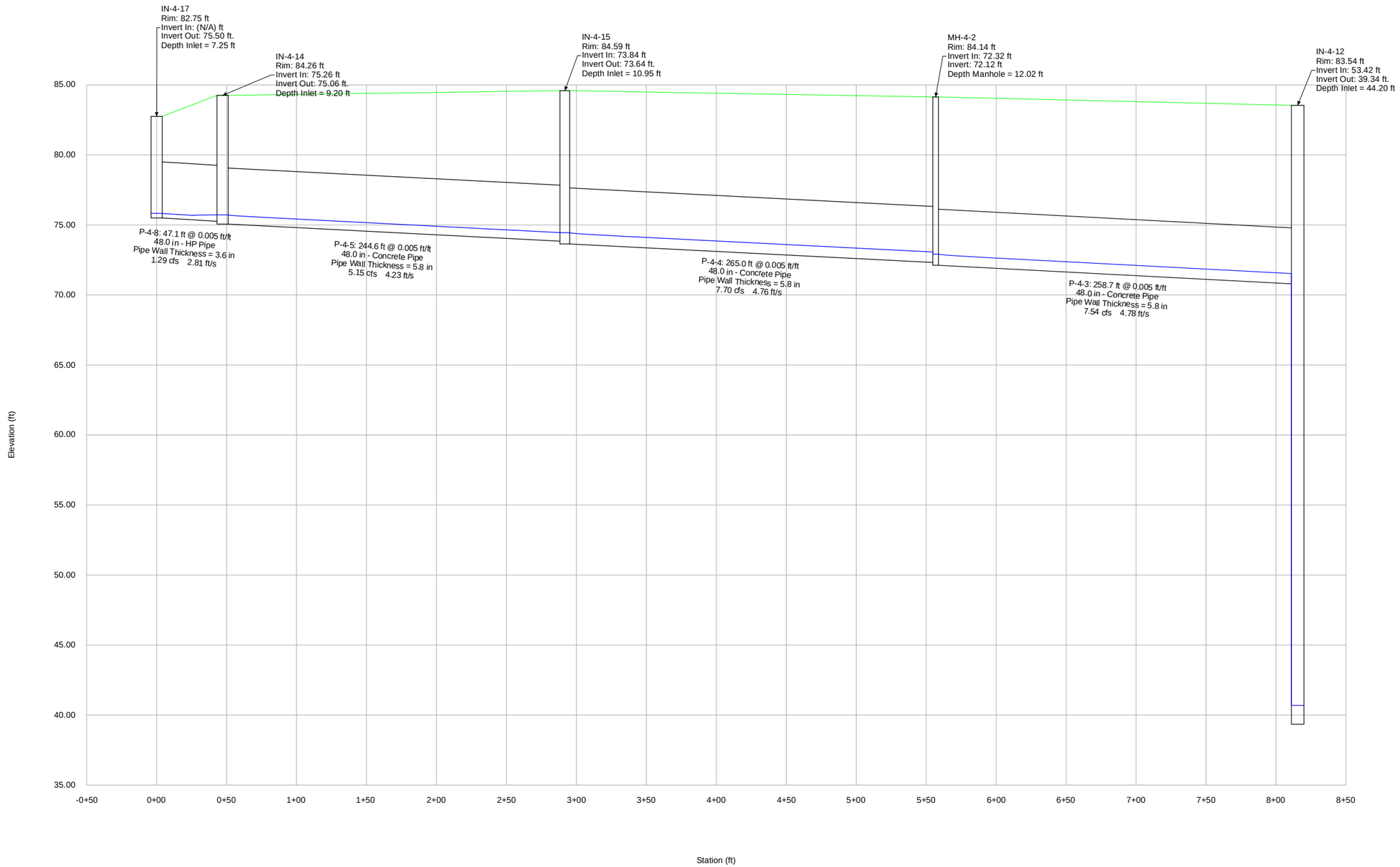
Engineering Profile - Profile - 4 - HW-4-2 TO MH-4-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

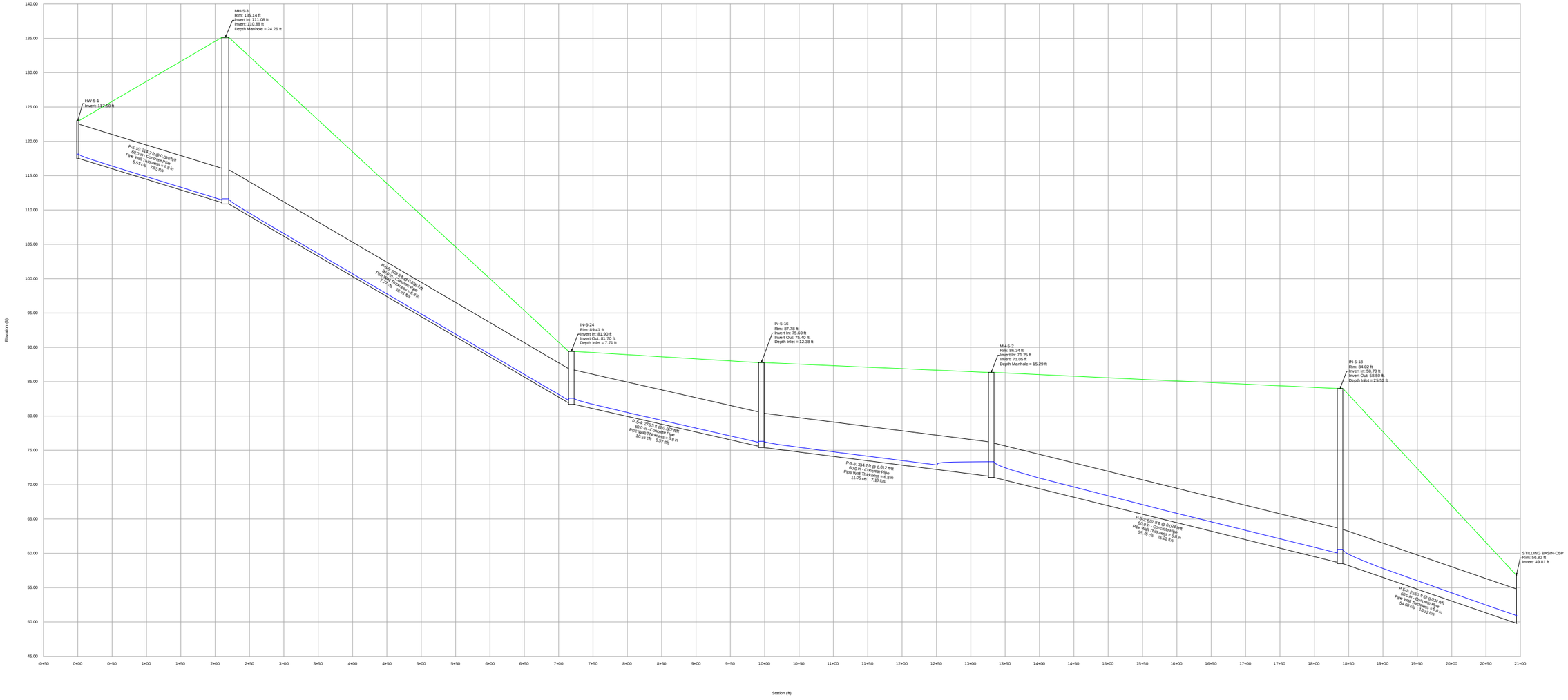
Engineering Profile - Profile - 4 - IN-4-17 TO IN-4-12 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

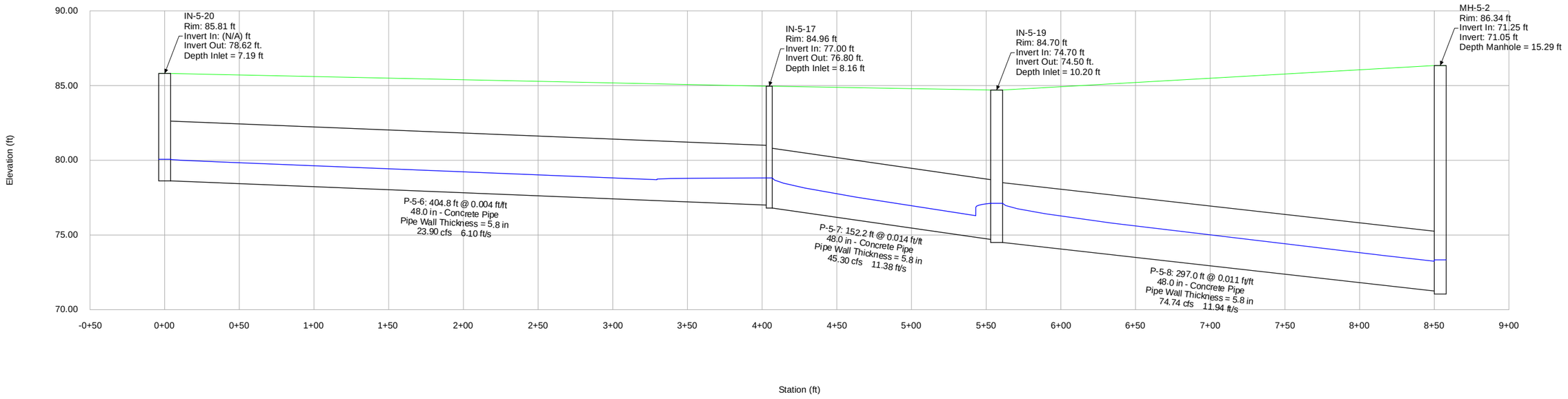
Profile Report

Engineering Profile - Profile - 5 - HW-5-1 TO STILLING BASIN-O5P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

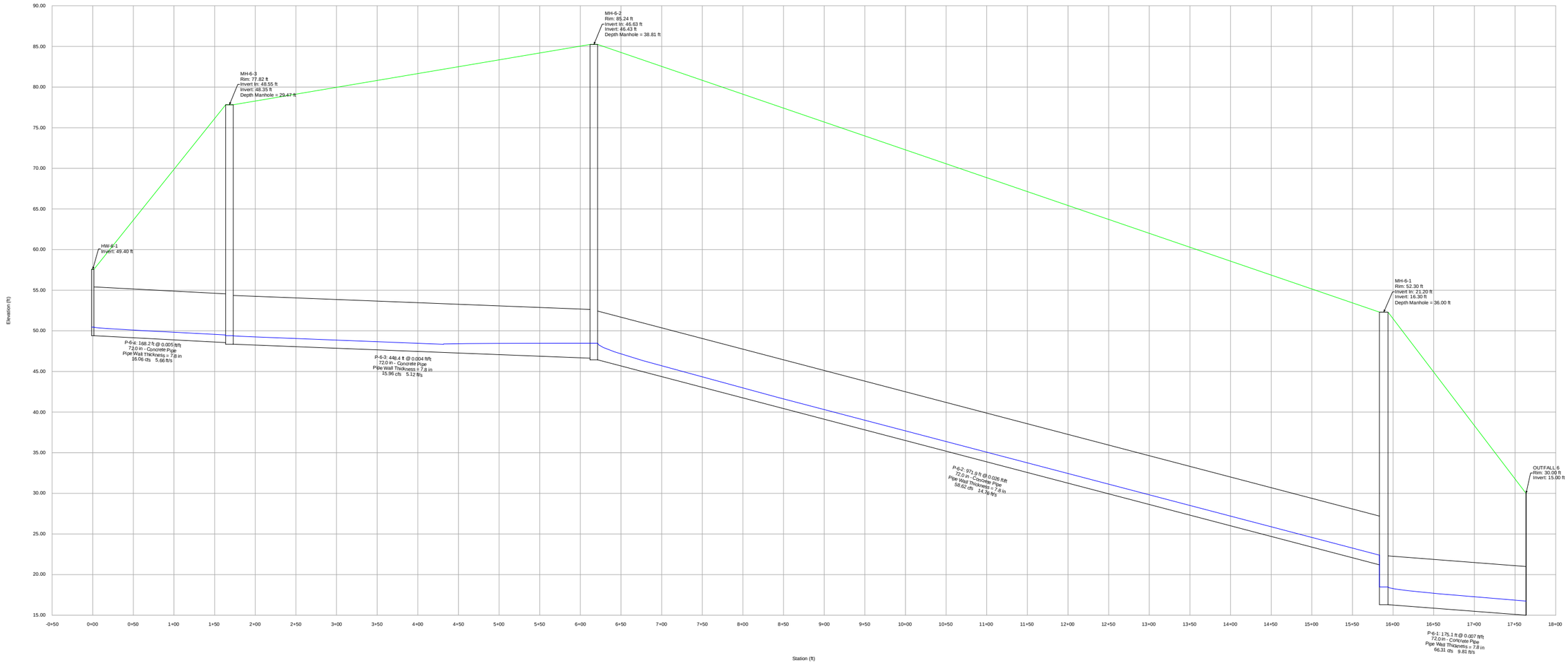
Profile Report
Engineering Profile - Profile - 5 - IN-5-20 TO IN-5-17 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

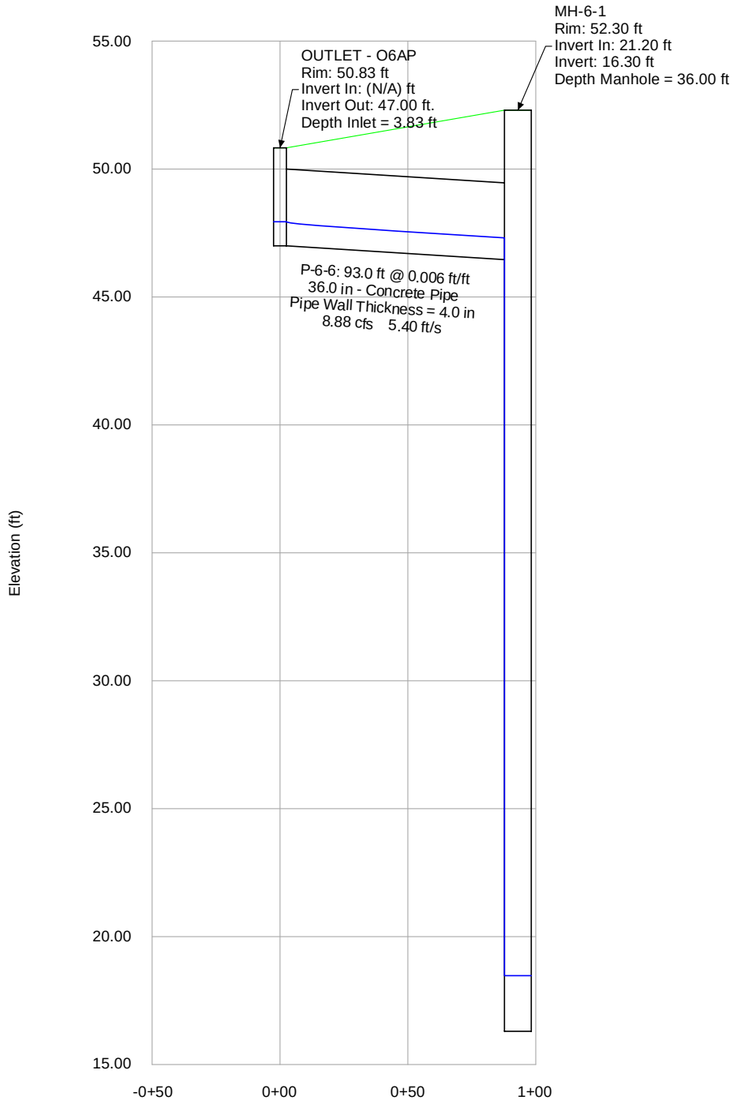
Engineering Profile - Profile - 6 - HW-6-1 TO OUTFALL 6 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

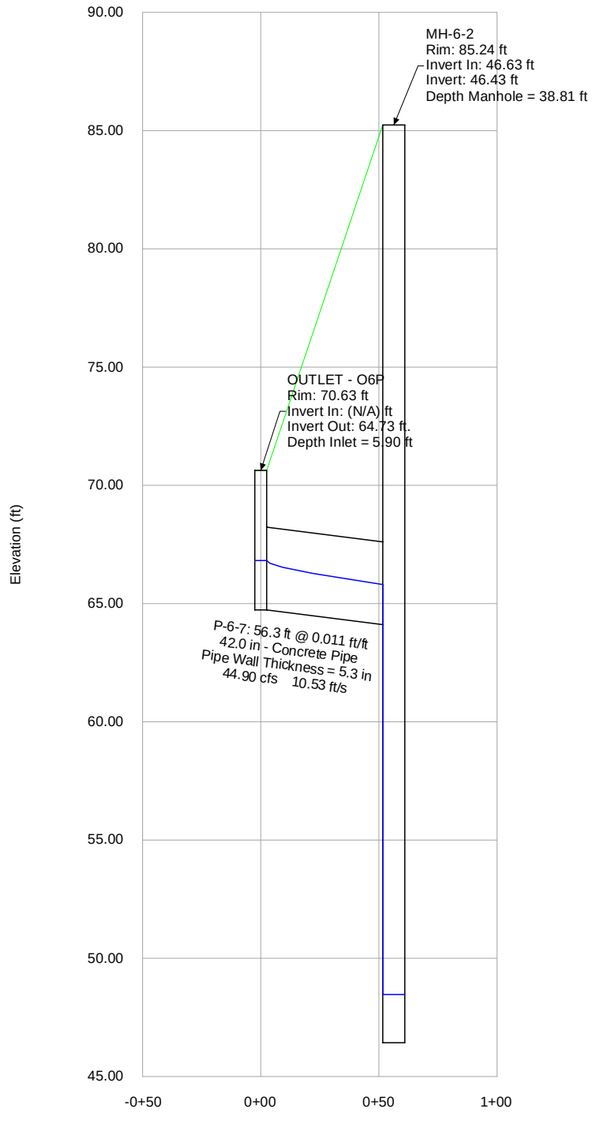
Engineering Profile - Profile - 6 - OUTLET- O6AP TO MH-6-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

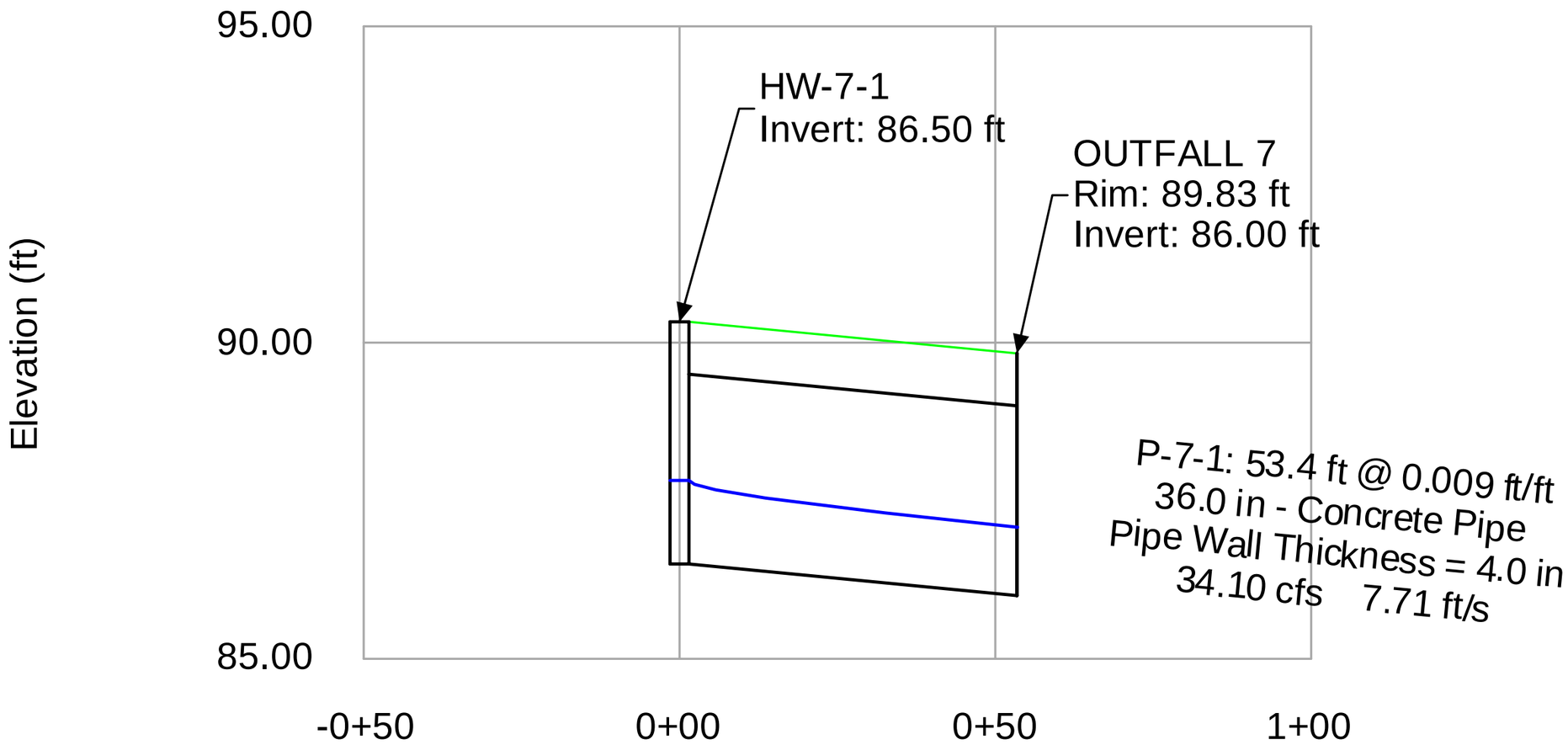
Engineering Profile - Profile - 6 - OUTLET-O6P TO MH-6-2 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

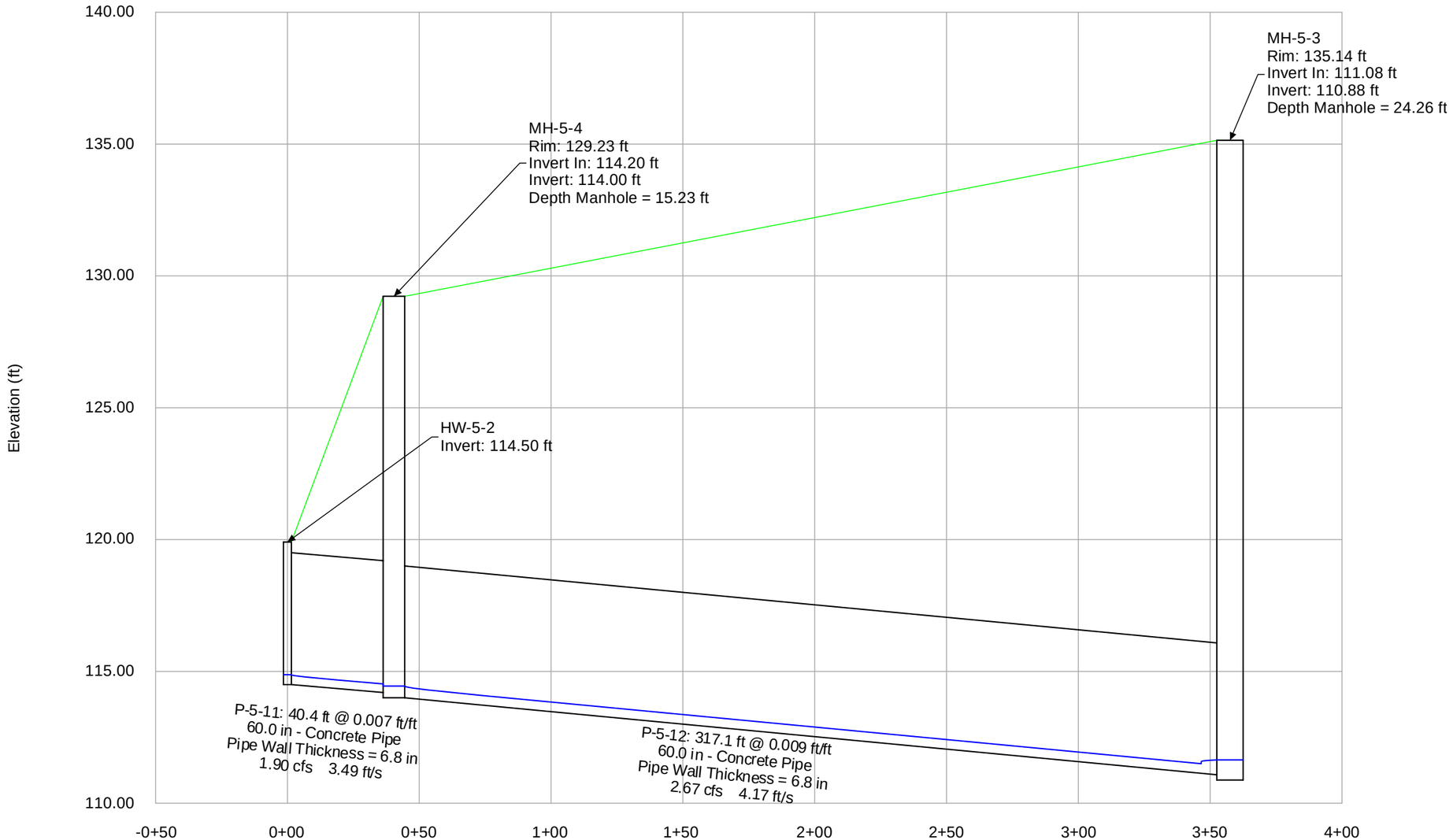
Engineering Profile - Profile - 7 - HW-7-1 TO OUTFALL 7 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

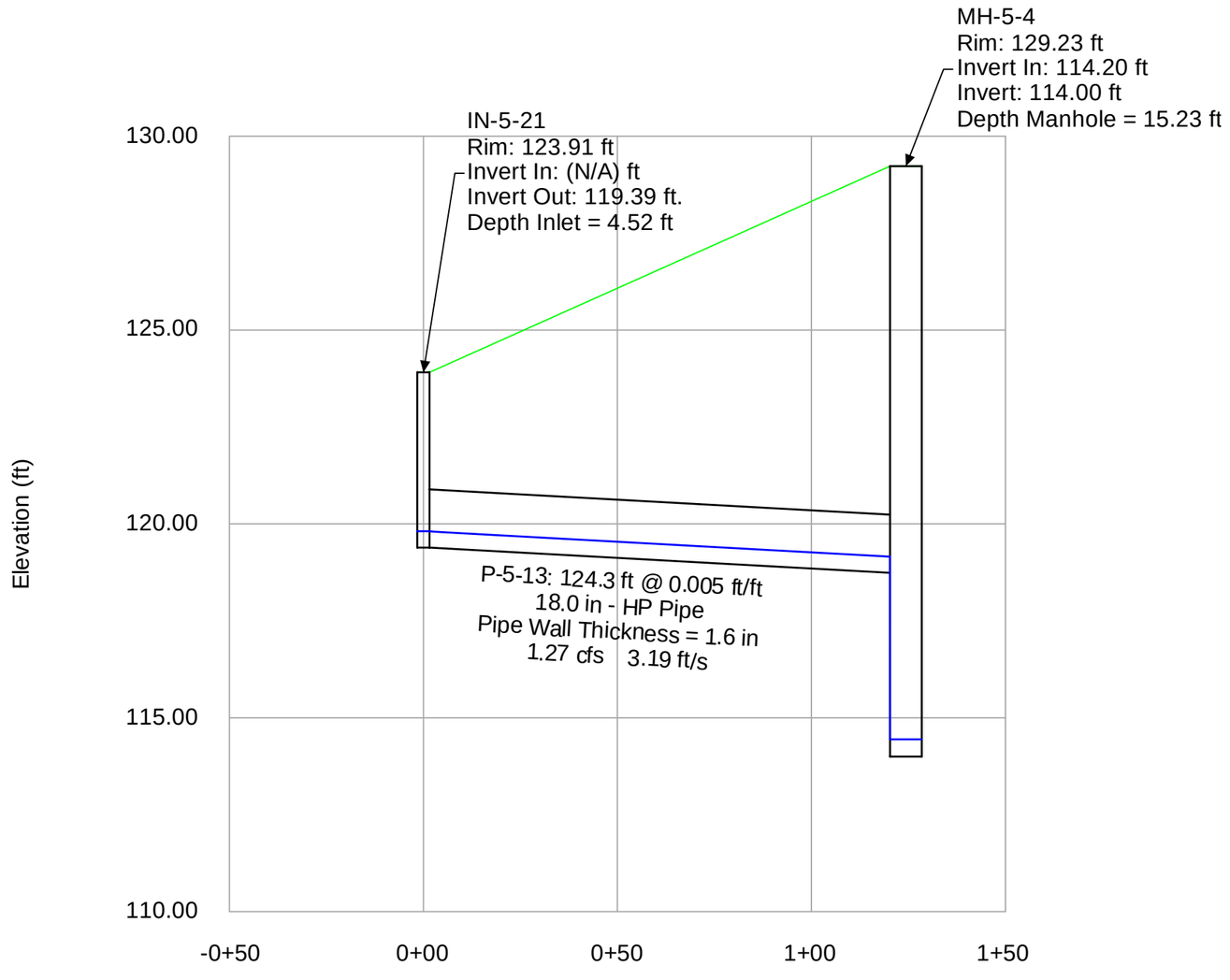
Engineering Profile - Profile - 5 - HW-5-2 to MH-5-3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

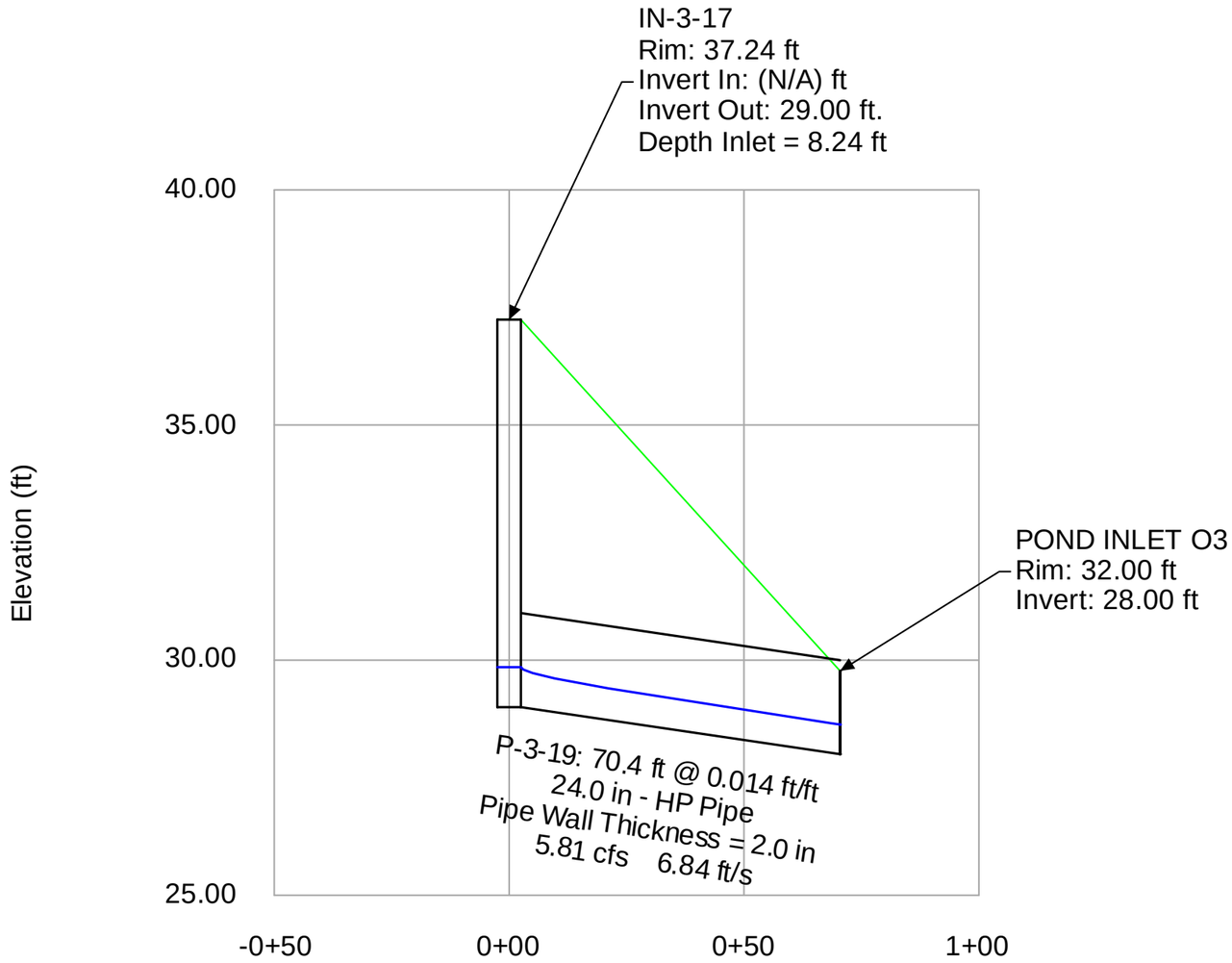
Engineering Profile - Profile - 5 - IN-5-21 TO MH-5-4 Water Tank (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

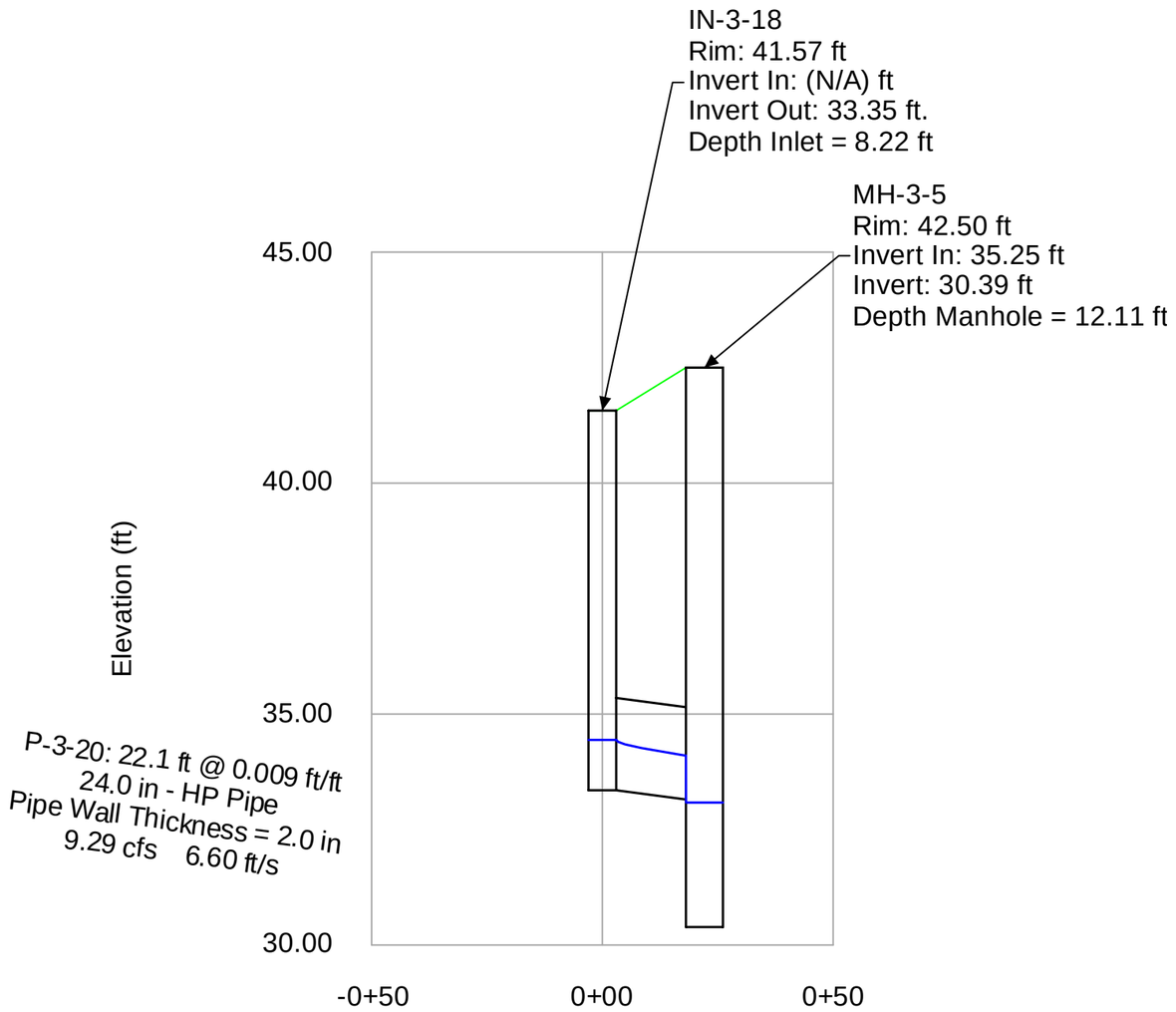
Engineering Profile - Profile - 3 - IN-3-17 TO POND INLET O3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

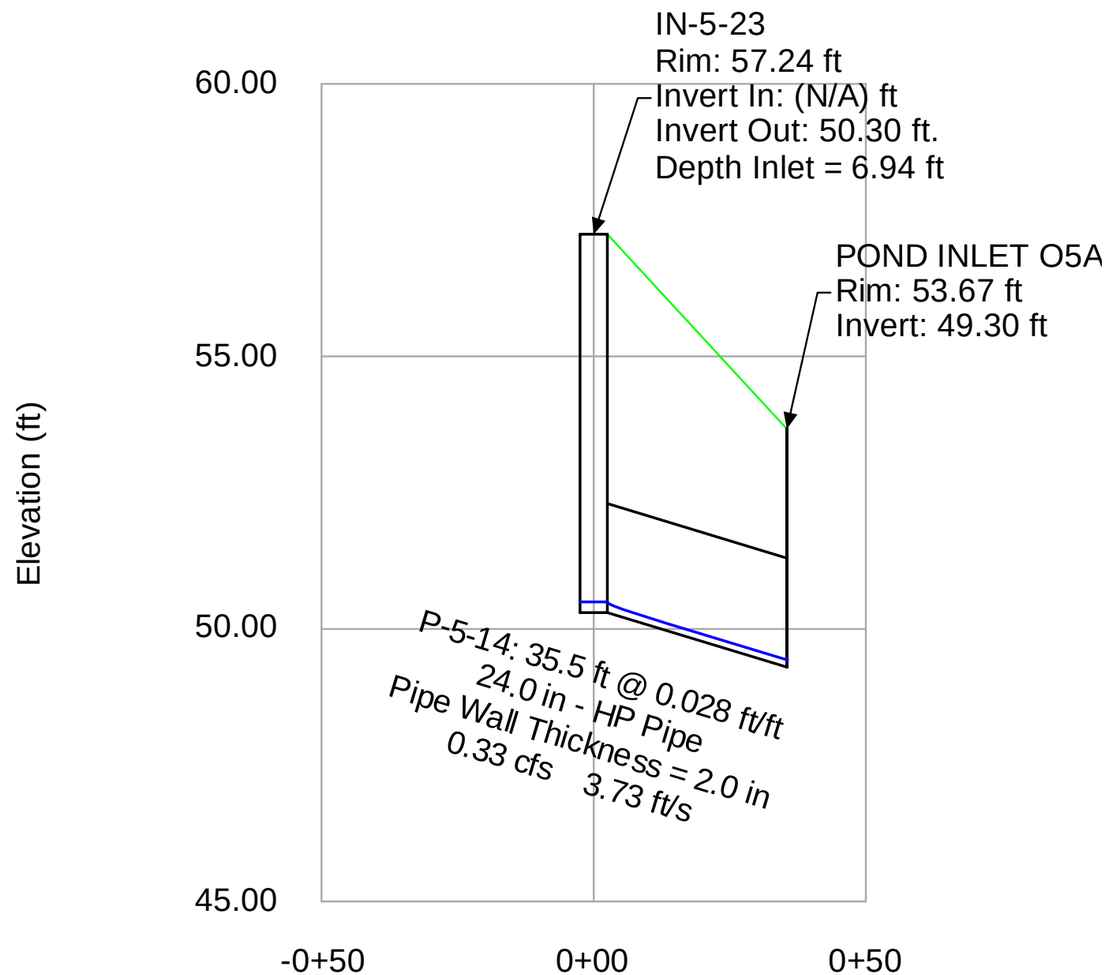
Engineering Profile - Profile - 3 - IN-3-18 TO MH-3-5 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

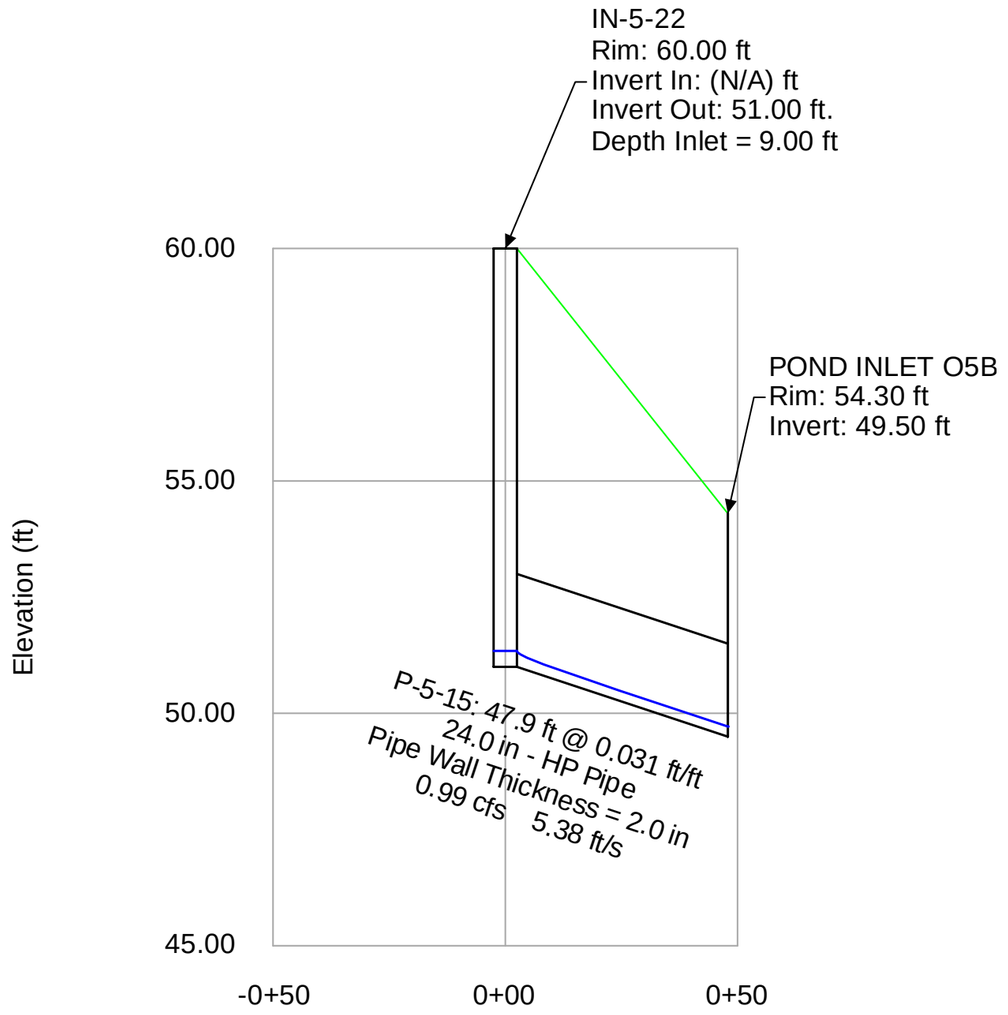
Engineering Profile - Profile - 5 - IN-5-23 TO POND INLET O5A (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

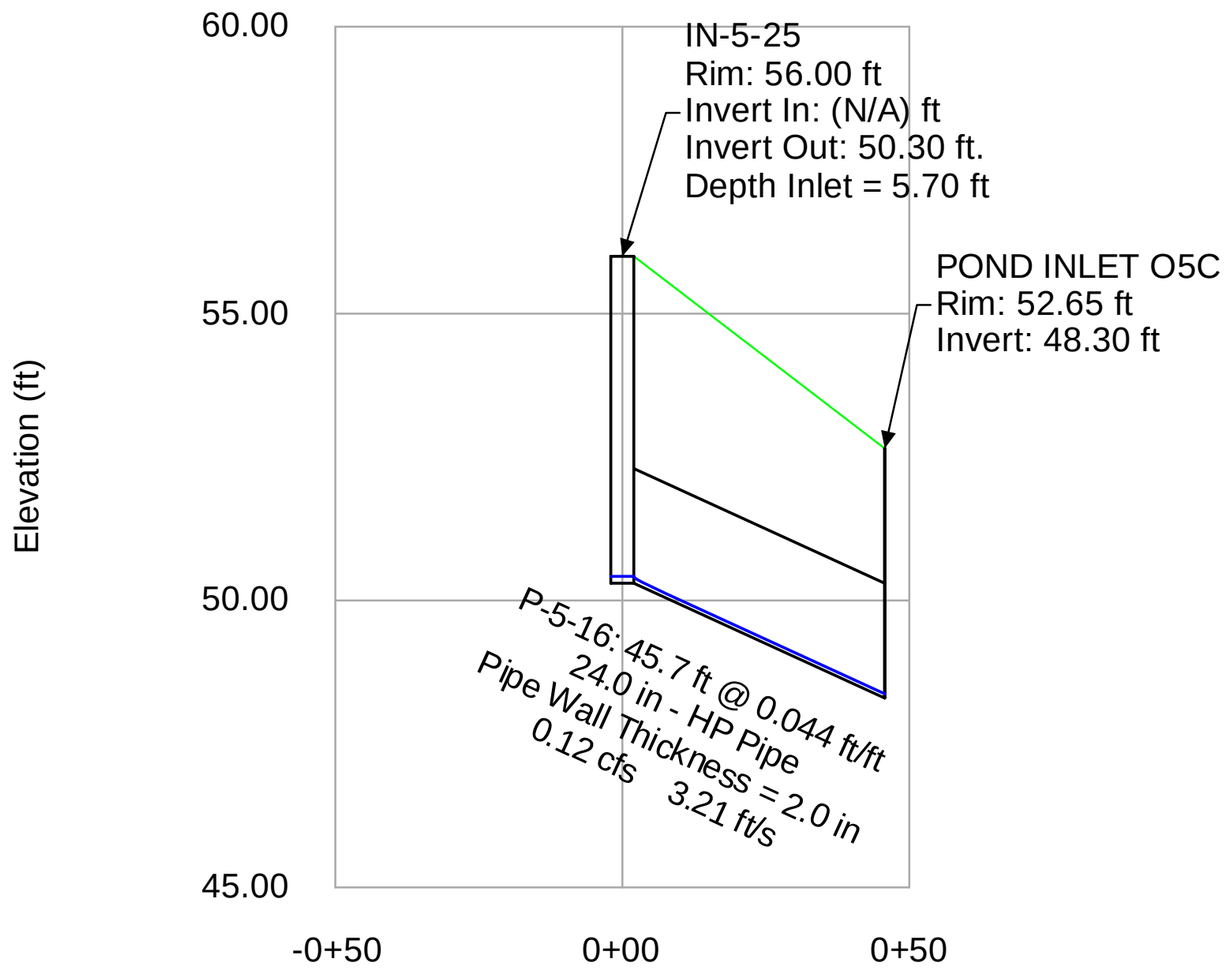
Engineering Profile - Profile - 5 - IN-5-22 TO POND INLET O5B (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

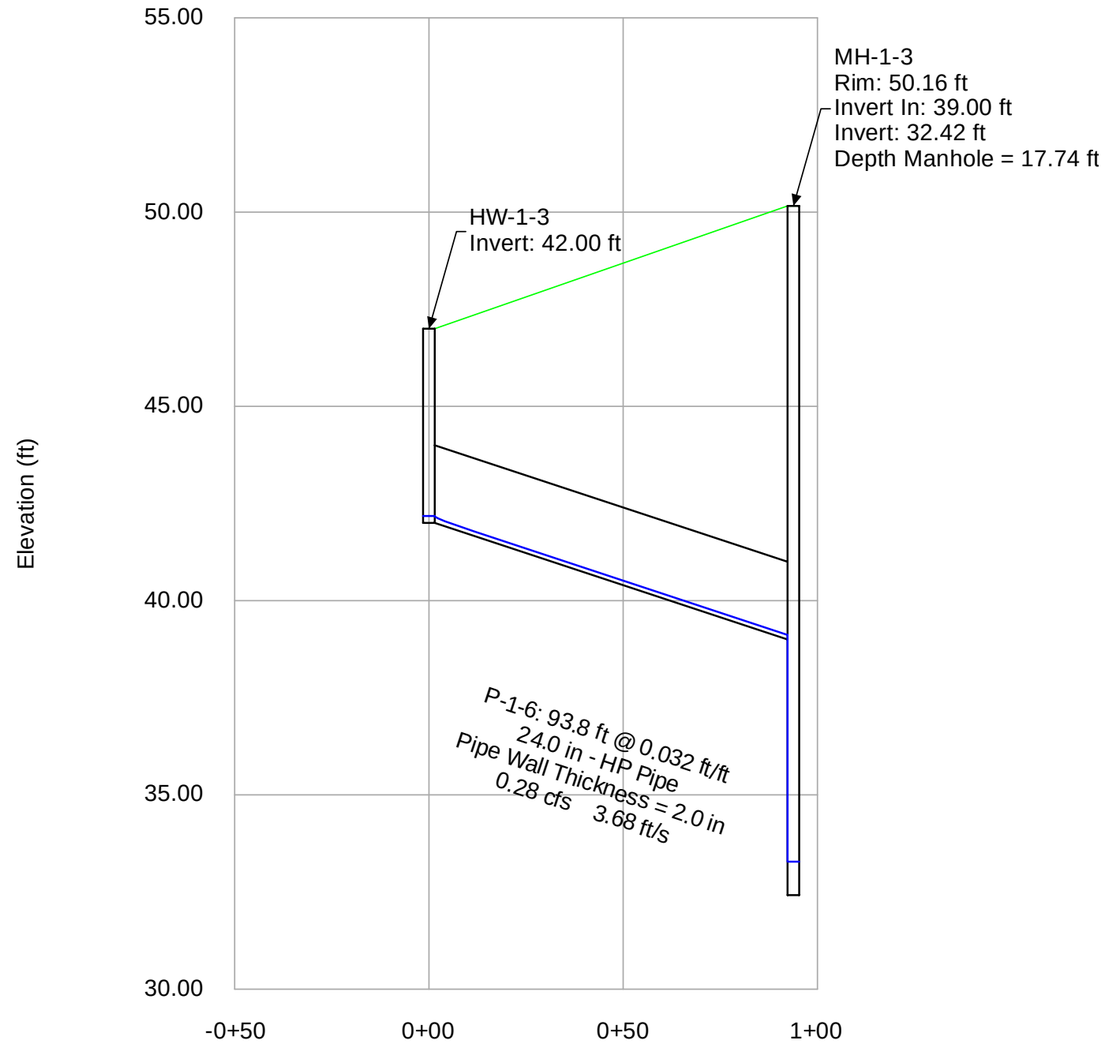
Engineering Profile - Profile - 5 - IN-5-25 TO POND INLET O5C (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

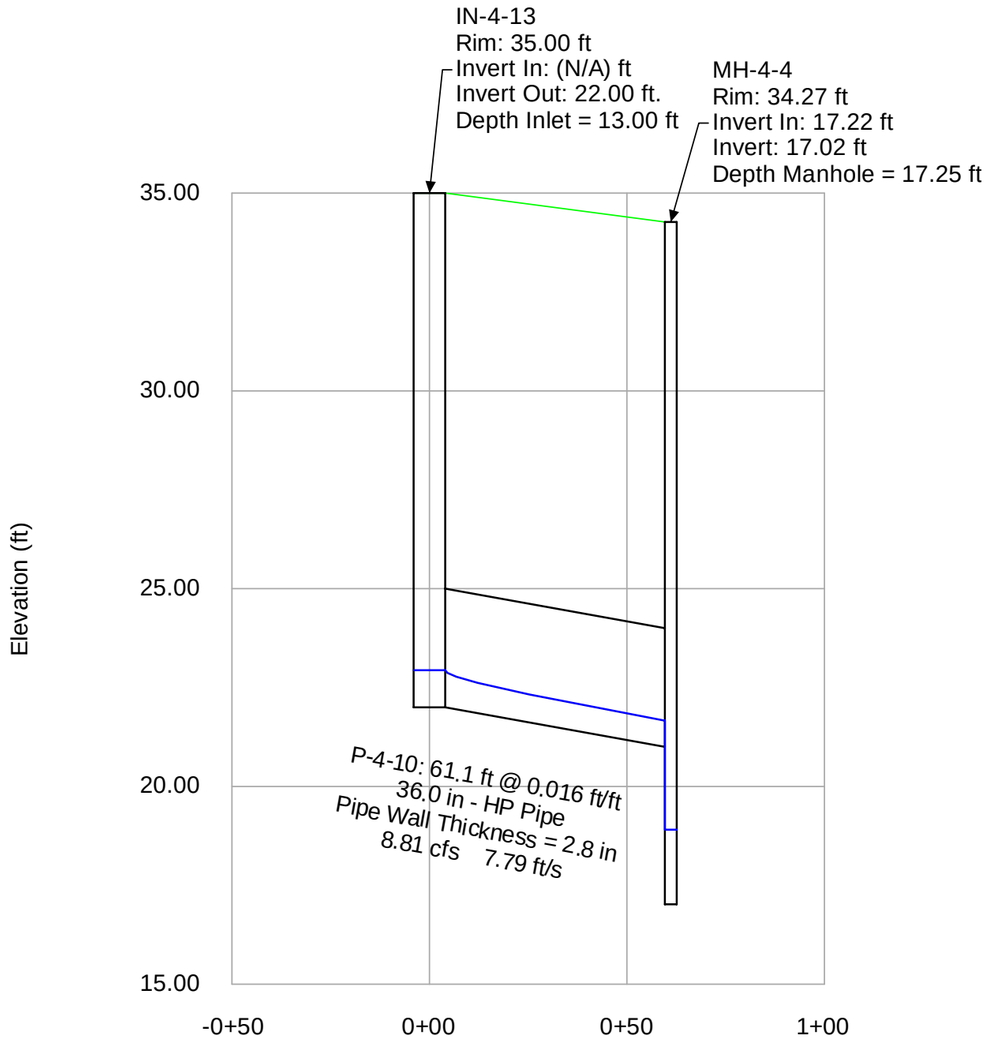
Engineering Profile - Profile - 1 HW-1-3 TO MH-1-3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

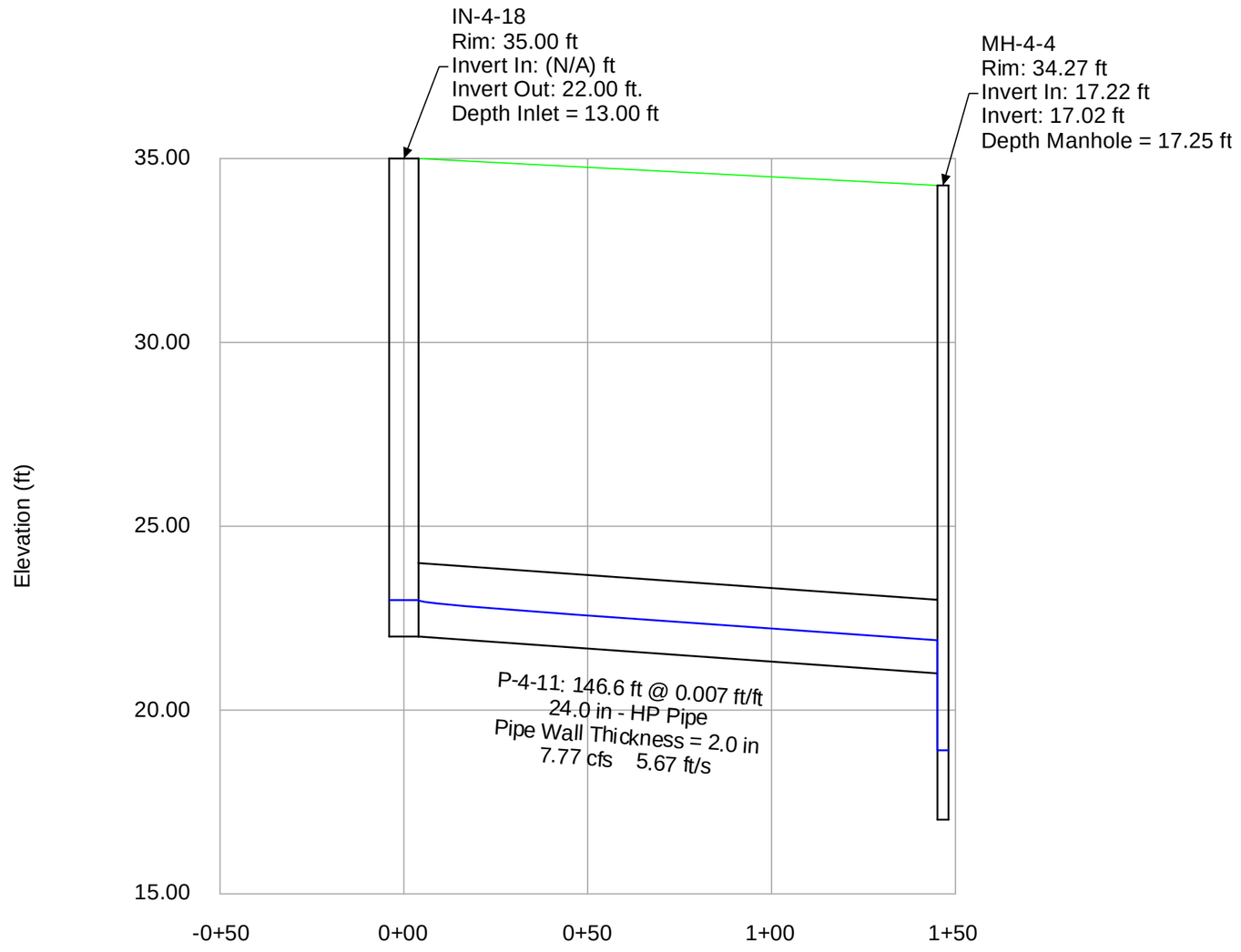
Engineering Profile - Profile - 4 - IN-4-13 TO MH-4-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

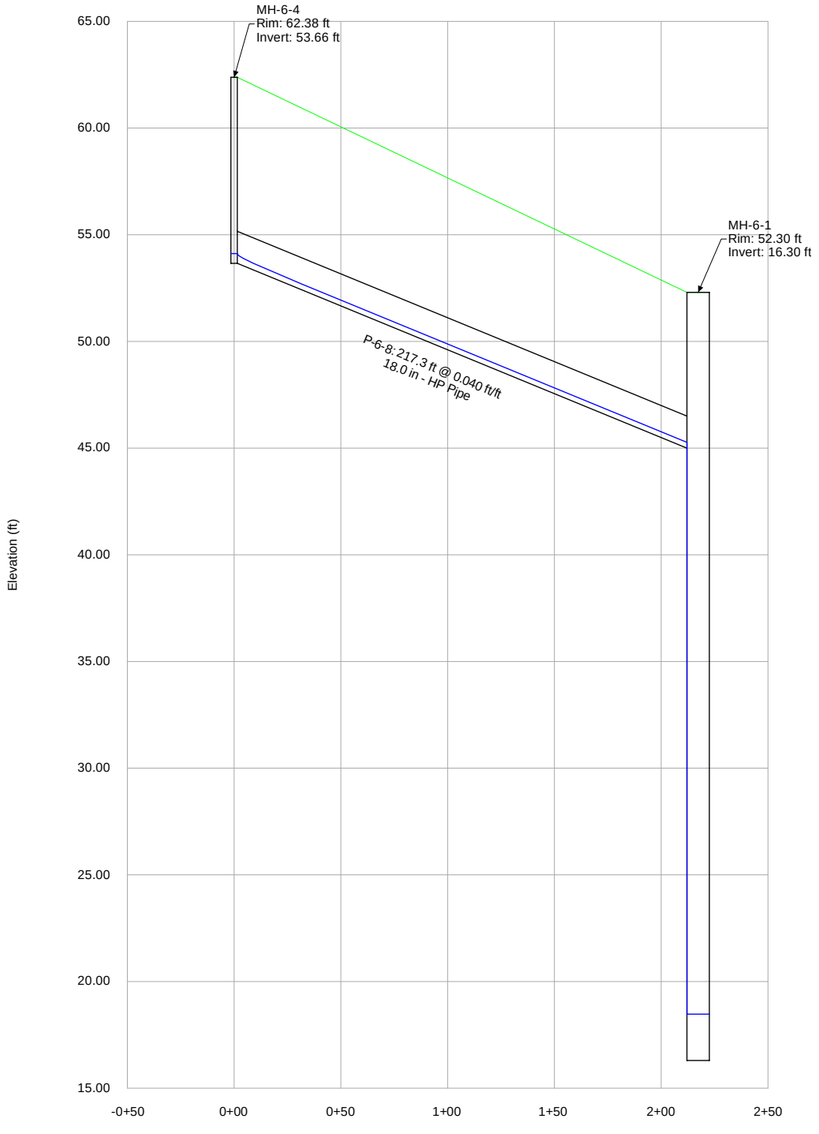
Engineering Profile - Profile - 4 - IN-4-18 TO MH-4-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



5-Yr

Profile Report

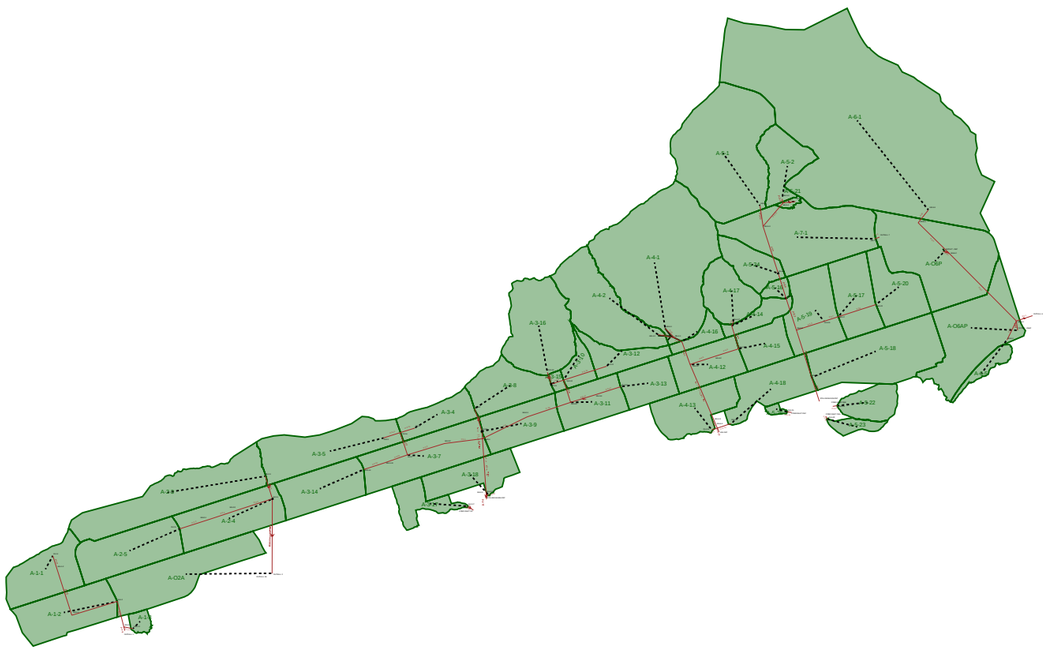
Engineering Profile - Profile - 6 - M-6-4 TO MH-6-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-YEAR STORMCAD OUTPUT FILES

CLIN BA01 AWARDED

Scenario: Scenario - 10 Yr



10-Yr Storm Catchment					
Label	Outflow Element	Scaled Area (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
A-1-1	IN-1-1	8.22	0.21	25.9	8.75
A-1-2	IN-1-2	9.52	0.22	28.8	9.96
A-1-3	HW-1-3	0.99	0.15	13.1	0.99
A-2-3	IN-2-3	16.45	0.27	32.5	19.99
A-2-4	IN-2-4	10.04	0.47	29.4	22.14
A-2-5	IN-2-5	10.06	0.51	26.9	25.46
A-3-10	IN-3-10	2.47	0.28	15.3	4.30
A-3-11	IN-3-11	6.35	0.51	23.3	17.33
A-3-12	IN-3-12	4.36	0.33	11.8	9.97
A-3-13	IN-3-13	4.99	0.44	27.3	10.80
A-3-14	IN-3-14	8.05	0.45	28.3	17.43
A-3-15	IN-3-15	0.63	0.37	7.2	1.97
A-3-16	IN-3-16	13.15	0.15	32.0	8.93
A-3-17	IN-3-17	3.72	0.39	18.8	8.47
A-3-18	IN-3-18	6.29	0.40	23.2	13.49
A-3-4	IN-3-4	5.06	0.31	12.6	10.60
A-3-5	IN-3-5	11.98	0.27	29.5	15.14
A-3-7	IN-3-7	11.83	0.45	21.3	29.64
A-3-8	IN-3-8	7.27	0.27	13.8	12.77
A-3-9	IN-3-9	7.45	0.51	28.8	18.07
A-4-1	HW-4-1	31.45	0.15	34.5	20.76
A-4-12	IN-4-12	6.67	0.47	23.5	16.71
A-4-13	IN-4-13	7.81	0.34	26.5	13.29
A-4-14	IN-4-14	2.89	0.38	16.9	6.64
A-4-15	IN-4-15	1.71	0.44	18.6	4.41
A-4-16	IN-4-16	2.13	0.42	10.1	6.52
A-4-17	IN-4-17	6.15	0.15	26.2	4.65
A-4-18	IN-4-18	7.70	0.31	26.2	12.03
A-4-2	HW-4-2	12.99	0.15	34.2	8.61
A-5-1	HW-5-1	24.61	0.16	32.4	17.75
A-5-16	IN-5-16	1.09	0.23	12.3	1.71
A-5-17	IN-5-17	7.53	0.62	17.4	27.96
A-5-18	IN-5-18	15.49	0.29	62.1	13.83
A-5-19	IN-5-19	9.29	0.68	15.8	38.93
A-5-2	HW-5-2	6.07	0.16	23.3	5.20
A-5-20	IN-5-20	6.85	0.68	13.7	30.39
A-5-21	IN-5-21	0.39	0.51	6.7	1.72
A-5-22	IN-5-22	4.01	0.15	18.0	3.56
A-5-23	IN-5-23	1.49	0.15	23.3	1.20
A-5-24	IN-5-24	4.79	0.25	11.1	8.47
A-5-25	IN-5-25	0.38	0.15	8.8	0.44
A-6-1	HW-6-1	80.53	0.15	42.9	48.09
A-6-5	MH-6-4	1.82	0.25	16.2	2.78
A-7-1	HW-7-1	17.78	0.47	21.0	46.80
A-O2A	OUTFALL 2A	12.55	0.36	41.6	18.28
A-O6AP	OUTLET - O6AP	14.82	0.24	28.5	17.03
A-O6P	OUTLET - O6P	19.07	0.22	28.8	19.96

10-Yr Storm Pipes									
Label	Start Node	Invert Start (ft)	Stop Node	Invert Stop (ft)	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Catalog Class
EX-P-2-1 (CULVERT #1)	IN-2-4	71.50	OUTFALL 2	30.84	60	760.4	0.053	0.024	CMP Pipe
EX-P-3-1 (CULVERT #2)(1)	MH-3-1	65.40	MH-3-5	35.25	60	577.1	0.052	0.024	CMP Pipe
EX-P-3-2 (CULVERT #2)	IN-3-9	69.80	MH-3-1	65.60	60	75.7	0.055	0.024	CMP Pipe
EX-P-4-2 (CULVERT #3)	IN-4-12	39.34	MH-4-3	17.88	78	630.9	0.034	0.024	CMP Pipe
P-1-1	IN-1-2	45.00	MH-1-3	39.00	48	269.8	0.022	0.013	Concrete Pipe
P-1-2	MH-1-1	77.19	IN-1-2	56.00	48	483.9	0.044	0.013	Concrete Pipe
P-1-3	MH-1-2	79.89	MH-1-1	77.39	48	509.7	0.005	0.013	Concrete Pipe
P-1-4	IN-1-1	81.58	MH-1-2	80.89	36	138.0	0.005	0.013	HP Pipe
P-1-5	MH-1-3	32.42	OUTFALL 1	32.00	48	40.0	0.011	0.013	Concrete Pipe
P-1-6	HW-1-3	42.00	MH-1-3	39.00	24	93.8	0.032	0.013	HP Pipe
P-2-1	IN-2-3	77.16	IN-2-4	73.50	36	243.9	0.015	0.013	Concrete Pipe
P-2-2	IN-2-5	78.89	MH-2-1	77.21	36	322.0	0.005	0.013	Concrete Pipe
P-2-3	MH-2-1	77.01	MH-2-2	75.56	36	322.0	0.005	0.013	Concrete Pipe
P-2-4	MH-2-2	75.36	IN-2-4	73.50	36	353.4	0.005	0.013	Concrete Pipe
P-3-1	MH-3-2	67.10	MH-3-1	65.60	60	389.6	0.004	0.013	Concrete Pipe
P-3-10	IN-3-12	76.21	IN-3-10	74.20	48	465.0	0.004	0.013	HP Pipe
P-3-11	IN-3-5	72.98	IN-3-6	72.30	36	179.2	0.004	0.013	HP Pipe
P-3-12	IN-3-4	72.75	IN-3-6	72.30	36	155.0	0.003	0.013	HP Pipe
P-3-13	MH-3-4	75.56	IN-3-11	72.60	36	264.0	0.011	0.013	Concrete Pipe
P-3-14	IN-3-13	77.14	MH-3-4	75.76	36	275.0	0.005	0.013	Concrete Pipe
P-3-15	IN-3-14	72.75	MH-3-13	72.01	36	235.0	0.003	0.013	Concrete Pipe
P-3-16	MH-3-13	71.81	IN-3-7	71.00	36	235.1	0.003	0.013	Concrete Pipe
P-3-17	IN-3-16	102.12	IN-3-15	76.06	36	126.5	0.206	0.013	HP Pipe
P-3-18	MH-3-5	30.39	STILLING BASIN-O3P	29.39	60	45.6	0.022	0.024	CMP Pipe
P-3-19	IN-3-17	29.00	POND INLET O3	28.00	24	70.4	0.014	0.013	HP Pipe
P-3-2	IN-3-7	69.00	MH-3-2	67.30	60	398.0	0.004	0.013	Concrete Pipe
P-3-20	IN-3-18	33.35	MH-3-5	33.15	24	22.1	0.009	0.013	HP Pipe
P-3-3	IN-3-6	71.30	IN-3-7	70.29	48	239.4	0.004	0.013	Concrete Pipe
P-3-4	IN-3-8	72.56	IN-3-9	70.80	48	242.6	0.007	0.013	Concrete Pipe
P-3-5	MH-3-3	68.05	MH-3-1	65.60	60	507.2	0.005	0.013	Concrete Pipe
P-3-6	IN-3-11	71.60	MH-3-3	69.05	48	472.0	0.005	0.013	Concrete Pipe
P-3-8	IN-3-10	74.20	IN-3-11	71.60	48	240.3	0.011	0.013	Concrete Pipe
P-3-9	IN-3-15	75.86	IN-3-10	75.20	36	133.5	0.005	0.013	HP Pipe
P-4-1	IN-4-16	55.87	IN-4-12	53.42	48	244.8	0.010	0.013	Concrete Pipe
P-4-10	IN-4-13	22.00	MH-4-4	21.00	36	61.1	0.016	0.013	HP Pipe
P-4-11	IN-4-18	22.00	MH-4-4	21.00	24	146.6	0.007	0.013	HP Pipe
P-4-12	MH-4-4	17.02	HW-O4P	16.77	78	43.2	0.006	0.024	CMP Pipe
P-4-2	MH-4-1	56.95	IN-4-16	56.07	48	88.4	0.010	0.013	Concrete Pipe
P-4-3	MH-4-2	72.12	IN-4-12	70.80	48	258.7	0.005	0.013	Concrete Pipe
P-4-4	IN-4-15	73.64	MH-4-2	72.32	48	265.0	0.005	0.013	Concrete Pipe
P-4-5	IN-4-14	75.06	IN-4-15	73.84	48	244.6	0.005	0.013	Concrete Pipe
P-4-6	HW-4-1	58.50	MH-4-1	57.15	48	135.4	0.010	0.013	Concrete Pipe
P-4-7	HW-4-2	66.50	MH-4-1	62.00	36	169.6	0.027	0.013	Concrete Pipe
P-4-8	IN-4-17	75.50	IN-4-14	75.26	48	47.1	0.005	0.013	HP Pipe
P-4-9	MH-4-3	17.68	MH-4-4	17.22	78	77.3	0.006	0.024	CMP Pipe
P-5-1	IN-5-18	58.50	STILLING BASIN-O5P	49.81	60	256.7	0.034	0.013	Concrete Pipe
P-5-10	HW-5-1	117.50	MH-5-3	111.08	60	214.7	0.030	0.013	Concrete Pipe
P-5-11	HW-5-2	114.50	MH-5-4	114.20	60	40.4	0.007	0.013	Concrete Pipe
P-5-12	MH-5-4	114.00	MH-5-3	111.08	60	317.1	0.009	0.013	Concrete Pipe
P-5-13	IN-5-21	119.39	MH-5-4	118.74	18	124.3	0.005	0.013	HP Pipe
P-5-14	IN-5-23	50.30	POND INLET O5A	49.30	24	35.5	0.028	0.013	HP Pipe
P-5-15	IN-5-22	51.00	POND INLET O5B	49.50	24	47.9	0.031	0.013	HP Pipe
P-5-16	IN-5-25	50.30	POND INLET O5C	48.30	24	45.7	0.044	0.013	HP Pipe
P-5-2	MH-5-2	71.05	IN-5-18	58.70	60	507.8	0.024	0.013	Concrete Pipe
P-5-3	IN-5-16	75.40	MH-5-2	71.25	60	334.7	0.012	0.013	Concrete Pipe
P-5-4	IN-5-24	81.70	IN-5-16	75.60	60	276.5	0.022	0.013	Concrete Pipe
P-5-5	MH-5-3	110.88	IN-5-24	81.90	60	503.8	0.058	0.013	Concrete Pipe
P-5-6	IN-5-20	78.62	IN-5-17	77.00	48	404.8	0.004	0.013	Concrete Pipe
P-5-7	IN-5-17	76.80	IN-5-19	74.70	48	152.2	0.014	0.013	Concrete Pipe
P-5-8	IN-5-19	74.50	MH-5-2	71.25	48	297.0	0.011	0.013	Concrete Pipe
P-6-1	MH-6-1	16.30	OUTFALL 6	15.00	72	175.1	0.007	0.013	Concrete Pipe
P-6-2	MH-6-2	46.43	MH-6-1	21.20	72	971.9	0.026	0.013	Concrete Pipe
P-6-3	MH-6-3	48.35	MH-6-2	46.63	72	448.4	0.004	0.013	Concrete Pipe
P-6-4	HW-6-1	49.40	MH-6-3	48.55	72	168.2	0.005	0.013	Concrete Pipe
P-6-6	OUTLET - O6AP	47.00	MH-6-1	46.46	36	93.0	0.006	0.013	Concrete Pipe
P-6-7	OUTLET - O6P	64.73	MH-6-2	64.11	42	56.3	0.011	0.013	Concrete Pipe
P-6-8	MH-6-4	53.66	MH-6-1	45.00	18	217.3	0.040	0.013	HP Pipe
P-7-1	HW-7-1	86.50	OUTFALL 7	86.00	36	53.4	0.009	0.013	Concrete Pipe

10-Yr Storm Inlets		
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)
IN-1-1	87.09	81.58
IN-1-2	88.00	45.00
IN-2-3	82.67	77.16
IN-2-4	81.90	71.50
IN-2-5	85.08	78.89
IN-3-10	81.81	74.20
IN-3-11	81.74	71.60
IN-3-12	82.46	76.21
IN-3-13	82.78	77.14
IN-3-14	78.77	72.75
IN-3-15	81.51	75.86
IN-3-16	112.25	102.12
IN-3-17	37.24	29.00
IN-3-18	41.57	33.35
IN-3-4	78.26	72.75
IN-3-5	78.20	72.98
IN-3-6	78.55	71.30
IN-3-7	77.37	69.00
IN-3-8	79.62	72.56
IN-3-9	79.04	69.80
IN-4-12	83.54	39.34
IN-4-13	35.00	22.00
IN-4-14	84.26	75.06
IN-4-15	84.59	73.64
IN-4-16	83.58	55.87
IN-4-17	82.75	75.50
IN-4-18	35.00	22.00
IN-5-16	87.78	75.40
IN-5-17	84.96	76.80
IN-5-18	84.02	58.50
IN-5-19	84.70	74.50
IN-5-20	0.00	78.62
IN-5-21	123.91	119.39
IN-5-22	60.00	51.00
IN-5-23	57.24	50.30
IN-5-24	89.41	81.70
IN-5-25	56.00	50.30
OUTLET - O6AP	50.83	47.00
OUTLET - O6P	70.63	64.73

10-Yr Storm Manholes		
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)
MH-1-1	89.54	77.19
MH-1-2	90.33	79.89
MH-1-3	50.16	32.42
MH-2-1	84.08	77.01
MH-2-2	83.05	75.36
MH-3-1	80.32	65.40
MH-3-13	78.06	71.81
MH-3-2	78.21	67.10
MH-3-3	80.35	68.05
MH-3-4	82.27	75.56
MH-3-5	42.50	30.39
MH-4-1	80.44	56.95
MH-4-2	84.14	72.12
MH-4-3	59.89	17.68
MH-4-4	34.27	17.02
MH-5-2	86.34	71.05
MH-5-3	135.14	110.88
MH-5-4	129.23	114.00
MH-6-1	52.30	16.30
MH-6-2	85.24	46.43
MH-6-3	77.82	48.35
MH-6-4	62.38	53.66

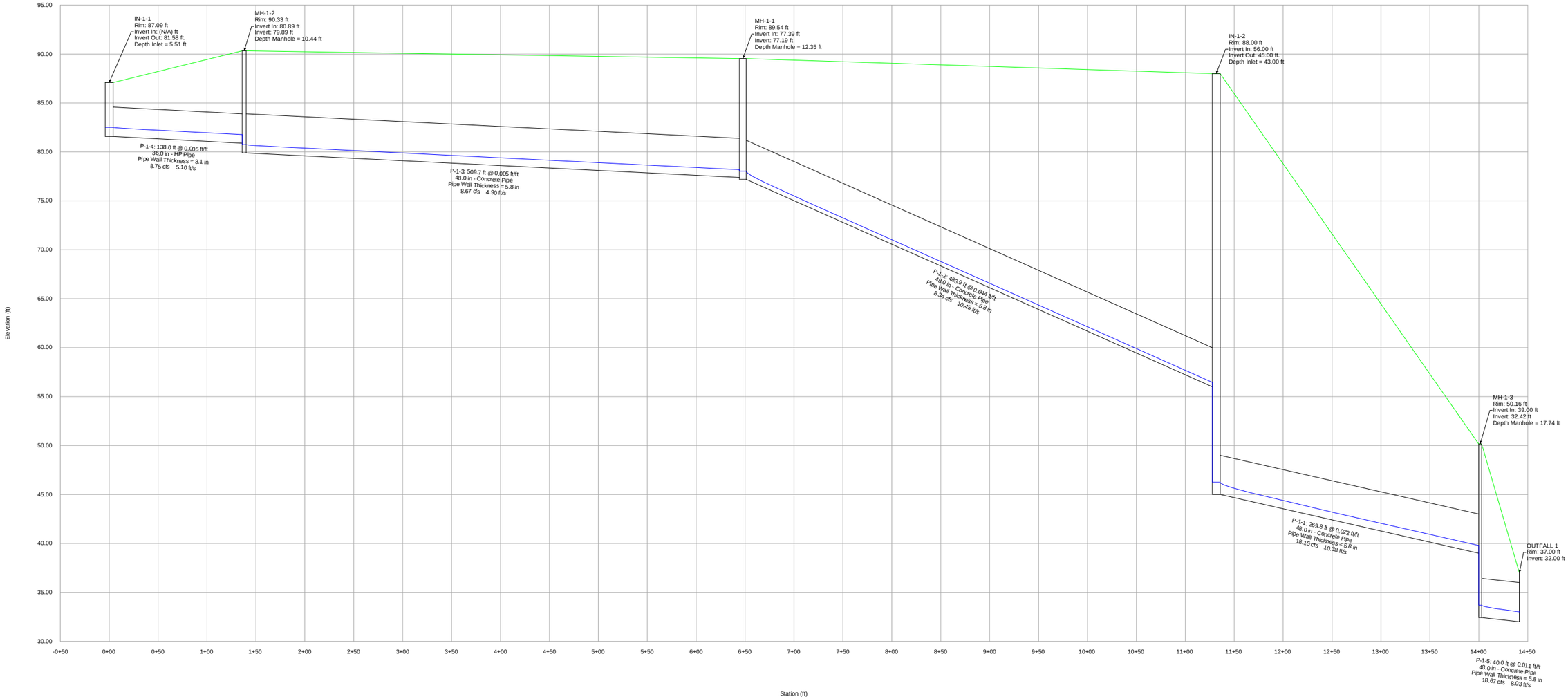
10-Yr Storm Outfall	
Label	Elevation (Invert) (ft)
OUTFALL 1	32.00
OUTFALL 2	30.84
STILLING BASIN-O3P	29.38
STILLING BASIN-O5P	49.81
OUTFALL 6	15.00
OUTFALL 2A	30.00
OUTFALL 7	86.00
POND INLET O3	28.00
POND INLET O5A	49.30
POND INLET O5B	49.50
POND INLET O5C	48.30

10-Yr Storm Headwall	
Label	Elevation (Invert) (ft)
HW-1-3	42.00
HW-4-1	58.50
HW-4-2	66.50
HW-5-1	117.50
HW-5-2	114.50
HW-6-1	49.40
HW-7-1	86.50
HW-O4P	16.77

10-Yr

Profile Report

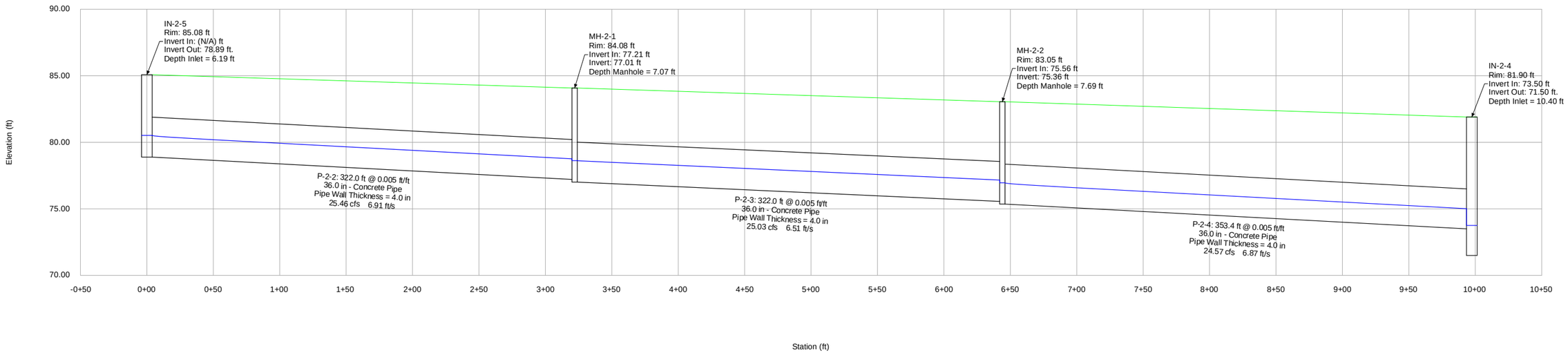
Engineering Profile - Profile - 1 - IN-1-1 TO OUTFALL 1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

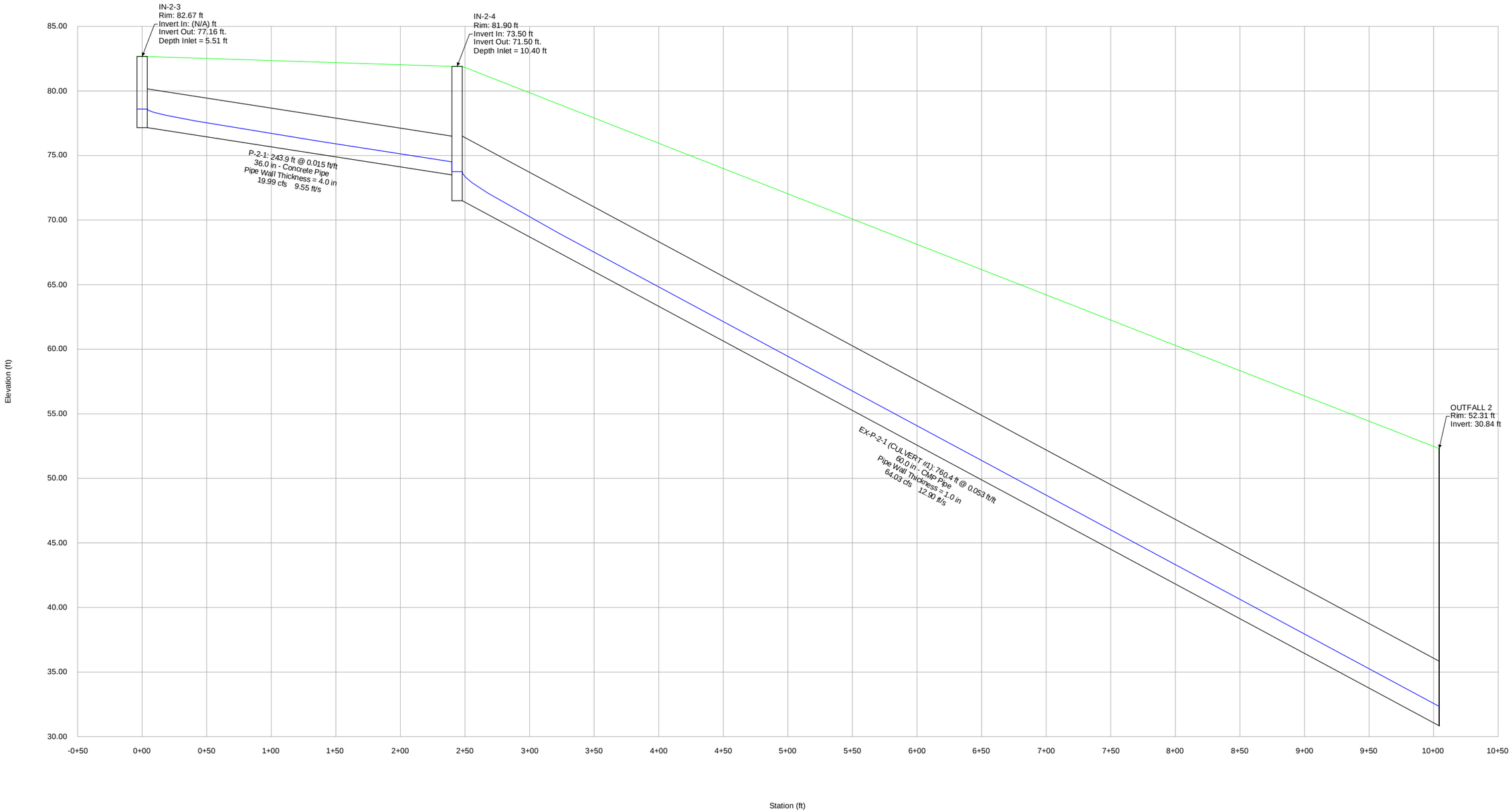
Engineering Profile - Profile - 2 - IN-2-5 TO IN-2-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

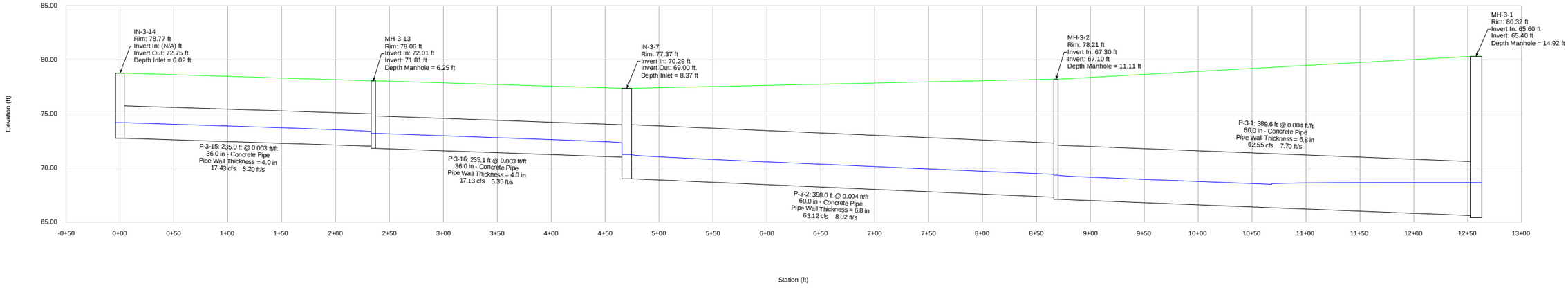
Engineering Profile - Profile - 2 - IN-2-3 TO OUTFALL 2 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

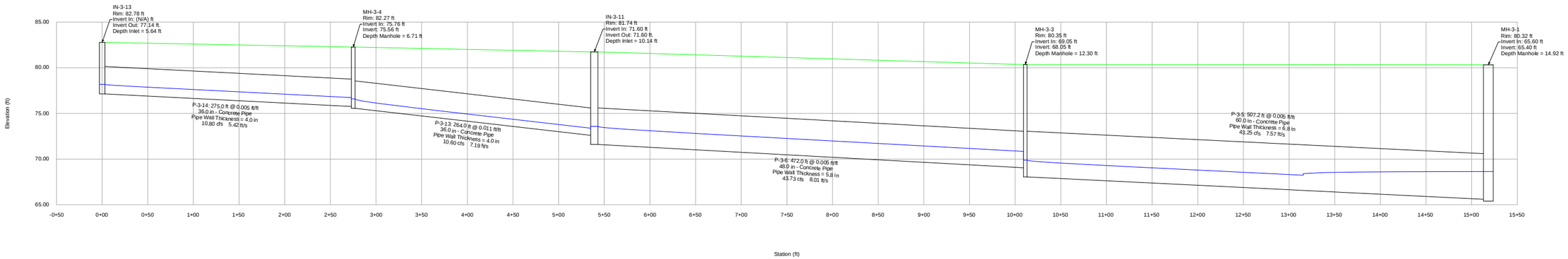
Engineering Profile - Profile - 3 - IN-3-14 TO MH-3-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

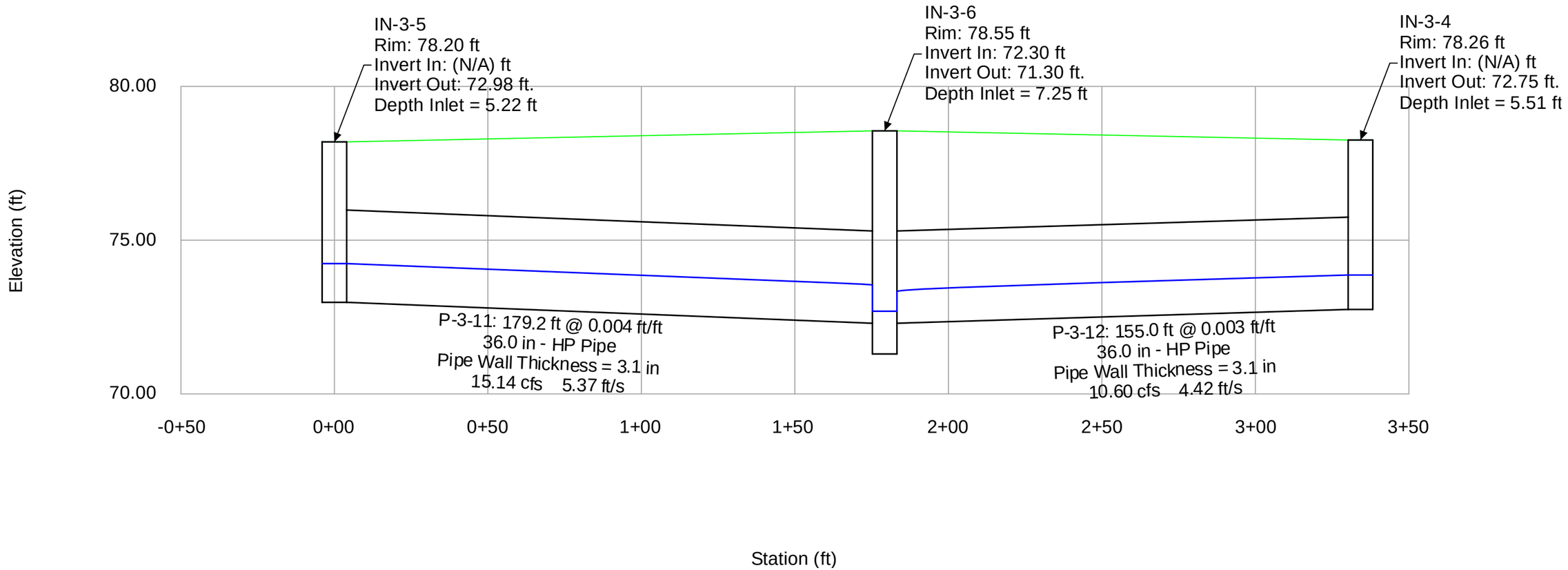
Engineering Profile - Profile - 3 - IN-3-13 TO MH-3-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

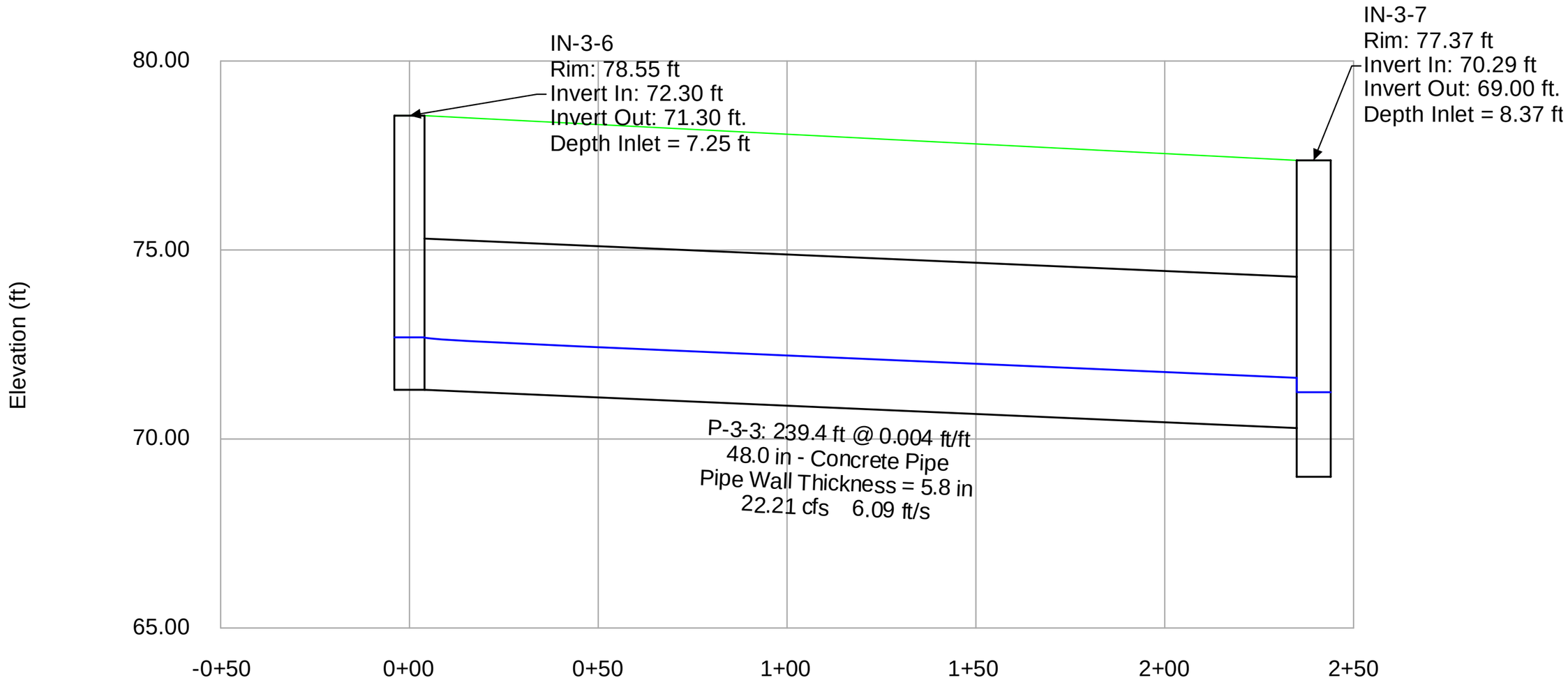
Engineering Profile - Profile - 3 - IN-3-5 TO IN-3-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

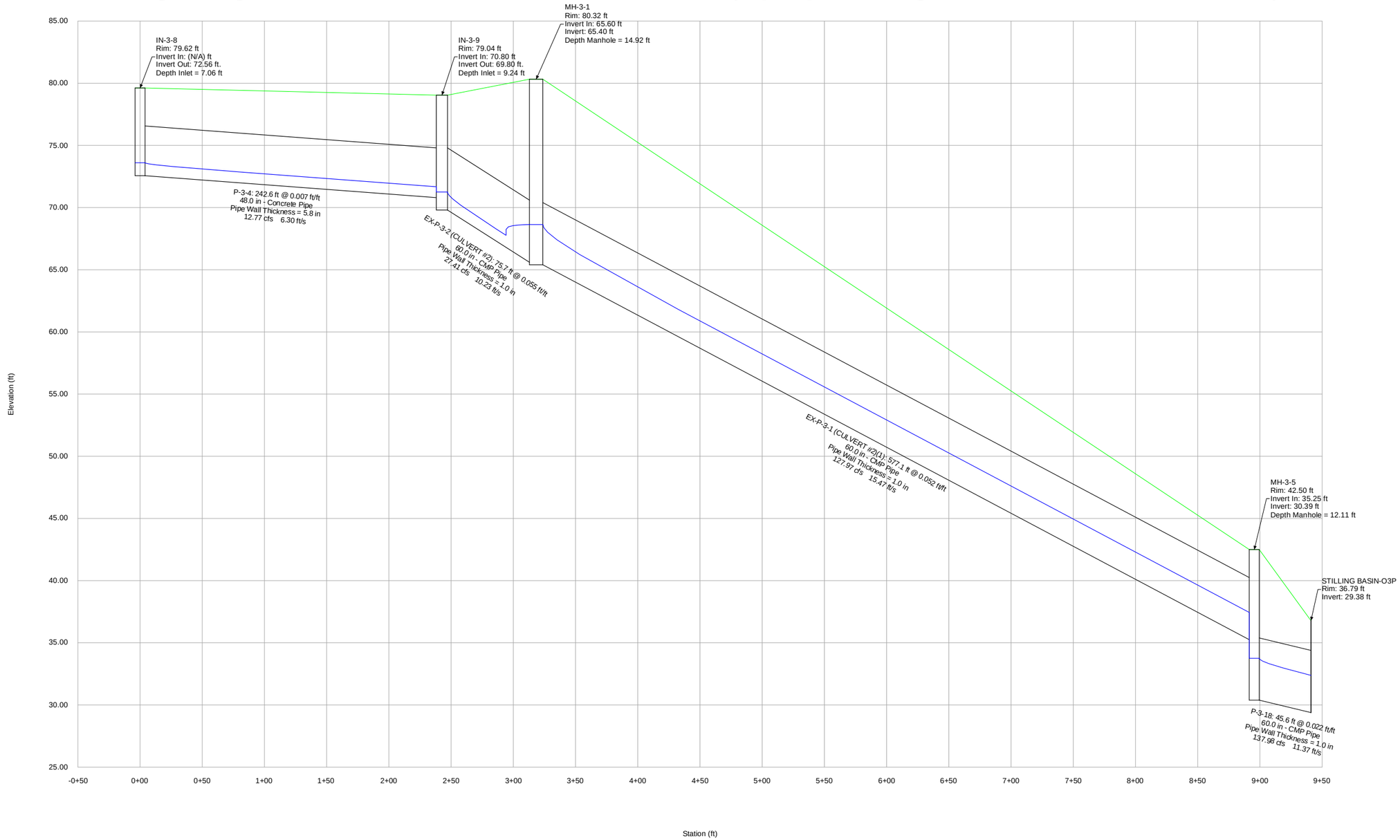
Engineering Profile - Profile - 3 - IN-3-6 TO IN-3-7 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

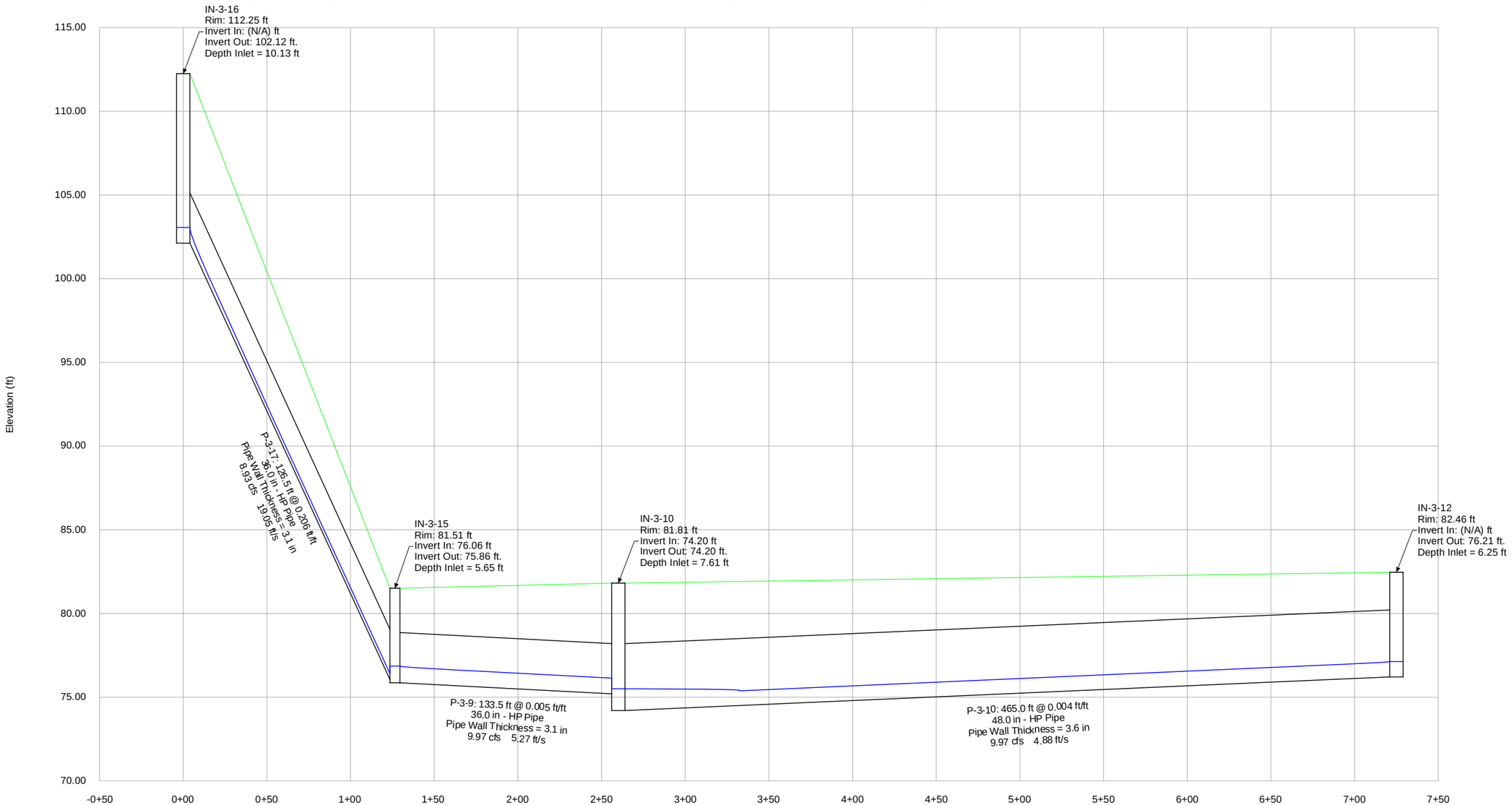
Engineering Profile - Profile - 3 - IN-3-8 TO STILING BASIN-O3P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

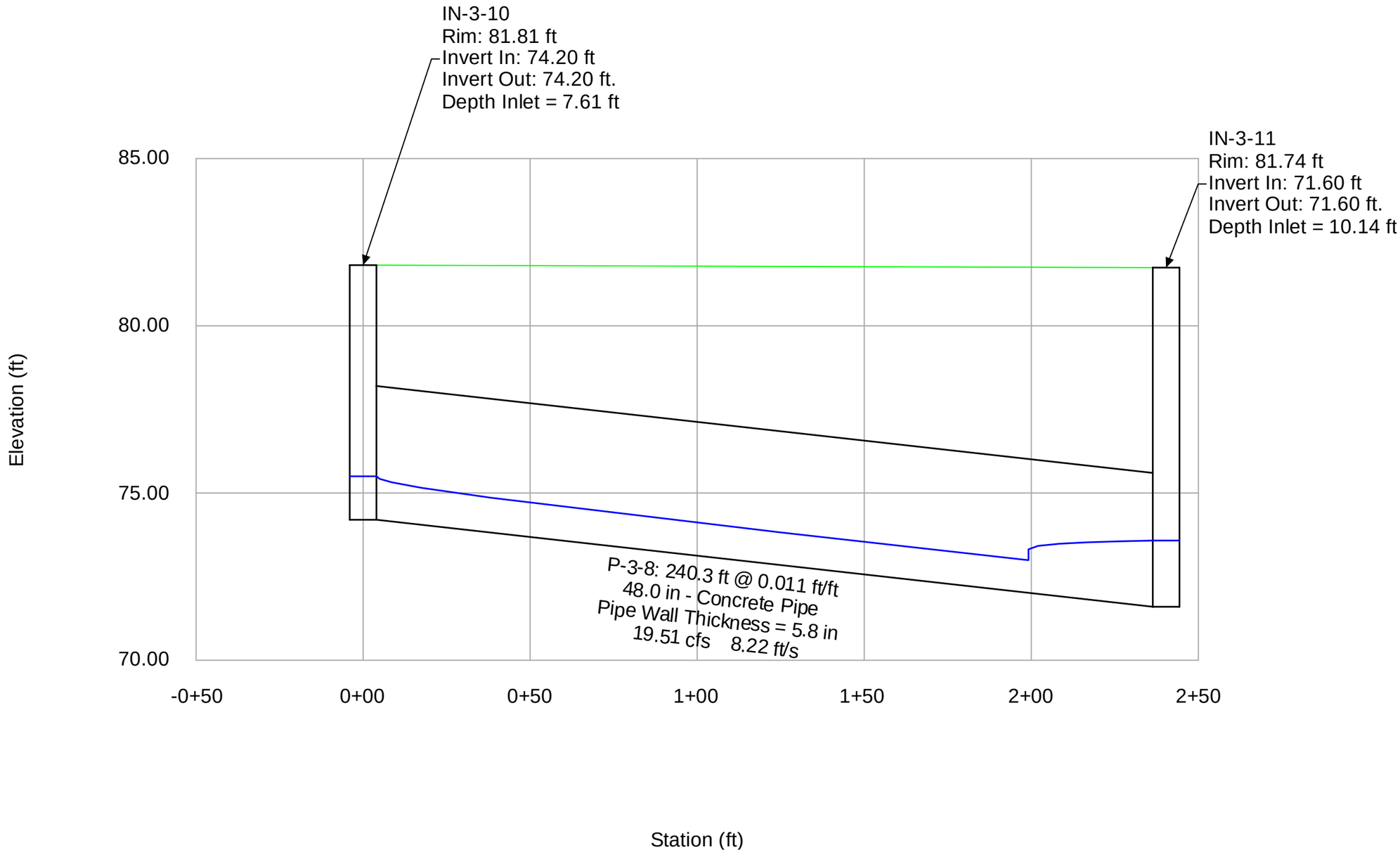
Engineering Profile - Profile - 3 - IN-3-16 TO IN-3-12 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

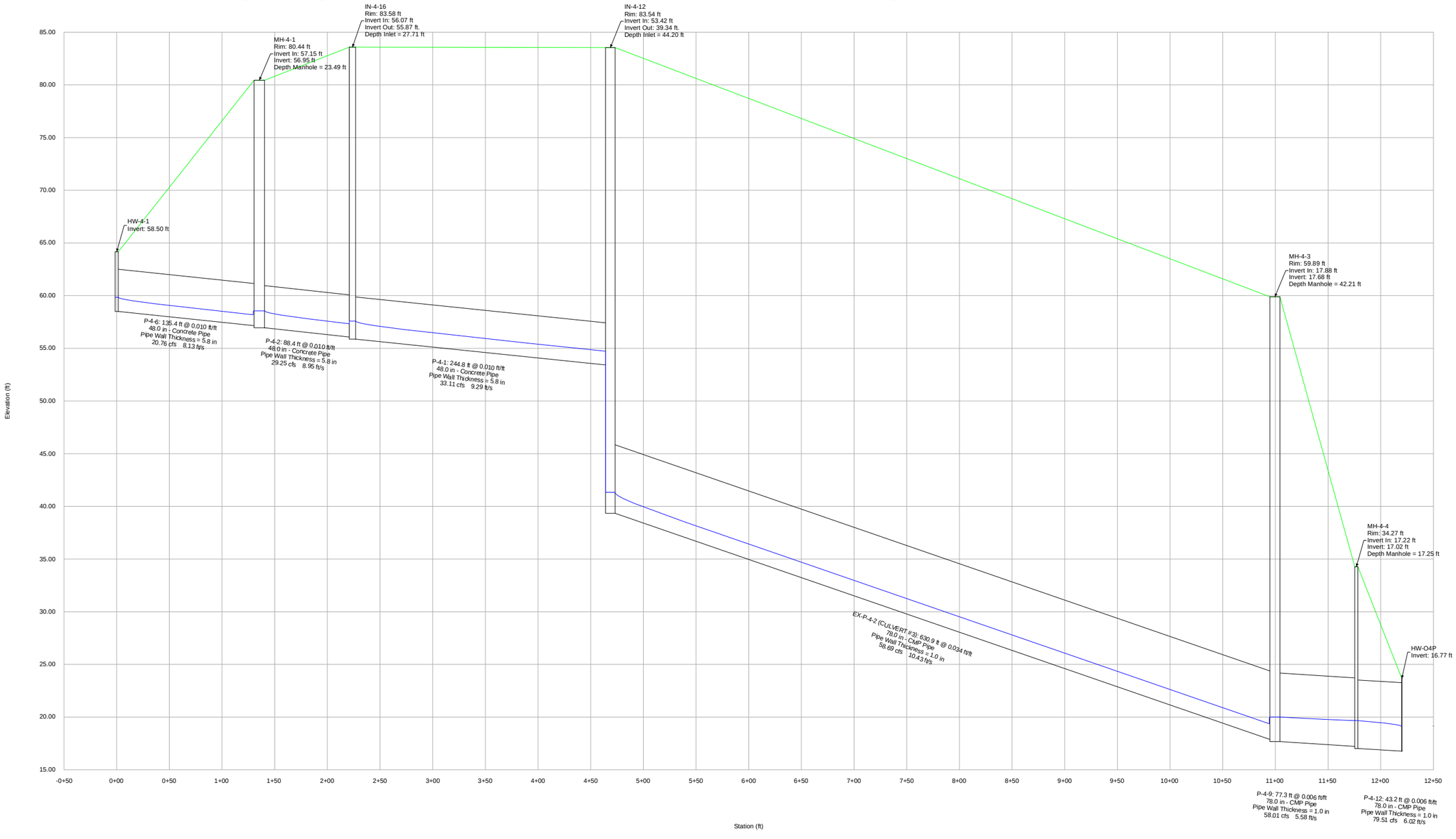
Engineering Profile - Profile - 3 - IN-3-10 TO IN-3-11 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

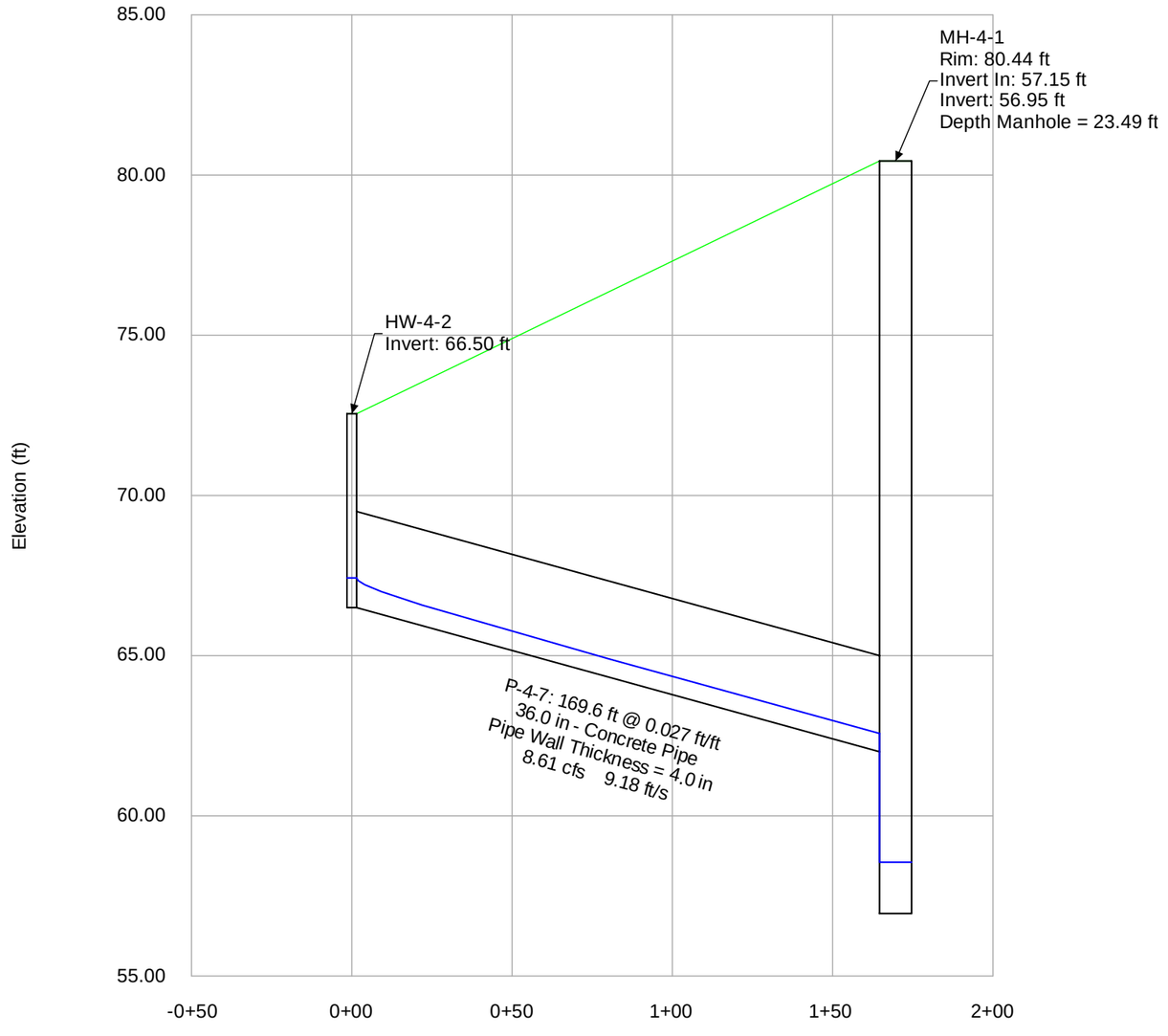
Engineering Profile - Profile - 4 - HW-4-1 TO HW-O4P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

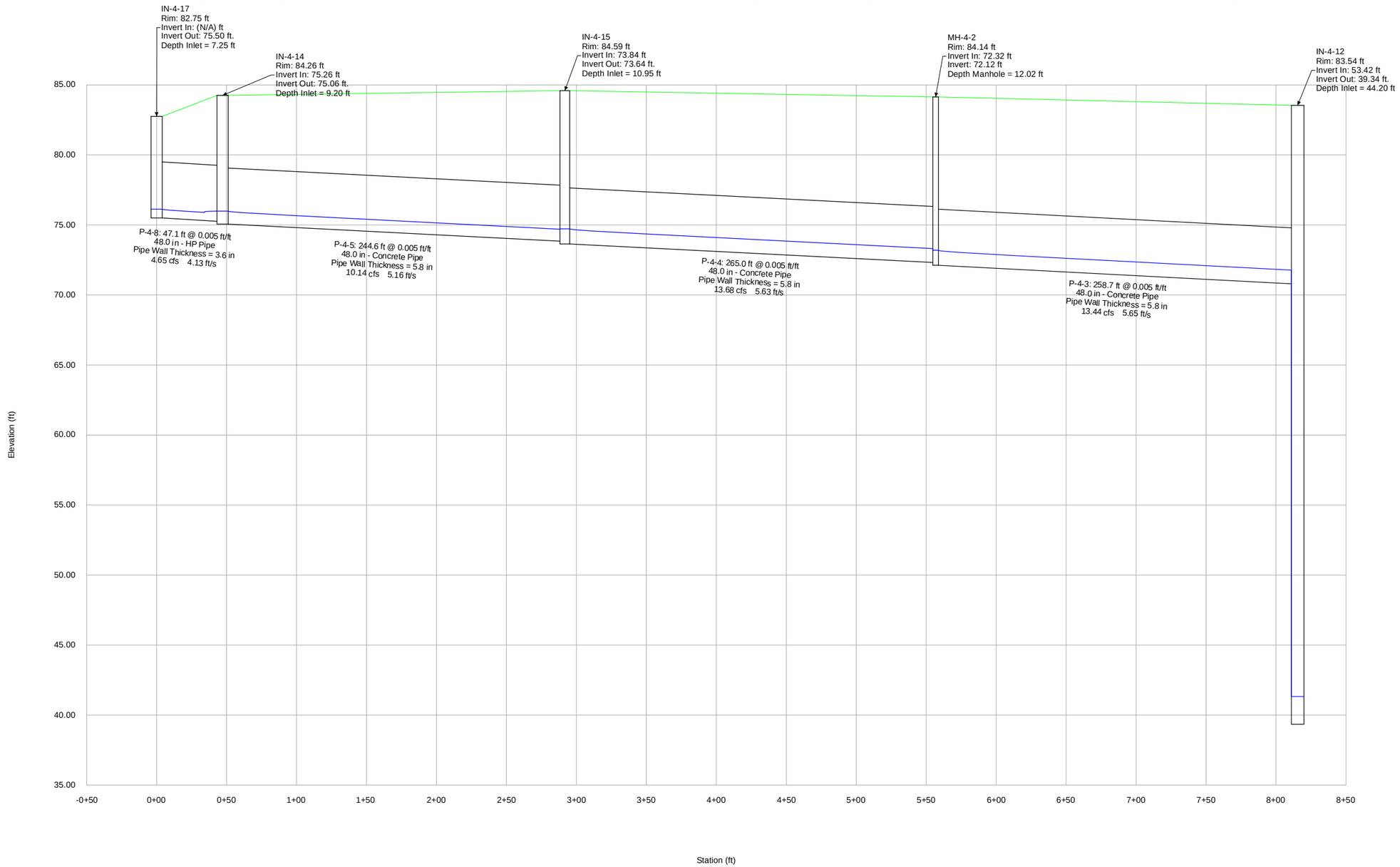
Engineering Profile - Profile - 4 - HW-4-2 TO MH-4-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

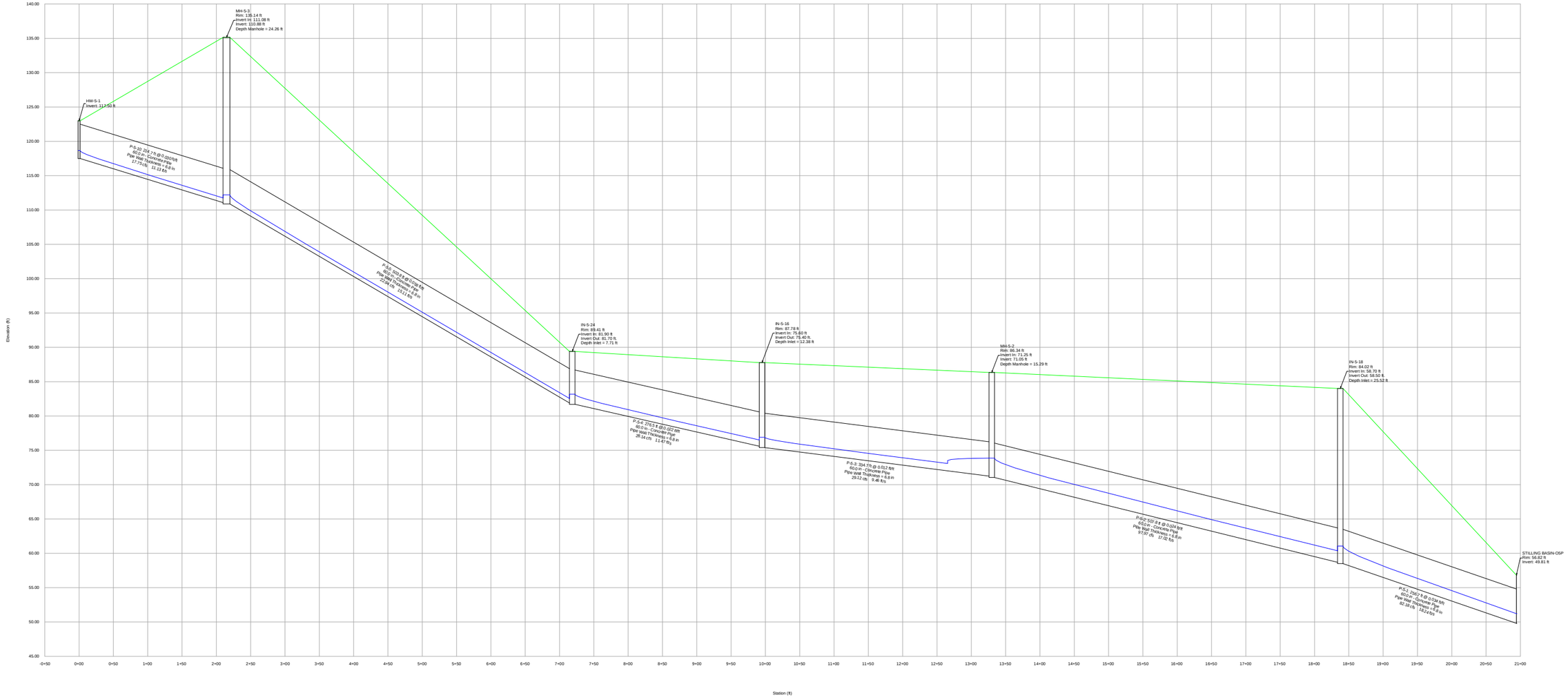
Engineering Profile - Profile - 4 - IN-4-17 TO IN-4-12 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

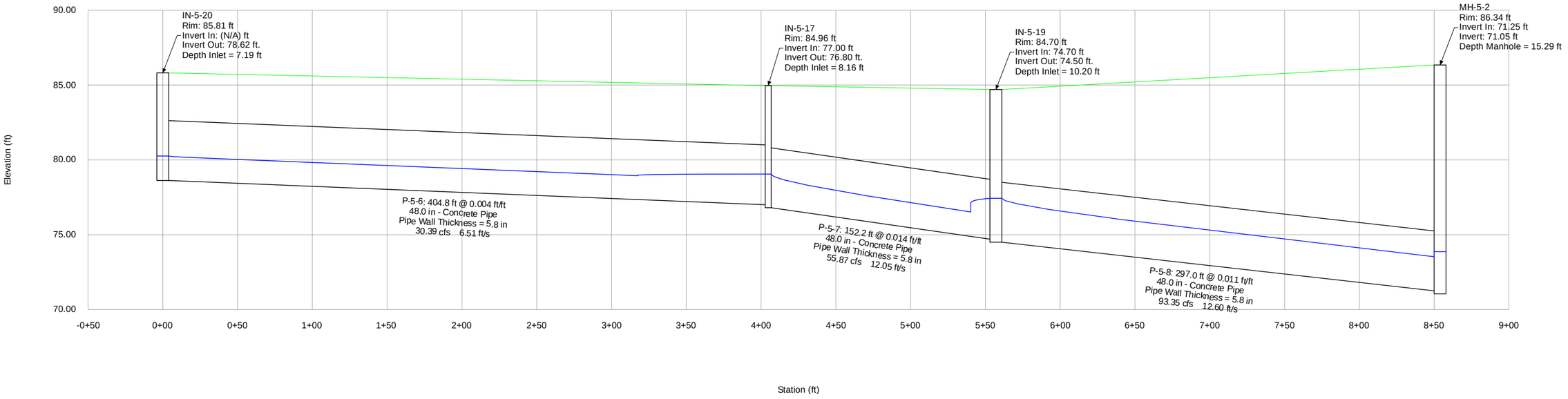
Engineering Profile - Profile - 5 - HW-5-1 TO STILLING BASIN-O5P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

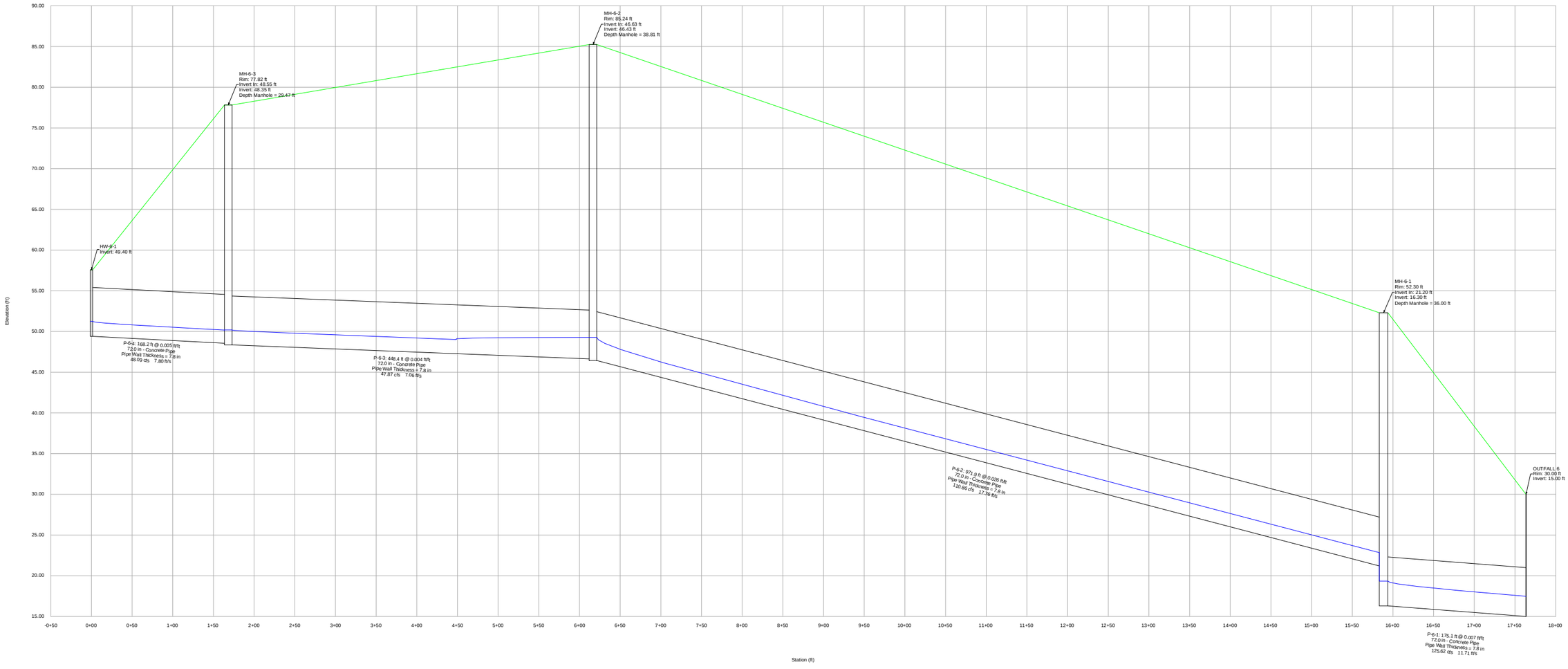
Engineering Profile - Profile - 5 - IN-5-20 TO IN-5-17 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

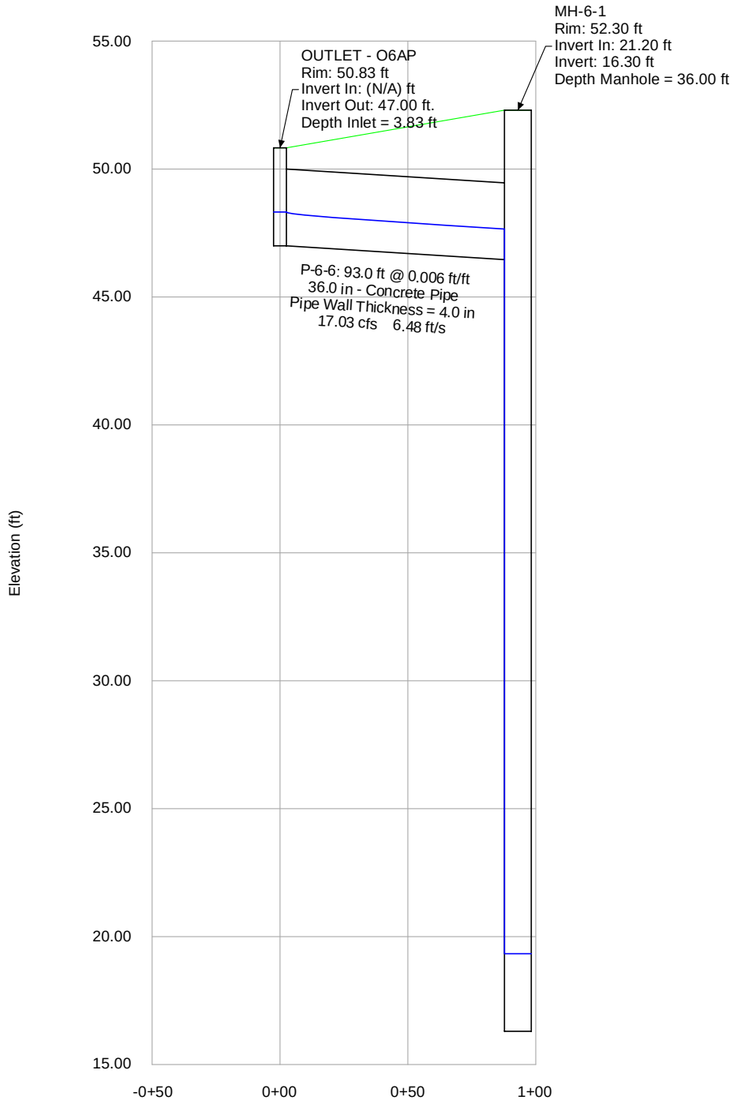
Engineering Profile - Profile - 6 - HW-6-1 TO OUTFALL 6 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

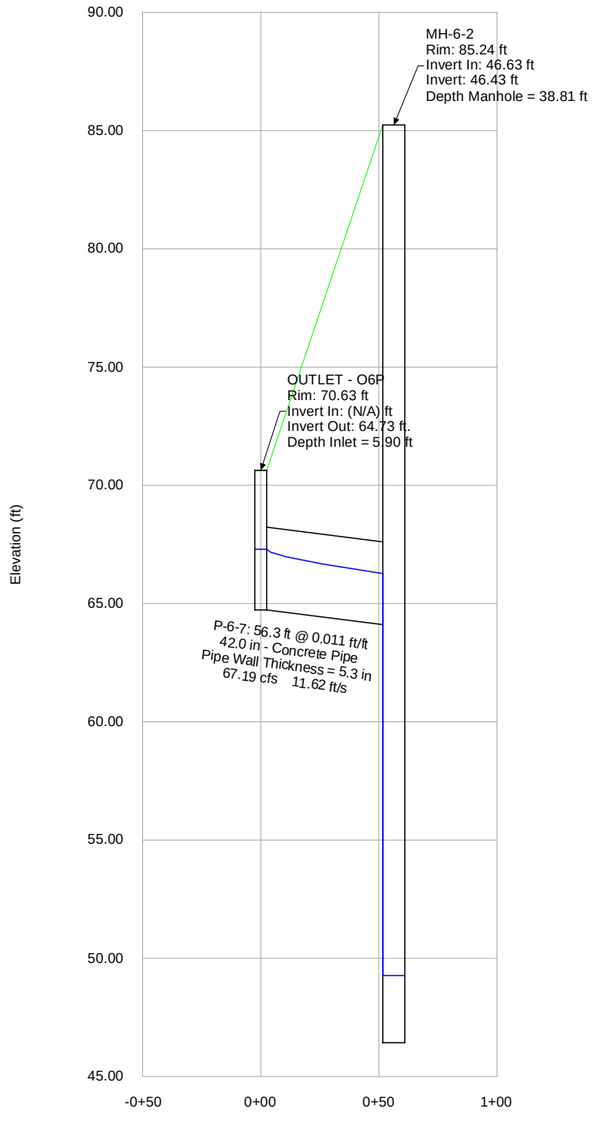
Engineering Profile - Profile - 6 - OUTLET- O6AP TO MH-6-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

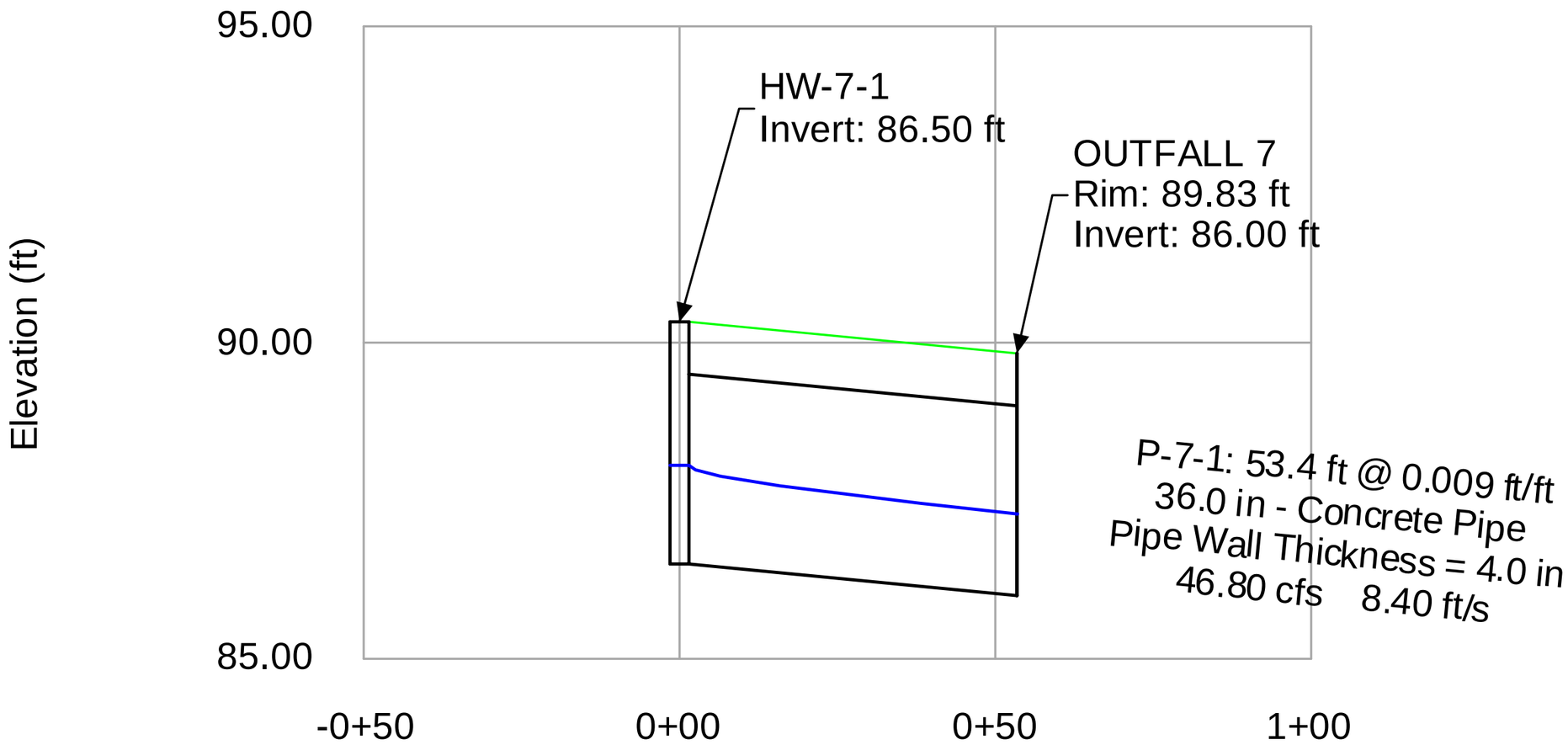
Engineering Profile - Profile - 6 - OUTLET-O6P TO MH-6-2 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

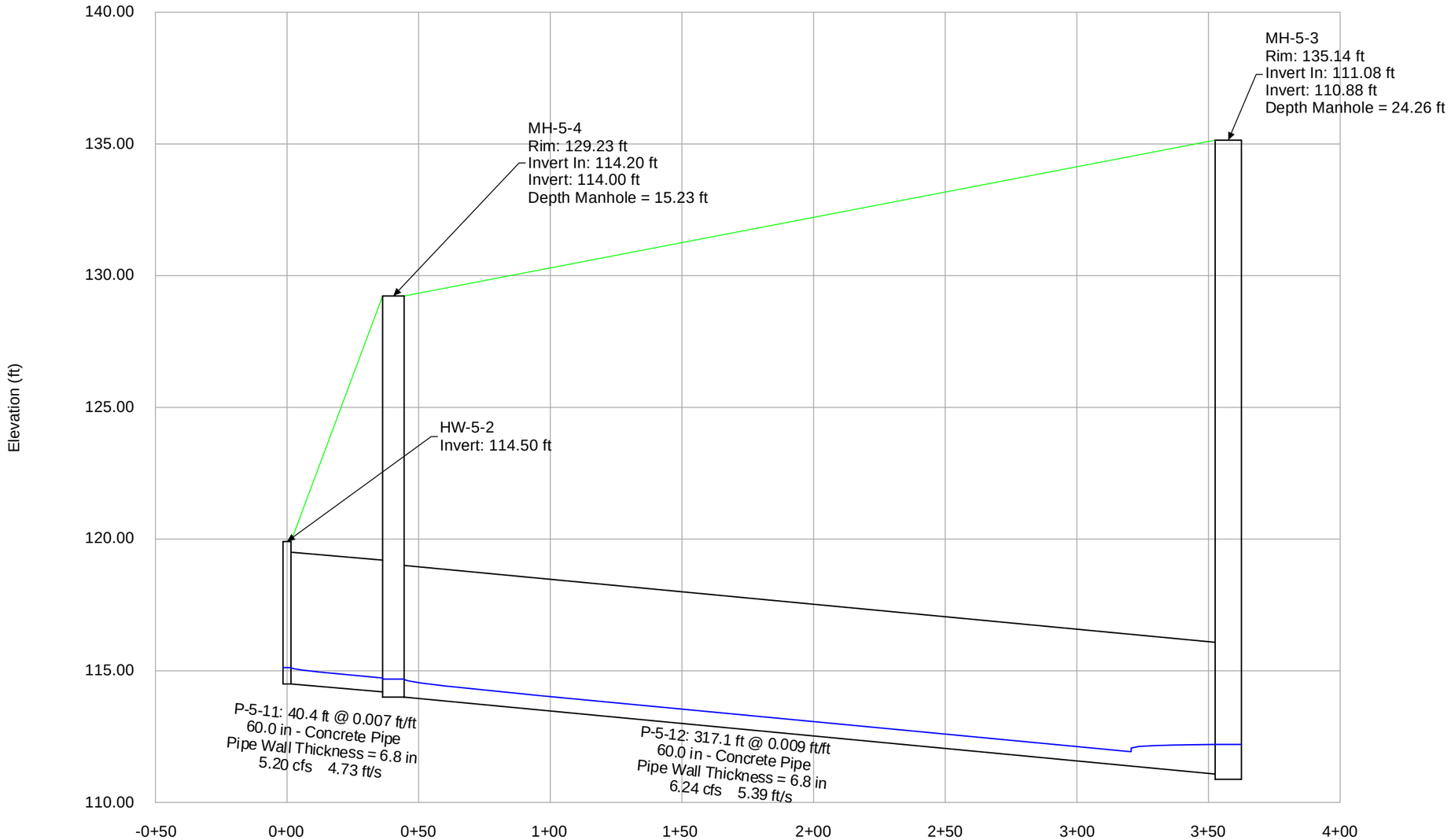
Engineering Profile - Profile - 7 - HW-7-1 TO OUTFALL 7 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

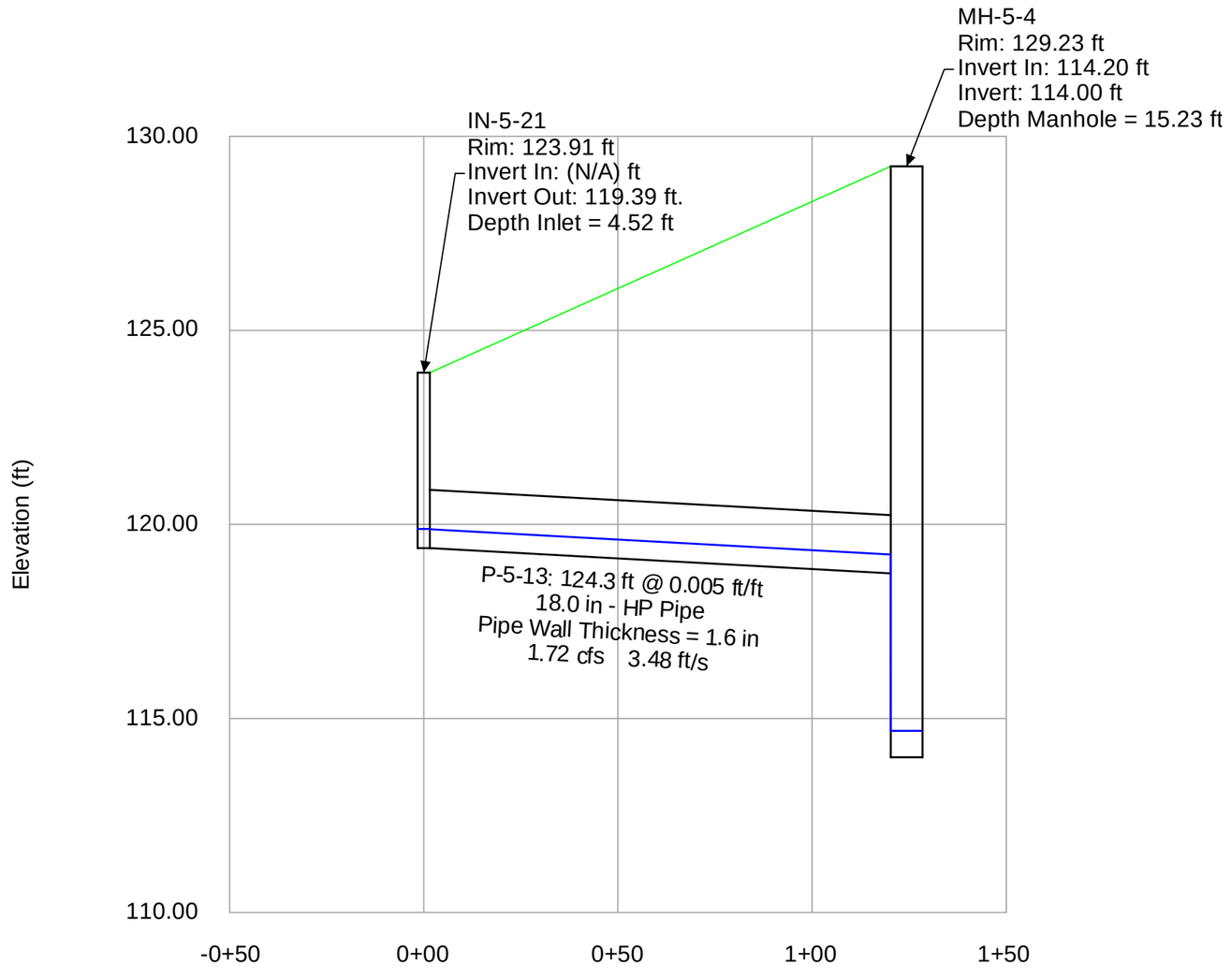
Engineering Profile - Profile - 5 - HW-5-2 to MH-5-3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

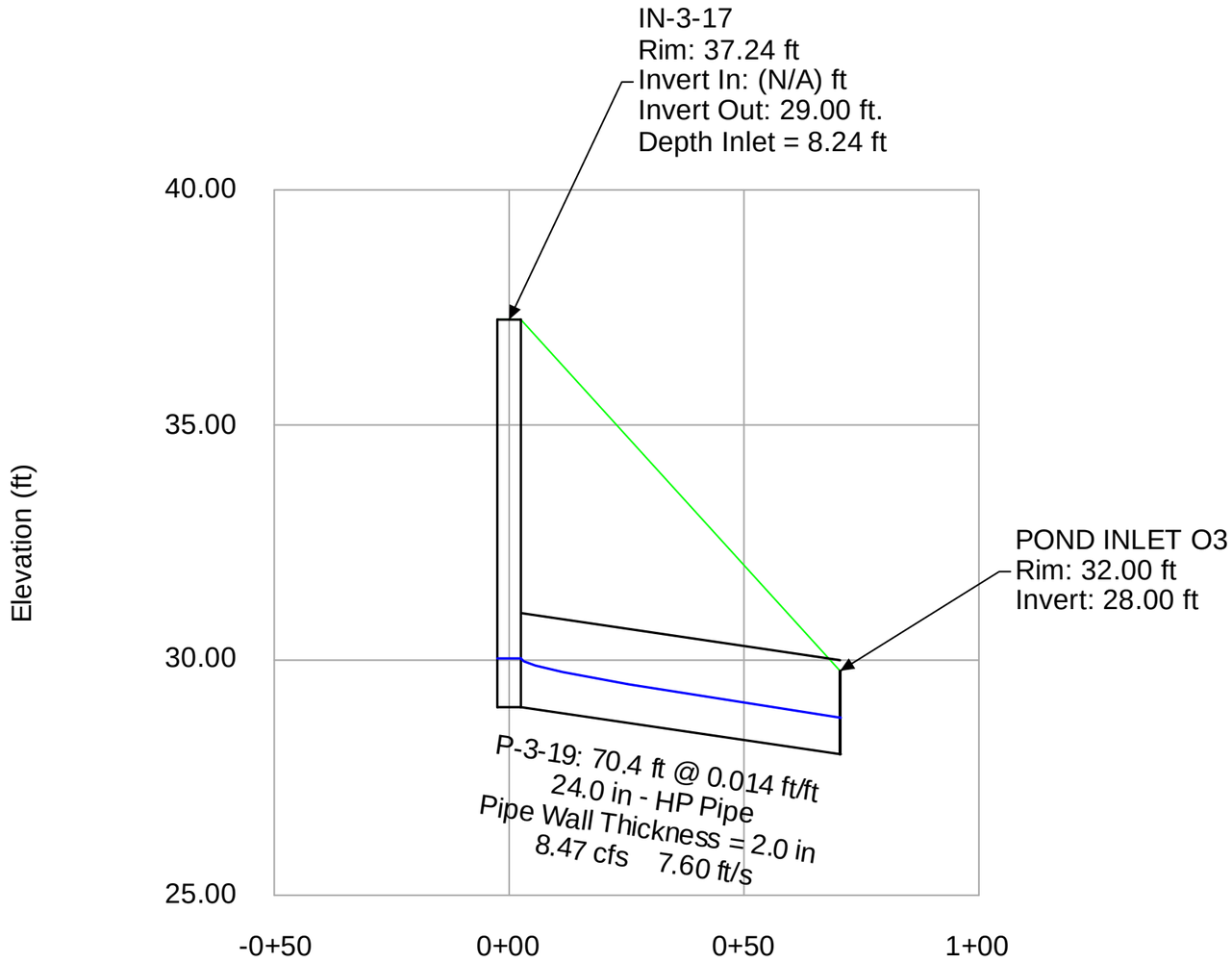
Engineering Profile - Profile - 5 - IN-5-21 TO MH-5-4 Water Tank (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

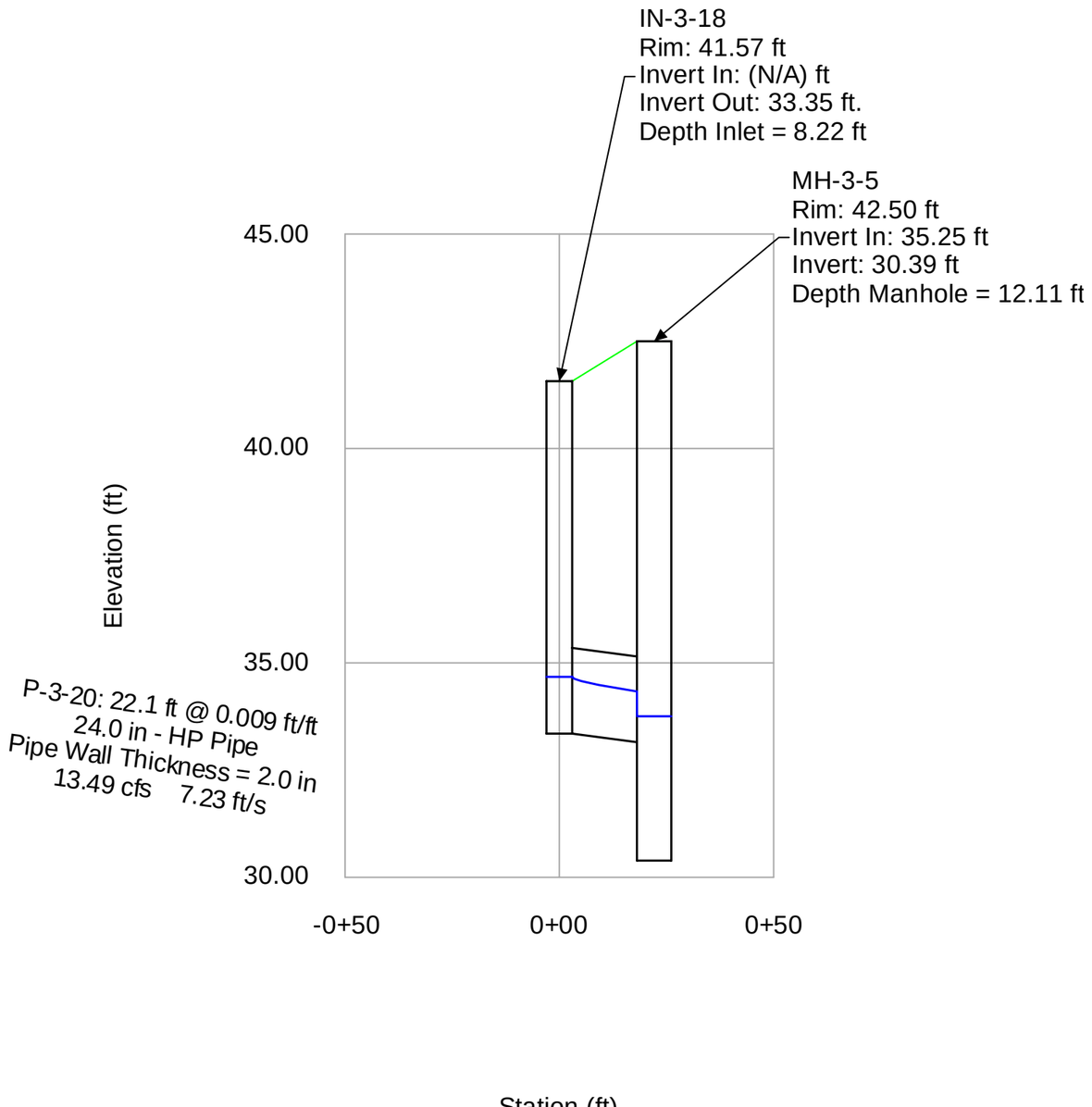
Engineering Profile - Profile - 3 - IN-3-17 TO POND INLET O3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

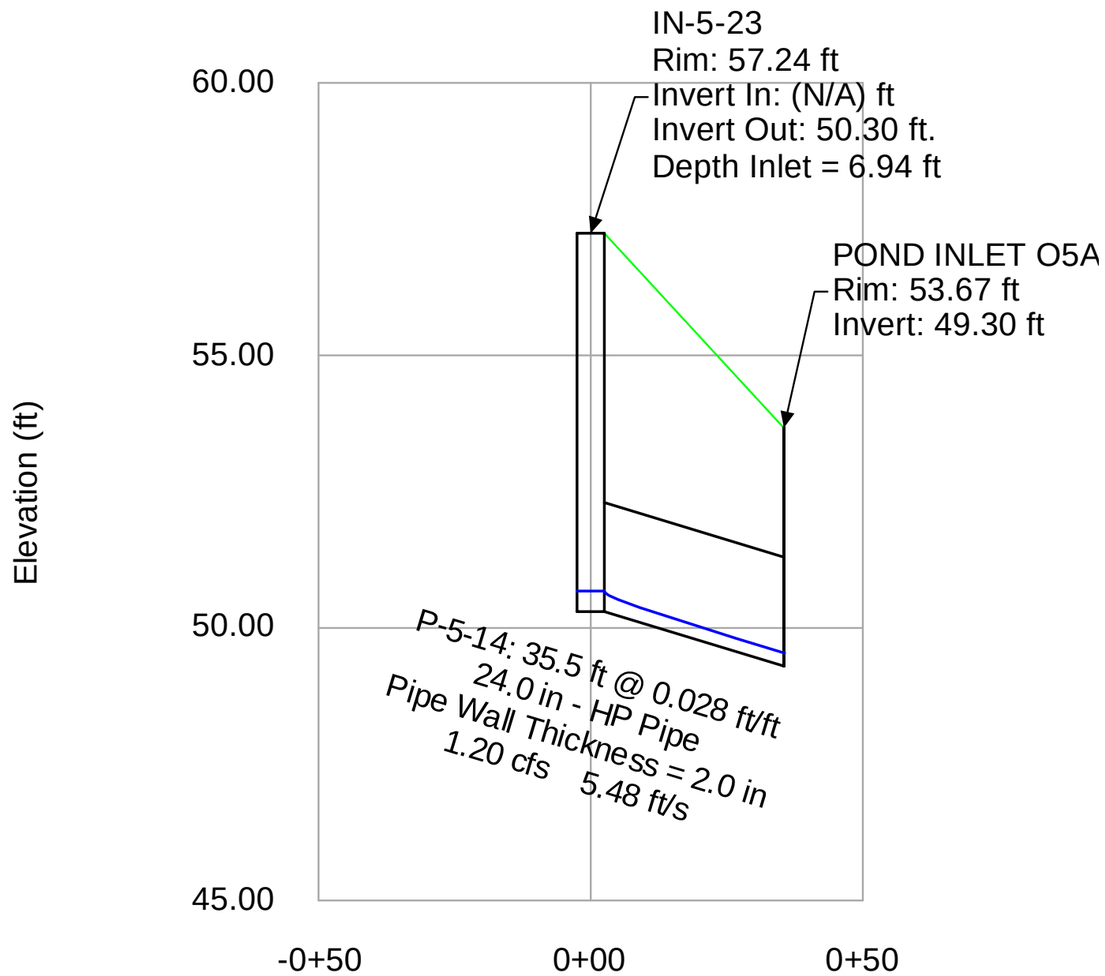
Engineering Profile - Profile - 3 - IN-3-18 TO MH-3-5 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

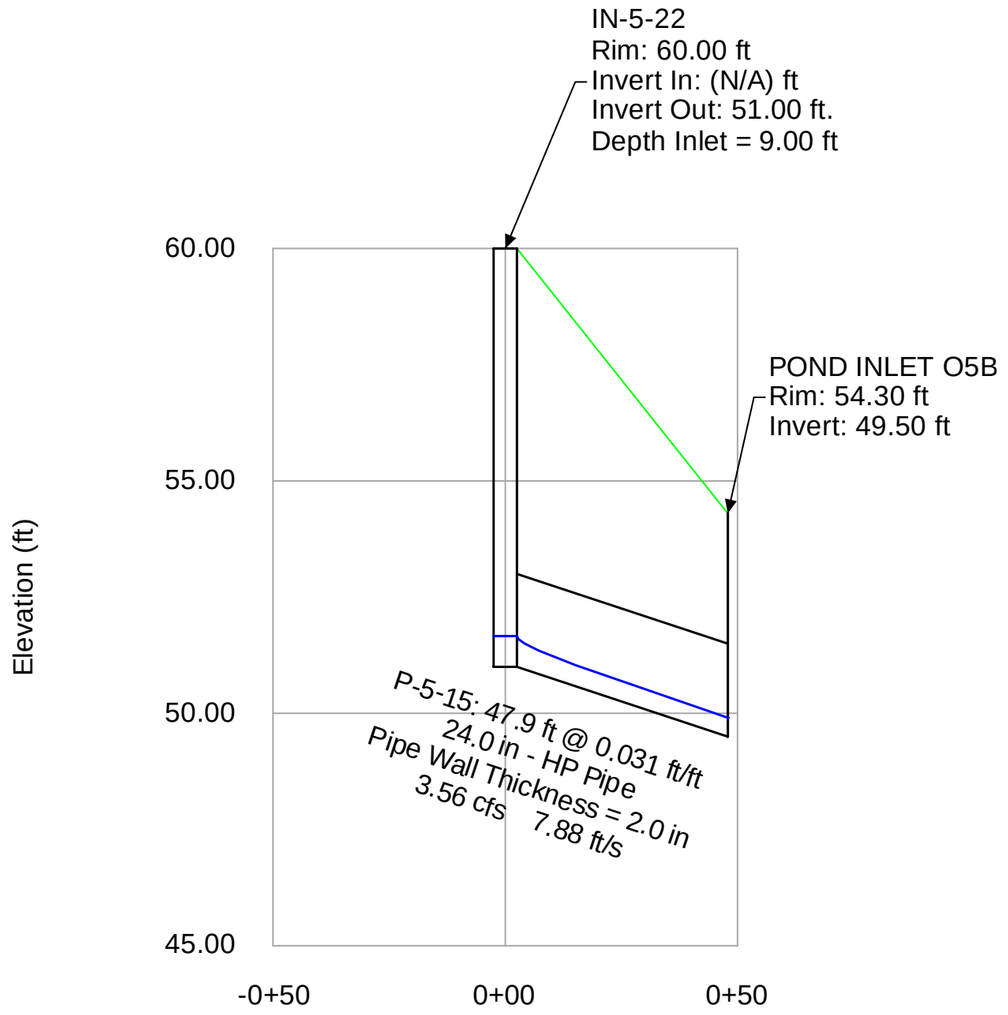
Engineering Profile - Profile - 5 - IN-5-23 TO POND INLET O5A (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

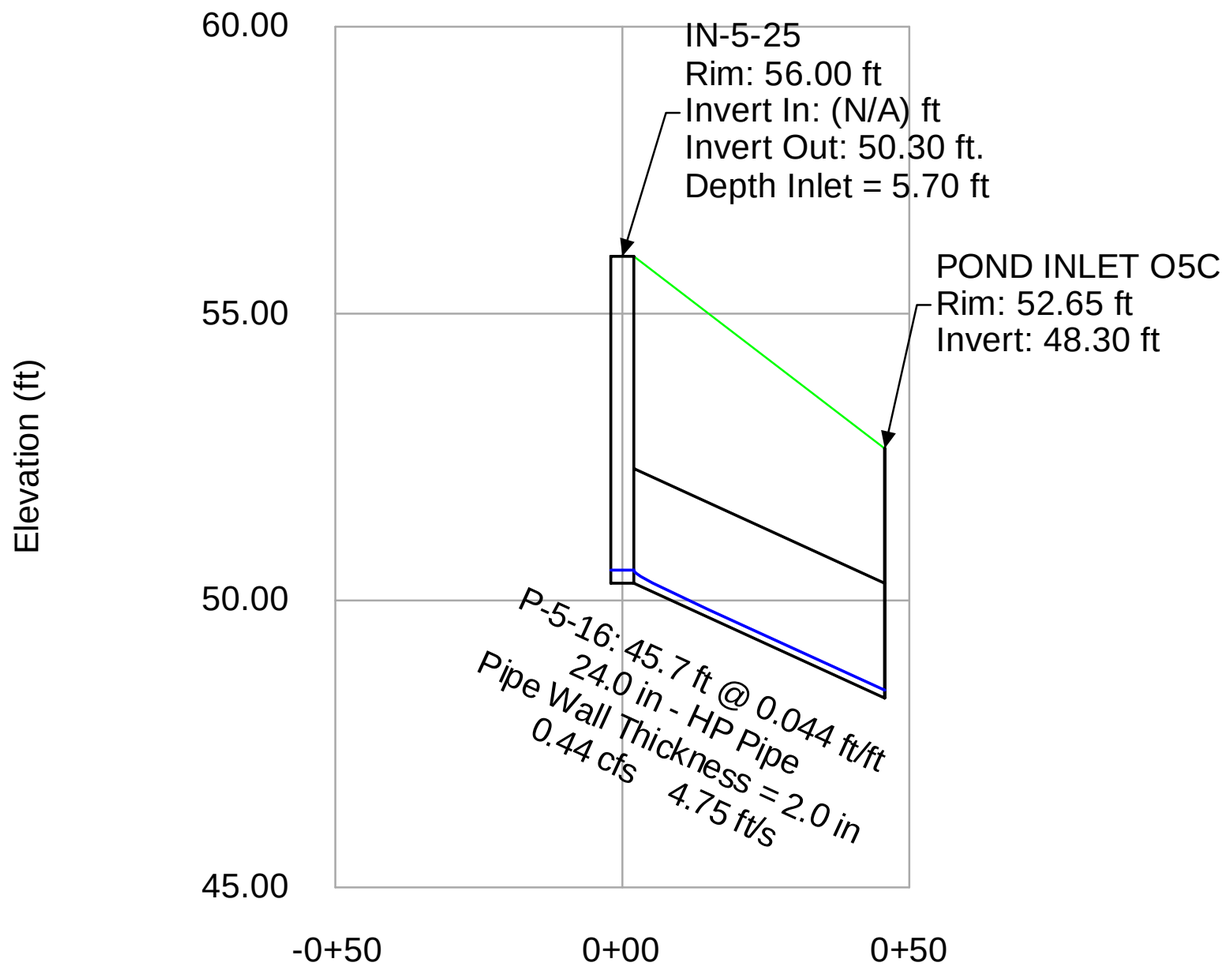
Engineering Profile - Profile - 5 - IN-5-22 TO POND INLET O5B (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

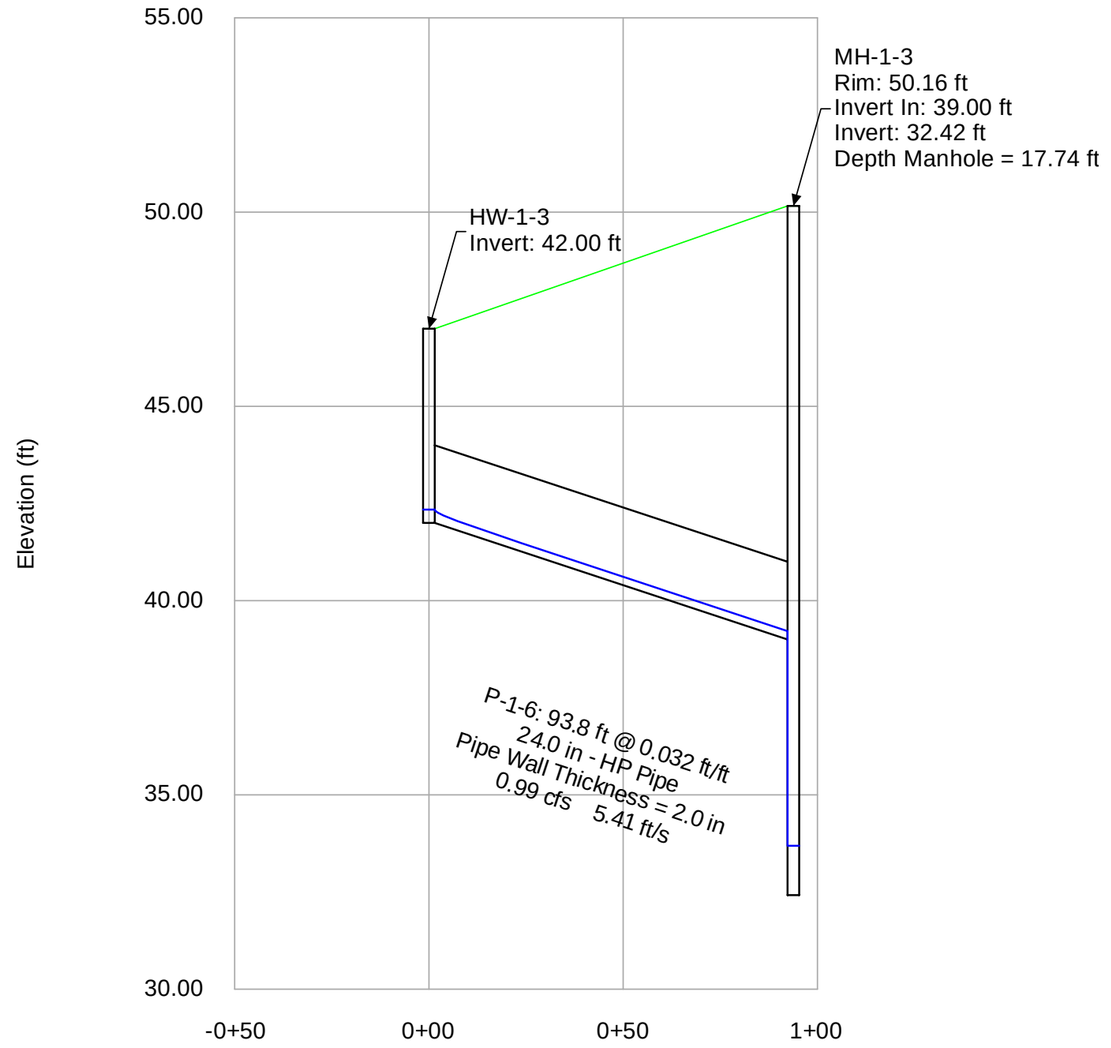
Engineering Profile - Profile - 5 - IN-5-25 TO POND INLET O5C (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

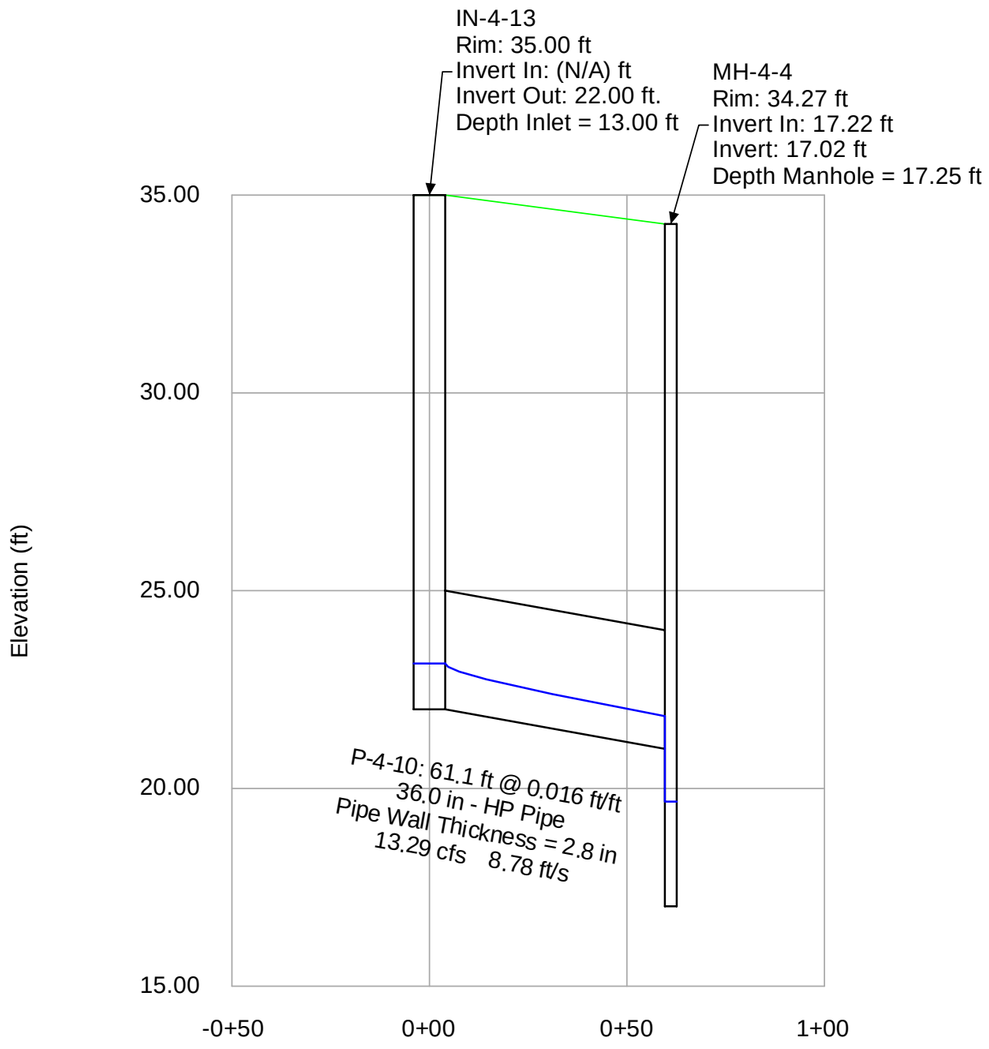
Engineering Profile - Profile - 1 HW-1-3 TO MH-1-3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

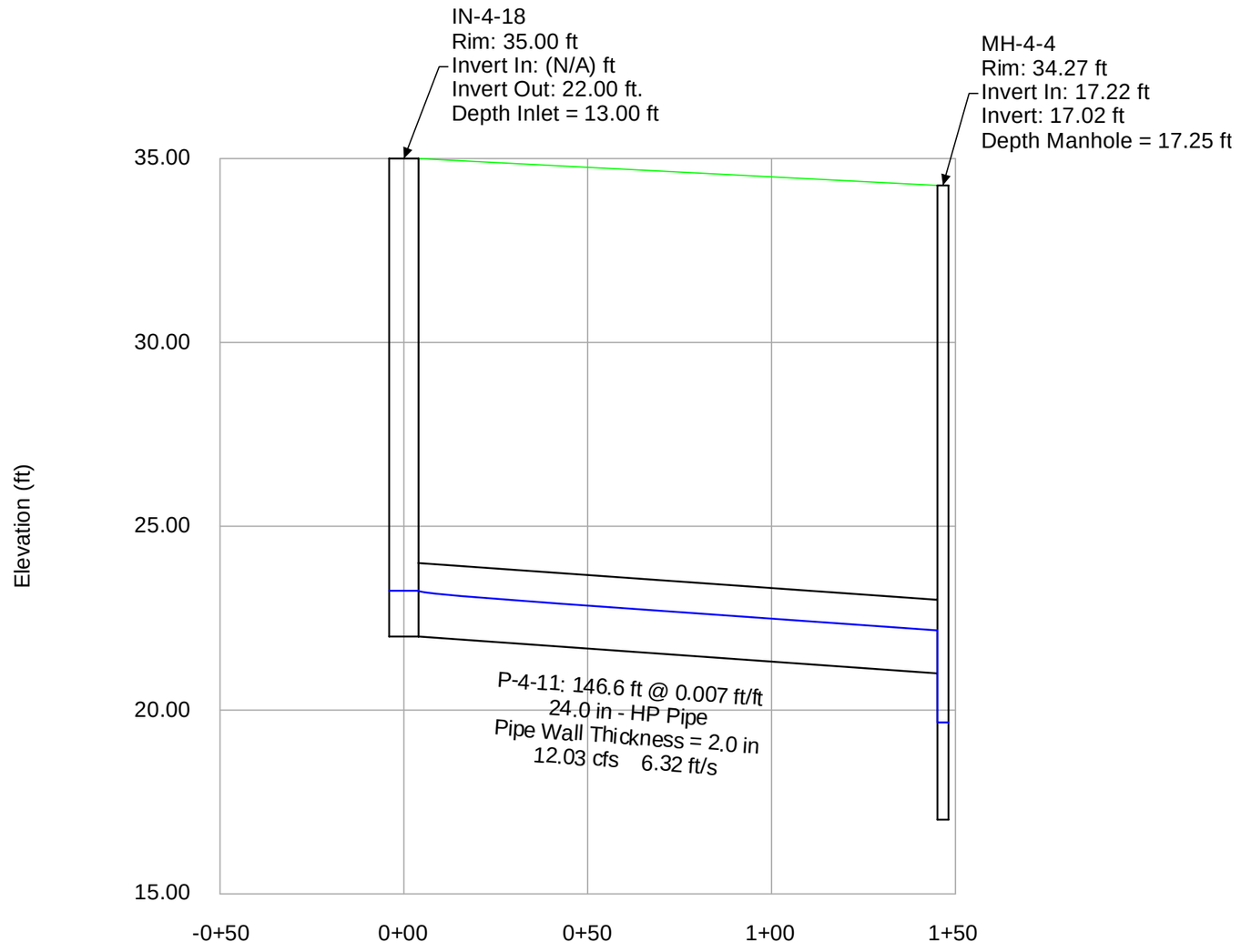
Engineering Profile - Profile - 4 - IN-4-13 TO MH-4-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

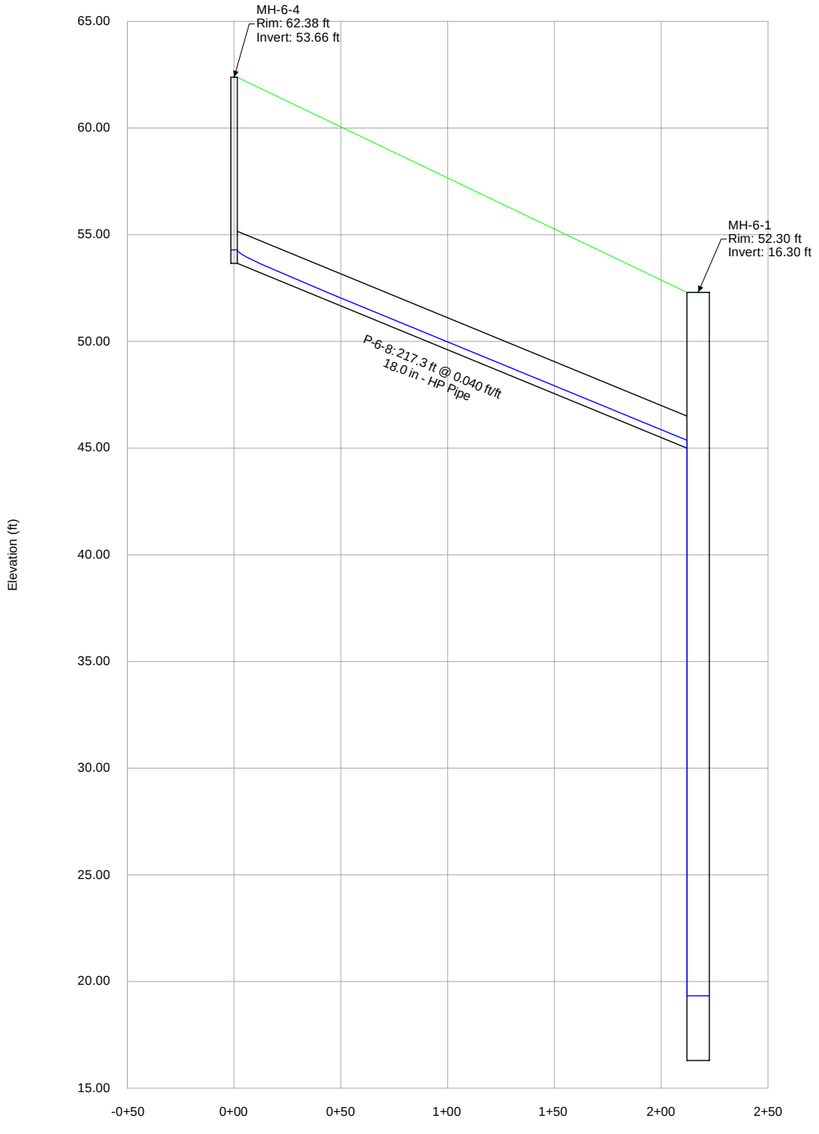
Engineering Profile - Profile - 4 - IN-4-18 TO MH-4-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



10-Yr

Profile Report

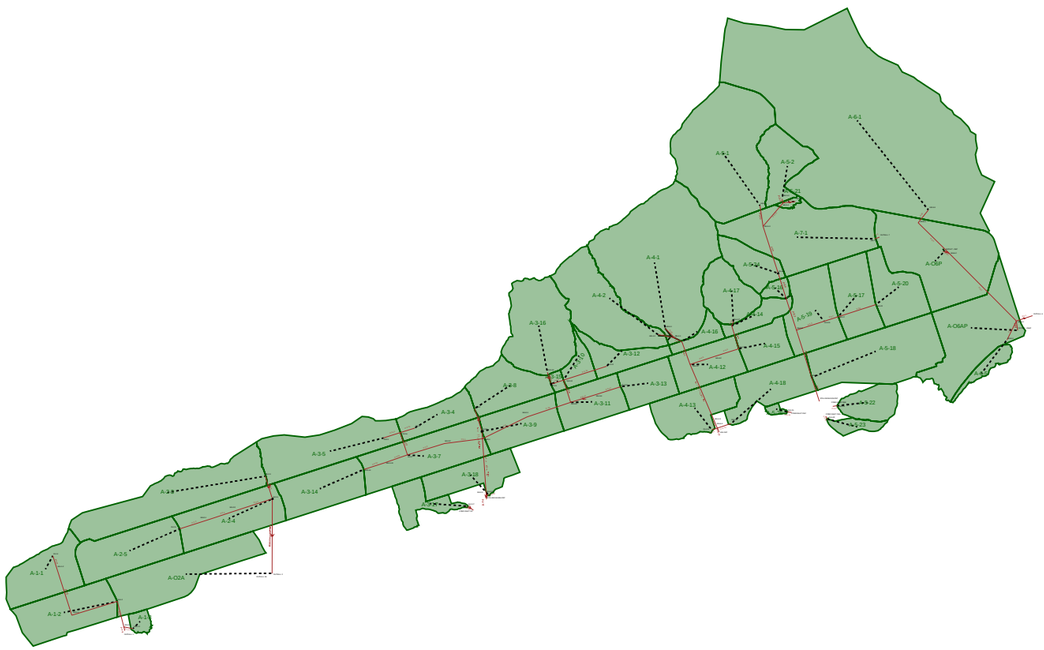
Engineering Profile - Profile - 6 - M-6-4 TO MH-6-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-YEAR STORMCAD OUTPUT FILES

CLIN BA01 AWARDED

Scenario: Base 50 Yr



50-Yr Storm Catchment					
Label	Outflow Element	Scaled Area (acres)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (cfs)
A-1-1	IN-1-1	8.22	0.44	25.9	25.42
A-1-2	IN-1-2	9.52	0.45	28.8	28.24
A-1-3	HW-1-3	0.99	0.40	13.1	3.66
A-2-3	IN-2-3	16.45	0.48	32.5	49.25
A-2-4	IN-2-4	10.04	0.61	29.4	39.82
A-2-5	IN-2-5	10.06	0.65	26.9	44.97
A-3-10	IN-3-10	2.47	0.49	15.3	10.44
A-3-11	IN-3-11	6.35	0.64	23.3	30.15
A-3-12	IN-3-12	4.36	0.52	11.8	21.85
A-3-13	IN-3-13	4.99	0.60	27.3	20.41
A-3-14	IN-3-14	8.05	0.60	28.3	32.20
A-3-15	IN-3-15	0.63	0.55	7.2	4.07
A-3-16	IN-3-16	13.15	0.40	32.0	32.99
A-3-17	IN-3-17	3.72	0.56	18.8	16.87
A-3-18	IN-3-18	6.29	0.57	23.2	26.65
A-3-4	IN-3-4	5.06	0.51	12.6	24.24
A-3-5	IN-3-5	11.98	0.49	29.5	38.07
A-3-7	IN-3-7	11.83	0.60	21.3	54.80
A-3-8	IN-3-8	7.27	0.48	13.8	31.52
A-3-9	IN-3-9	7.45	0.64	28.8	31.43
A-4-1	HW-4-1	31.45	0.40	34.5	76.73
A-4-12	IN-4-12	6.67	0.62	23.5	30.56
A-4-13	IN-4-13	7.81	0.53	26.5	28.72
A-4-14	IN-4-14	2.89	0.56	16.9	13.57
A-4-15	IN-4-15	1.71	0.60	18.6	8.34
A-4-16	IN-4-16	2.13	0.58	10.1	12.54
A-4-17	IN-4-17	6.15	0.40	26.2	17.18
A-4-18	IN-4-18	7.70	0.51	26.2	27.42
A-4-2	HW-4-2	12.99	0.40	34.2	31.80
A-5-1	HW-5-1	24.61	0.41	32.4	63.01
A-5-16	IN-5-16	1.09	0.46	12.3	4.76
A-5-17	IN-5-17	7.53	0.74	17.4	46.29
A-5-18	IN-5-18	15.49	0.50	62.1	33.07
A-5-19	IN-5-19	9.29	0.76	15.8	60.35
A-5-2	HW-5-2	6.07	0.41	23.3	18.46
A-5-20	IN-5-20	6.85	0.75	13.7	46.56
A-5-21	IN-5-21	0.39	0.64	6.7	3.00
A-5-22	IN-5-22	4.01	0.40	18.0	13.18
A-5-23	IN-5-23	1.49	0.40	23.3	4.42
A-5-24	IN-5-24	4.79	0.47	11.1	22.17
A-5-25	IN-5-25	0.38	0.40	8.8	1.65
A-6-1	HW-6-1	80.53	0.41	42.9	182.19
A-6-5	MH-6-4	1.82	0.47	16.2	7.26
A-7-1	HW-7-1	17.78	0.62	21.0	85.61
A-O2A	OUTFALL 2A	12.55	0.54	41.6	38.01
A-O6AP	OUTLET - O6AP	14.82	0.46	28.5	45.24
A-O6P	OUTLET - O6P	19.07	0.45	28.8	56.57

50-Yr Storm Pipes									
Label	Start Node	Invert Start (ft)	Stop Node	Invert Stop (ft)	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Catalog Class
EX-P-2-1 (CULVERT #1)	IN-2-4	71.50	OUTFALL 2	30.84	60	760.4	0.053	0.024	CMP Pipe
EX-P-3-1 (CULVERT #2)(1)	MH-3-1	65.40	MH-3-5	35.25	60	577.1	0.052	0.024	CMP Pipe
EX-P-3-2 (CULVERT #2)	IN-3-9	69.80	MH-3-1	65.60	60	75.7	0.055	0.024	CMP Pipe
EX-P-4-2 (CULVERT #3)	IN-4-12	39.34	MH-4-3	17.88	78	630.9	0.034	0.024	CMP Pipe
P-1-1	IN-1-2	45.00	MH-1-3	39.00	48	269.8	0.022	0.013	Concrete Pipe
P-1-2	MH-1-1	77.19	IN-1-2	56.00	48	483.9	0.044	0.013	Concrete Pipe
P-1-3	MH-1-2	79.89	MH-1-1	77.39	48	509.7	0.005	0.013	Concrete Pipe
P-1-4	IN-1-1	81.58	MH-1-2	80.89	36	138.0	0.005	0.013	HP Pipe
P-1-5	MH-1-3	32.42	OUTFALL 1	32.00	48	40.0	0.011	0.013	Concrete Pipe
P-1-6	HW-1-3	42.00	MH-1-3	39.00	24	93.8	0.032	0.013	HP Pipe
P-2-1	IN-2-3	77.16	IN-2-4	73.50	36	243.9	0.015	0.013	Concrete Pipe
P-2-2	IN-2-5	78.89	MH-2-1	77.21	36	322.0	0.005	0.013	Concrete Pipe
P-2-3	MH-2-1	77.01	MH-2-2	75.56	36	322.0	0.005	0.013	Concrete Pipe
P-2-4	MH-2-2	75.36	IN-2-4	73.50	36	353.4	0.005	0.013	Concrete Pipe
P-3-1	MH-3-2	67.10	MH-3-1	65.60	60	389.6	0.004	0.013	Concrete Pipe
P-3-10	IN-3-12	76.21	IN-3-10	74.20	48	465.0	0.004	0.013	HP Pipe
P-3-11	IN-3-5	72.98	IN-3-6	72.30	36	179.2	0.004	0.013	HP Pipe
P-3-12	IN-3-4	72.75	IN-3-6	72.30	36	155.0	0.003	0.013	HP Pipe
P-3-13	MH-3-4	75.56	IN-3-11	72.60	36	264.0	0.011	0.013	Concrete Pipe
P-3-14	IN-3-13	77.14	MH-3-4	75.76	36	275.0	0.005	0.013	Concrete Pipe
P-3-15	IN-3-14	72.75	MH-3-13	72.01	36	235.0	0.003	0.013	Concrete Pipe
P-3-16	MH-3-13	71.81	IN-3-7	71.00	36	235.1	0.003	0.013	Concrete Pipe
P-3-17	IN-3-16	102.12	IN-3-15	76.06	36	126.5	0.206	0.013	HP Pipe
P-3-18	MH-3-5	30.39	STILLING BASIN-03P	29.39	60	45.6	0.022	0.024	CMP Pipe
P-3-19	IN-3-17	29.00	POND INLET 03	28.00	24	70.4	0.014	0.013	HP Pipe
P-3-2	IN-3-7	69.00	MH-3-2	67.30	60	398.0	0.004	0.013	Concrete Pipe
P-3-20	IN-3-18	33.35	MH-3-5	33.15	24	22.1	0.009	0.013	HP Pipe
P-3-3	IN-3-6	71.30	IN-3-7	70.29	48	239.4	0.004	0.013	Concrete Pipe
P-3-4	IN-3-8	72.56	IN-3-9	70.80	48	242.6	0.007	0.013	Concrete Pipe
P-3-5	MH-3-3	68.05	MH-3-1	65.60	60	507.2	0.005	0.013	Concrete Pipe
P-3-6	IN-3-11	71.60	MH-3-3	69.05	48	472.0	0.005	0.013	Concrete Pipe
P-3-8	IN-3-10	74.20	IN-3-11	71.60	48	240.3	0.011	0.013	Concrete Pipe
P-3-9	IN-3-15	75.86	IN-3-10	75.20	36	133.5	0.005	0.013	HP Pipe
P-4-1	IN-4-16	55.87	IN-4-12	53.42	48	244.8	0.010	0.013	Concrete Pipe
P-4-10	IN-4-13	22.00	MH-4-4	21.00	36	61.1	0.016	0.013	HP Pipe
P-4-11	IN-4-18	22.00	MH-4-4	21.00	24	146.6	0.007	0.013	HP Pipe
P-4-12	MH-4-4	17.02	HW-04P	16.77	78	43.2	0.006	0.024	CMP Pipe
P-4-2	MH-4-1	56.95	IN-4-16	56.07	48	88.4	0.010	0.013	Concrete Pipe
P-4-3	MH-4-2	72.12	IN-4-12	70.80	48	258.7	0.005	0.013	Concrete Pipe
P-4-4	IN-4-15	73.64	MH-4-2	72.32	48	265.0	0.005	0.013	Concrete Pipe
P-4-5	IN-4-14	75.06	IN-4-15	73.84	48	244.6	0.005	0.013	Concrete Pipe
P-4-6	HW-4-1	58.50	MH-4-1	57.15	48	135.4	0.010	0.013	Concrete Pipe
P-4-7	HW-4-2	66.50	MH-4-1	62.00	36	169.6	0.027	0.013	Concrete Pipe
P-4-8	IN-4-17	75.50	IN-4-14	75.26	48	47.1	0.005	0.013	HP Pipe
P-4-9	MH-4-3	17.68	MH-4-4	17.22	78	77.3	0.006	0.024	CMP Pipe
P-5-1	IN-5-18	58.50	STILLING BASIN-05P	49.81	60	256.7	0.034	0.013	Concrete Pipe
P-5-10	HW-5-1	117.50	MH-5-3	111.08	60	214.7	0.030	0.013	Concrete Pipe
P-5-11	HW-5-2	114.50	MH-5-4	114.20	60	40.4	0.007	0.013	Concrete Pipe
P-5-12	MH-5-4	114.00	MH-5-3	111.08	60	317.1	0.009	0.013	Concrete Pipe
P-5-13	IN-5-21	119.39	MH-5-4	118.74	18	124.3	0.005	0.013	HP Pipe
P-5-14	IN-5-23	50.30	POND INLET 05A	49.30	24	35.5	0.028	0.013	HP Pipe
P-5-15	IN-5-22	51.00	POND INLET 05B	49.50	24	47.9	0.031	0.013	HP Pipe
P-5-16	IN-5-25	50.30	POND INLET 05C	48.30	24	45.7	0.044	0.013	HP Pipe
P-5-2	MH-5-2	71.05	IN-5-18	58.70	60	507.8	0.024	0.013	Concrete Pipe
P-5-3	IN-5-16	75.40	MH-5-2	71.25	60	334.7	0.012	0.013	Concrete Pipe
P-5-4	IN-5-24	81.70	IN-5-16	75.60	60	276.5	0.022	0.013	Concrete Pipe
P-5-5	MH-5-3	110.88	IN-5-24	81.90	60	503.8	0.058	0.013	Concrete Pipe
P-5-6	IN-5-20	78.62	IN-5-17	77.00	48	404.8	0.004	0.013	Concrete Pipe
P-5-7	IN-5-17	76.80	IN-5-19	74.70	48	152.2	0.014	0.013	Concrete Pipe
P-5-8	IN-5-19	74.50	MH-5-2	71.25	48	297.0	0.011	0.013	Concrete Pipe
P-6-1	MH-6-1	16.30	OUTFALL 6	15.00	72	175.1	0.007	0.013	Concrete Pipe
P-6-2	MH-6-2	46.43	MH-6-1	21.20	72	971.9	0.026	0.013	Concrete Pipe
P-6-3	MH-6-3	48.35	MH-6-2	46.63	72	448.4	0.004	0.013	Concrete Pipe
P-6-4	HW-6-1	49.40	MH-6-3	48.55	72	168.2	0.005	0.013	Concrete Pipe
P-6-6	OUTLET - 06AP	47.00	MH-6-1	46.46	36	93.0	0.006	0.013	Concrete Pipe
P-6-7	OUTLET - 06P	64.73	MH-6-2	64.11	42	56.3	0.011	0.013	Concrete Pipe
P-6-8	MH-6-4	53.66	MH-6-1	45.00	18	217.3	0.040	0.013	HP Pipe
P-7-1	HW-7-1	86.50	OUTFALL 7	86.00	36	53.4	0.009	0.013	Concrete Pipe

50-Yr Storm Inlets		
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)
IN-1-1	87.09	81.58
IN-1-2	88.00	45.00
IN-2-3	82.67	77.16
IN-2-4	81.90	71.50
IN-2-5	85.08	78.89
IN-3-10	81.81	74.20
IN-3-11	81.74	71.60
IN-3-12	82.46	76.21
IN-3-13	82.78	77.14
IN-3-14	78.77	72.75
IN-3-15	81.51	75.86
IN-3-16	112.25	102.12
IN-3-17	37.24	29.00
IN-3-18	41.57	33.35
IN-3-4	78.26	72.75
IN-3-5	78.20	72.98
IN-3-6	78.55	71.30
IN-3-7	77.37	69.00
IN-3-8	79.62	72.56
IN-3-9	79.04	69.80
IN-4-12	83.54	39.34
IN-4-13	35.00	22.00
IN-4-14	84.26	75.06
IN-4-15	84.59	73.64
IN-4-16	83.58	55.87
IN-4-17	82.75	75.50
IN-4-18	35.00	22.00
IN-5-16	87.78	75.40
IN-5-17	84.96	76.80
IN-5-18	84.02	58.50
IN-5-19	84.70	74.50
IN-5-20	0.00	78.62
IN-5-21	123.91	119.39
IN-5-22	60.00	51.00
IN-5-23	57.24	50.30
IN-5-24	89.41	81.70
IN-5-25	56.00	50.30
OUTLET - O6AP	50.83	47.00
OUTLET - O6P	70.63	64.73

50-Yr Storm Manholes		
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)
MH-1-1	89.54	77.19
MH-1-2	90.33	79.89
MH-1-3	50.16	32.42
MH-2-1	84.08	77.01
MH-2-2	83.05	75.36
MH-3-1	80.32	65.40
MH-3-13	78.06	71.81
MH-3-2	78.21	67.10
MH-3-3	80.35	68.05
MH-3-4	82.27	75.56
MH-3-5	42.50	30.39
MH-4-1	80.44	56.95
MH-4-2	84.14	72.12
MH-4-3	59.89	17.68
MH-4-4	34.27	17.02
MH-5-2	86.34	71.05
MH-5-3	135.14	110.88
MH-5-4	129.23	114.00
MH-6-1	52.30	16.30
MH-6-2	85.24	46.43
MH-6-3	77.82	48.35
MH-6-4	62.38	53.66

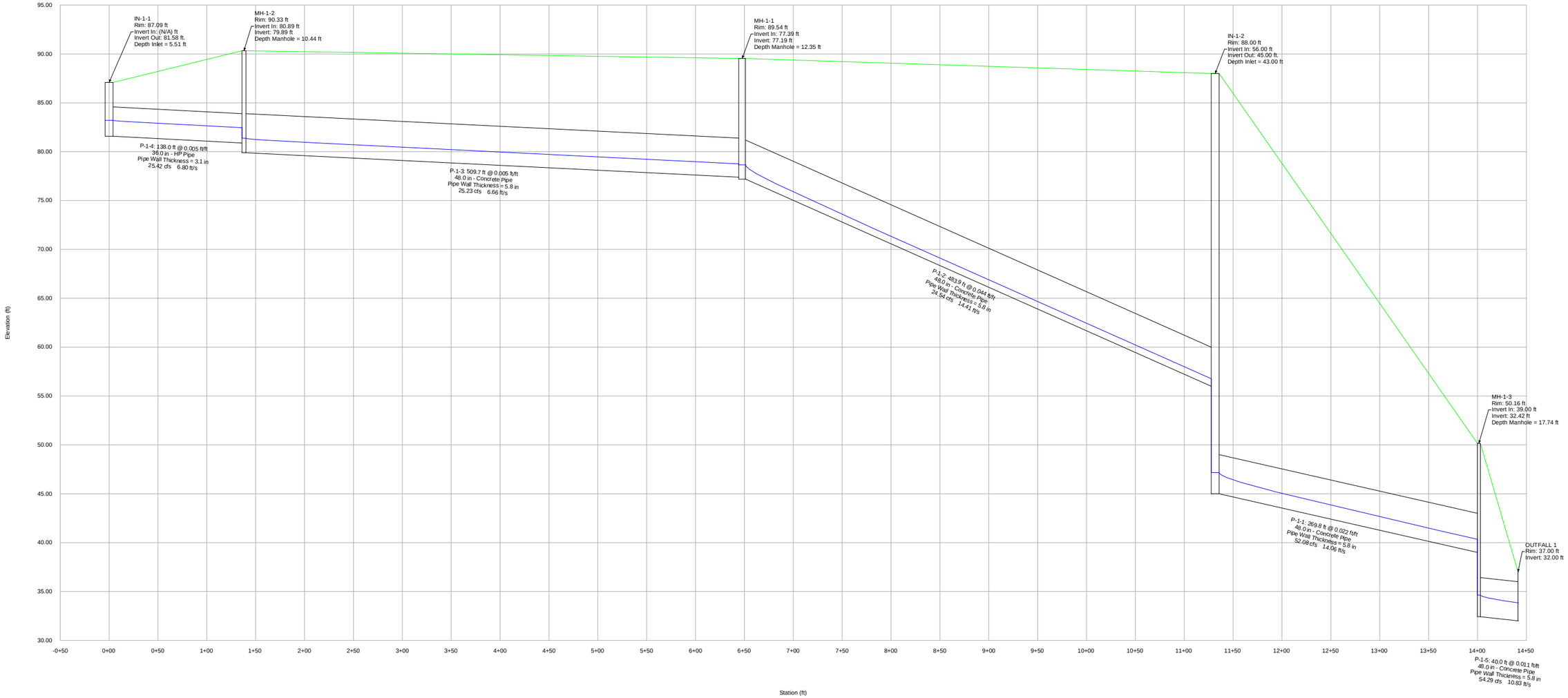
50-Yr Storm Outfall	
Label	Elevation (Invert) (ft)
OUTFALL 1	32.00
OUTFALL 2	30.84
STILLING BASIN-O3P	29.38
STILLING BASIN-O5P	49.81
OUTFALL 6	15.00
OUTFALL 2A	30.00
OUTFALL 7	86.00
POND INLET O3	28.00
POND INLET O5A	49.30
POND INLET O5B	49.50
POND INLET O5C	48.30

50-Yr Storm Headwall	
Label	Elevation (Invert) (ft)
HW-1-3	42.00
HW-4-1	58.50
HW-4-2	66.50
HW-5-1	117.50
HW-5-2	114.50
HW-6-1	49.40
HW-7-1	86.50
HW-O4P	16.77

50-Yr

Profile Report

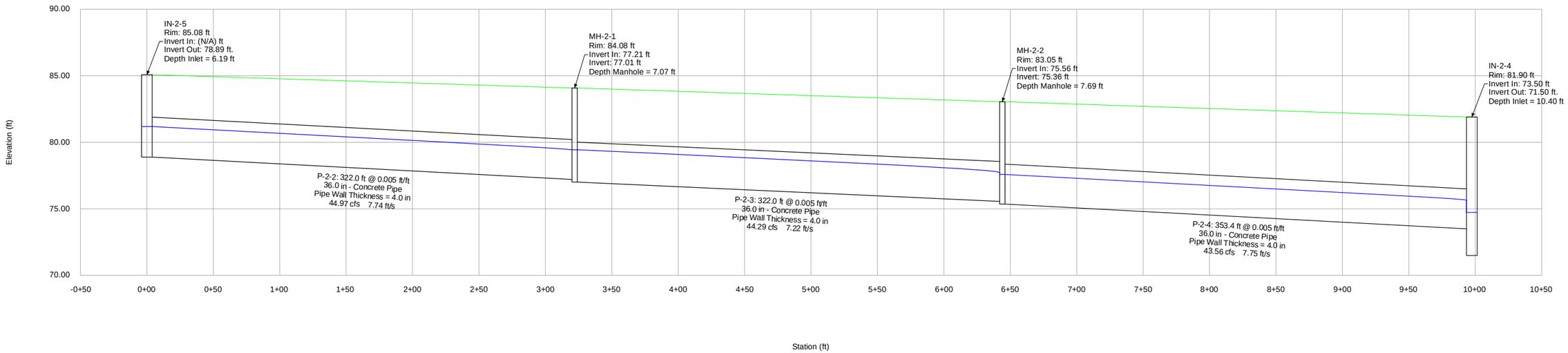
Engineering Profile - Profile - 1 - IN-1-1 TO OUTFALL 1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

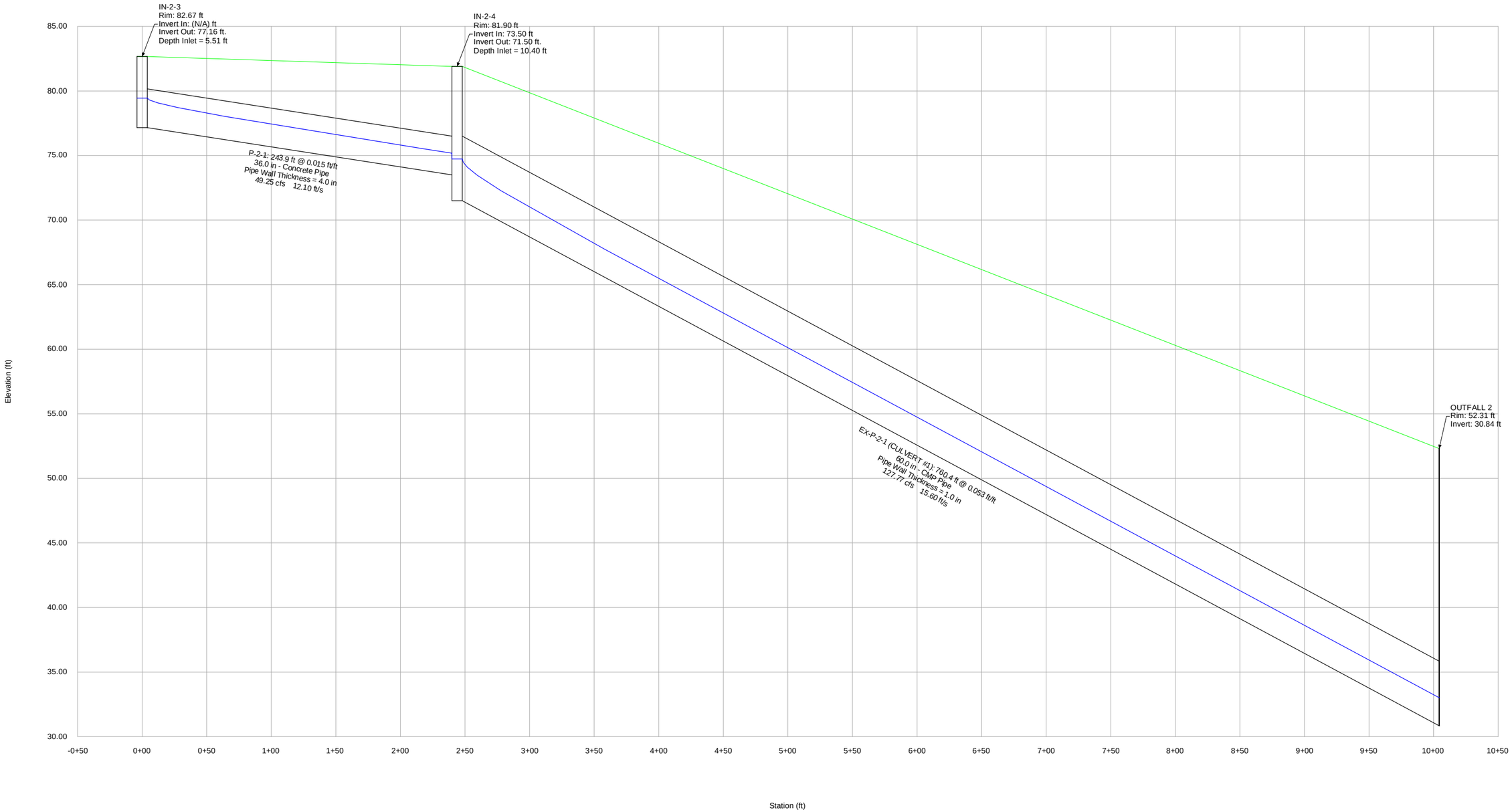
Engineering Profile - Profile - 2 - IN-2-5 TO IN-2-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

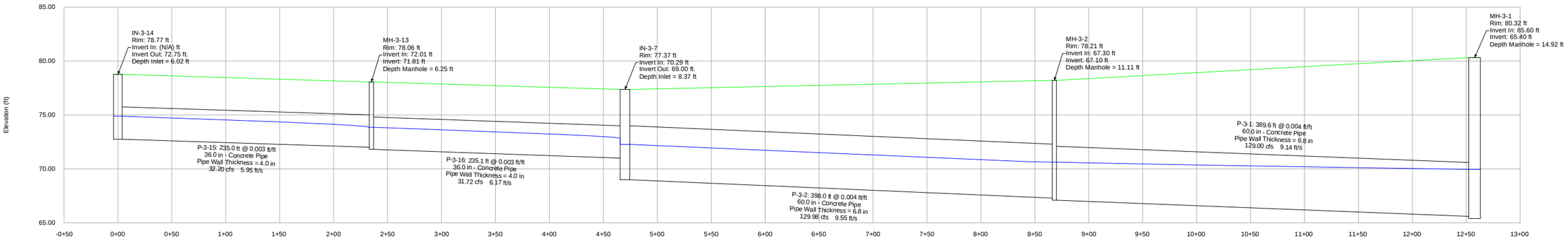
Engineering Profile - Profile - 2 - IN-2-3 TO OUTFALL 2 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

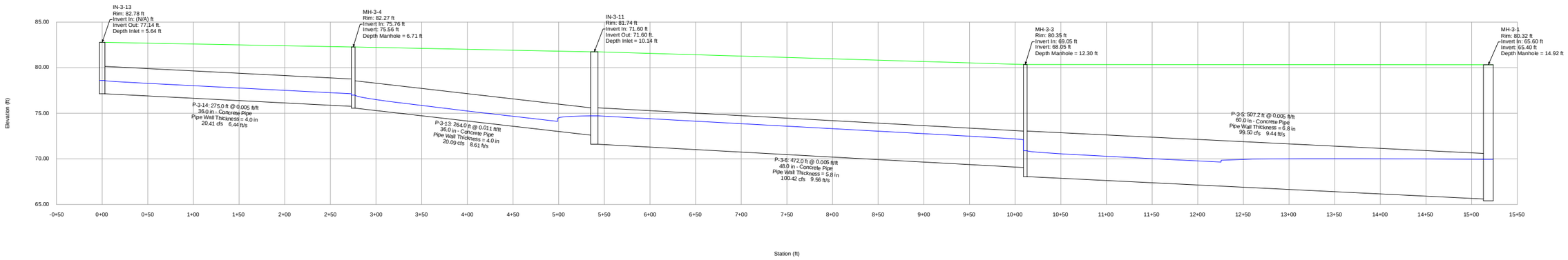
Engineering Profile - Profile - 3 - IN-3-14 TO MH-3-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

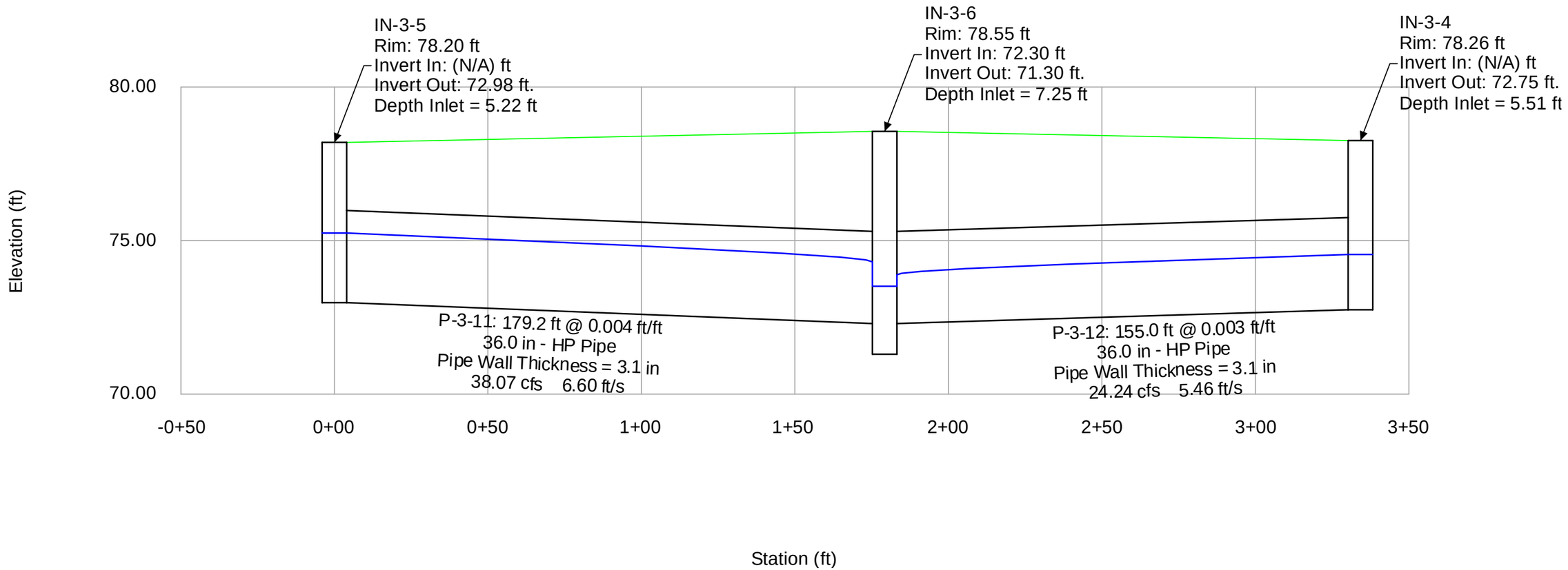
Engineering Profile - Profile - 3 - IN-3-13 TO MH-3-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



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Profile Report

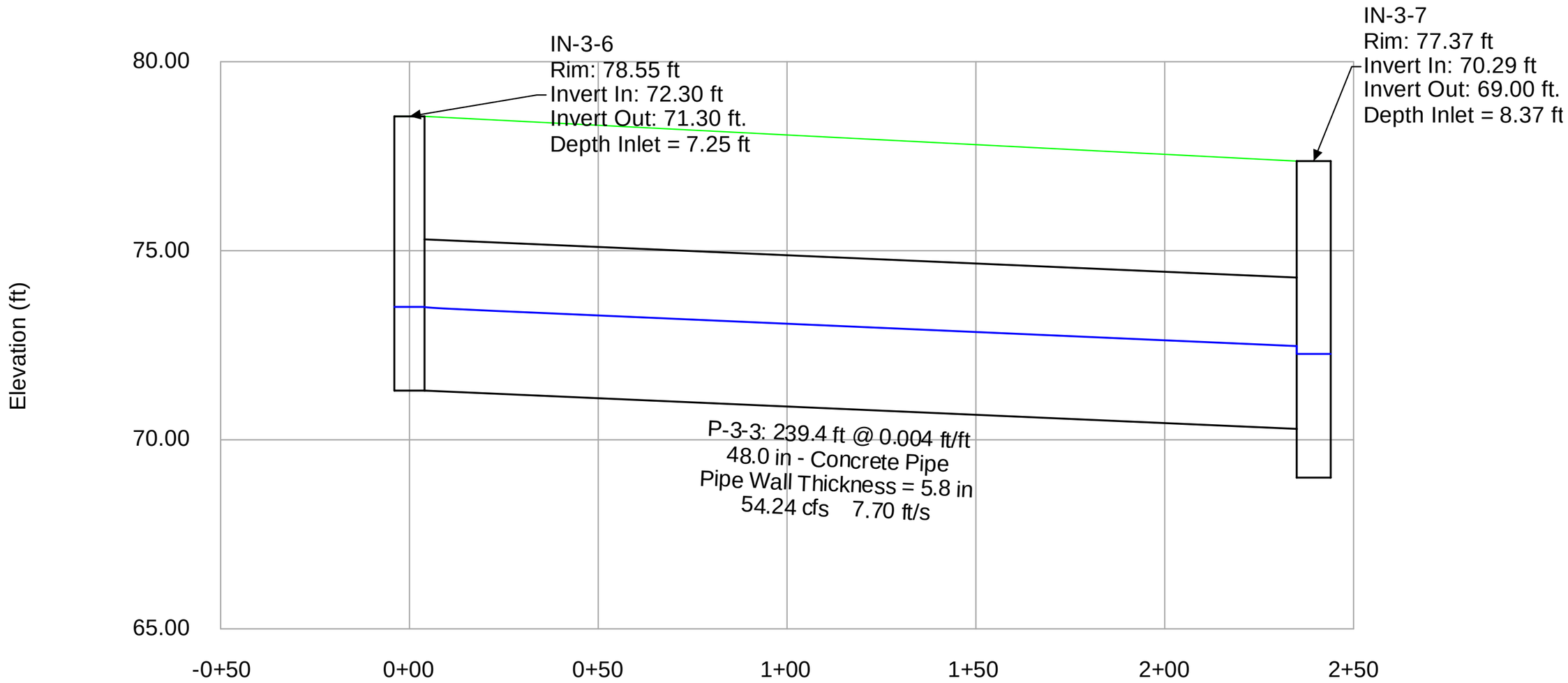
Engineering Profile - Profile - 3 - IN-3-5 TO IN-3-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

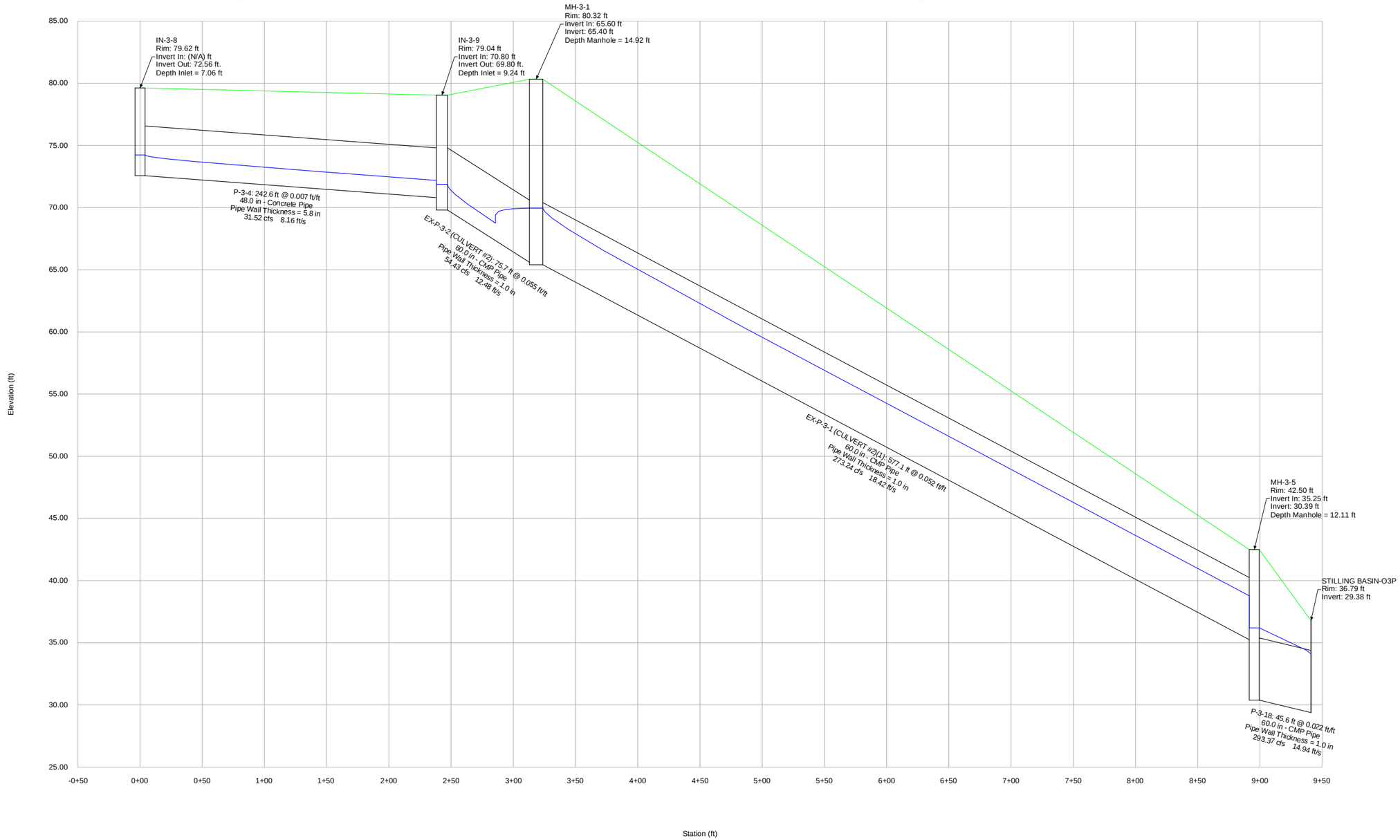
Engineering Profile - Profile - 3 - IN-3-6 TO IN-3-7 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

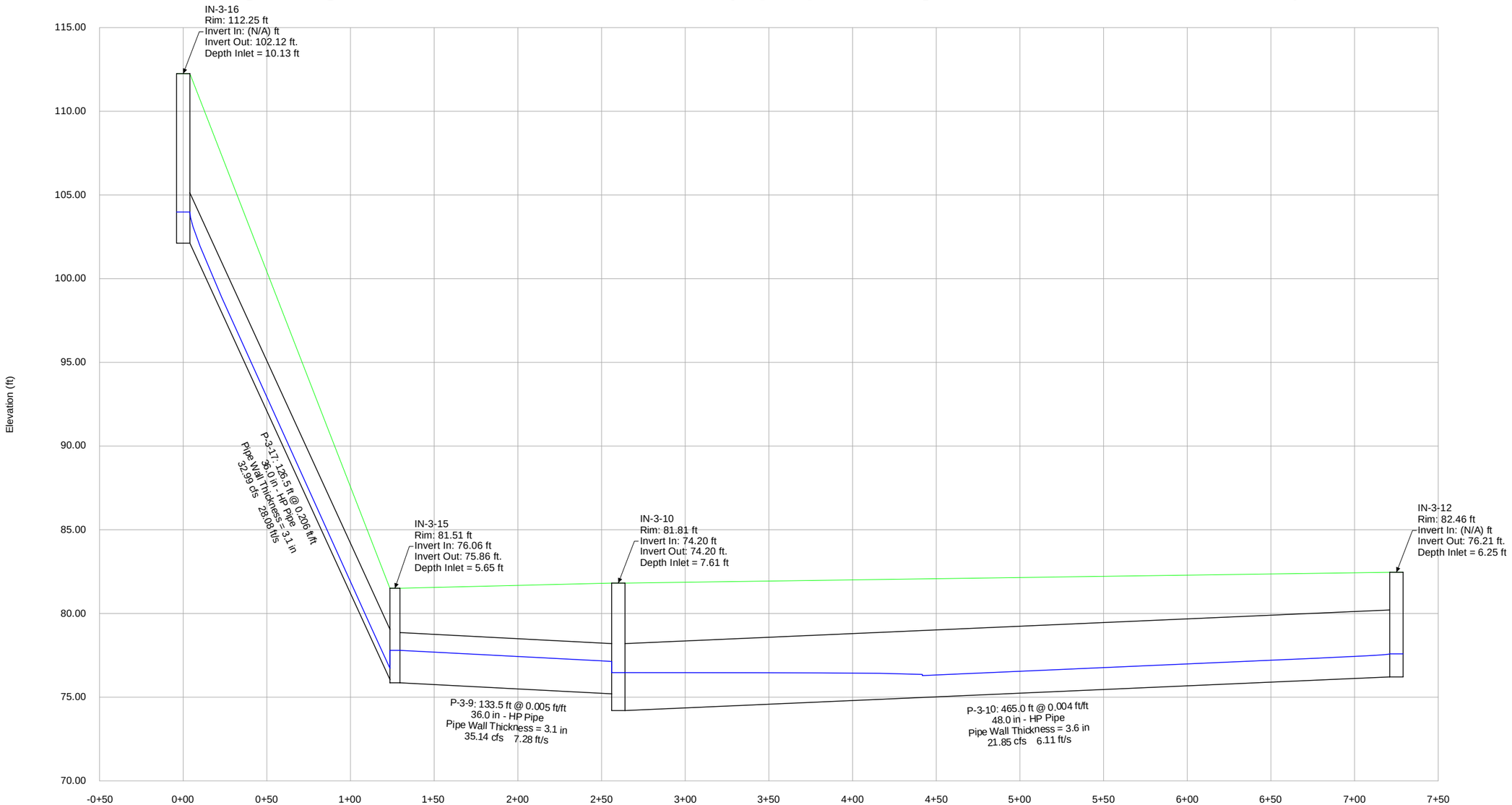
Engineering Profile - Profile - 3 - IN-3-8 TO STILING BASIN-O3P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

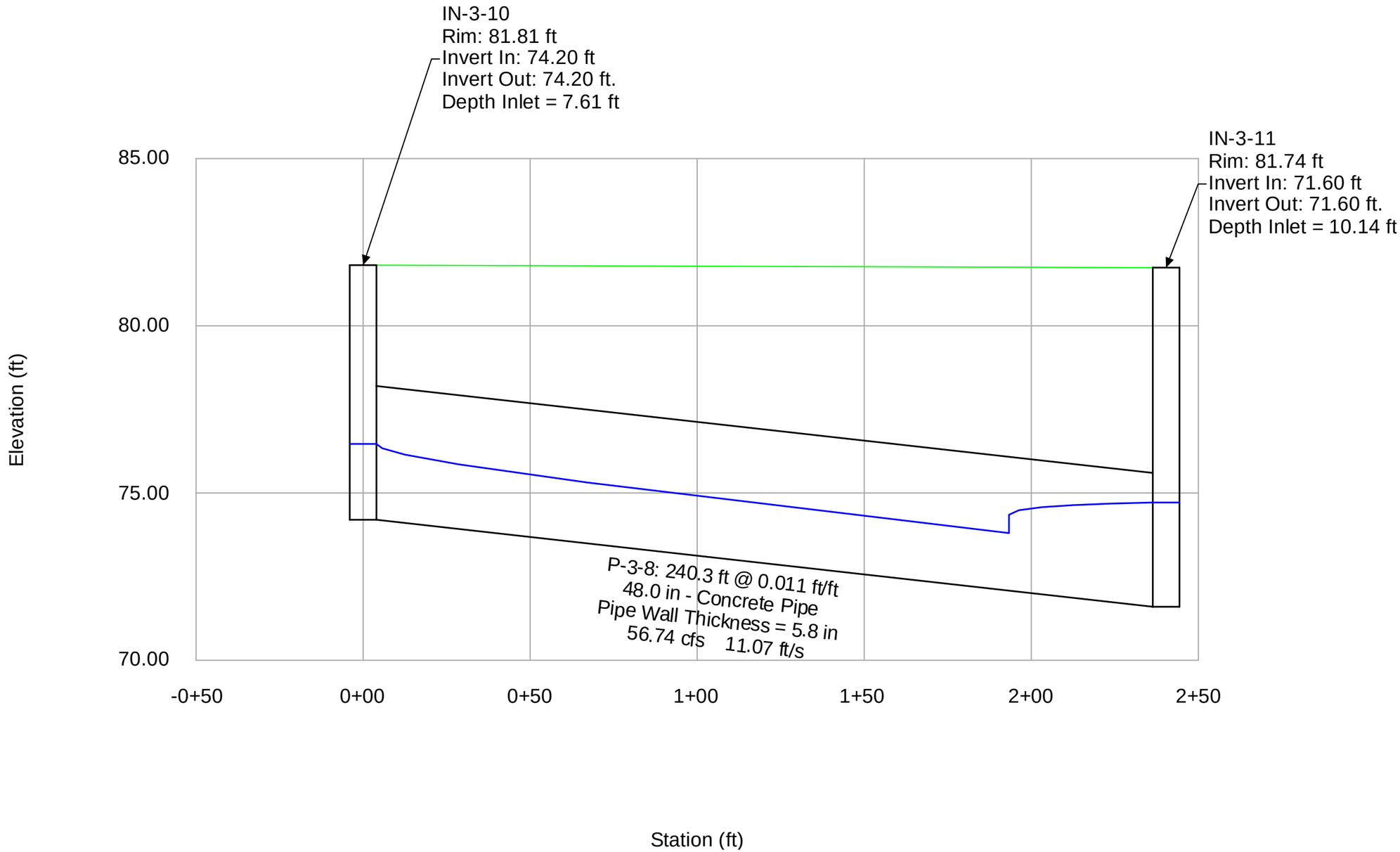
Engineering Profile - Profile - 3 - IN-3-16 TO IN-3-12 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



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Profile Report

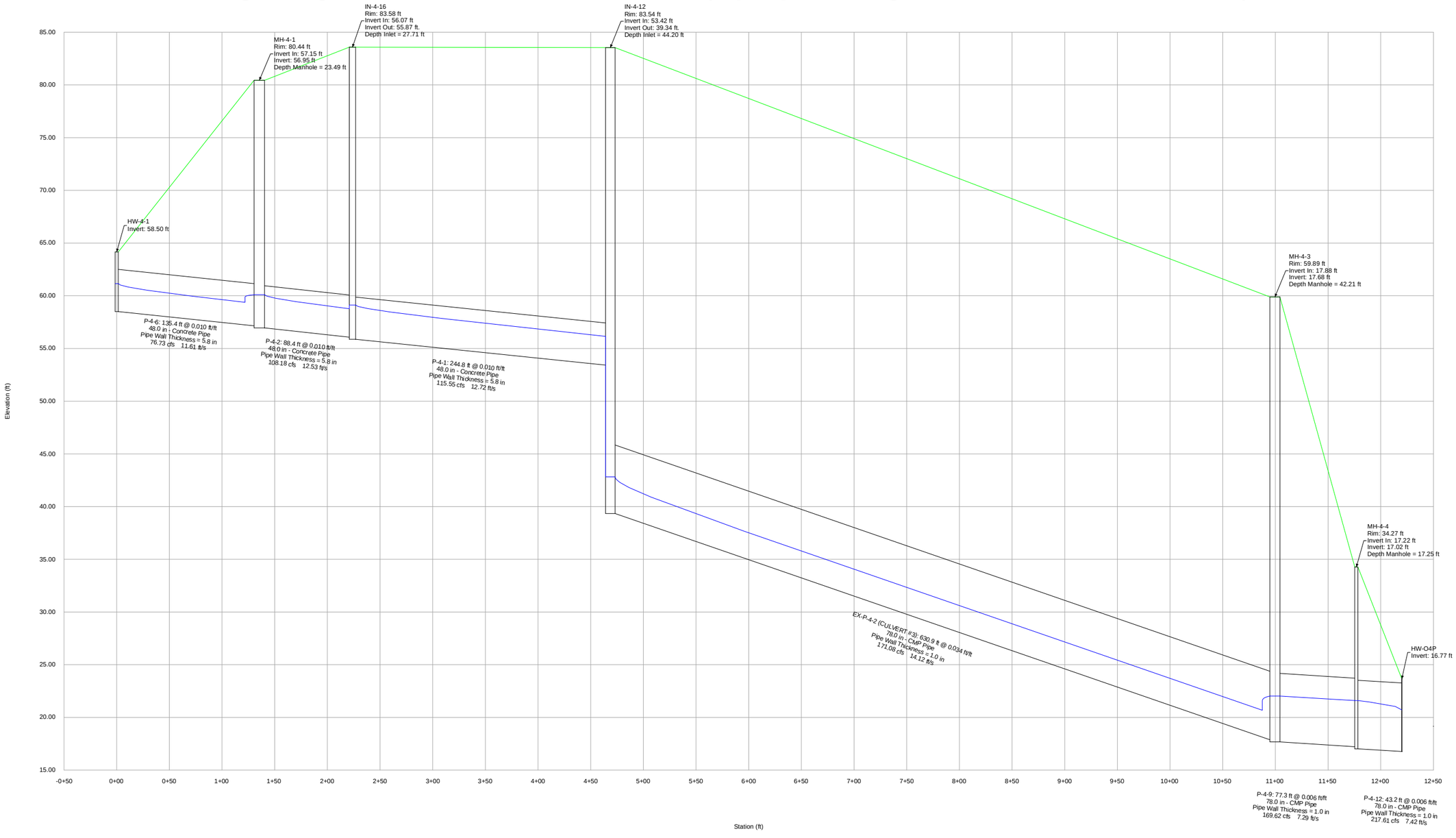
Engineering Profile - Profile - 3 - IN-3-10 TO IN-3-11 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

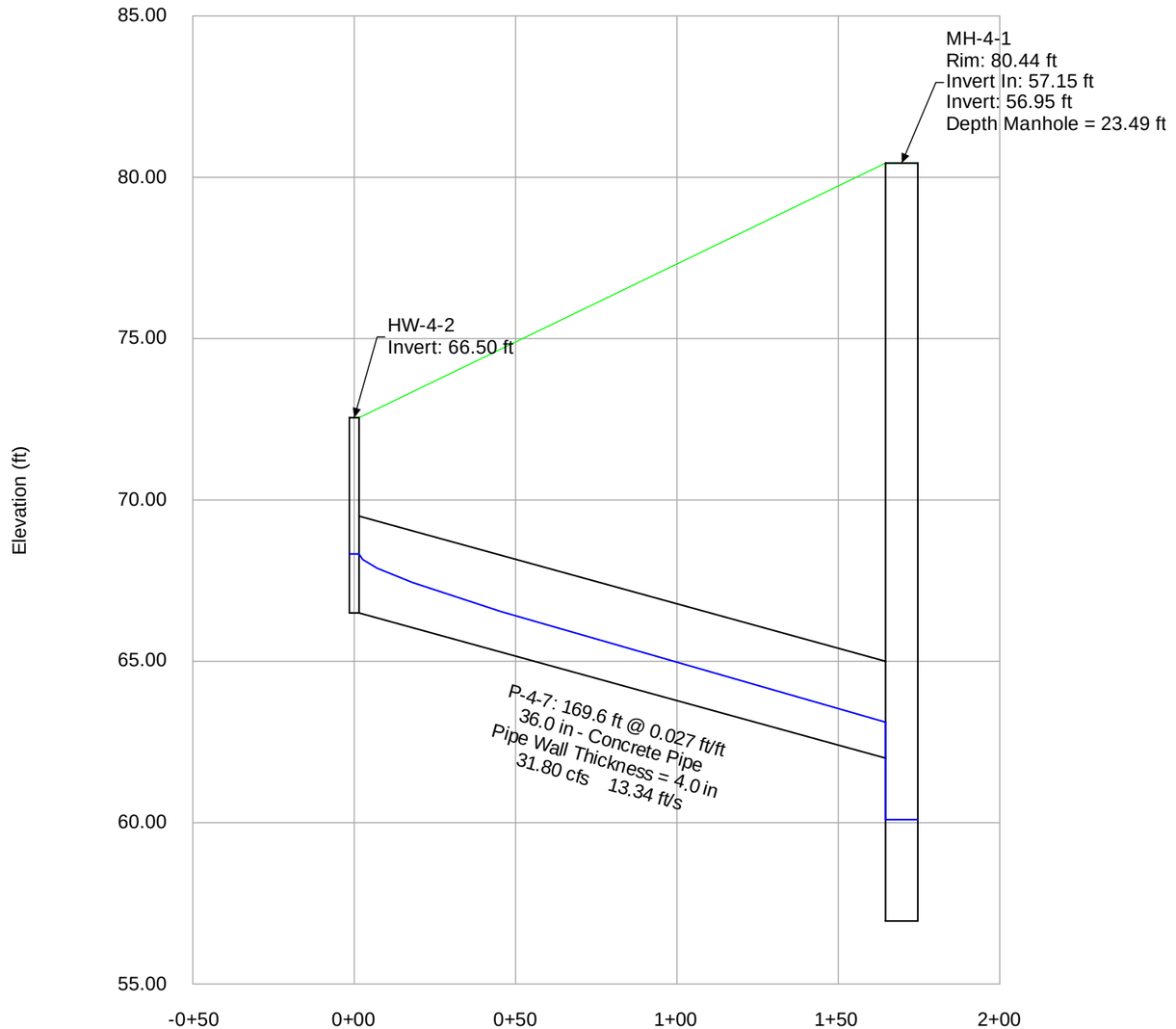
Engineering Profile - Profile - 4 - HW-4-1 TO HW-O4P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

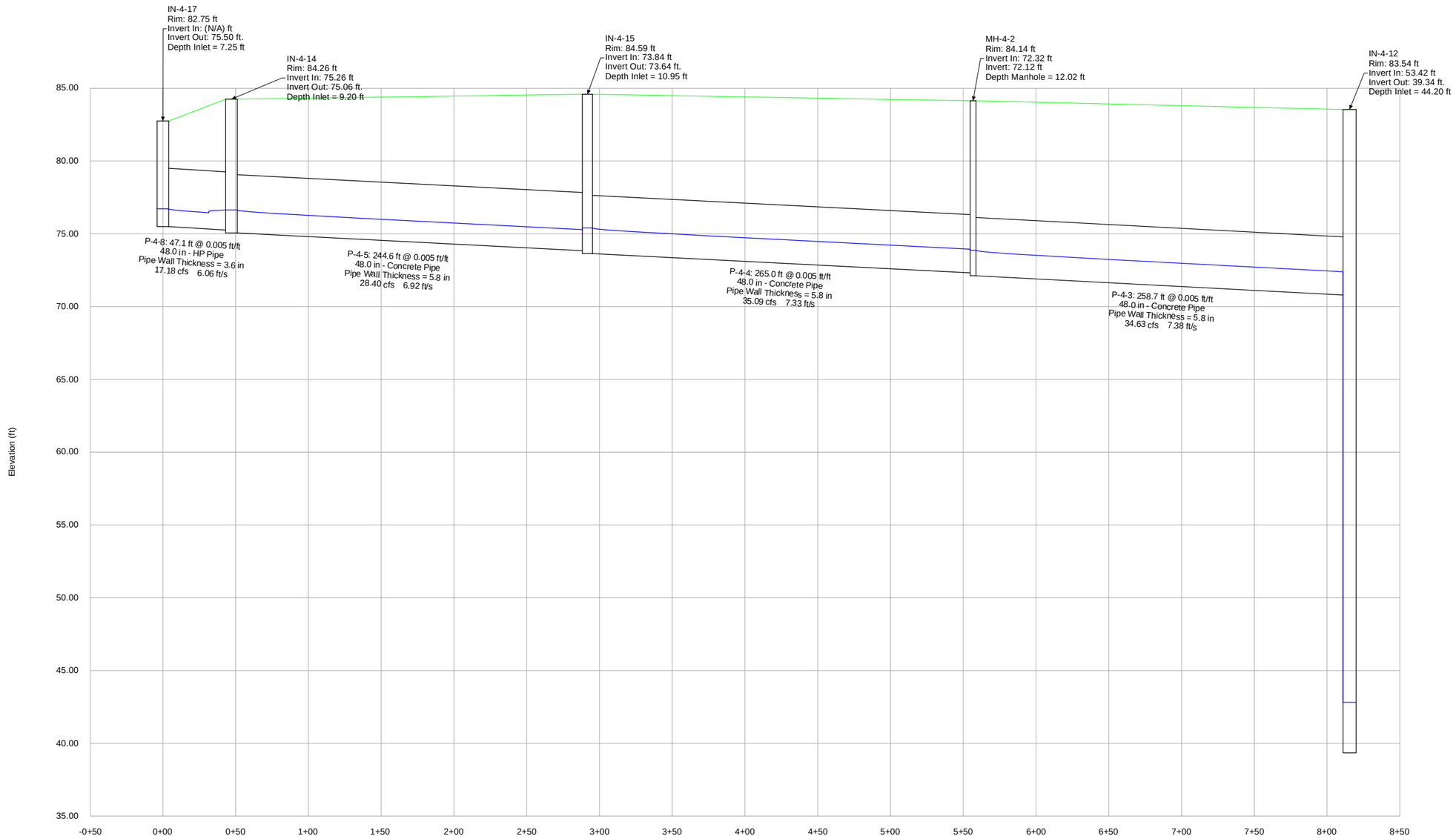
Engineering Profile - Profile - 4 - HW-4-2 TO MH-4-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

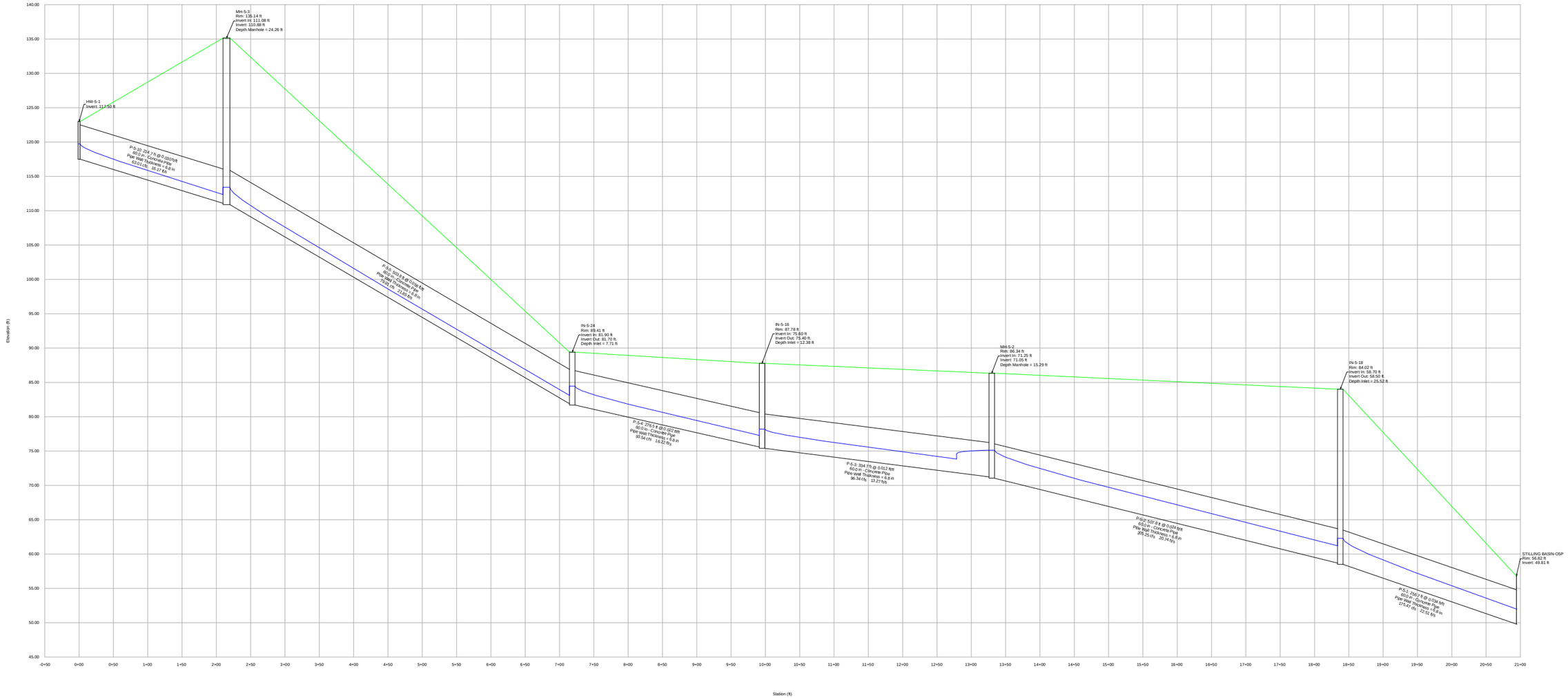
Engineering Profile - Profile - 4 - IN-4-17 TO IN-4-12 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

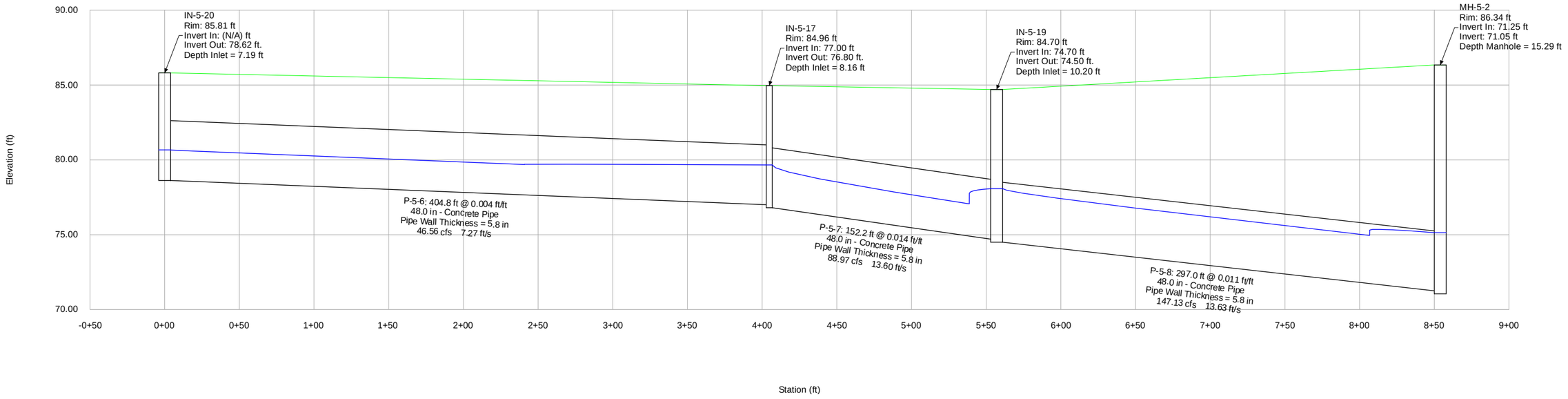
Engineering Profile - Profile - 5 - HW-5-1 TO STILLING BASIN-O5P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

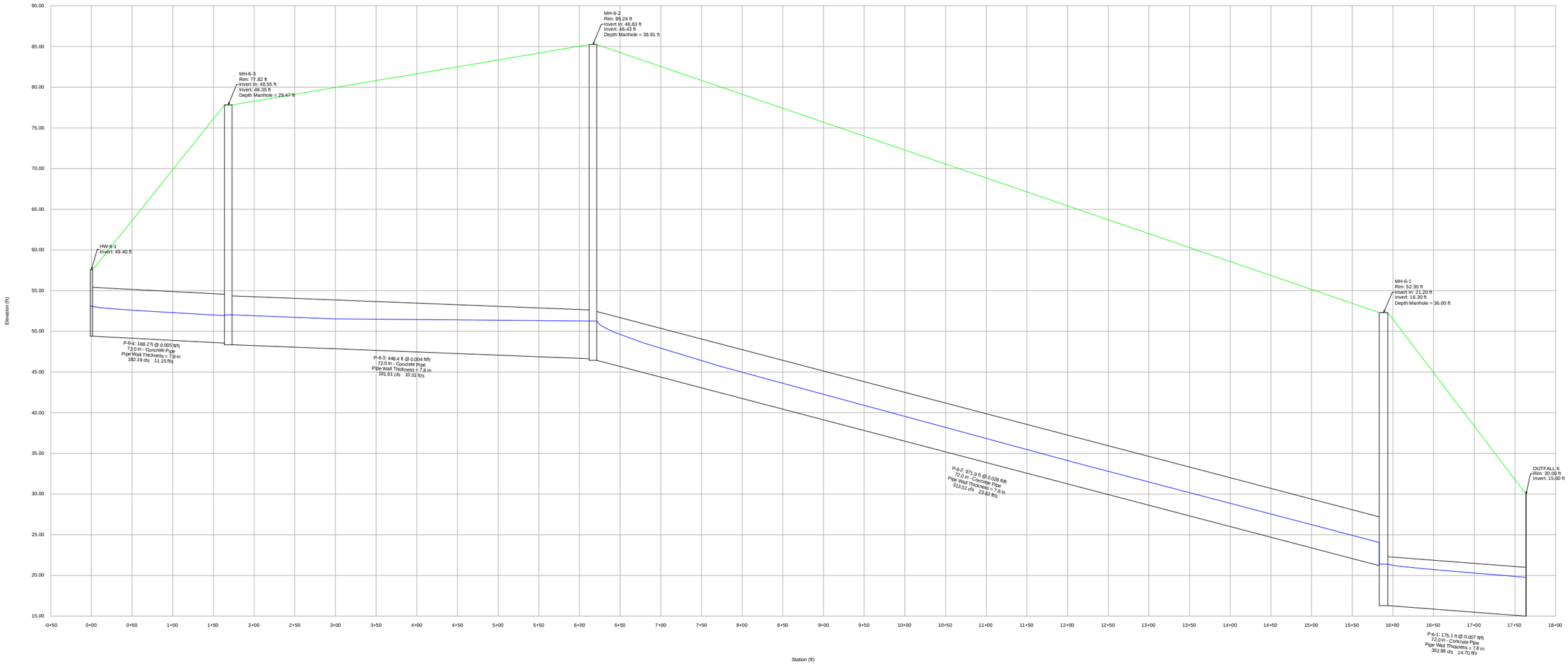
Engineering Profile - Profile - 5 - IN-5-20 TO IN-5-17 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

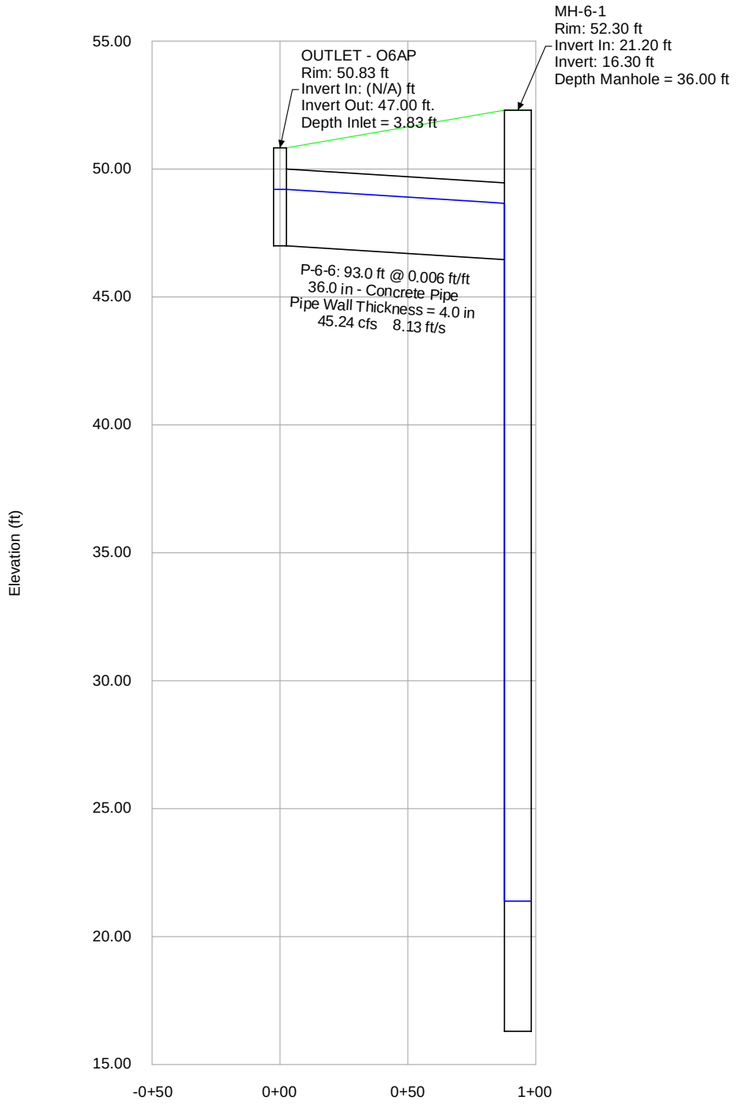
Engineering Profile - Profile - 6 - HW-6-1 TO OUTFALL 6 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

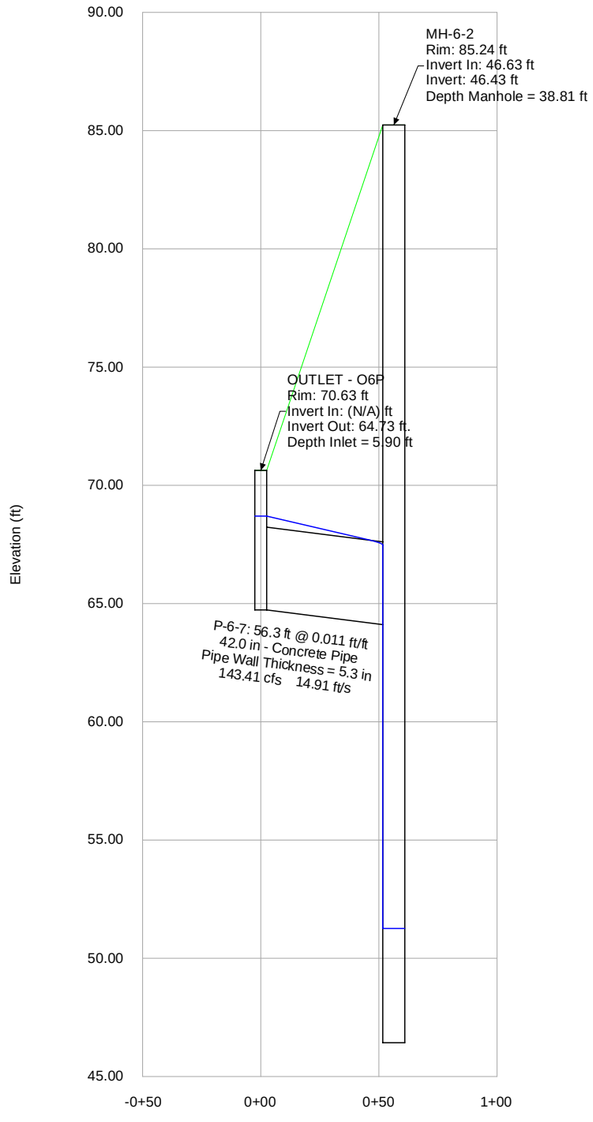
Engineering Profile - Profile - 6 - OUTLET- O6AP TO MH-6-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

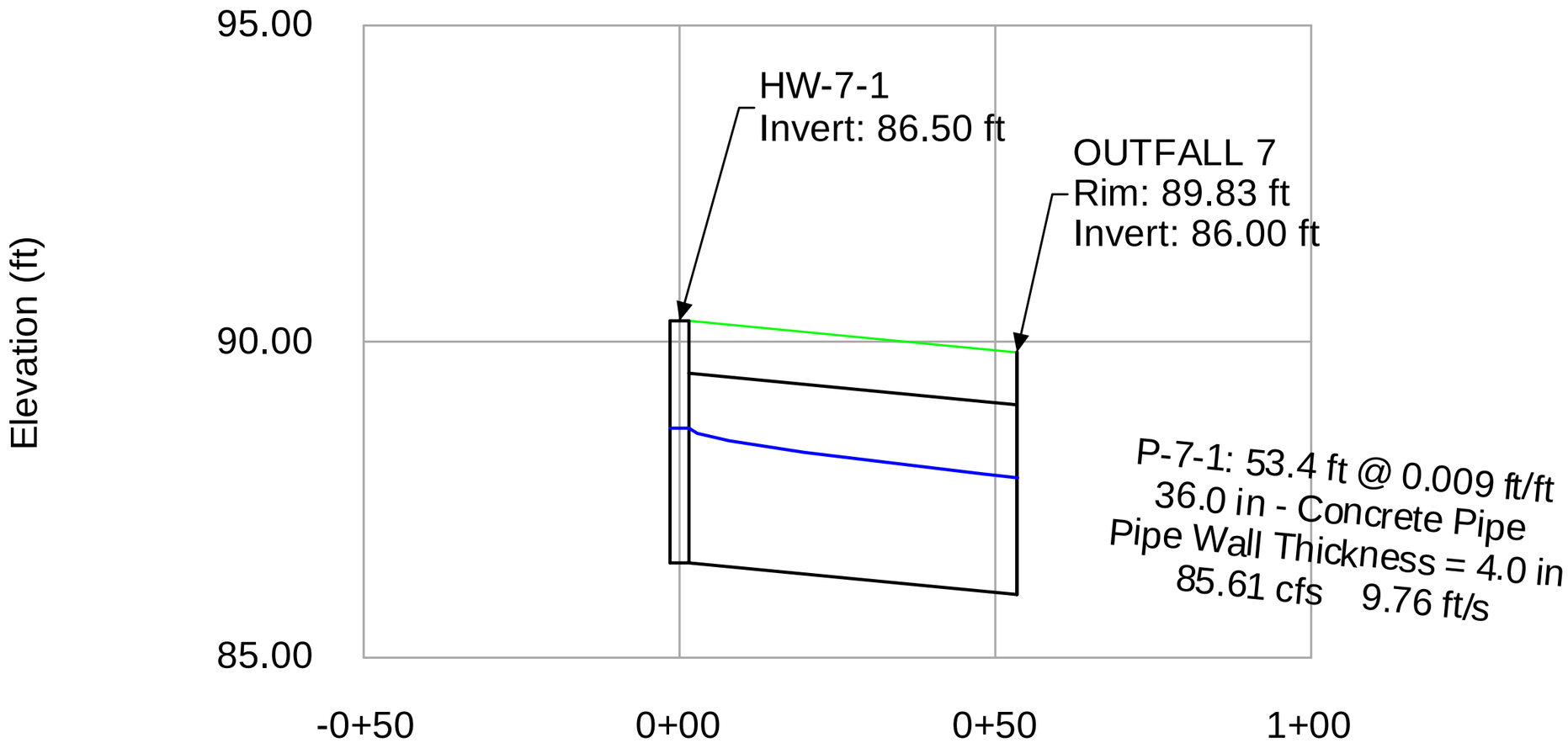
Engineering Profile - Profile - 6 - OUTLET-O6P TO MH-6-2 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

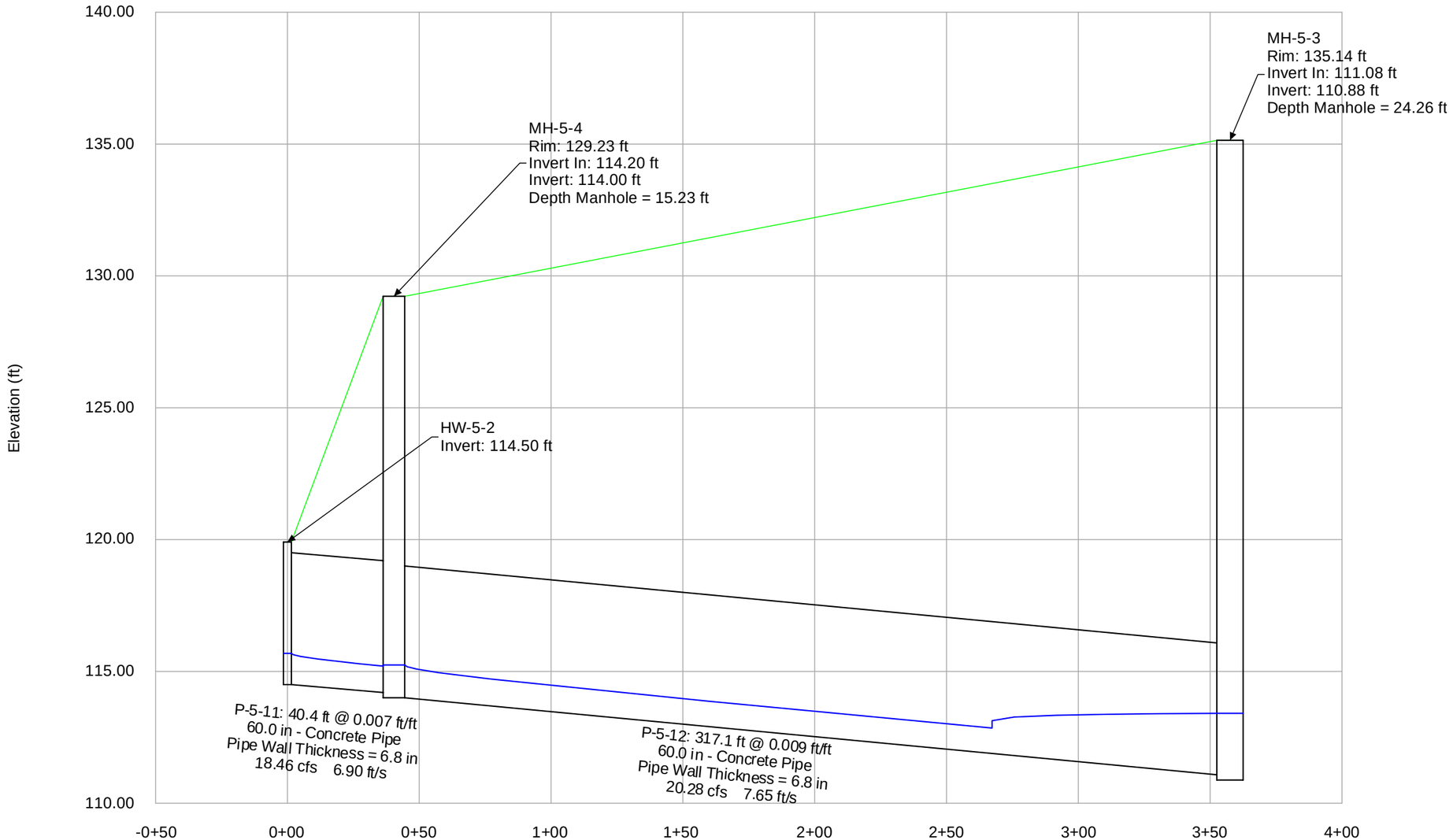
Engineering Profile - Profile - 7 - HW-7-1 TO OUTFALL 7 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

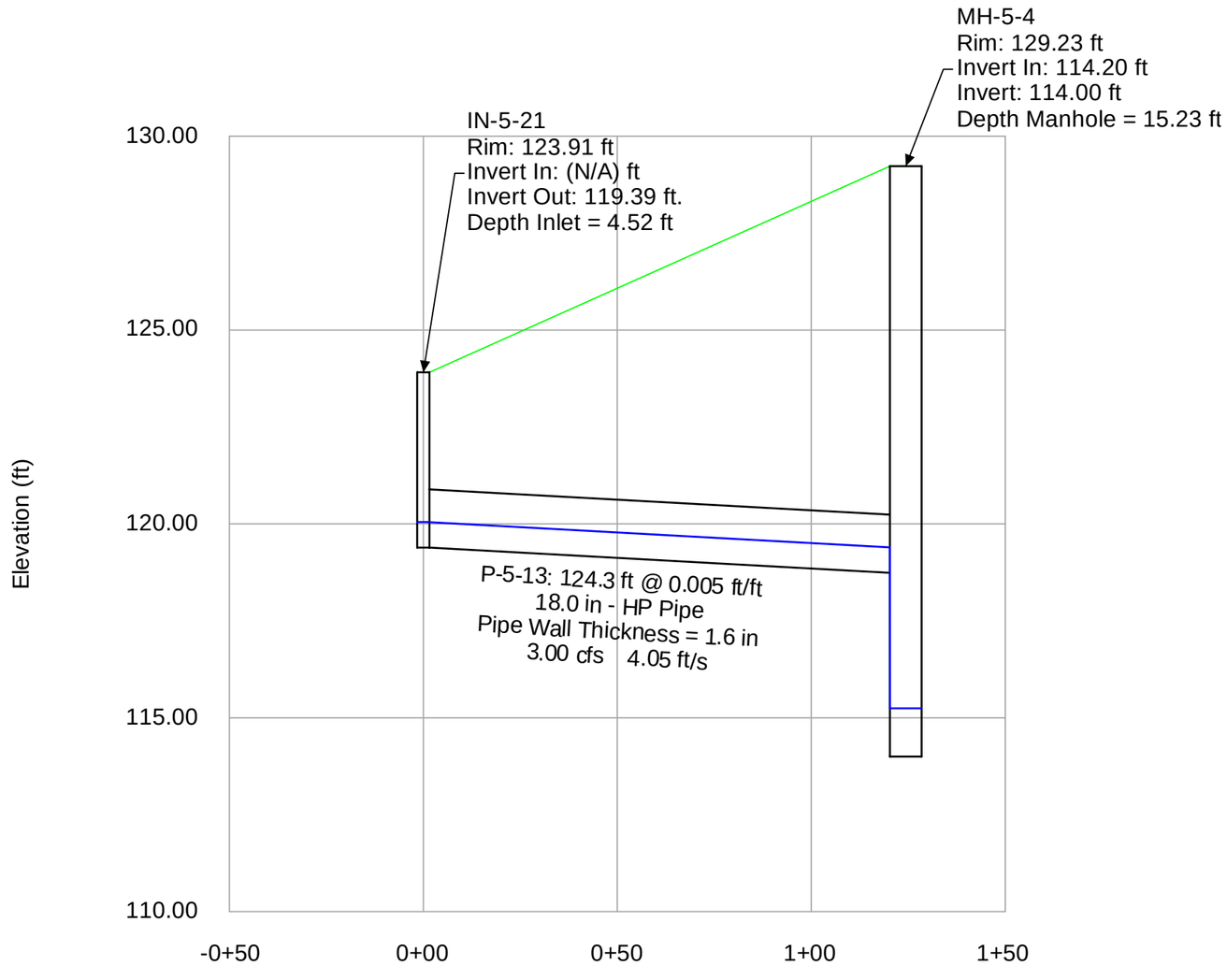
Engineering Profile - Profile - 5 - HW-5-2 to MH-5-3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

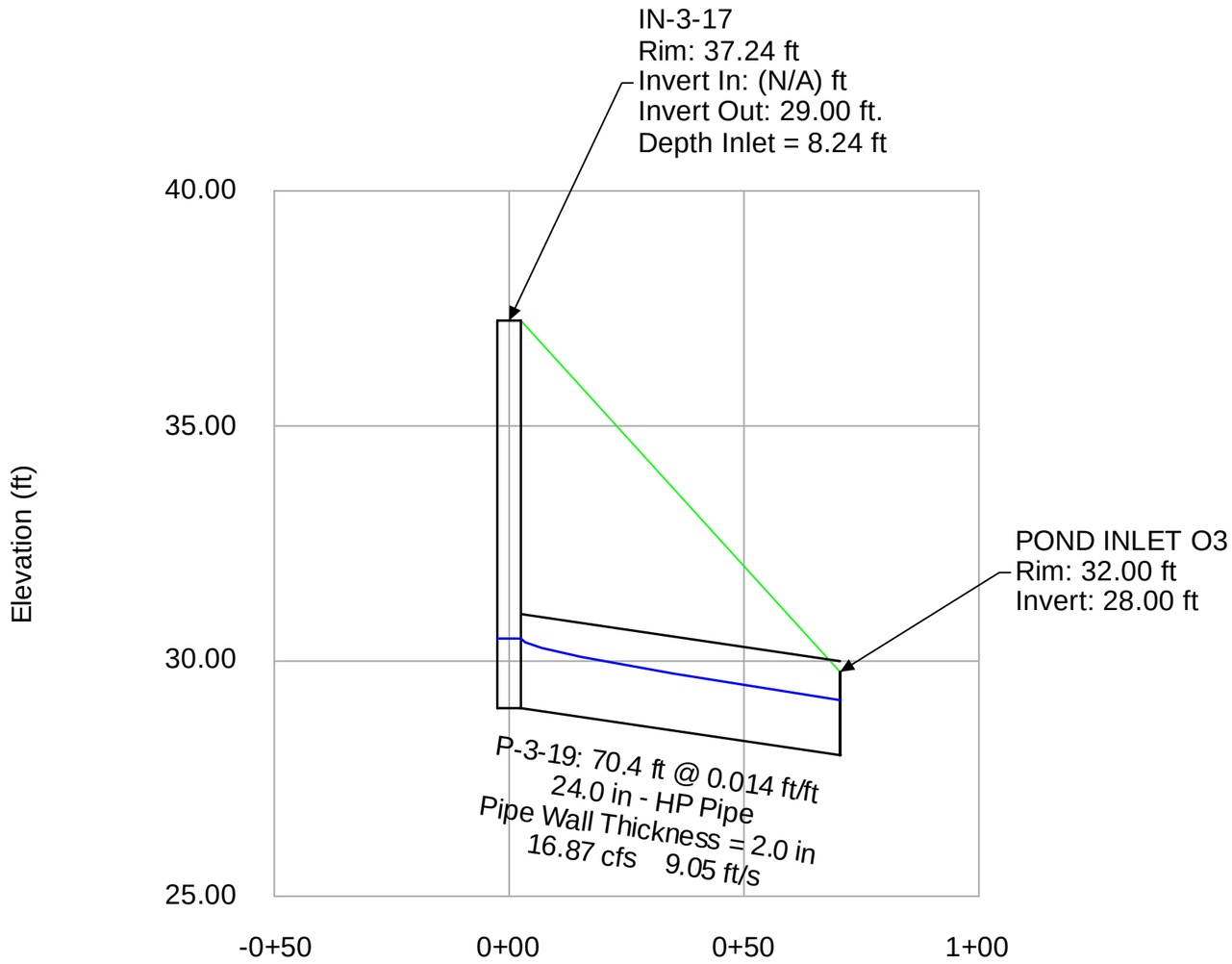
Engineering Profile - Profile - 5 - IN-5-21 TO MH-5-4 Water Tank (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

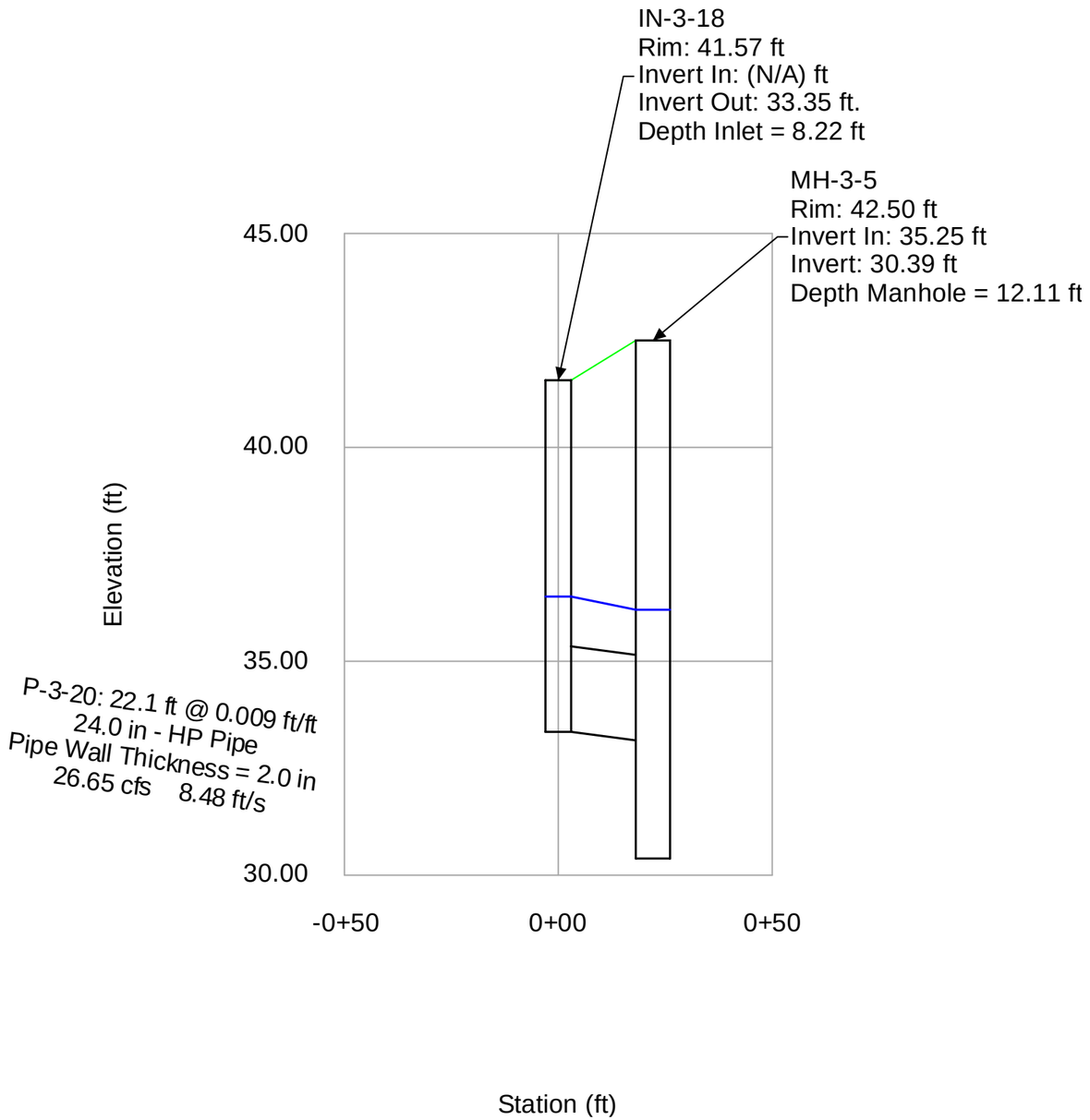
Engineering Profile - Profile - 3 - IN-3-17 TO POND INLET O3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

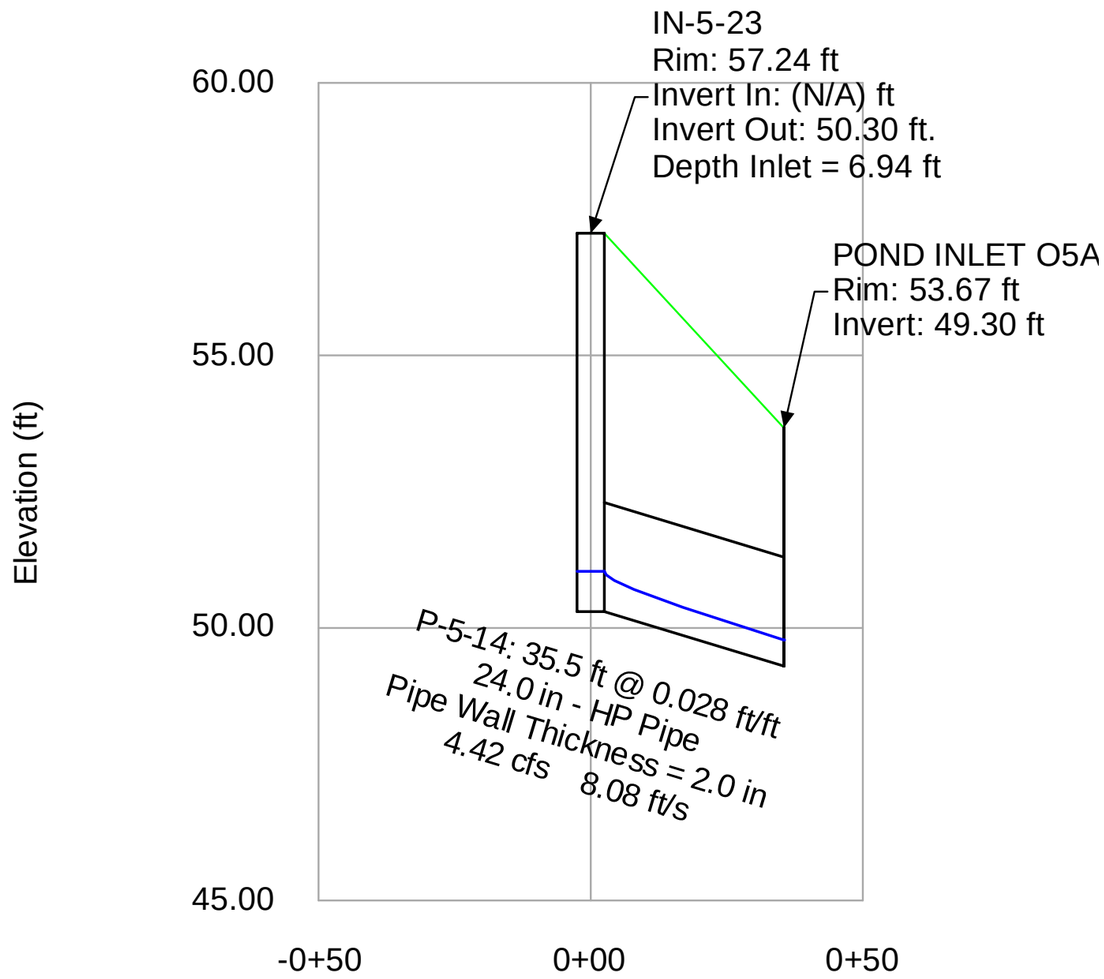
Engineering Profile - Profile - 3 - IN-3-18 TO MH-3-5 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

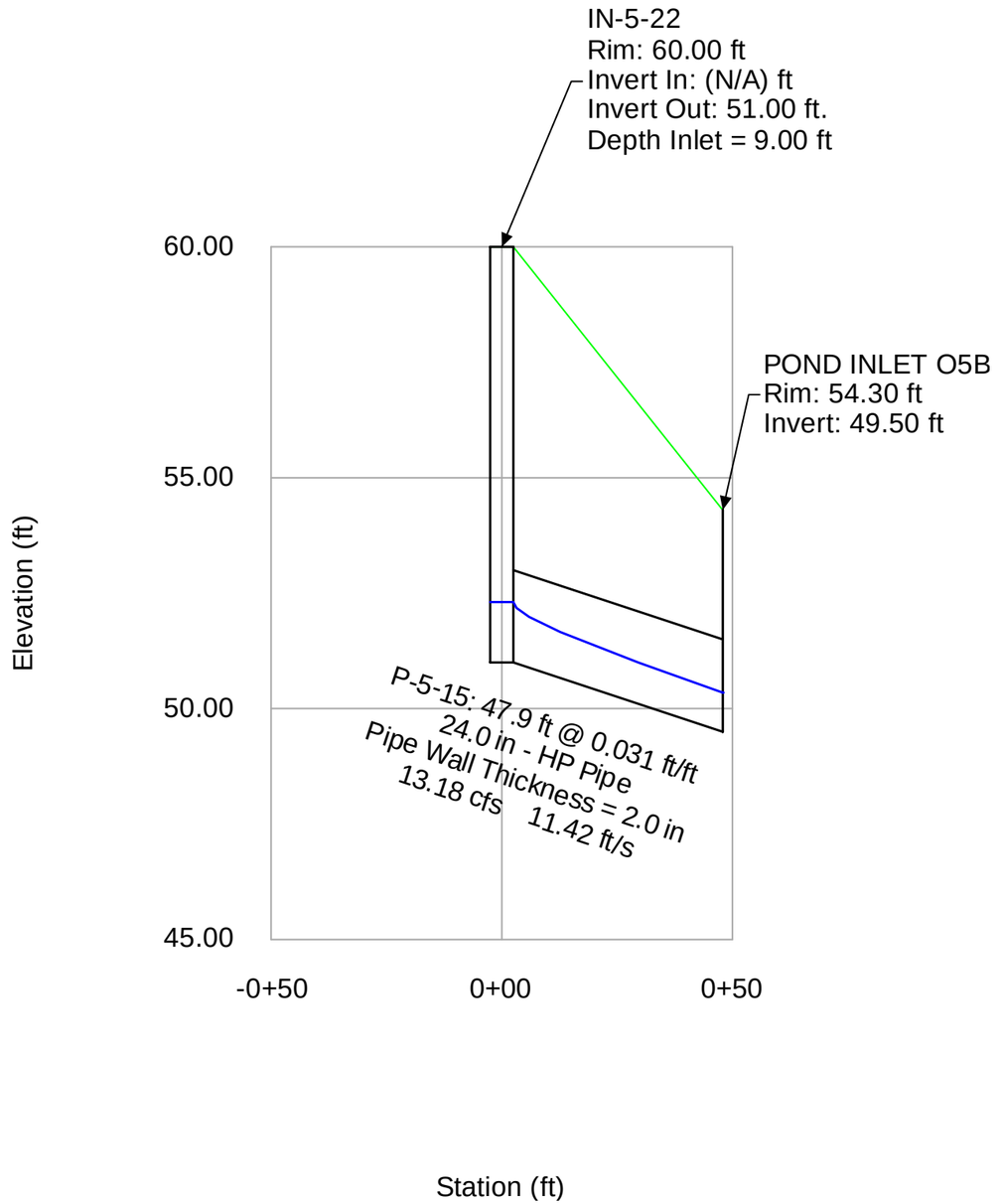
Engineering Profile - Profile - 5 - IN-5-23 TO POND INLET O5A (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

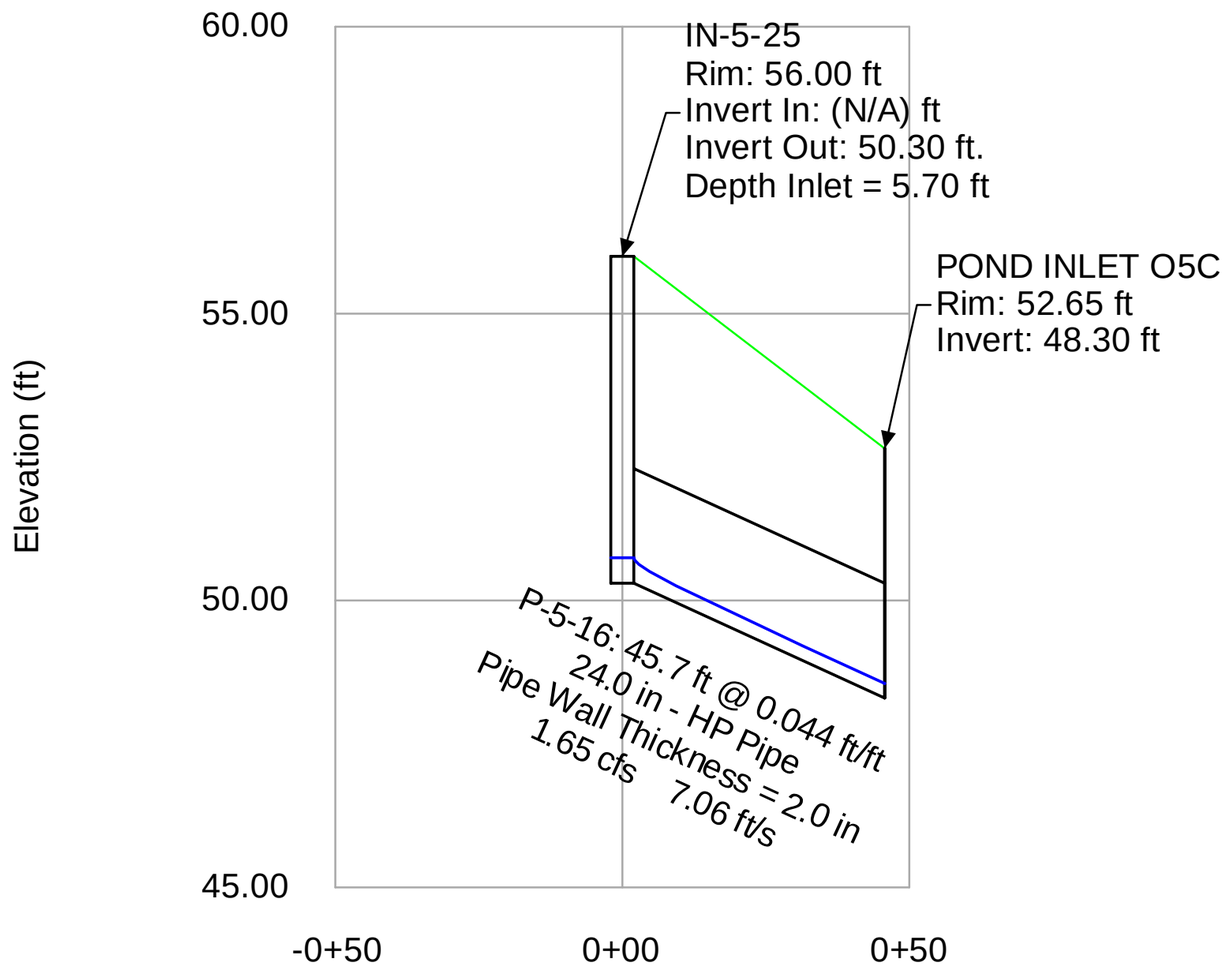
Engineering Profile - Profile - 5 - IN-5-22 TO POND INLET O5B (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

Profile Report

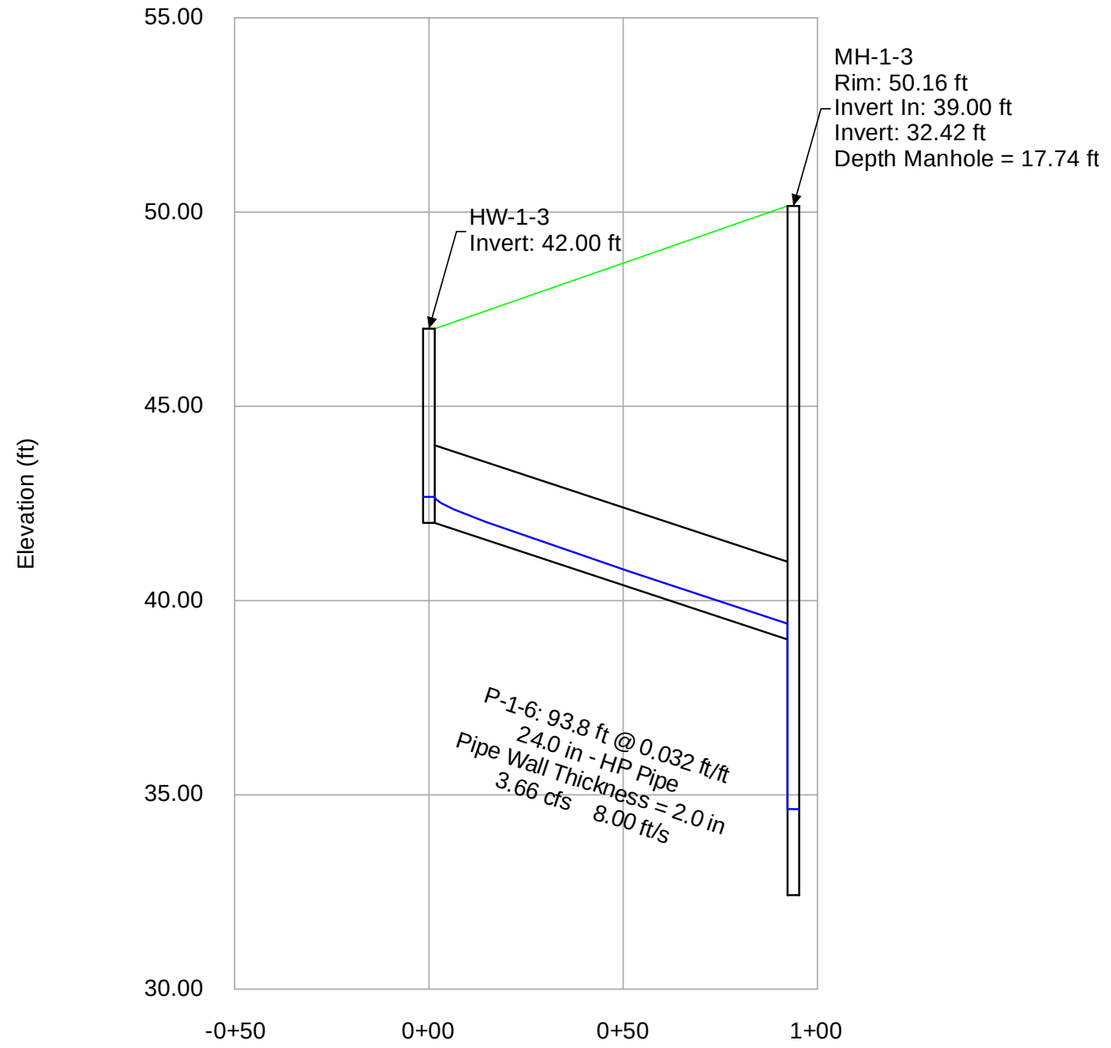
Engineering Profile - Profile - 5 - IN-5-25 TO POND INLET O5C (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



50-Yr

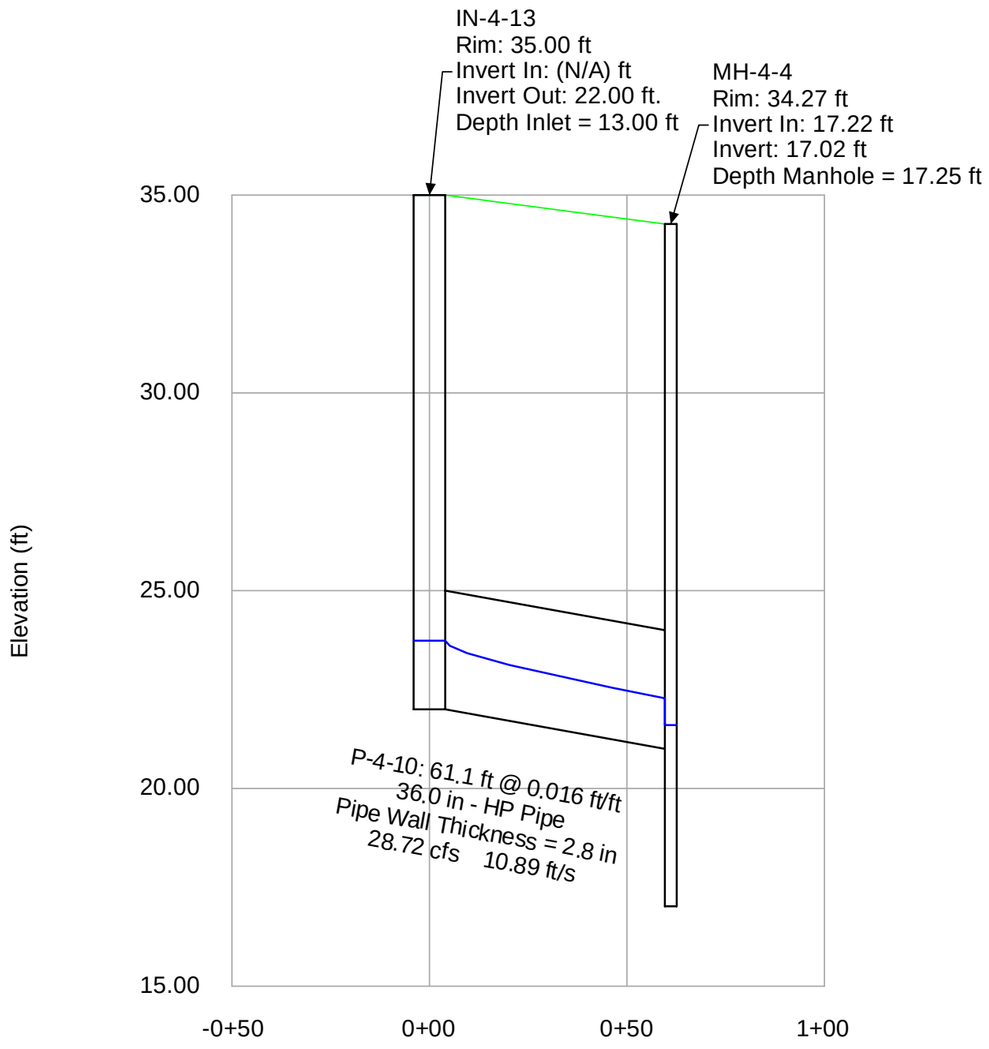
Profile Report

Engineering Profile - Profile - 1 HW-1-3 TO MH-1-3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



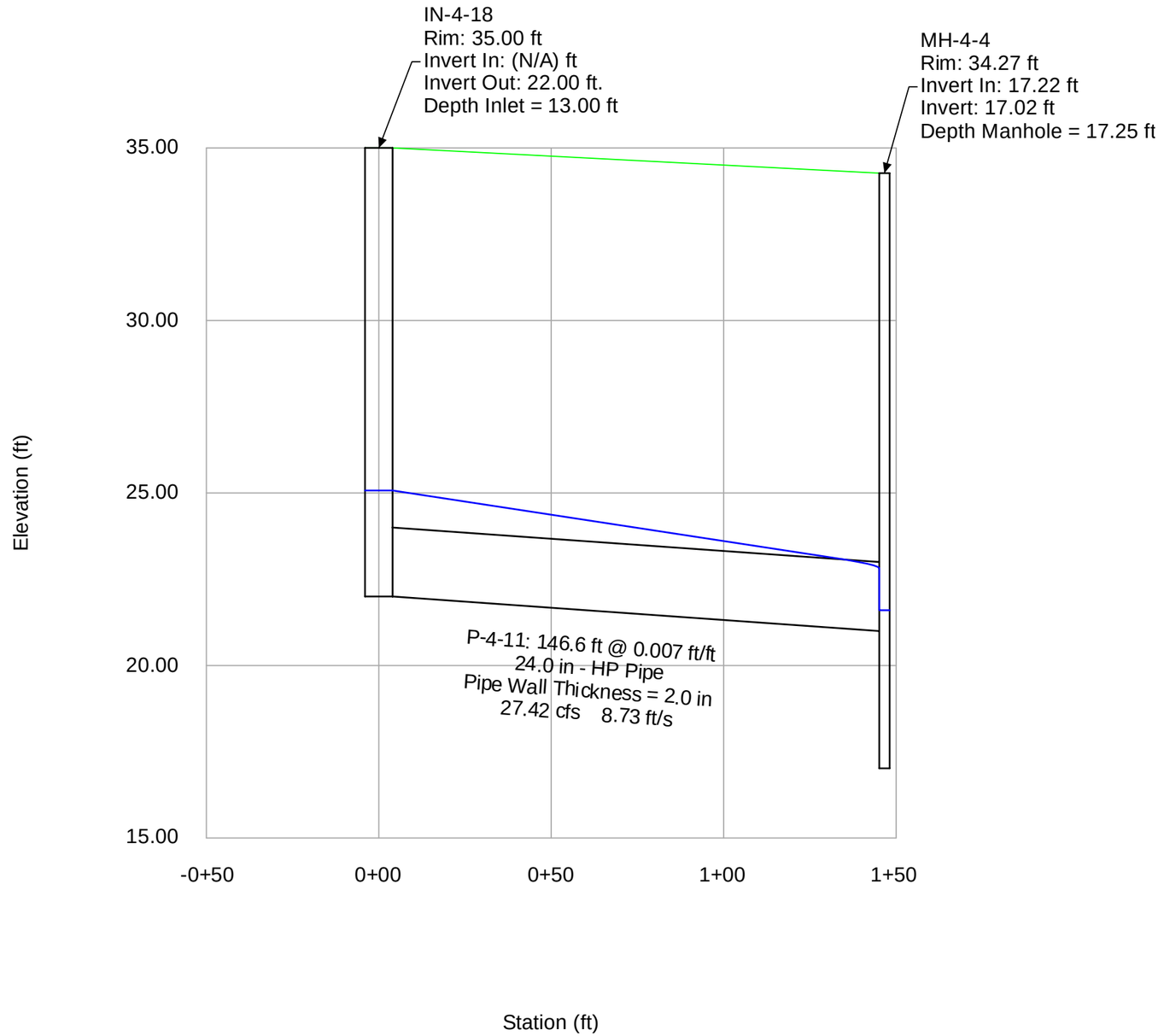
Profile Report

Engineering Profile - Profile - 4 - IN-4-13 TO MH-4-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



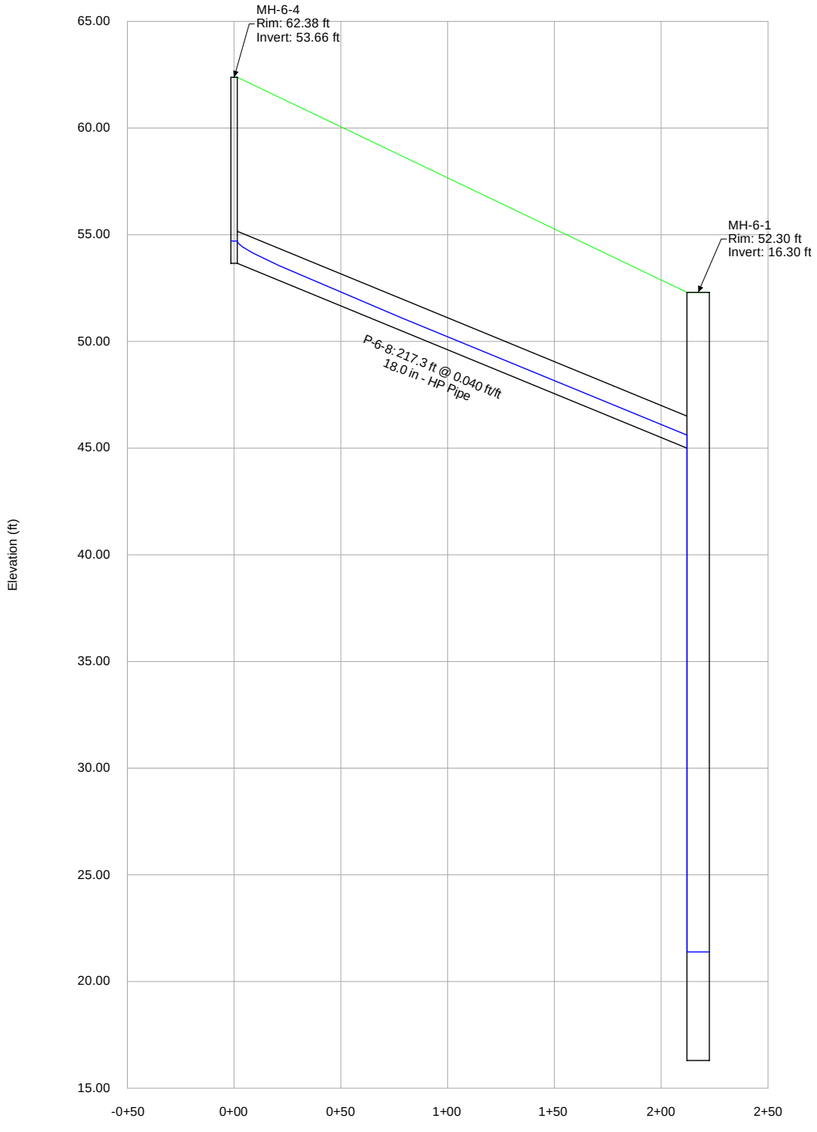
Profile Report

Engineering Profile - Profile - 4 - IN-4-18 TO MH-4-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



Profile Report

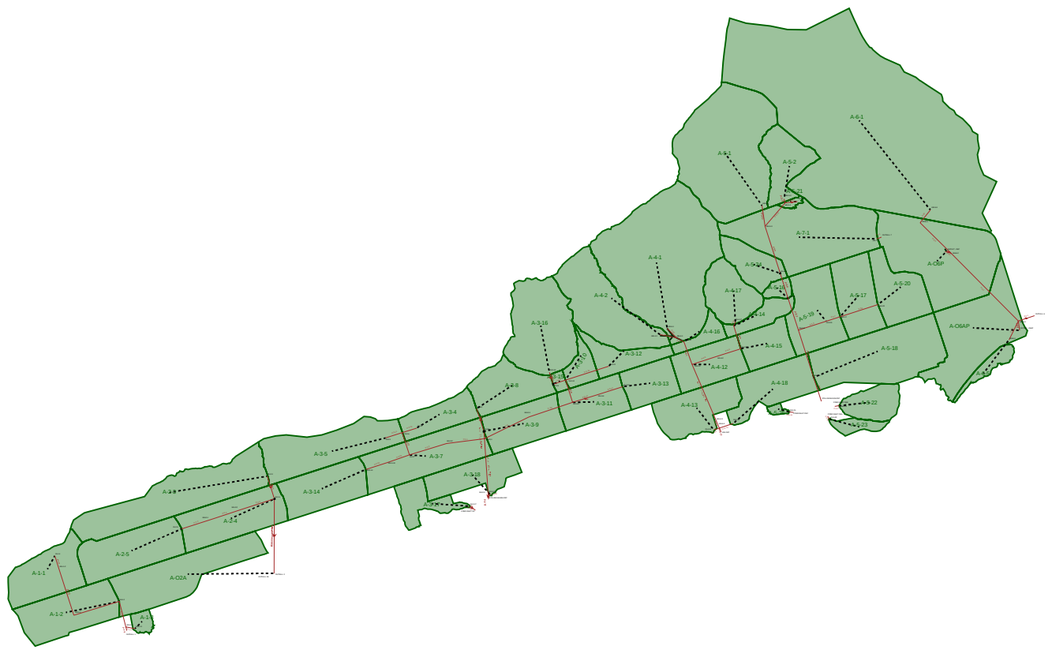
Engineering Profile - Profile - 6 - M-6-4 TO MH-6-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-YEAR STORMCAD OUTPUT FILES

CLIN BA01 AWARDED

Scenario: Scenario - 100 Yr



100-Yr Storm Catchment					
Label	**Outflow Element**	**Scaled Area (acres)**	**Runoff Coefficient (Rational)**	**Time of Concentration (min)**	**Flow (Total Out) (cfs)**
A-1-1	IN-1-1	8.22	0.53	25.9	34.37
A-1-2	IN-1-2	9.52	0.53	28.8	37.34
A-1-3	HW-1-3	0.99	0.49	13.1	5.03
A-2-3	IN-2-3	16.45	0.56	32.5	64.50
A-2-4	IN-2-4	10.04	0.67	29.4	49.09
A-2-5	IN-2-5	10.06	0.70	26.9	54.36
A-3-10	IN-3-10	2.47	0.57	15.3	13.62
A-3-11	IN-3-11	6.35	0.69	23.3	36.49
A-3-12	IN-3-12	4.36	0.59	11.8	27.76
A-3-13	IN-3-13	4.99	0.65	27.3	24.82
A-3-14	IN-3-14	8.05	0.66	28.3	39.76
A-3-15	IN-3-15	0.63	0.61	7.2	5.07
A-3-16	IN-3-16	13.15	0.49	32.0	45.37
A-3-17	IN-3-17	3.72	0.63	18.8	21.29
A-3-18	IN-3-18	6.29	0.63	23.2	33.07
A-3-4	IN-3-4	5.06	0.58	12.6	30.89
A-3-5	IN-3-5	11.98	0.56	29.5	48.85
A-3-7	IN-3-7	11.83	0.66	21.3	67.65
A-3-8	IN-3-8	7.27	0.56	13.8	41.23
A-3-9	IN-3-9	7.45	0.69	28.8	38.04
A-4-1	HW-4-1	31.45	0.49	34.5	105.51
A-4-12	IN-4-12	6.67	0.67	23.5	37.06
A-4-13	IN-4-13	7.81	0.60	26.5	36.49
A-4-14	IN-4-14	2.89	0.62	16.9	16.85
A-4-15	IN-4-15	1.71	0.66	18.6	10.29
A-4-16	IN-4-16	2.13	0.64	10.1	15.48
A-4-17	IN-4-17	6.15	0.49	26.2	23.62
A-4-18	IN-4-18	7.70	0.58	26.2	35.00
A-4-2	HW-4-2	12.99	0.49	34.2	43.73
A-5-1	HW-5-1	24.61	0.50	32.4	86.26
A-5-16	IN-5-16	1.09	0.54	12.3	6.25
A-5-17	IN-5-17	7.53	0.78	17.4	54.75
A-5-18	IN-5-18	15.49	0.57	62.1	42.26
A-5-19	IN-5-19	9.29	0.79	15.8	70.40
A-5-2	HW-5-2	6.07	0.50	23.3	25.27
A-5-20	IN-5-20	6.85	0.79	13.7	54.98
A-5-21	IN-5-21	0.39	0.69	6.7	3.64
A-5-22	IN-5-22	4.01	0.49	18.0	18.12
A-5-23	IN-5-23	1.49	0.49	23.3	6.08
A-5-24	IN-5-24	4.79	0.55	11.1	29.05
A-5-25	IN-5-25	0.38	0.49	8.8	2.26
A-6-1	HW-6-1	80.53	0.49	42.9	244.32
A-6-5	MH-6-4	1.82	0.55	16.2	9.53
A-7-1	HW-7-1	17.78	0.67	21.0	103.82
A-O2A	OUTFALL 2A	12.55	0.61	41.6	48.18
A-O6AP	OUTLET - O6AP	14.82	0.54	28.5	59.62
A-O6P	OUTLET - O6P	19.07	0.53	28.8	74.79

100-Yr Storm Pipes									
Label	Start Node	Invert Start (ft)	Stop Node	Invert Stop (ft)	Diameter (in)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Manning's n	Catalog Class
EX-P-2-1 (CULVERT #1)	IN-2-4	71.50	OUTFALL 2	30.84	60	760.4	0.053	0.024	CMP Pipe
EX-P-3-1 (CULVERT #2)(1)	MH-3-1	65.40	MH-3-5	35.25	60	577.1	0.052	0.024	CMP Pipe
EX-P-3-2 (CULVERT #2)	IN-3-9	69.80	MH-3-1	65.60	60	75.7	0.055	0.024	CMP Pipe
EX-P-4-2 (CULVERT #3)	IN-4-12	39.34	MH-4-3	17.88	78	630.9	0.034	0.024	CMP Pipe
P-1-1	IN-1-2	45.00	MH-1-3	39.00	48	269.8	0.022	0.013	Concrete Pipe
P-1-2	MH-1-1	77.19	IN-1-2	56.00	48	483.9	0.044	0.013	Concrete Pipe
P-1-3	MH-1-2	79.89	MH-1-1	77.39	48	509.7	0.005	0.013	Concrete Pipe
P-1-4	IN-1-1	81.58	MH-1-2	80.89	36	138.0	0.005	0.013	HP Pipe
P-1-5	MH-1-3	32.42	OUTFALL 1	32.00	48	40.0	0.011	0.013	Concrete Pipe
P-1-6	HW-1-3	42.00	MH-1-3	39.00	24	93.8	0.032	0.013	HP Pipe
P-2-1	IN-2-3	77.16	IN-2-4	73.50	36	243.9	0.015	0.013	Concrete Pipe
P-2-2	IN-2-5	78.89	MH-2-1	77.21	36	322.0	0.005	0.013	Concrete Pipe
P-2-3	MH-2-1	77.01	MH-2-2	75.56	36	322.0	0.005	0.013	Concrete Pipe
P-2-4	MH-2-2	75.36	IN-2-4	73.50	36	353.4	0.005	0.013	Concrete Pipe
P-3-1	MH-3-2	67.10	MH-3-1	65.60	60	389.6	0.004	0.013	Concrete Pipe
P-3-10	IN-3-12	76.21	IN-3-10	74.20	48	465.0	0.004	0.013	HP Pipe
P-3-11	IN-3-5	72.98	IN-3-6	72.30	36	179.2	0.004	0.013	HP Pipe
P-3-12	IN-3-4	72.75	IN-3-6	72.30	36	155.0	0.003	0.013	HP Pipe
P-3-13	MH-3-4	75.56	IN-3-11	72.60	36	264.0	0.011	0.013	Concrete Pipe
P-3-14	IN-3-13	77.14	MH-3-4	75.76	36	275.0	0.005	0.013	Concrete Pipe
P-3-15	IN-3-14	72.75	MH-3-13	72.01	36	235.0	0.003	0.013	Concrete Pipe
P-3-16	MH-3-13	71.81	IN-3-7	71.00	36	235.1	0.003	0.013	Concrete Pipe
P-3-17	IN-3-16	102.12	IN-3-15	76.06	36	126.5	0.206	0.013	HP Pipe
P-3-18	MH-3-5	30.39	STILLING BASIN-O3P	29.39	60	45.6	0.022	0.024	CMP Pipe
P-3-19	IN-3-17	29.00	POND INLET O3	28.00	24	70.4	0.014	0.013	HP Pipe
P-3-2	IN-3-7	69.00	MH-3-2	67.30	60	398.0	0.004	0.013	Concrete Pipe
P-3-20	IN-3-18	33.35	MH-3-5	33.15	24	22.1	0.009	0.013	HP Pipe
P-3-3	IN-3-6	71.30	IN-3-7	70.29	48	239.4	0.004	0.013	Concrete Pipe
P-3-4	IN-3-8	72.56	IN-3-9	70.80	48	242.6	0.007	0.013	Concrete Pipe
P-3-5	MH-3-3	68.05	MH-3-1	65.60	60	507.2	0.005	0.013	Concrete Pipe
P-3-6	IN-3-11	71.60	MH-3-3	69.05	48	472.0	0.005	0.013	Concrete Pipe
P-3-8	IN-3-10	74.20	IN-3-11	71.60	48	240.3	0.011	0.013	Concrete Pipe
P-3-9	IN-3-15	75.86	IN-3-10	75.20	36	133.5	0.005	0.013	HP Pipe
P-4-1	IN-4-16	55.87	IN-4-12	53.42	48	244.8	0.010	0.013	Concrete Pipe
P-4-10	IN-4-13	22.00	MH-4-4	21.00	36	61.1	0.016	0.013	HP Pipe
P-4-11	IN-4-18	22.00	MH-4-4	21.00	24	146.6	0.007	0.013	HP Pipe
P-4-12	MH-4-4	17.02	HW-O4P	16.77	78	43.2	0.006	0.024	CMP Pipe
P-4-2	MH-4-1	56.95	IN-4-16	56.07	48	88.4	0.010	0.013	Concrete Pipe
P-4-3	MH-4-2	72.12	IN-4-12	70.80	48	258.7	0.005	0.013	Concrete Pipe
P-4-4	IN-4-15	73.64	MH-4-2	72.32	48	265.0	0.005	0.013	Concrete Pipe
P-4-5	IN-4-14	75.06	IN-4-15	73.84	48	244.6	0.005	0.013	Concrete Pipe
P-4-6	HW-4-1	58.50	MH-4-1	57.15	48	135.4	0.010	0.013	Concrete Pipe
P-4-7	HW-4-2	66.50	MH-4-1	62.00	36	169.6	0.027	0.013	Concrete Pipe
P-4-8	IN-4-17	75.50	IN-4-14	75.26	48	47.1	0.005	0.013	HP Pipe
P-4-9	MH-4-3	17.68	MH-4-4	17.22	78	77.3	0.006	0.024	CMP Pipe
P-5-1	IN-5-18	58.50	STILLING BASIN-O5P	49.81	60	256.7	0.034	0.013	Concrete Pipe
P-5-10	HW-5-1	117.50	MH-5-3	111.08	60	214.7	0.030	0.013	Concrete Pipe
P-5-11	HW-5-2	114.50	MH-5-4	114.20	60	40.4	0.007	0.013	Concrete Pipe
P-5-12	MH-5-4	114.00	MH-5-3	111.08	60	317.1	0.009	0.013	Concrete Pipe
P-5-13	IN-5-21	119.39	MH-5-4	118.74	18	124.3	0.005	0.013	HP Pipe
P-5-14	IN-5-23	50.30	POND INLET O5A	49.30	24	35.5	0.028	0.013	HP Pipe
P-5-15	IN-5-22	51.00	POND INLET O5B	49.50	24	47.9	0.031	0.013	HP Pipe
P-5-16	IN-5-25	50.30	POND INLET O5C	48.30	24	45.7	0.044	0.013	HP Pipe
P-5-2	MH-5-2	71.05	IN-5-18	58.70	60	507.8	0.024	0.013	Concrete Pipe
P-5-3	IN-5-16	75.40	MH-5-2	71.25	60	334.7	0.012	0.013	Concrete Pipe
P-5-4	IN-5-24	81.70	IN-5-16	75.60	60	276.5	0.022	0.013	Concrete Pipe
P-5-5	MH-5-3	110.88	IN-5-24	81.90	60	503.8	0.058	0.013	Concrete Pipe
P-5-6	IN-5-20	78.62	IN-5-17	77.00	48	404.8	0.004	0.013	Concrete Pipe
P-5-7	IN-5-17	76.80	IN-5-19	74.70	48	152.2	0.014	0.013	Concrete Pipe
P-5-8	IN-5-19	74.50	MH-5-2	71.25	48	297.0	0.011	0.013	Concrete Pipe
P-6-1	MH-6-1	16.30	OUTFALL 6	15.00	72	175.1	0.007	0.013	Concrete Pipe
P-6-2	MH-6-2	46.43	MH-6-1	21.20	72	971.9	0.026	0.013	Concrete Pipe
P-6-3	MH-6-3	48.35	MH-6-2	46.63	72	448.4	0.004	0.013	Concrete Pipe
P-6-4	HW-6-1	49.40	MH-6-3	48.55	72	168.2	0.005	0.013	Concrete Pipe
P-6-6	OUTLET - O6AP	47.00	MH-6-1	46.46	36	93.0	0.006	0.013	Concrete Pipe
P-6-7	OUTLET - O6P	64.73	MH-6-2	64.11	42	56.3	0.011	0.013	Concrete Pipe
P-6-8	MH-6-4	53.66	MH-6-1	45.00	18	217.3	0.040	0.013	HP Pipe
P-7-1	HW-7-1	86.50	OUTFALL 7	86.00	36	53.4	0.009	0.013	Concrete Pipe

100-Yr Storm Inlets		
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)
IN-1-1	87.09	81.58
IN-1-2	88.00	45.00
IN-2-3	82.67	77.16
IN-2-4	81.90	71.50
IN-2-5	85.08	78.89
IN-3-10	81.81	74.20
IN-3-11	81.74	71.60
IN-3-12	82.46	76.21
IN-3-13	82.78	77.14
IN-3-14	78.77	72.75
IN-3-15	81.51	75.86
IN-3-16	112.25	102.12
IN-3-17	37.24	29.00
IN-3-18	41.57	33.35
IN-3-4	78.26	72.75
IN-3-5	78.20	72.98
IN-3-6	78.55	71.30
IN-3-7	77.37	69.00
IN-3-8	79.62	72.56
IN-3-9	79.04	69.80
IN-4-12	83.54	39.34
IN-4-13	35.00	22.00
IN-4-14	84.26	75.06
IN-4-15	84.59	73.64
IN-4-16	83.58	55.87
IN-4-17	82.75	75.50
IN-4-18	35.00	22.00
IN-5-16	87.78	75.40
IN-5-17	84.96	76.80
IN-5-18	84.02	58.50
IN-5-19	84.70	74.50
IN-5-20	0.00	78.62
IN-5-21	123.91	119.39
IN-5-22	60.00	51.00
IN-5-23	57.24	50.30
IN-5-24	89.41	81.70
IN-5-25	56.00	50.30
OUTLET - O6AP	50.83	47.00
OUTLET - O6P	70.63	64.73

100-Yr Storm Manholes		
Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)
MH-1-1	89.54	77.19
MH-1-2	90.33	79.89
MH-1-3	50.16	32.42
MH-2-1	84.08	77.01
MH-2-2	83.05	75.36
MH-3-1	80.32	65.40
MH-3-13	78.06	71.81
MH-3-2	78.21	67.10
MH-3-3	80.35	68.05
MH-3-4	82.27	75.56
MH-3-5	42.50	30.39
MH-4-1	80.44	56.95
MH-4-2	84.14	72.12
MH-4-3	59.89	17.68
MH-4-4	34.27	17.02
MH-5-2	86.34	71.05
MH-5-3	135.14	110.88
MH-5-4	129.23	114.00
MH-6-1	52.30	16.30
MH-6-2	85.24	46.43
MH-6-3	77.82	48.35
MH-6-4	62.38	53.66

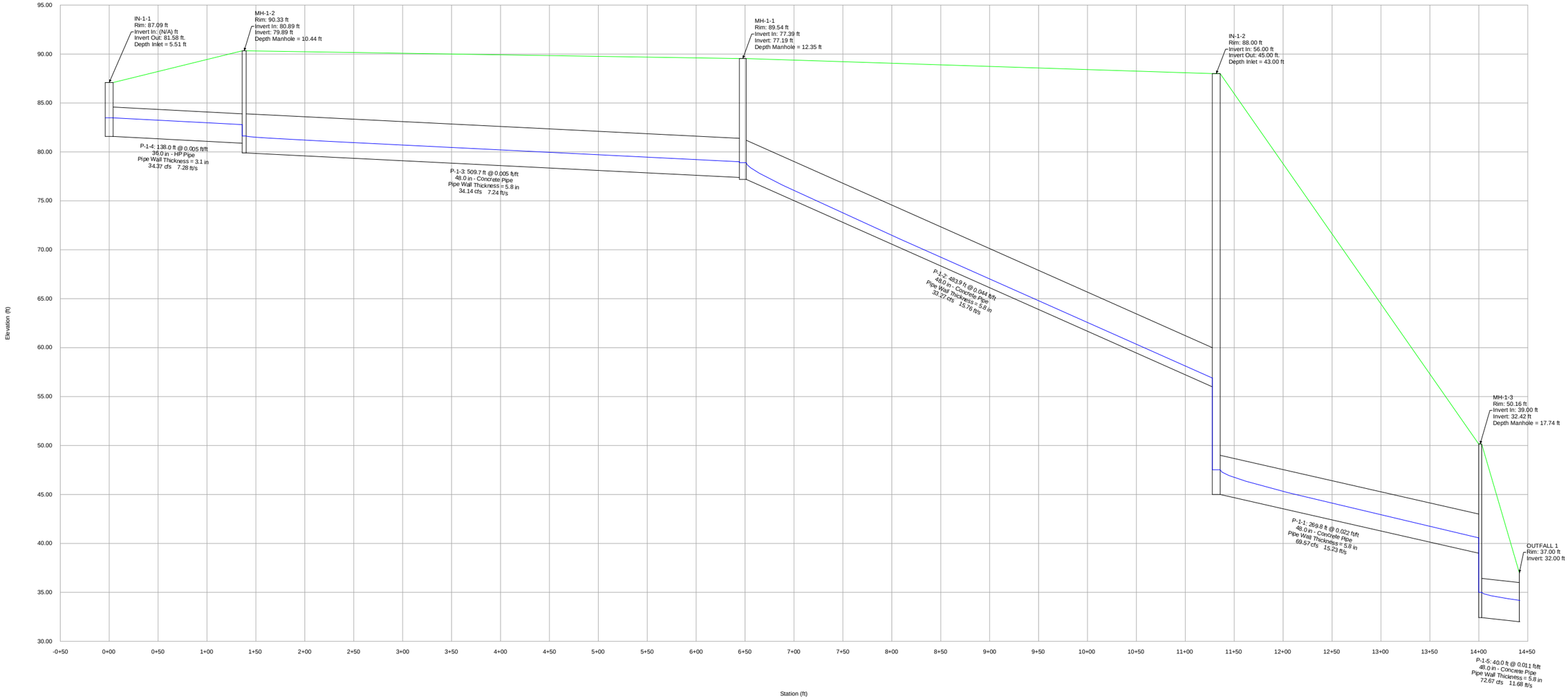
100-Yr Storm Outfall	
Label	Elevation (Invert) (ft)
OUTFALL 1	32.00
OUTFALL 2	30.84
STILLING BASIN-O3P	29.38
STILLING BASIN-O5P	49.81
OUTFALL 6	15.00
OUTFALL 2A	30.00
OUTFALL 7	86.00
POND INLET O3	28.00
POND INLET O5A	49.30
POND INLET O5B	49.50
POND INLET O5C	48.30

100-Yr Storm Headwall	
Label	Elevation (Invert) (ft)
HW-1-3	42.00
HW-4-1	58.50
HW-4-2	66.50
HW-5-1	117.50
HW-5-2	114.50
HW-6-1	49.40
HW-7-1	86.50
HW-O4P	16.77

100-Yr

Profile Report

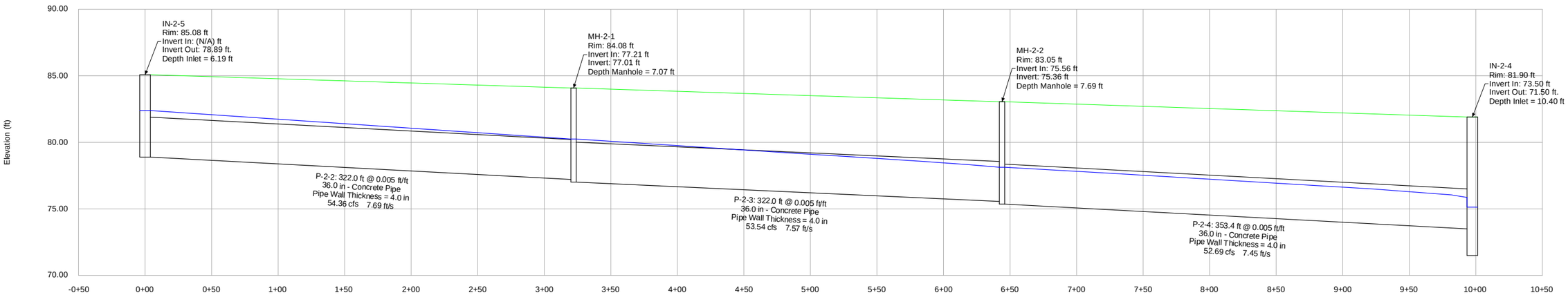
Engineering Profile - Profile - 1 - IN-1-1 TO OUTFALL 1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

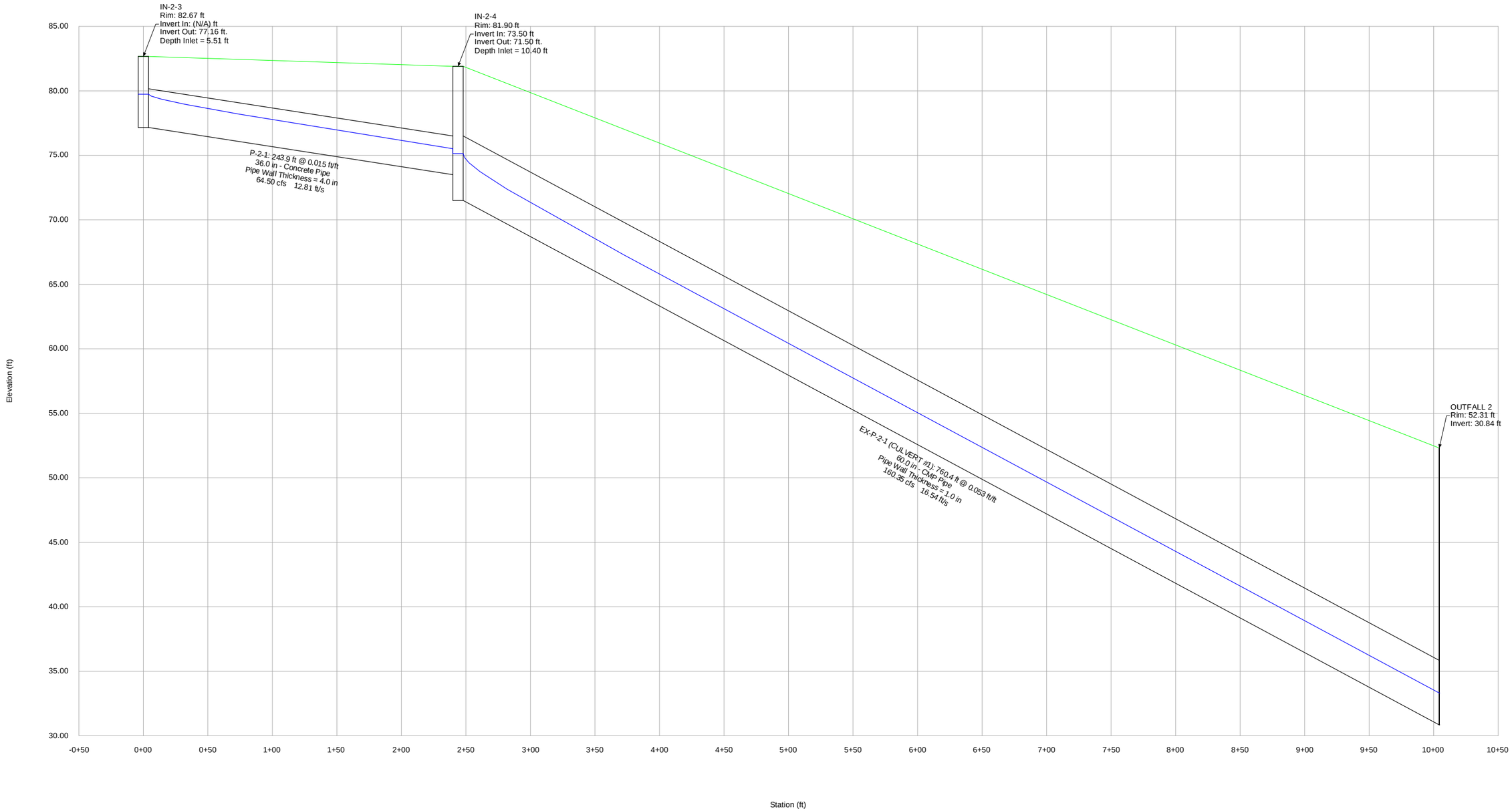
Engineering Profile - Profile - 2 - IN-2-5 TO IN-2-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

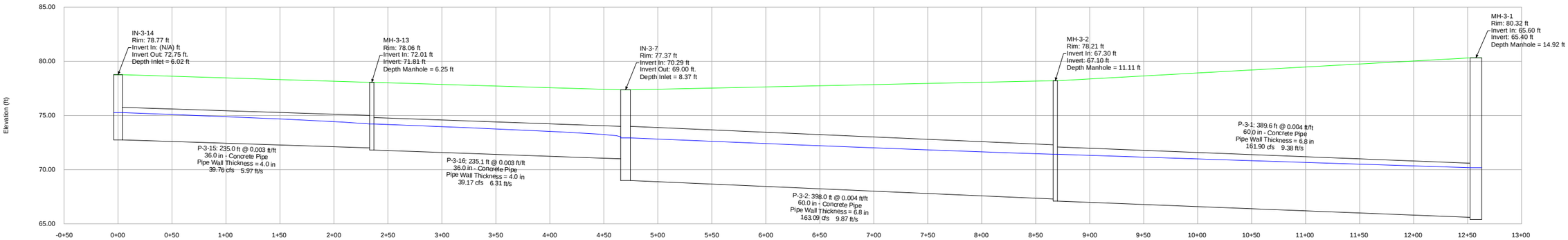
Engineering Profile - Profile - 2 - IN-2-3 TO OUTFALL 2 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

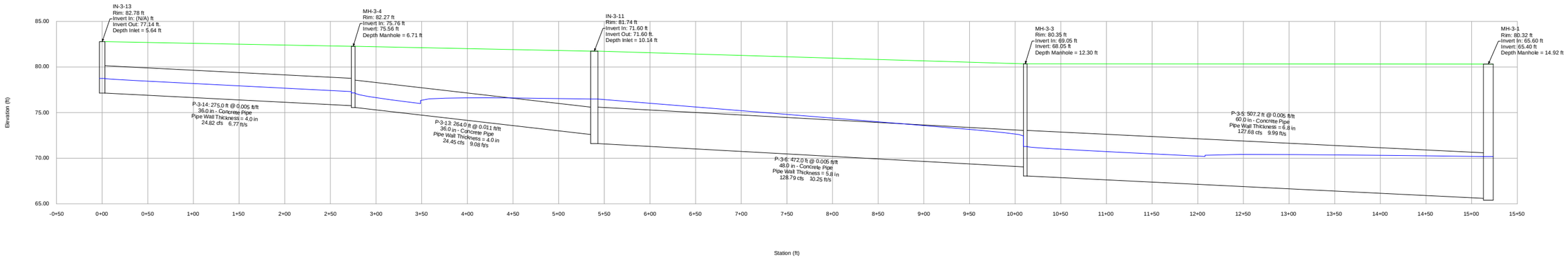
Engineering Profile - Profile - 3 - IN-3-14 TO MH-3-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

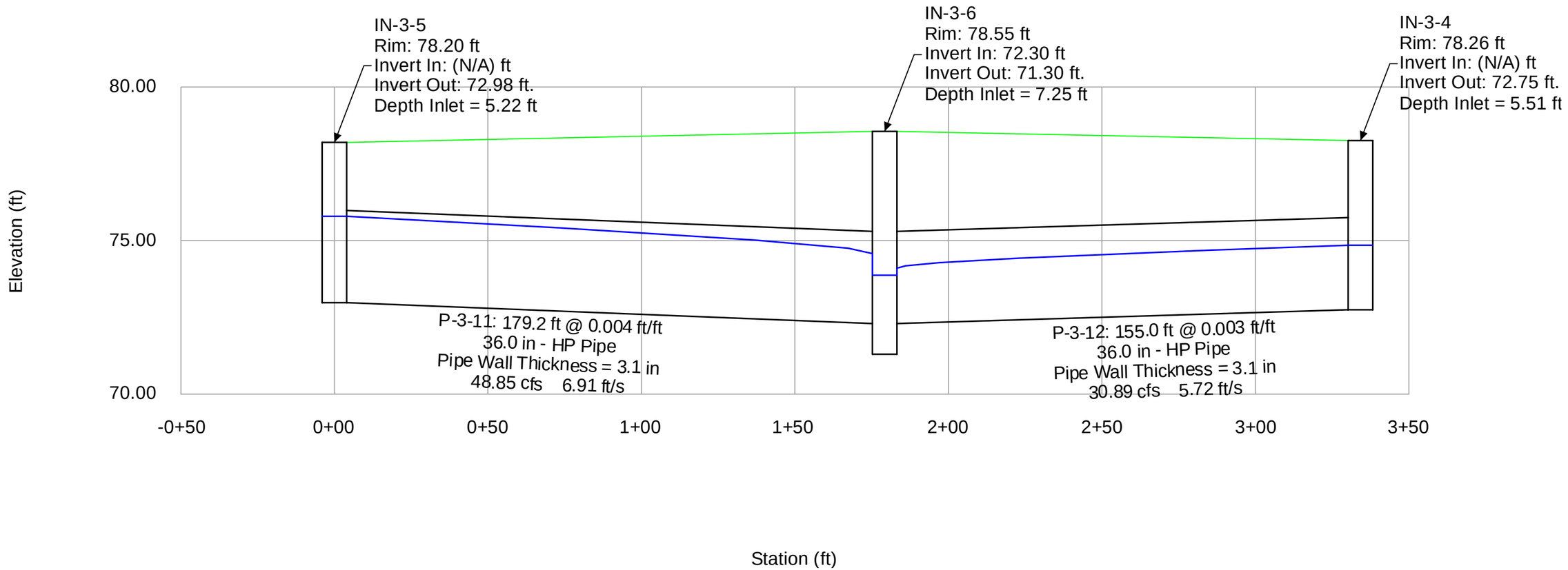
Engineering Profile - Profile - 3 - IN-3-13 TO MH-3-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

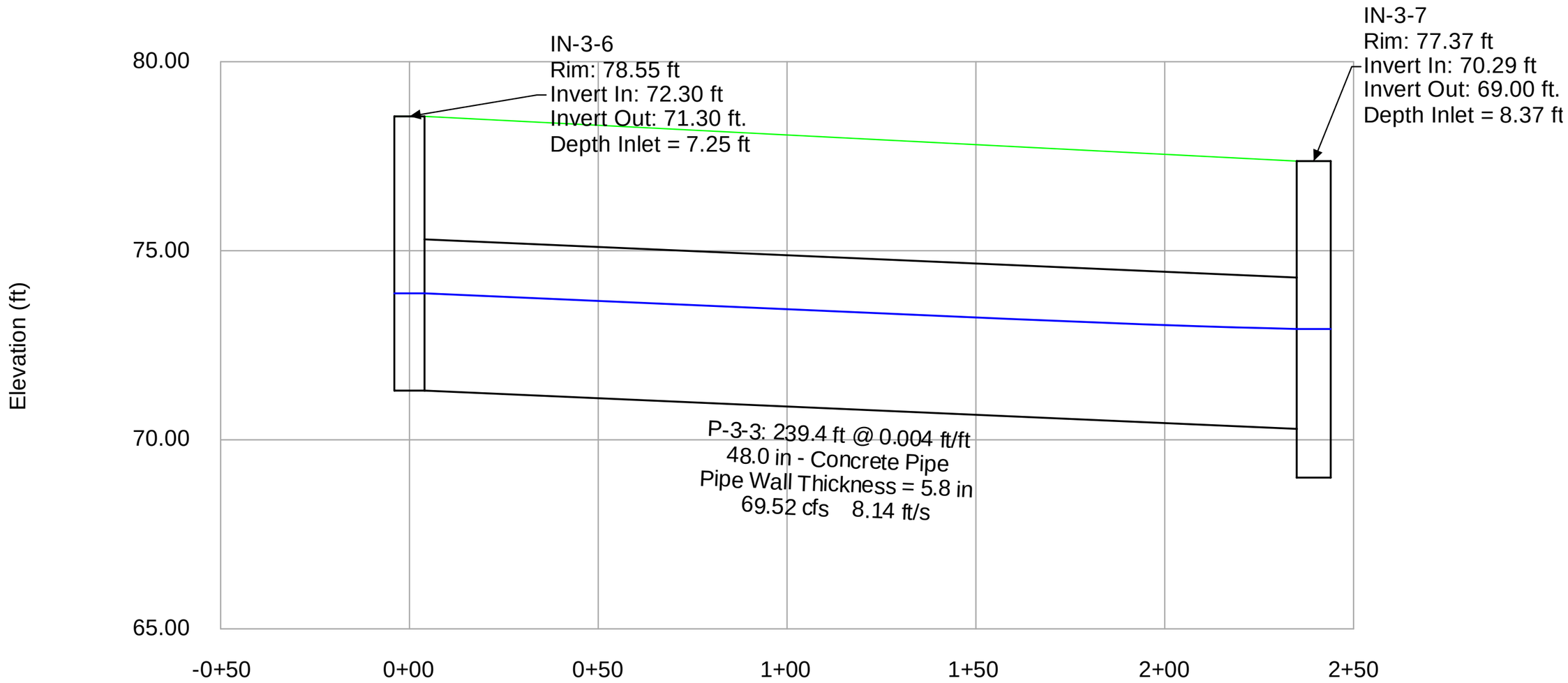
Engineering Profile - Profile - 3 - IN-3-5 TO IN-3-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

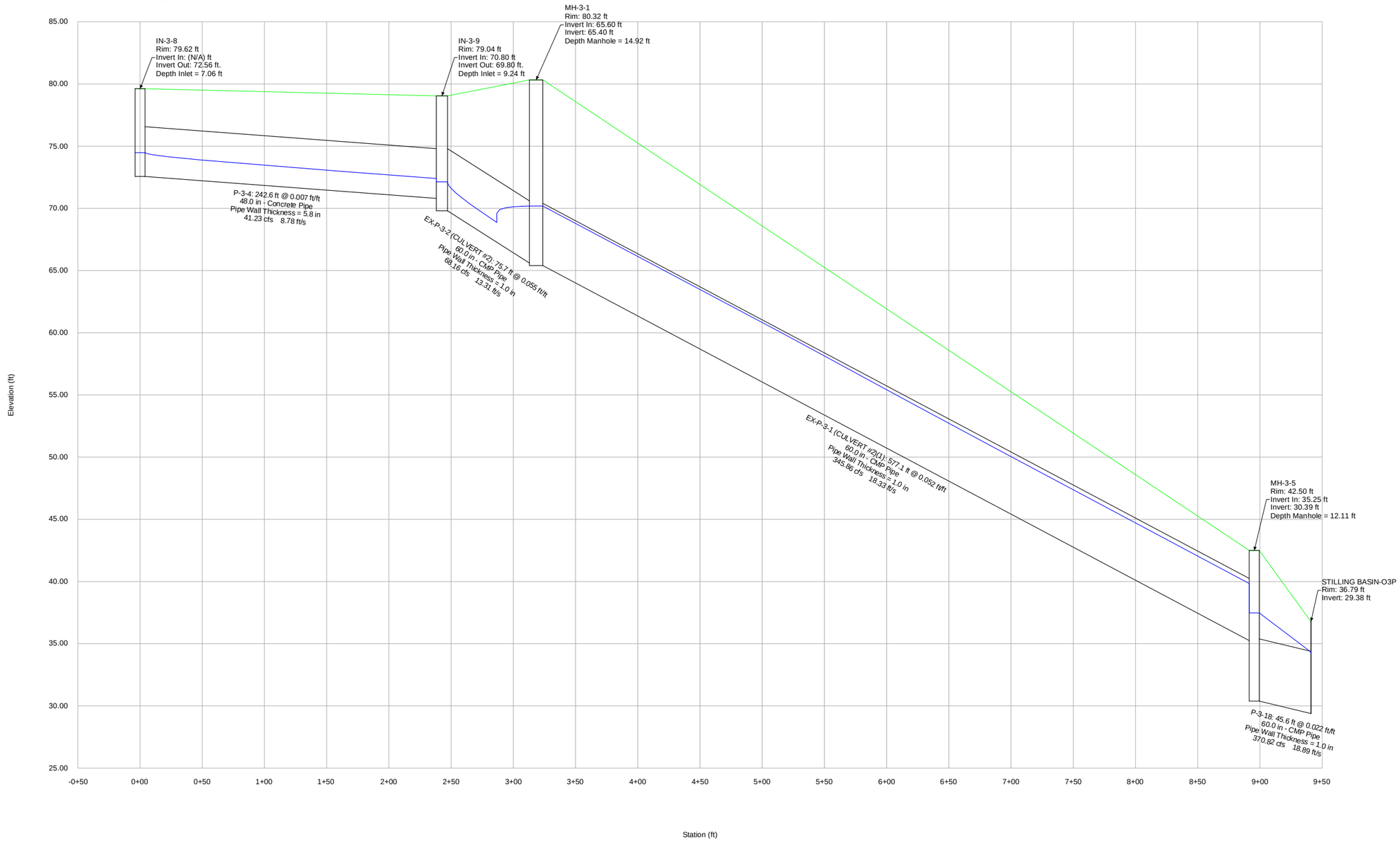
Engineering Profile - Profile - 3 - IN-3-6 TO IN-3-7 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

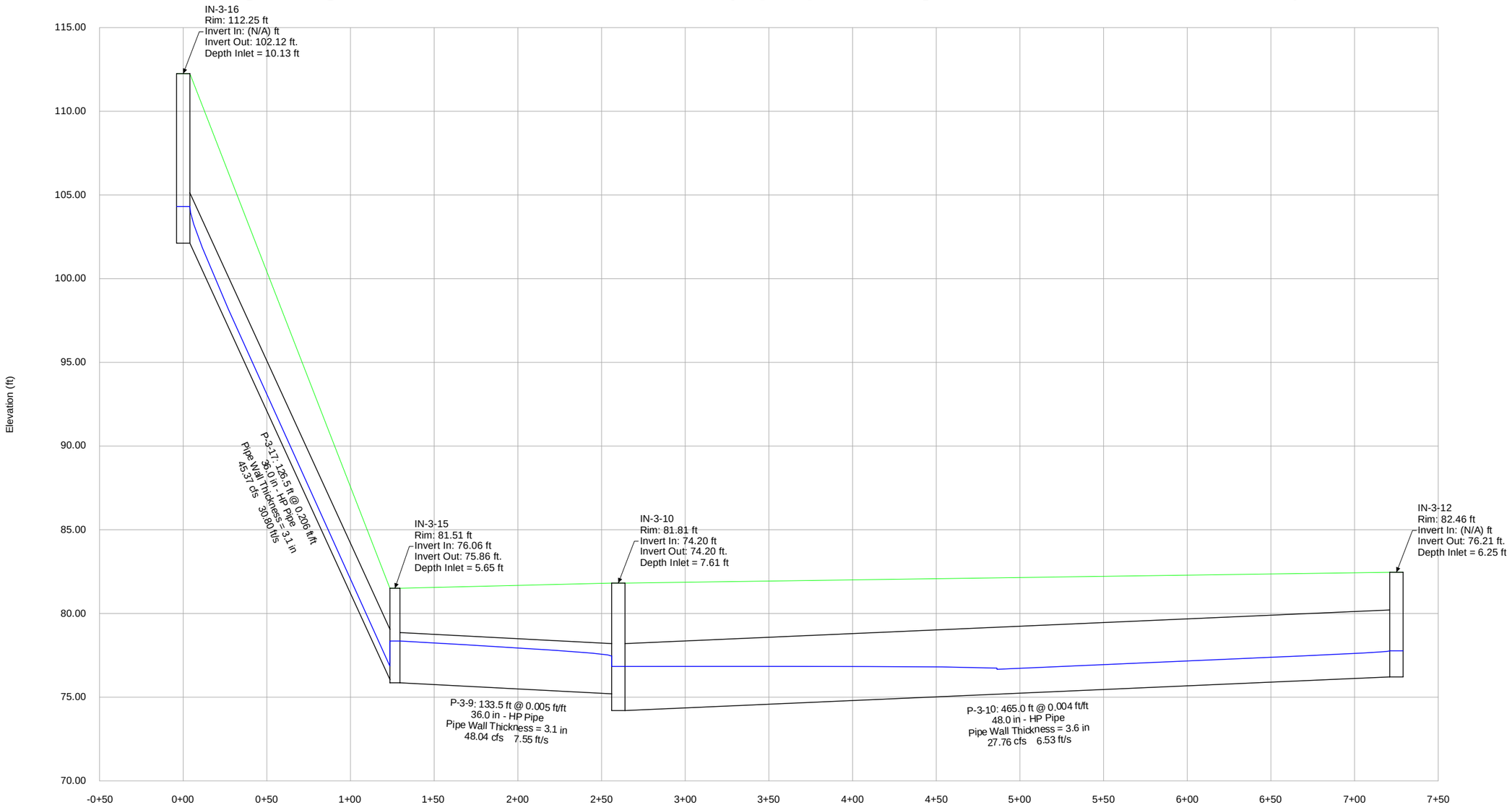
Engineering Profile - Profile - 3 - IN-3-8 TO STILING BASIN-O3P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

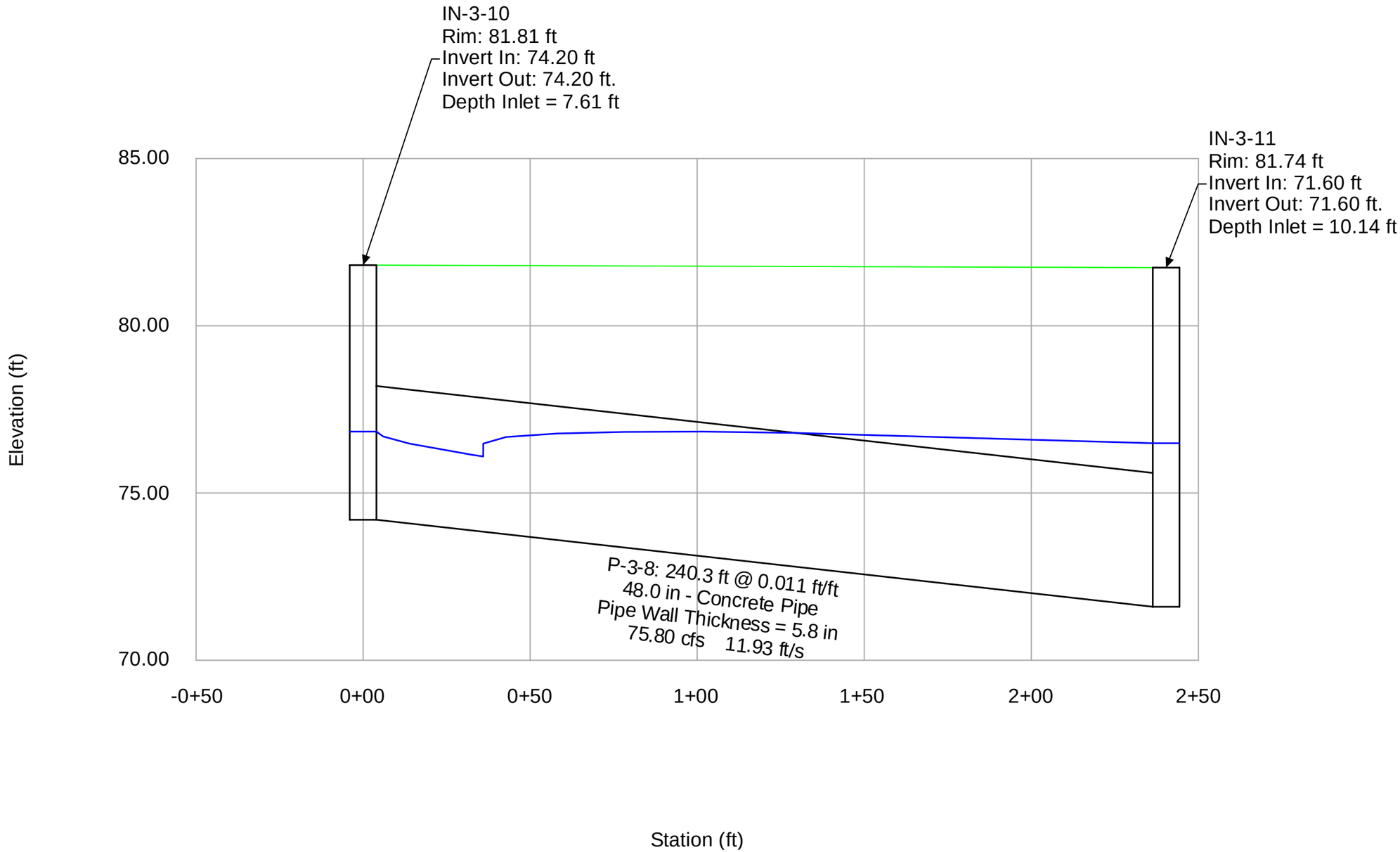
Engineering Profile - Profile - 3 - IN-3-16 TO IN-3-12 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

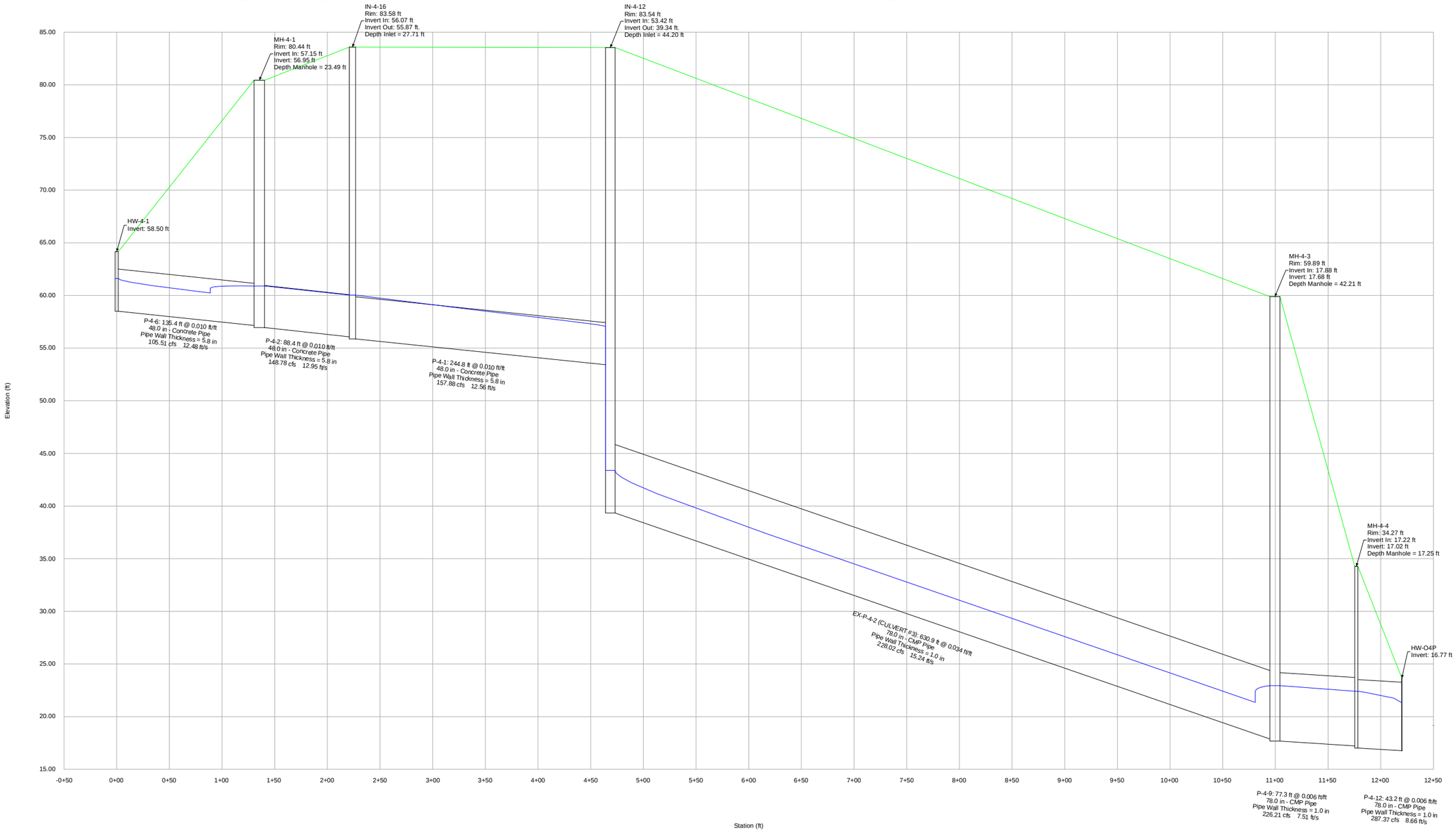
Engineering Profile - Profile - 3 - IN-3-10 TO IN-3-11 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

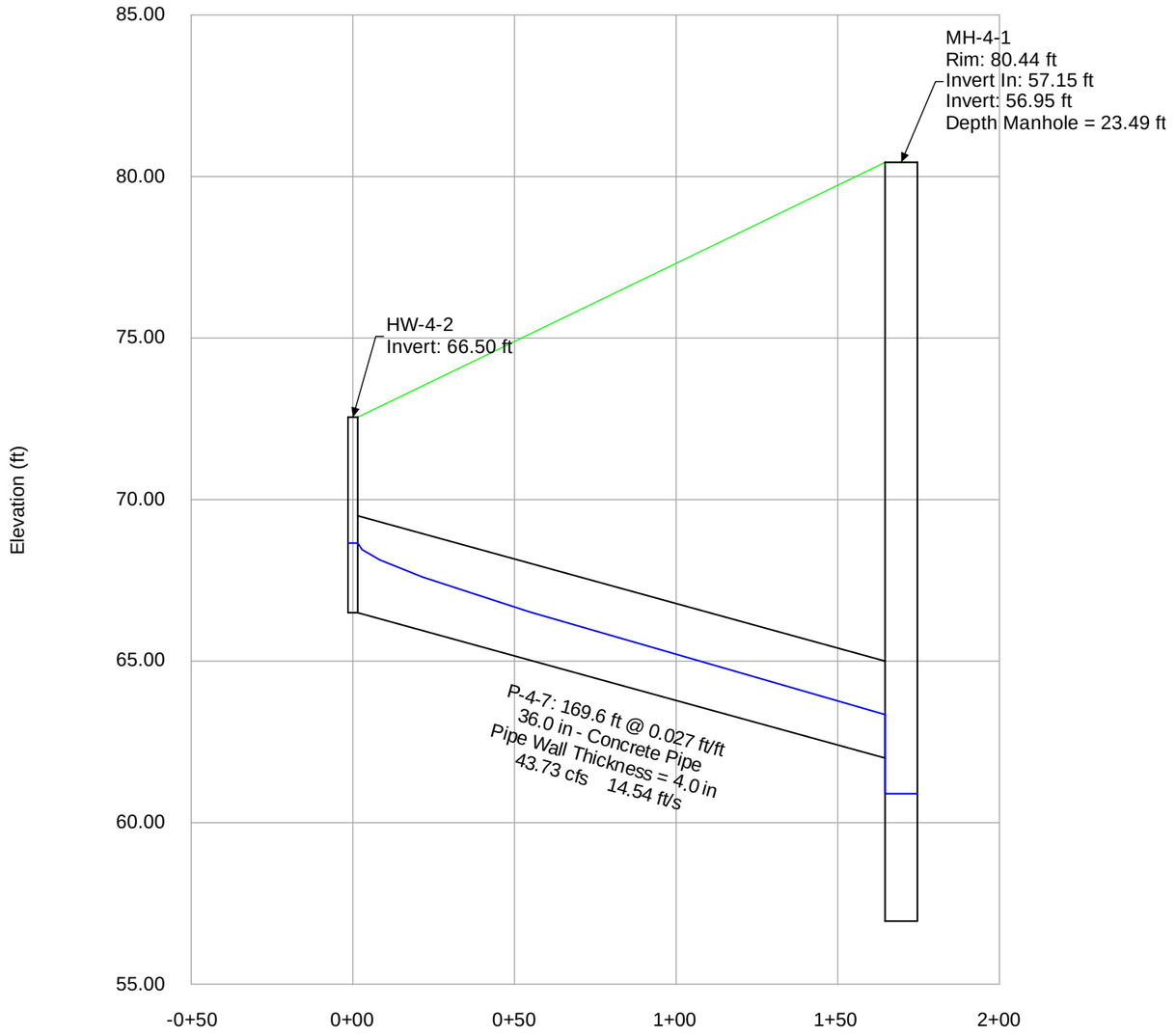
Engineering Profile - Profile - 4 - HW-4-1 TO HW-O4P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

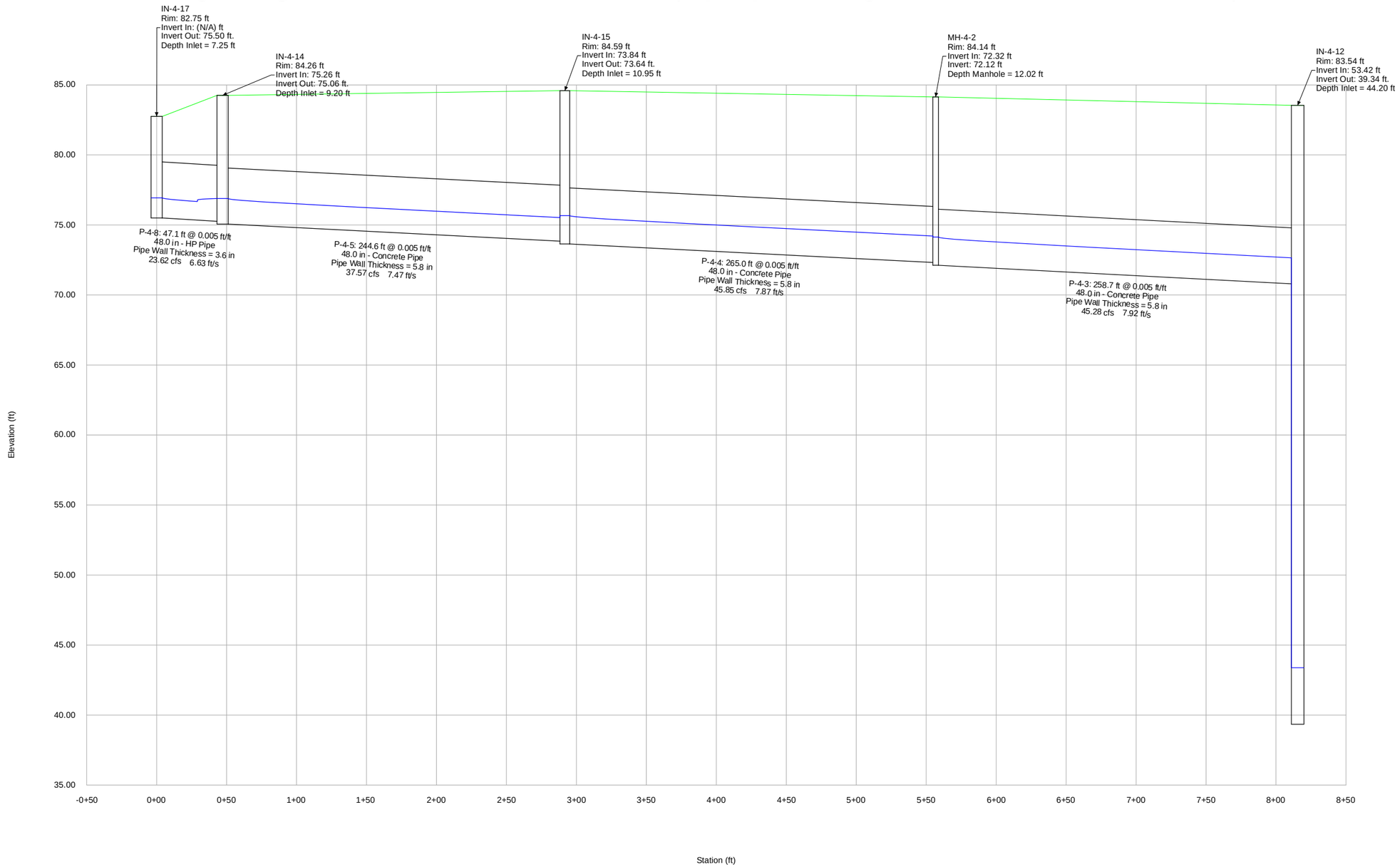
Engineering Profile - Profile - 4 - HW-4-2 TO MH-4-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

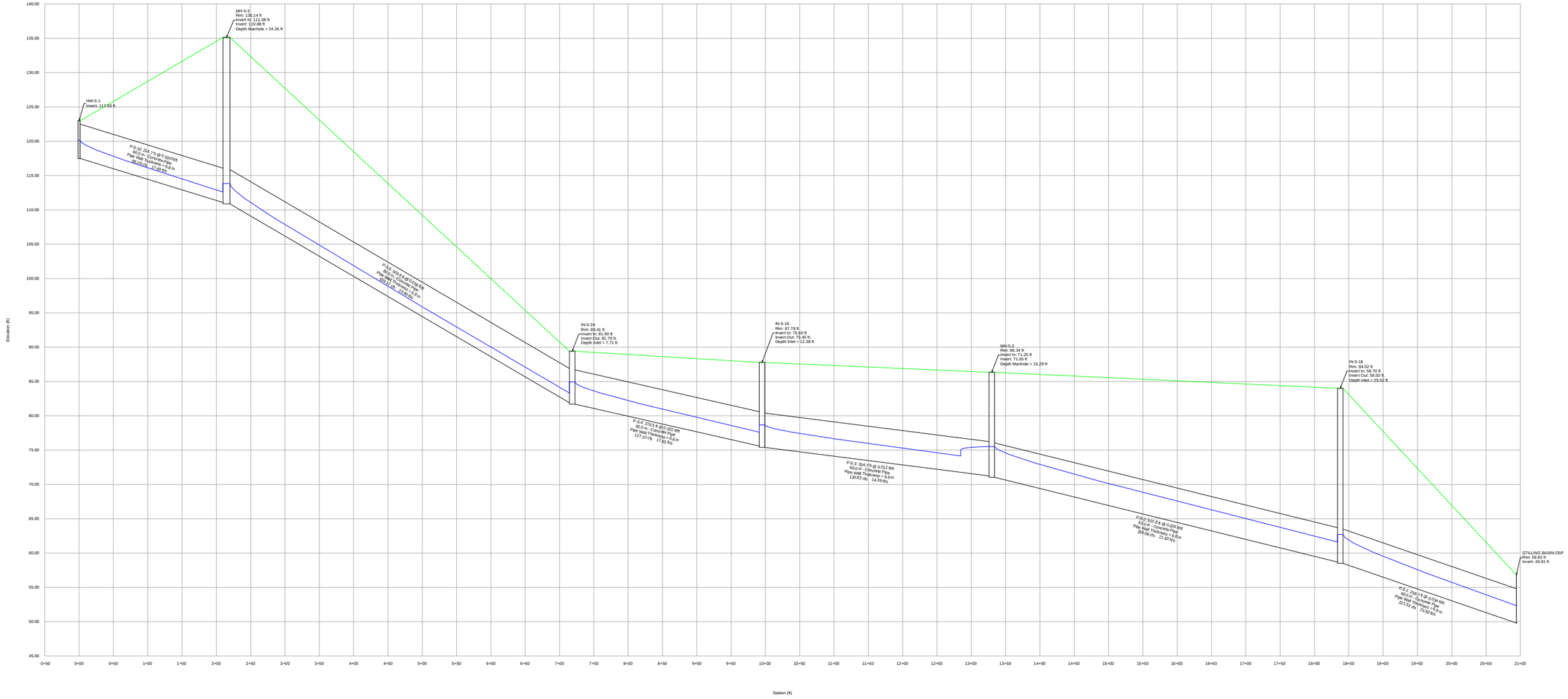
Engineering Profile - Profile - 4 - IN-4-17 TO IN-4-12 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

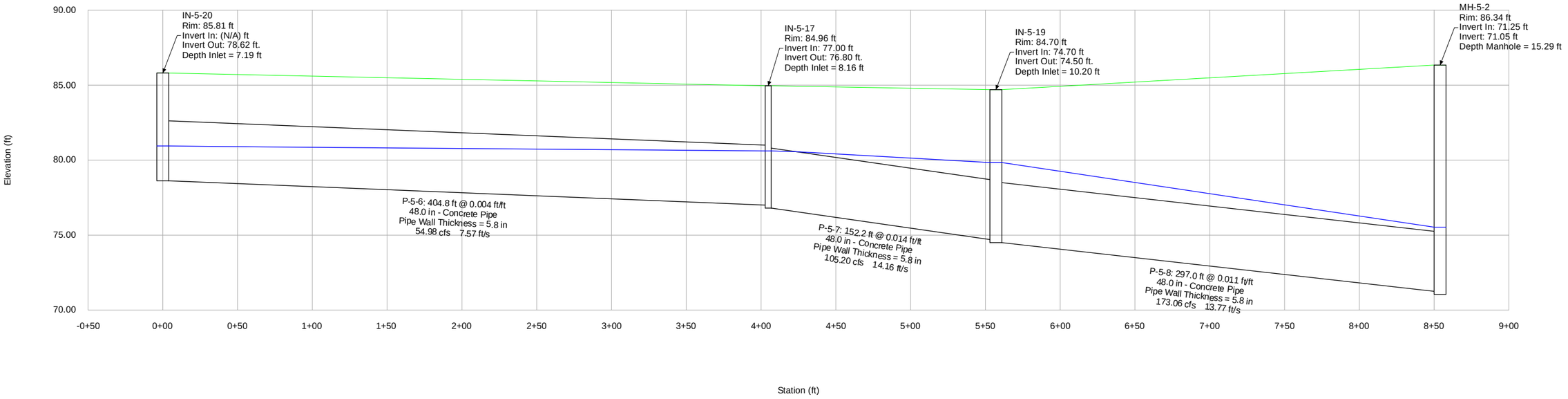
Engineering Profile - Profile - 5 - HW-5-1 TO STILLING BASIN-O5P (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

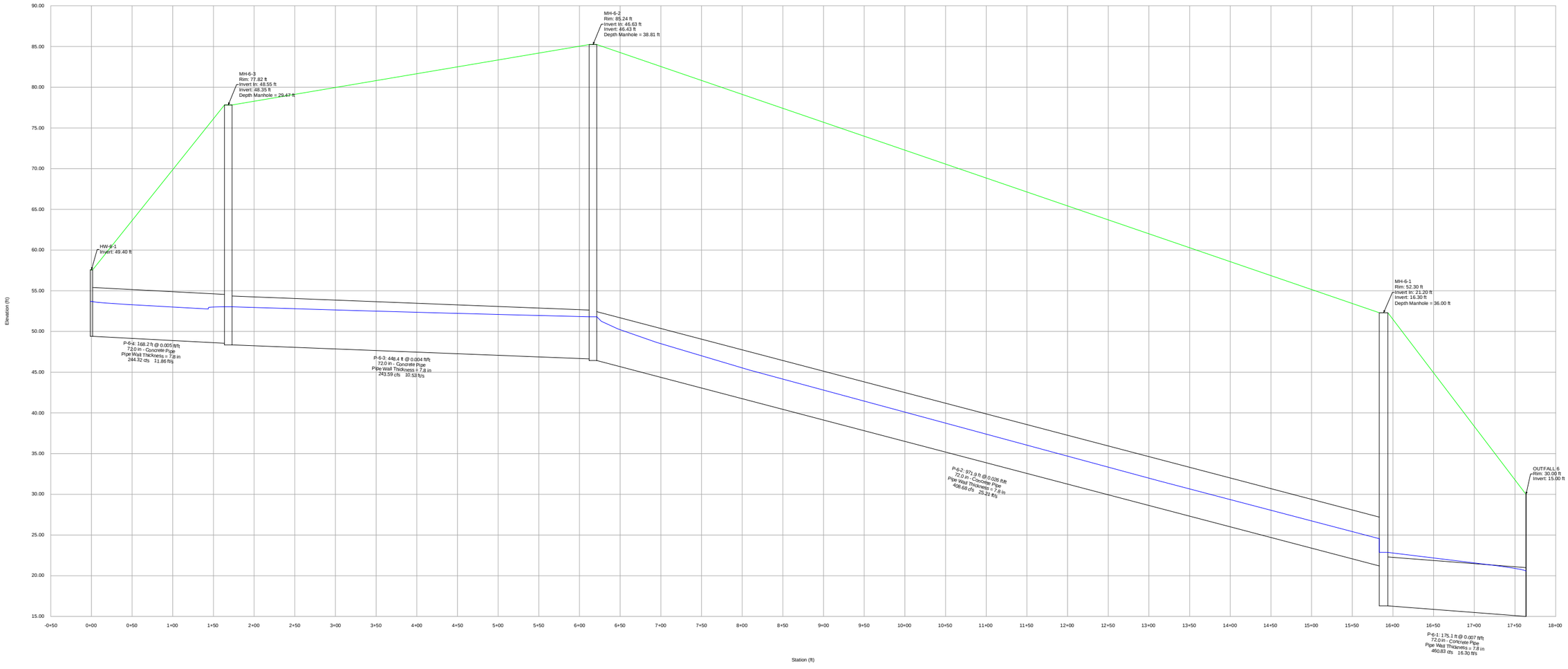
Engineering Profile - Profile - 5 - IN-5-20 TO IN-5-17 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

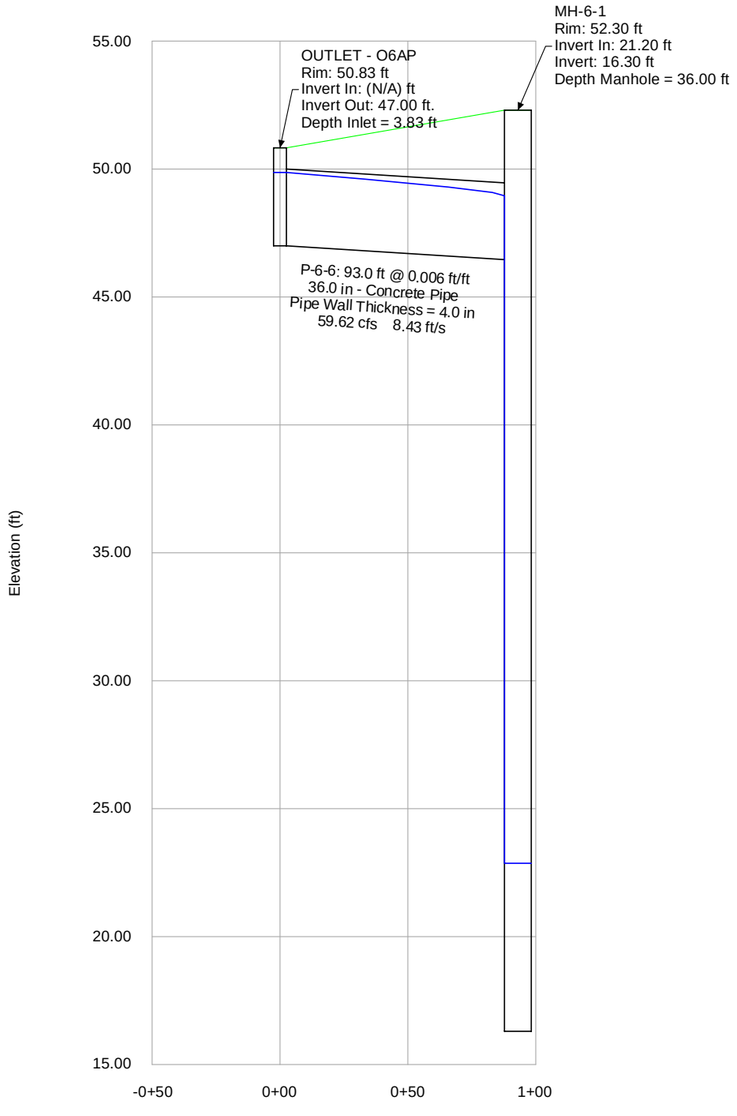
Engineering Profile - Profile - 6 - HW-6-1 TO OUTFALL 6 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

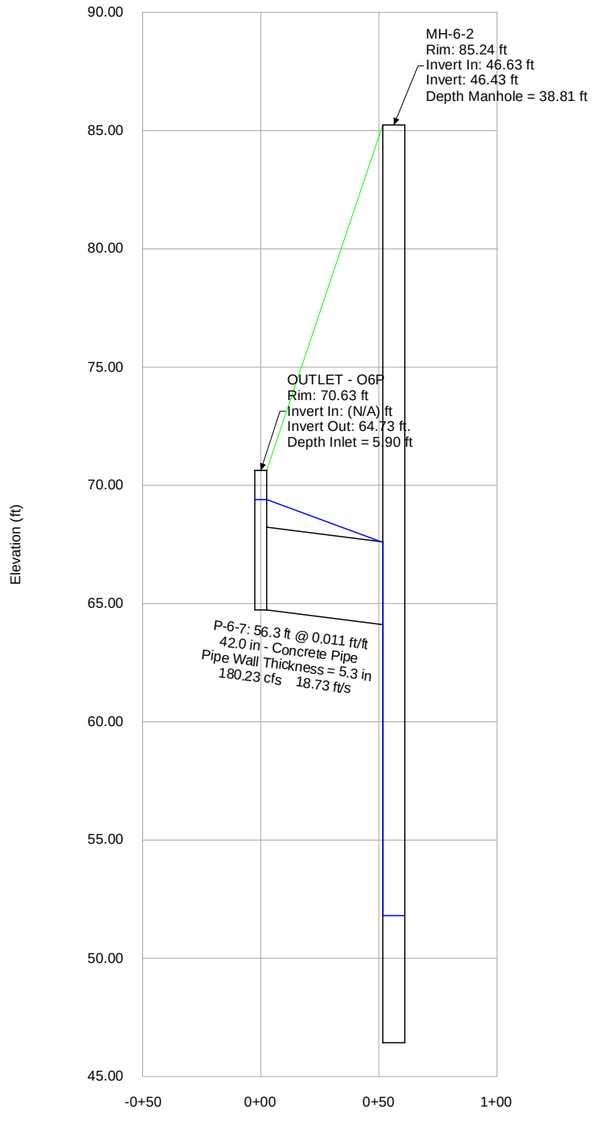
Engineering Profile - Profile - 6 - OUTLET- O6AP TO MH-6-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

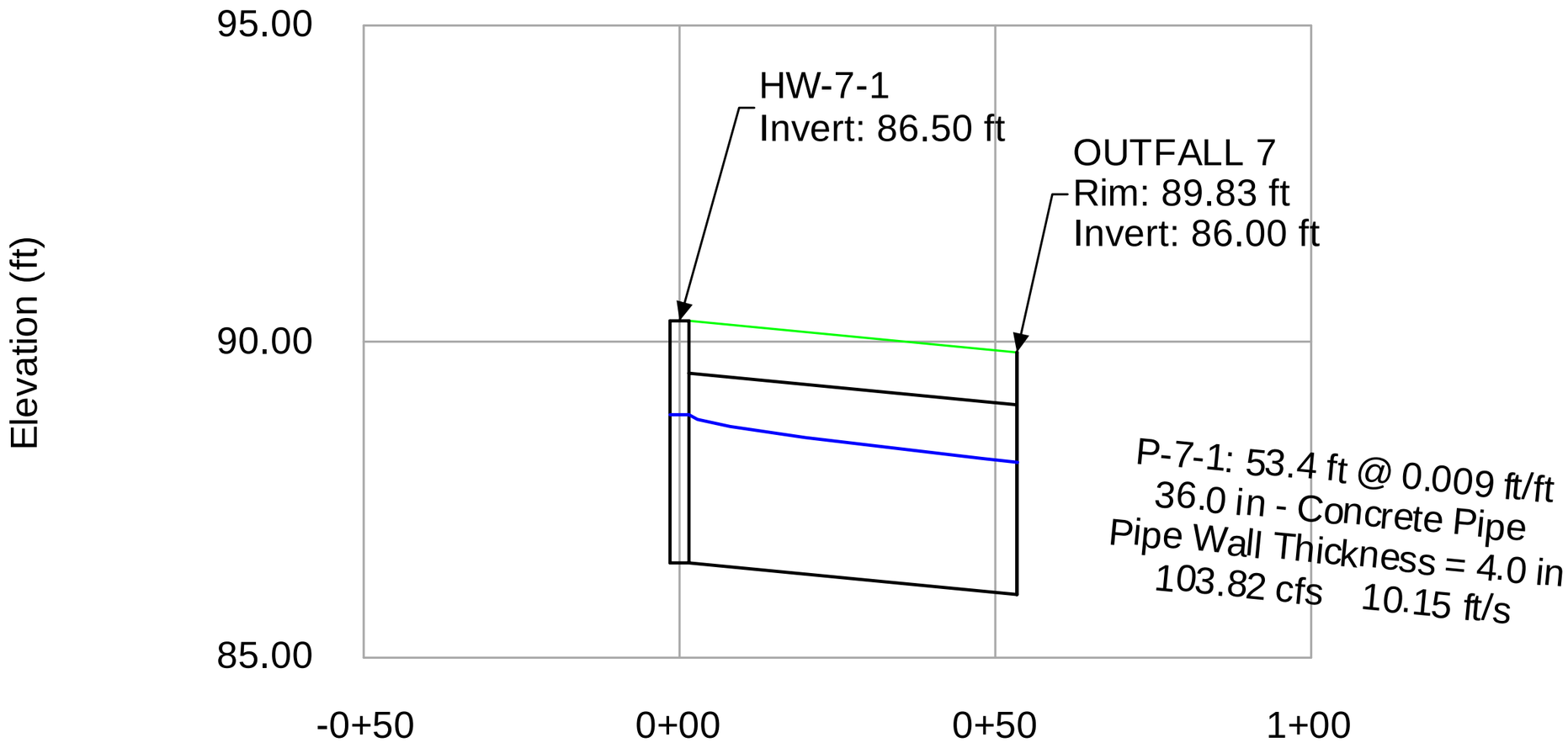
Engineering Profile - Profile - 6 - OUTLET-O6P TO MH-6-2 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

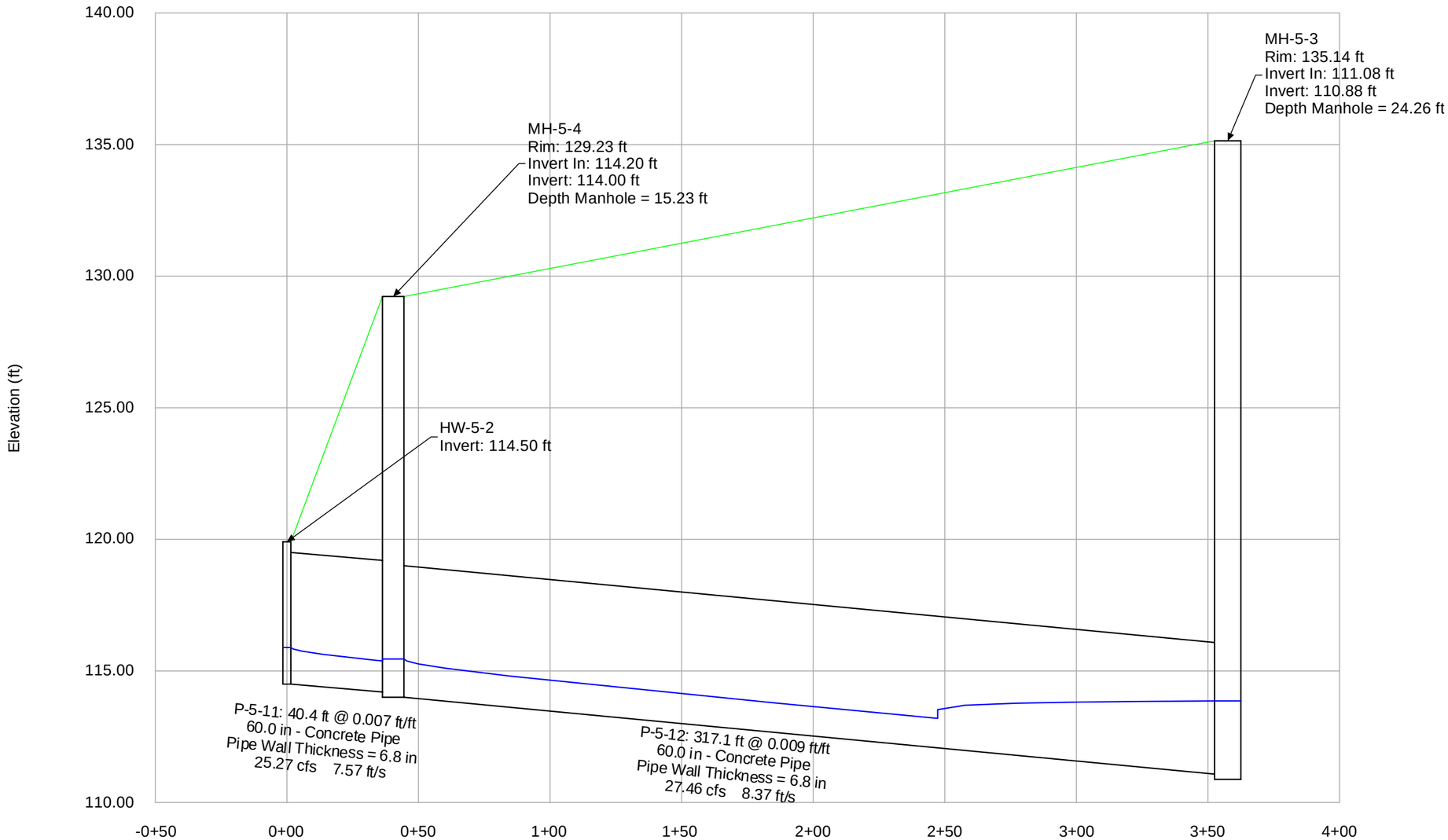
Engineering Profile - Profile - 7 - HW-7-1 TO OUTFALL 7 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

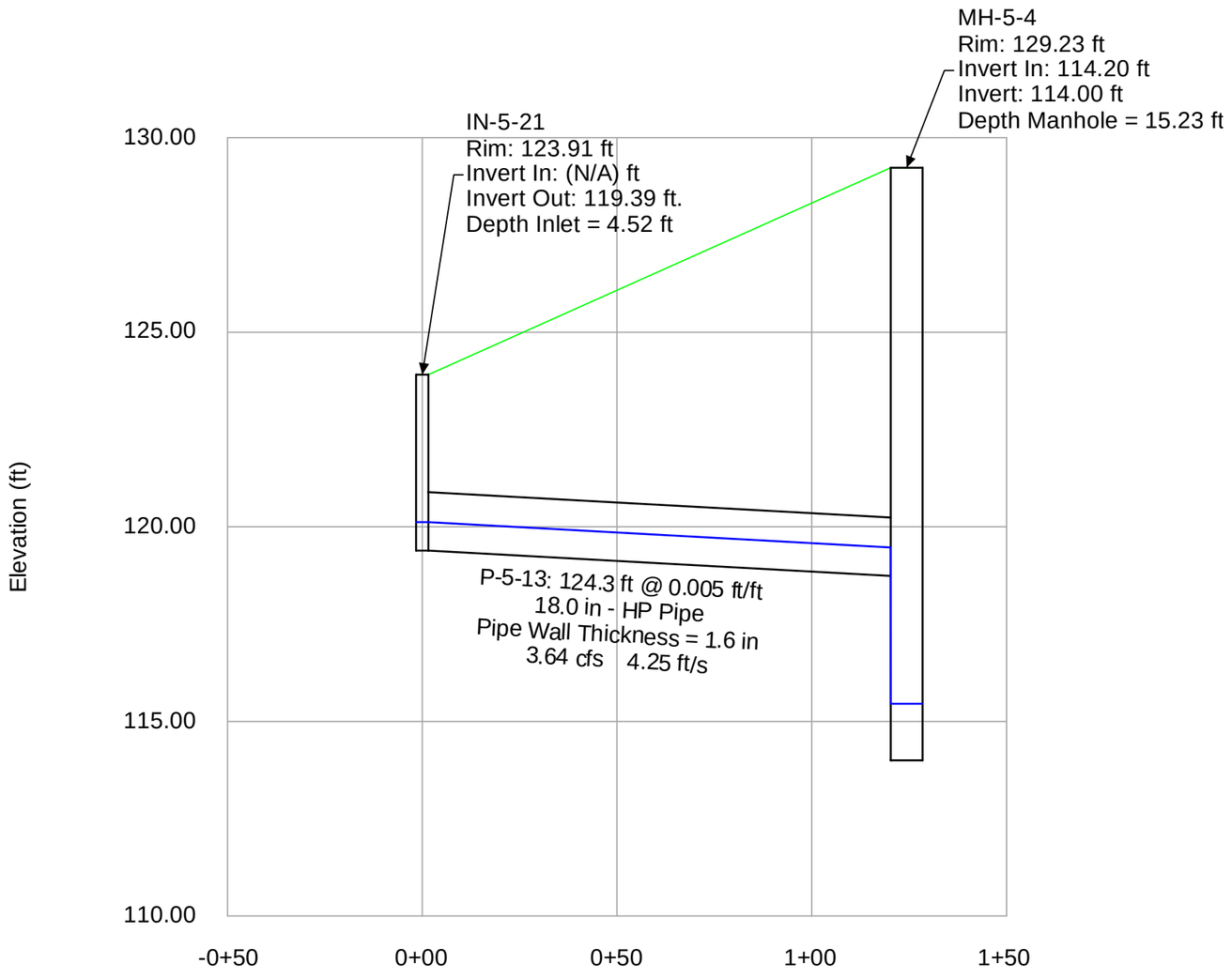
Engineering Profile - Profile - 5 - HW-5-2 to MH-5-3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

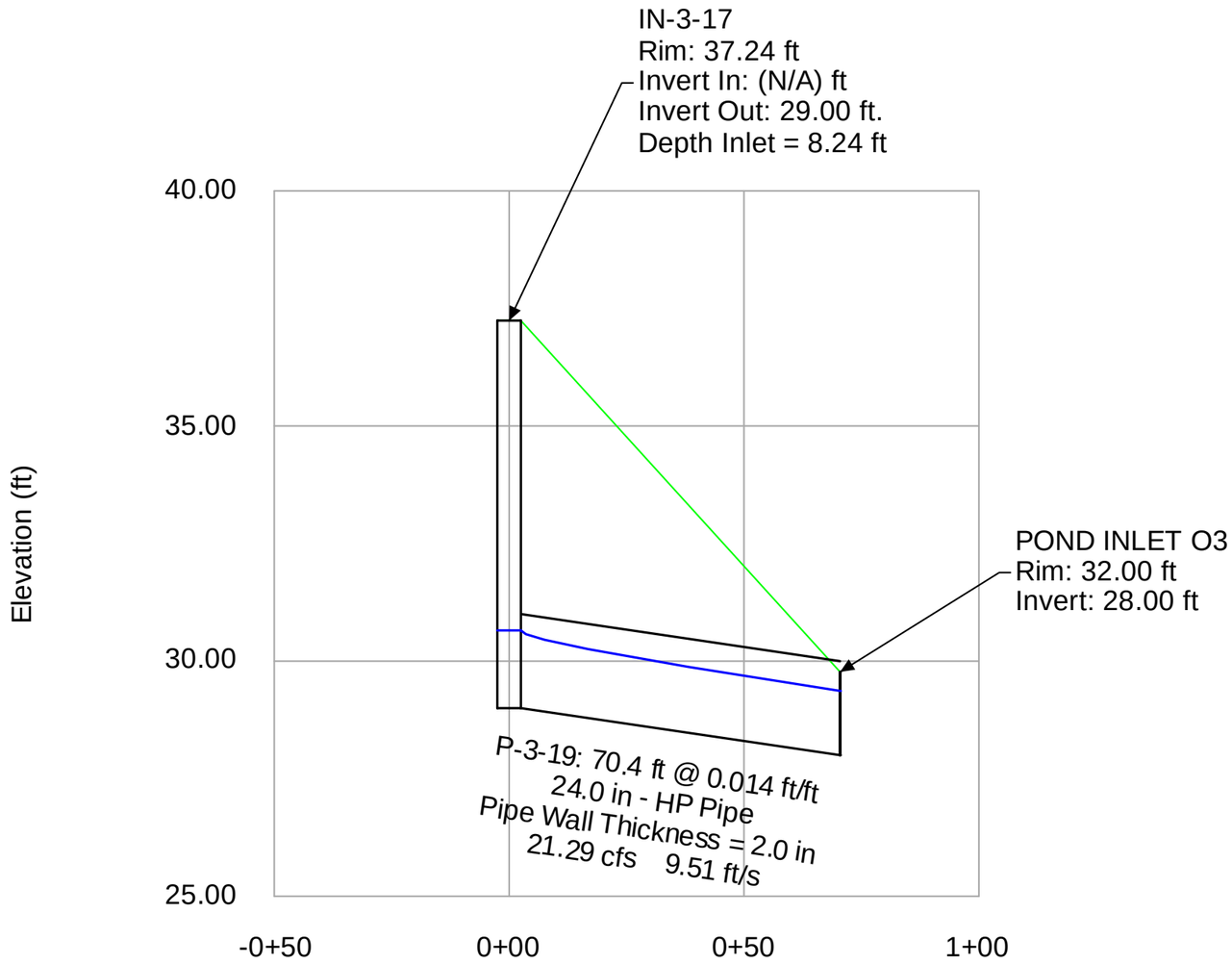
Engineering Profile - Profile - 5 - IN-5-21 TO MH-5-4 Water Tank (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

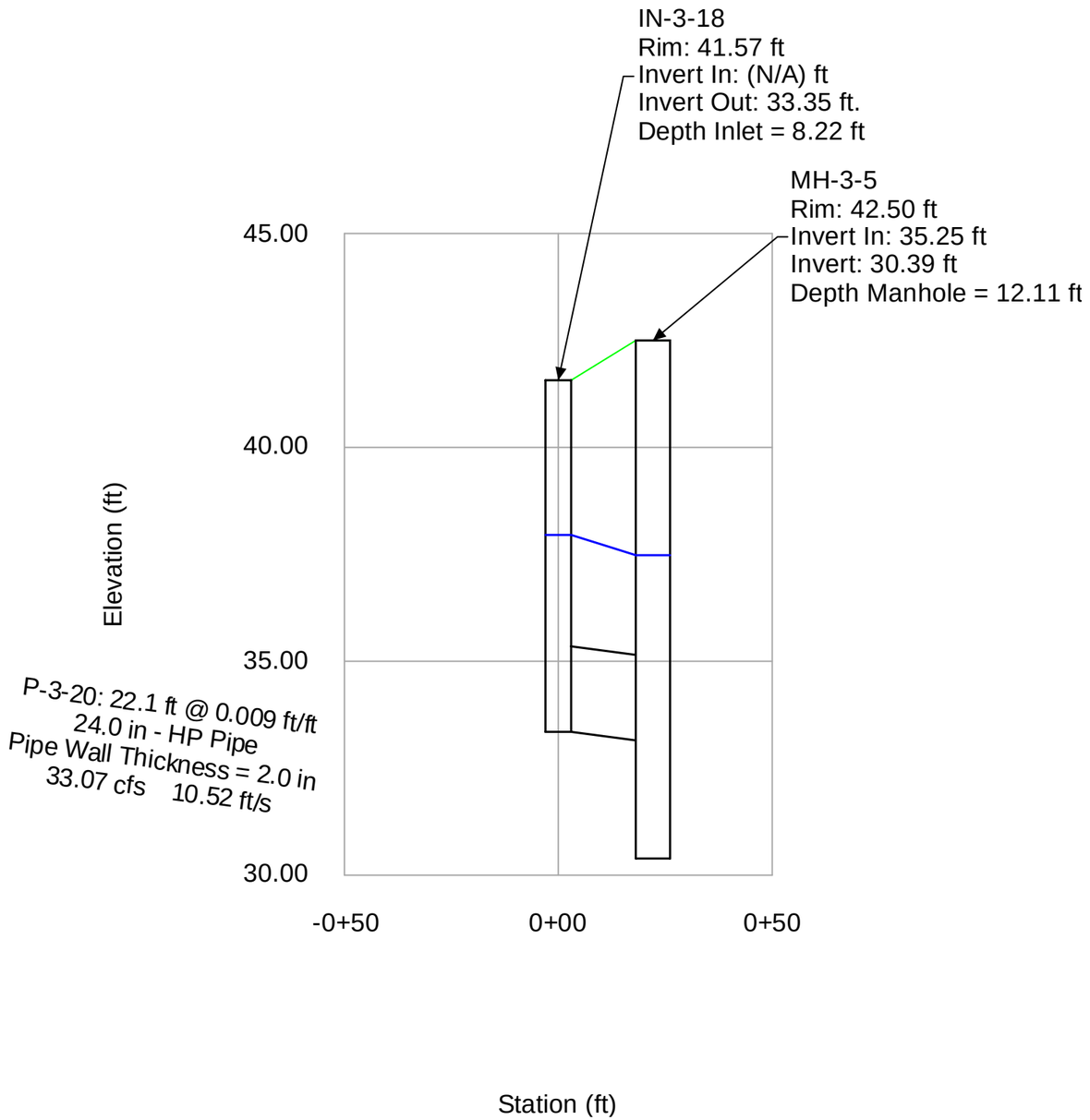
Engineering Profile - Profile - 3 - IN-3-17 TO POND INLET O3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

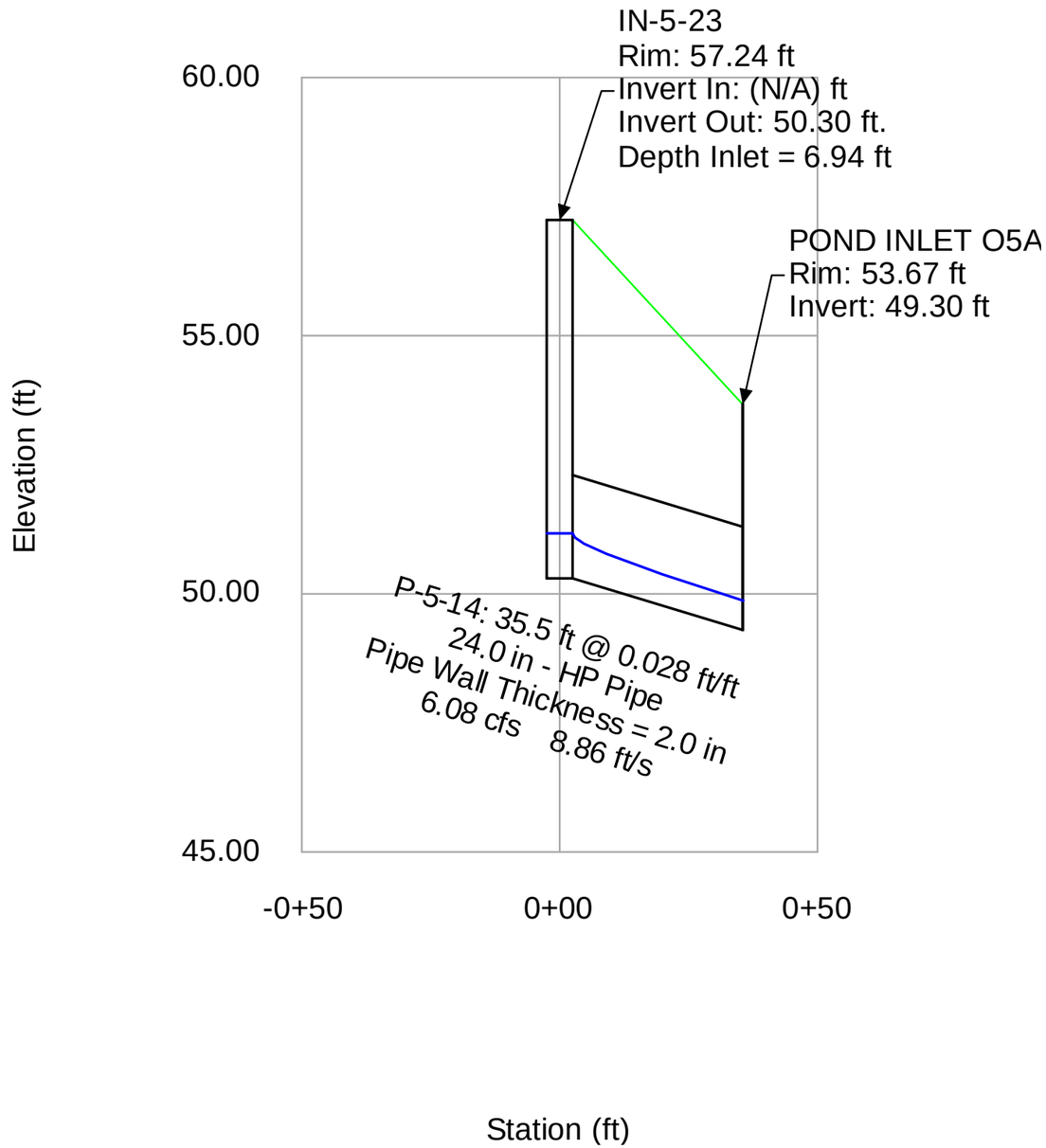
Engineering Profile - Profile - 3 - IN-3-18 TO MH-3-5 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

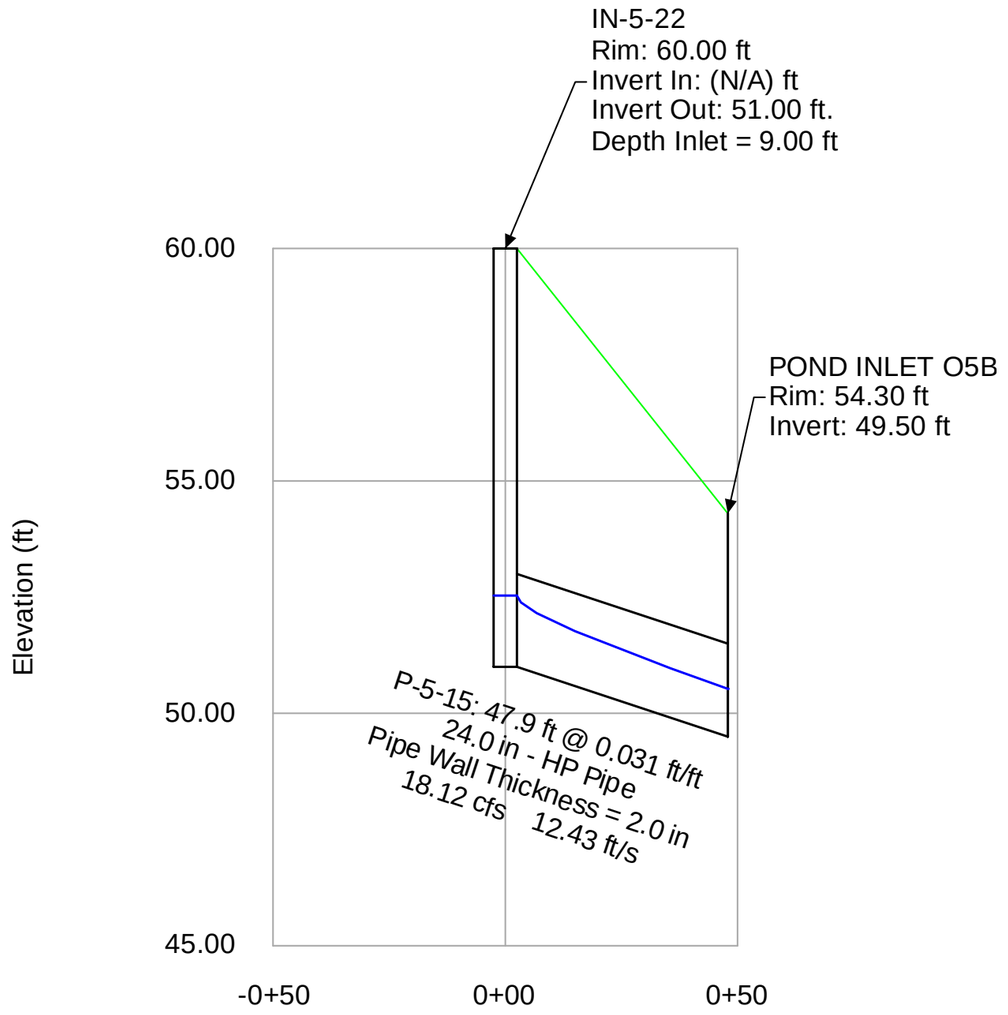
Engineering Profile - Profile - 5 - IN-5-23 TO POND INLET O5A (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

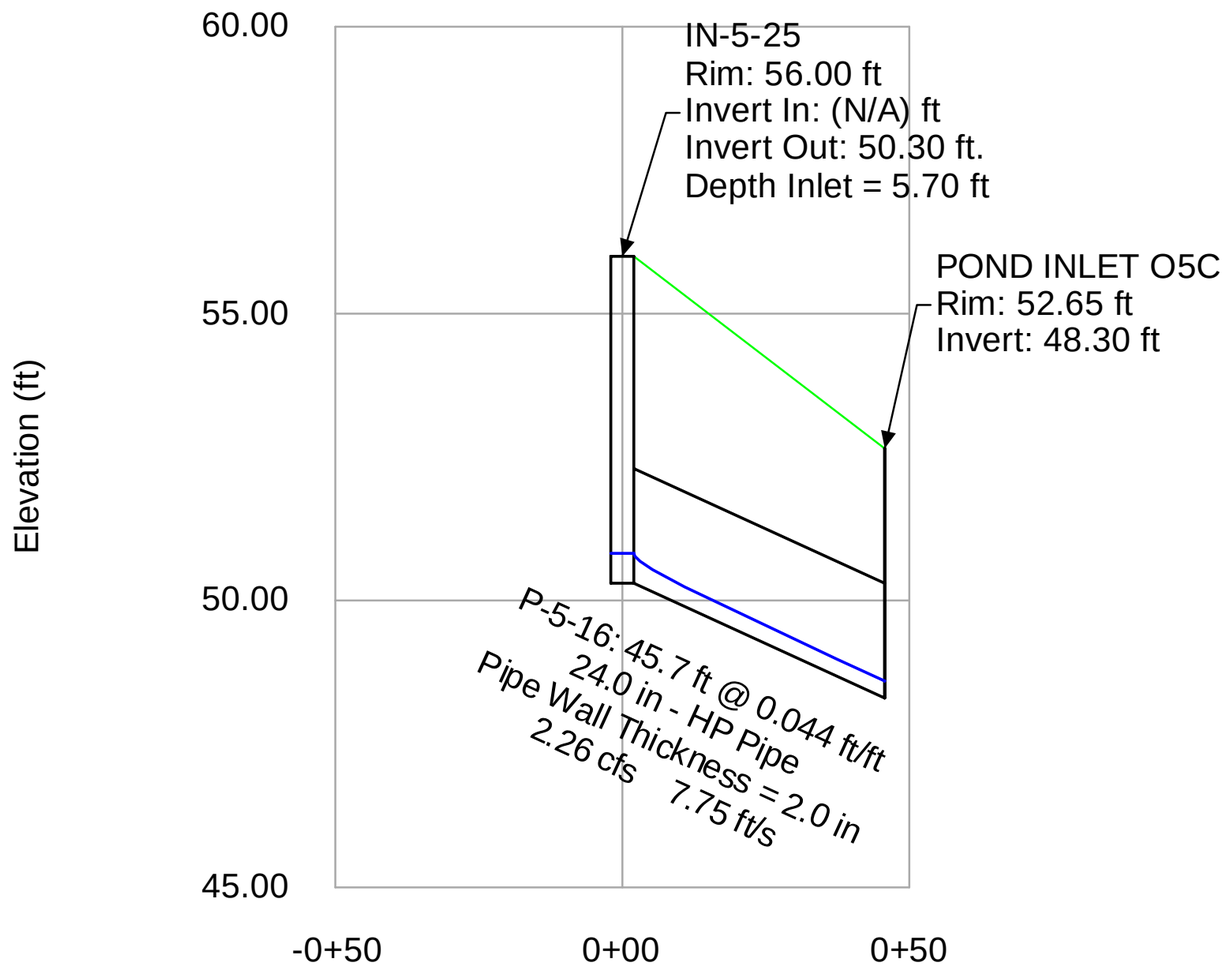
Engineering Profile - Profile - 5 - IN-5-22 TO POND INLET O5B (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

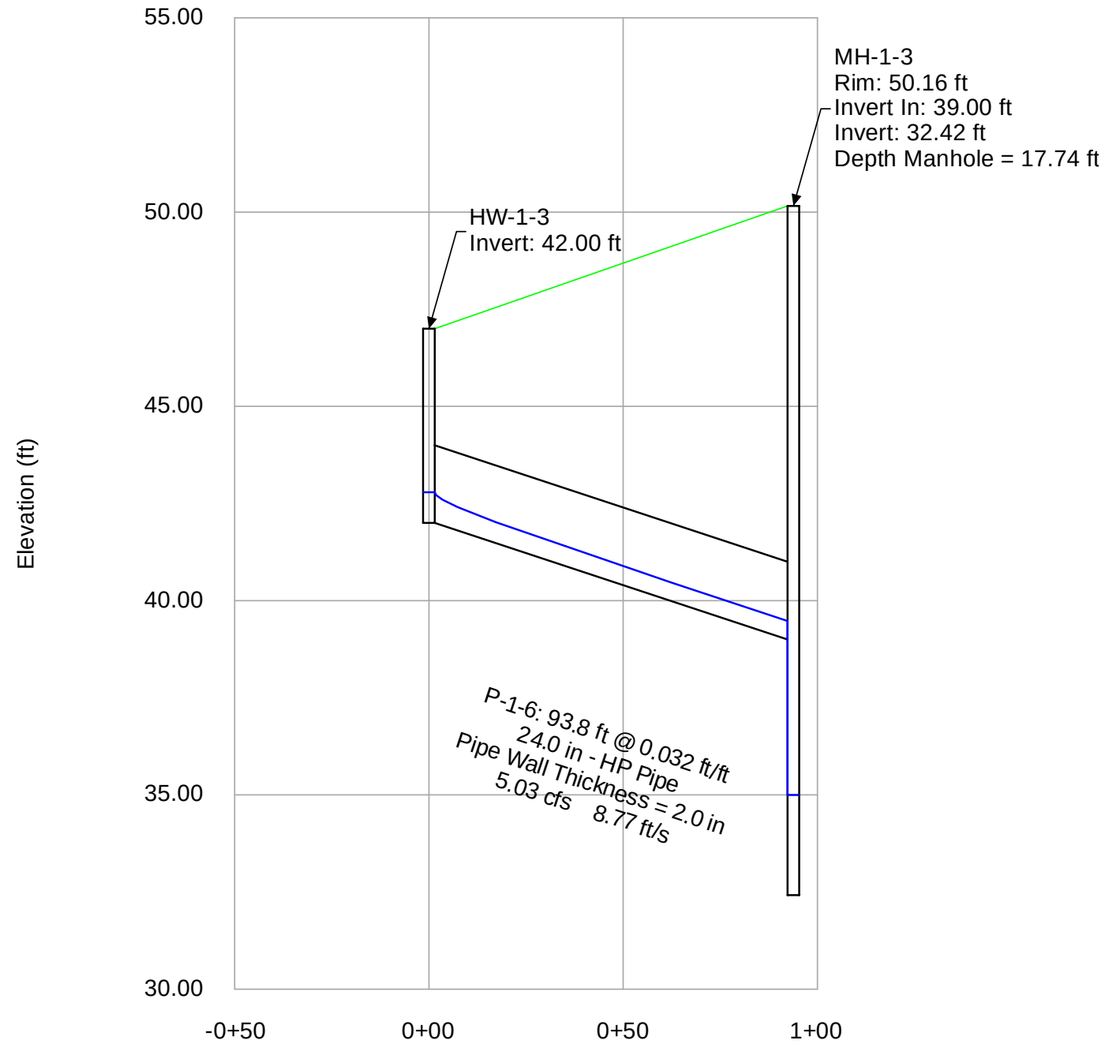
Engineering Profile - Profile - 5 - IN-5-25 TO POND INLET O5C (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

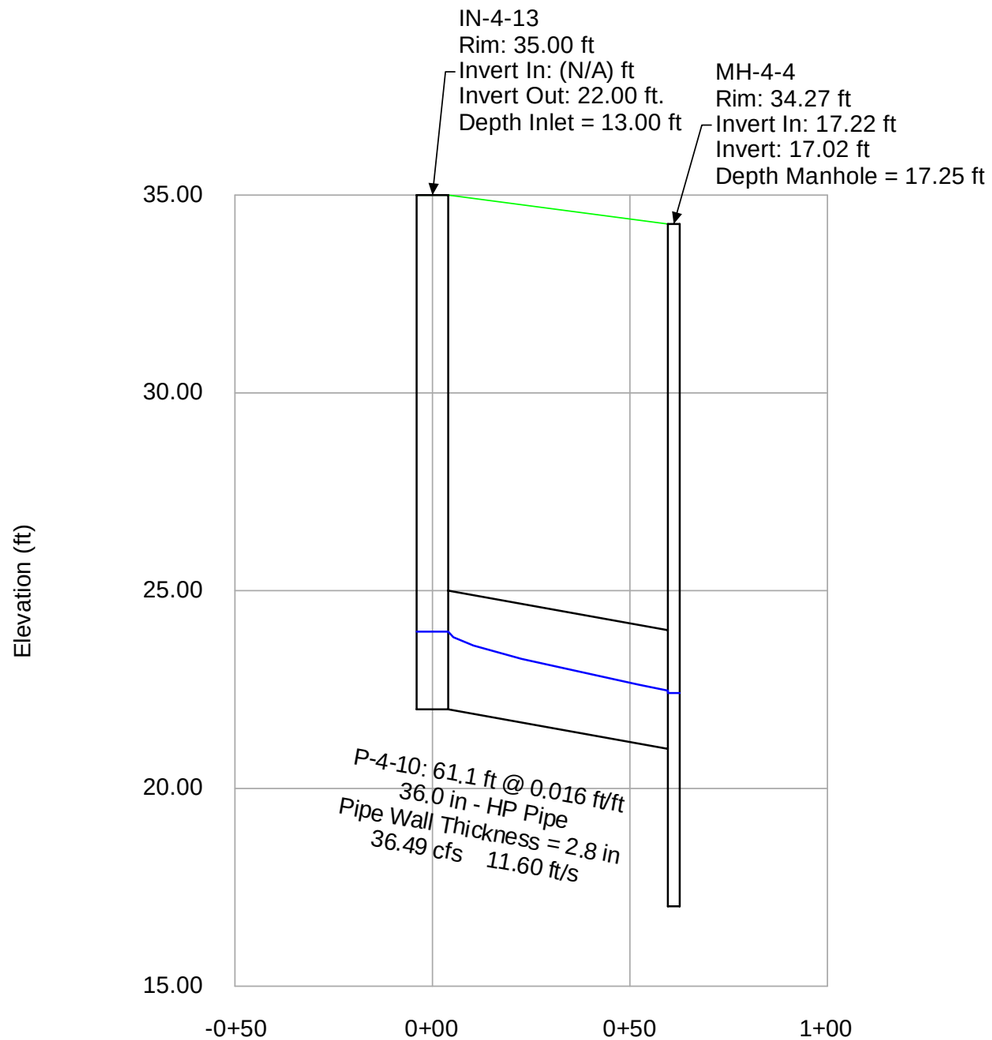
Engineering Profile - Profile - 1 HW-1-3 TO MH-1-3 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

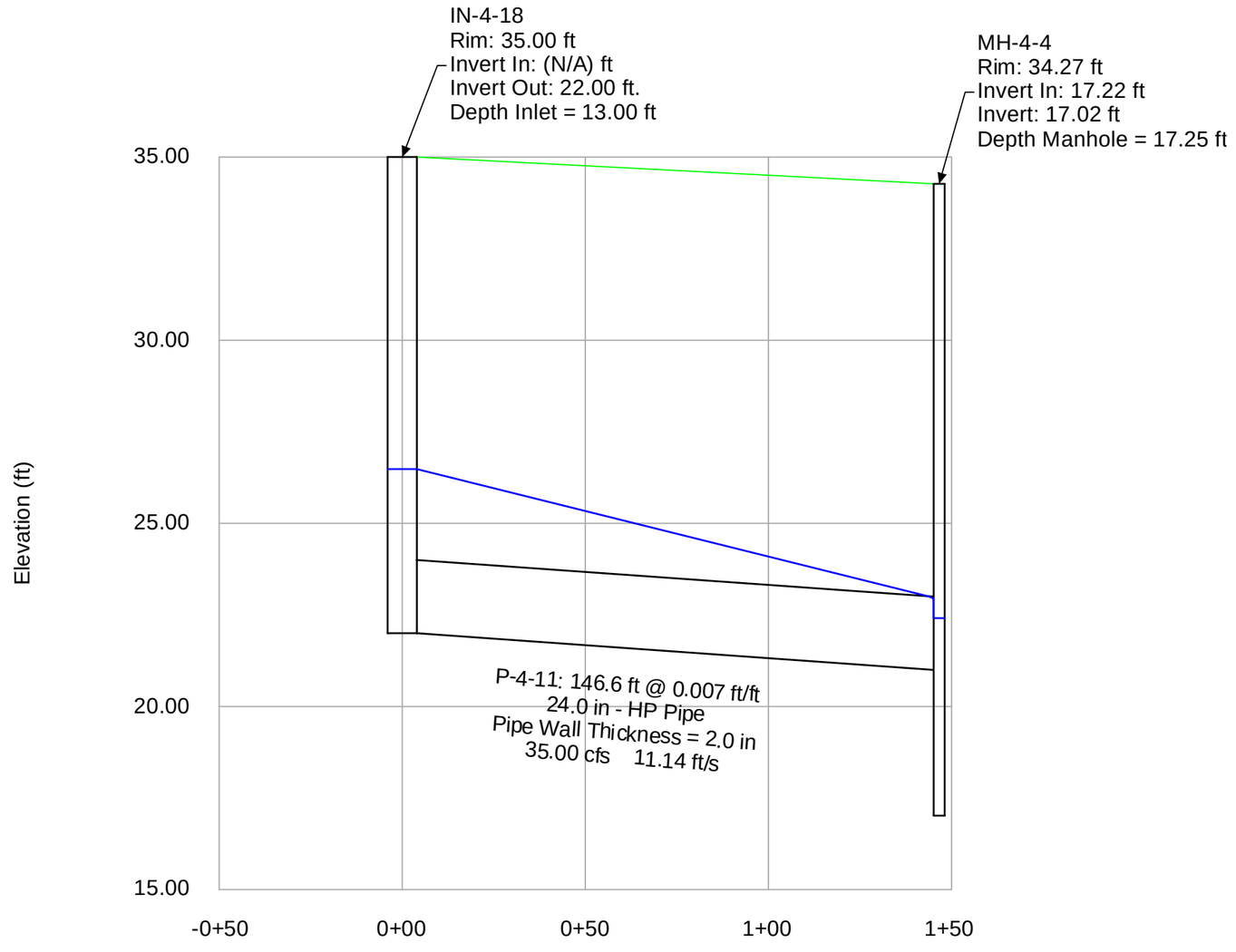
Engineering Profile - Profile - 4 - IN-4-13 TO MH-4-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

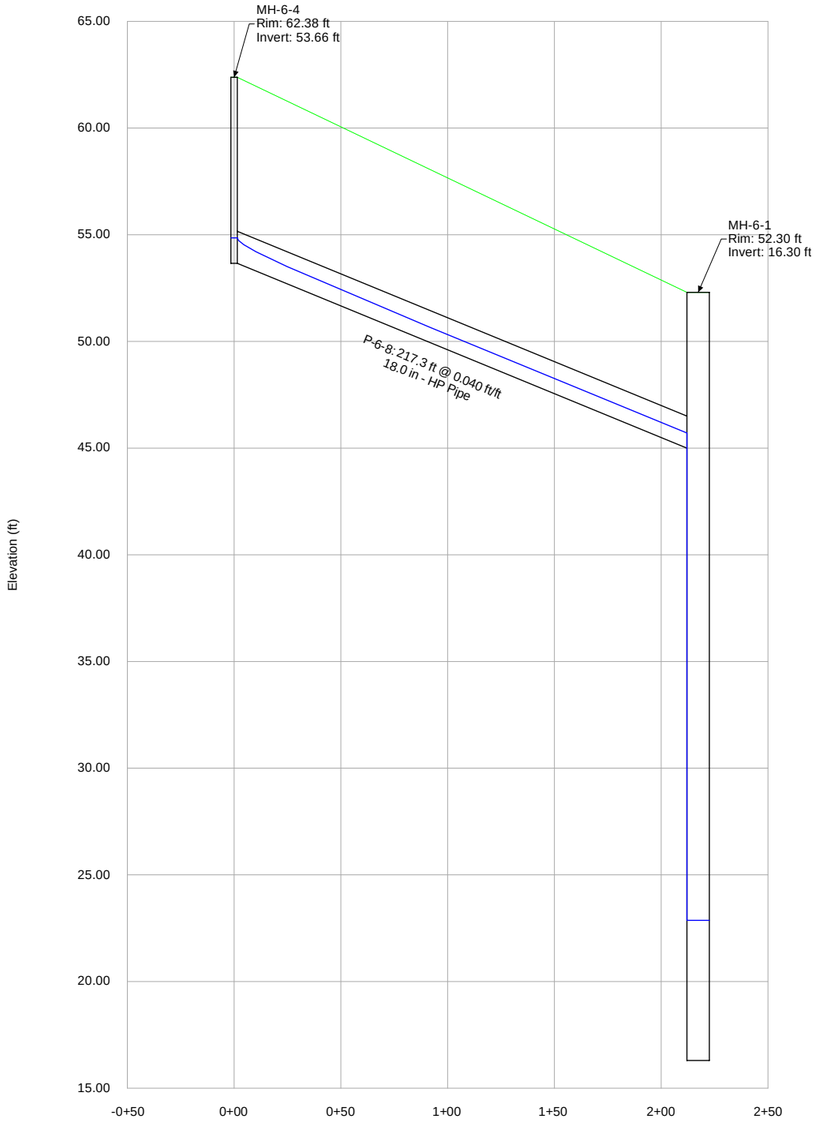
Engineering Profile - Profile - 4 - IN-4-18 TO MH-4-4 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



100-Yr

Profile Report

Engineering Profile - Profile - 6 - M-6-4 TO MH-6-1 (Yap Airport Drainage Model Alternate Bid 09-11-25.stsw)



POND CALCULATIONS

UNAFFECTED BY CLIN BA01

Pond Watershed Data

Watershed	$A_{Undeveloped}$	A_{Paved}	A_{total}	A_{total}	Impervious %	Watershed Length	U/S Elevation	D/S Elevation	Average Watershed Slope	Weighted Watershed Slope	Length to Centroid
	(ft^2)	(ft^2)	(ft^2)	(acres)		(ft)	(ft)	(ft)	(ft/ft)	(ft/ft)	(ft)
Outfall 3	3325533	1208171	4533704	104.08	28.12%	3767	132.5	26.2	0.028	0.010	955
Outfall 4	3284676	506389	3791065	87.03	15.09%	3191	264.2	14.6	0.078	0.059	1329
Outfall 5	2851861	956427	3808288	87.43	26.61%	3832	258.0	47.0	0.055	0.041	1589
Outfall 6	1168728	436687	1605415	36.86	28.66%	2563	187.3	67.9	0.047	0.016	799
Outfall 6A	565830	79616	645446	14.82	14.09%	1261	141.8	48.2	0.074	0.043	468

Watershed	Basins
Outfall 3	A-3-4, A-3-5, A-3-7, A-3-8, A-3-9, A-3-10, A-3-11, A-3-12, A-3-13, A-3-14, A-3-15, A-3-16, A-3-17, A-3-18, A-O3P
Outfall 4	A-4-1, A-4-2, A-4-12, A-4-13, A-4-14, A-4-15, A-4-16, A-4-17, A-4-18, A-O4P
Outfall 5	A-5-1, A-5-2, A-5-16, A-5-17, A-5-18, A-5-19, A-5-20, A-5-21, A-5-22, A-5-23, A-5-24, A-5-25, A-O5P
Outfall 6	A-7-1, A-O6P
Outfall 6A	A-O6AP

Note: Undeveloped Area is considered 2% impervious and Paved Area is considered 100% impervious.

Pond Watershed Weighted Slope Calculations

Watershed	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
Outfall 3	327.59	132.5	108.5	0.0733	174.95
	83.07	108.5	82.5	0.3130	62.86
	1233.04	82.5	78.2	0.0035	317.08
	177.75			0.0038	46.66
	239.43			0.0042	64.38
	398.03			0.0043	107.63
	389.60			0.0039	102.91
	577.12			0.0522	284.12
	38.99			0.0255	16.16
	302.05			0.0050	84.69
	3766.67		**Wt'd Slope**	**0.0104**	1261.46

Watershed	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
Outfall 4	495.96	264.2	163.1	0.2038	338.59
	626.05	163.1	100.1	0.1006	360.80
	679.37	100.1	58.5	0.0612	347.52
	134.39			0.0309	58.34
	88.43			0.0469	42.43
	244.79			0.0325	107.56
	655.89			0.0336	290.50
	78.45			0.0044	21.33
	187.69			0.0050	52.63
	3191.02		**Wt'd Slope**	**0.0592**	1619.70

Watershed	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
Outfall 5	680.59	258.0	158.1	0.1468	429.43
	356.84	158.1	135.6	0.0631	183.82
	405.92	135.6	117.5	0.0446	192.42
	210.06			0.0306	90.97
	503.76			0.0575	253.83
	276.50			0.0224	111.11
	334.69			0.0124	116.70
	507.81			0.0243	208.09
	252.23			0.0335	111.64
	303.60			0.0050	85.12
	3832.00		**Wt'd Slope**	**0.0412**	1783.14

Pond Watershed Weighted Slope Calculations

Watershed	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
Outfall 6	156.72	187.3	156.3	0.1978	106.22
	39.22	156.3	144.2	0.3085	29.58
	516.32	144.2	122.4	0.0422	241.57
	116.00	122.4	91.0	0.2707	84.77
	951.90	91.0	89.6	0.0015	200.66
	72.06			0.0070	21.90
	384.92	86.0	76.4	0.0250	158.80
	62.98	76.4	69.4	0.1108	37.15
	262.81			0.0050	73.69
	2562.93		**Wt'd Slope**	**0.0163**	954.34

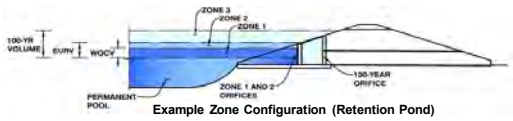
Watershed	Length, ft	U/S Elev	D/S Elev	Slope, ft/ft	L*S^0.24
Outfall 6A	7.66	141.8	135.2	0.8681	7.40
	304.70	135.2	133.2	0.0064	90.65
	12.98	133.2	123.6	0.7396	12.07
	152.50	123.6	106.6	0.1115	90.07
	14.69	106.6	91.1	1.0551	14.88
	212.64	91.1	82.8	0.0390	97.63
	285.48	82.8	60.3	0.0788	155.15
	193.31	60.3	55.1	0.0269	81.17
	76.90	55.1	48.2	0.0897	43.11
	1260.86		**Wt'd Slope**	**0.0428**	592.15

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Yap International Airport

Basin ID: Outfall 3 Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	104.08	acres
Watershed Length =	3,767	ft
Watershed Length to Centroid =	955	ft
Watershed Slope =	0.010	ft/ft
Watershed Imperviousness =	28.12%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	3.0	hours
Location for 1-hr Rainfall Depths =	User Input	

Drain Time Too Short

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.262	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.644	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.93 in.) =	9.771	acre-feet	1.93	inches
5-yr Runoff Volume (P1 = 2.59 in.) =	15.783	acre-feet	2.59	inches
10-yr Runoff Volume (P1 = 3.1 in.) =	20.569	acre-feet	3.10	inches
25-yr Runoff Volume (P1 = 3.78 in.) =	27.237	acre-feet	3.78	inches
50-yr Runoff Volume (P1 = 4.3 in.) =	32.298	acre-feet	4.30	inches
100-yr Runoff Volume (P1 = 4.82 in.) =	37.480	acre-feet	4.82	inches
500-yr Runoff Volume (P1 = 6.07 in.) =	49.746	acre-feet	6.07	inches
Approximate 2-yr Detention Volume =	3.669	acre-feet		
Approximate 5-yr Detention Volume =	6.637	acre-feet		
Approximate 10-yr Detention Volume =	7.936	acre-feet		
Approximate 25-yr Detention Volume =	9.571	acre-feet		
Approximate 50-yr Detention Volume =	10.127	acre-feet		
Approximate 100-yr Detention Volume =	12.518	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.262	acre-feet
Zone 2 Volume (100-year - Zone 1) =	11.256	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	12.518	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

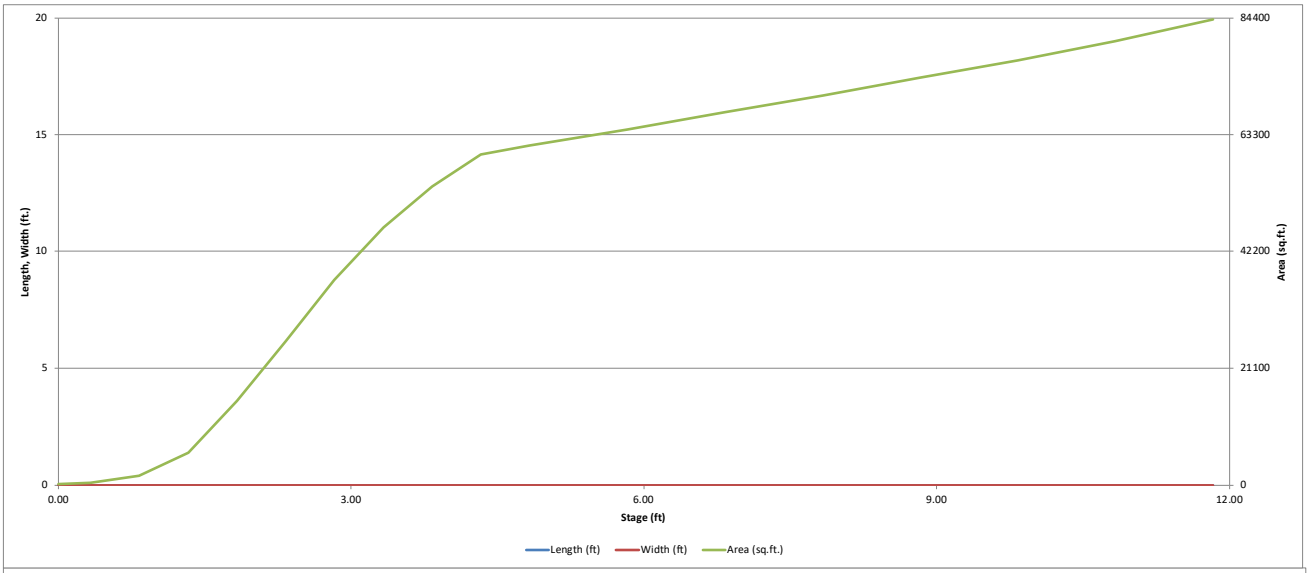
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

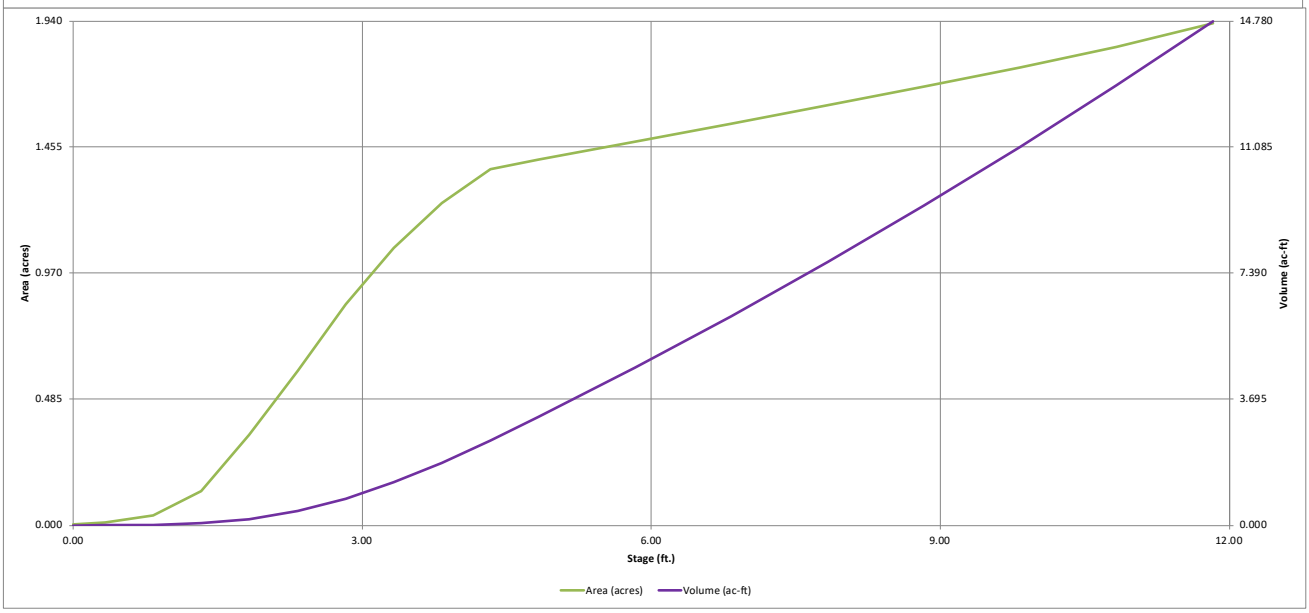
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	151	0.003		
26.5	--	0.33	--	--	--	435	0.010	97	0.002
27	--	0.83	--	--	--	1,682	0.039	626	0.014
27.5	--	1.33	--	--	--	5,767	0.132	2,488	0.057
28	--	1.83	--	--	--	15,201	0.349	7,730	0.177
28.5	--	2.33	--	--	--	25,910	0.595	18,008	0.413
29	--	2.83	--	--	--	37,063	0.851	33,752	0.775
29.5	--	3.33	--	--	--	46,499	1.067	54,642	1.254
30	--	3.83	--	--	--	53,966	1.239	79,759	1.831
30.5	--	4.33	--	--	--	59,643	1.369	108,161	2.483
31	--	4.83	--	--	--	61,293	1.407	138,395	3.177
32	--	5.83	--	--	--	64,246	1.475	201,165	4.618
33	--	6.83	--	--	--	67,266	1.544	266,921	6.128
34	--	7.83	--	--	--	70,353	1.615	335,731	7.707
35	--	8.83	--	--	--	73,508	1.688	407,661	9.359
36	--	9.83	--	--	--	76,731	1.761	482,781	11.083
37	--	10.83	--	--	--	80,100	1.839	561,196	12.883
38	--	11.83	--	--	--	84,114	1.931	643,303	14.768

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



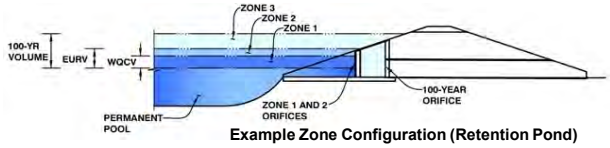


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Yap International Airport**

Basin ID: **Outfall 3 Pond**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.34	1.262	Orifice Plate
Zone 2 (100-year)	10.64	11.256	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)		12.518	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²

Underdrain Orifice Centroid = feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 3.75 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = 96.00 sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row = 6.667E-01 ft²

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00							
Orifice Area (sq. inches)	96.00							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =			inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =			ft²
Vertical Orifice Centroid =			feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.75		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	20.00		feet
Overflow Weir Grate Slope =	3.00		H:V
Horiz. Length of Weir Sides =	12.00		feet
Overflow Grate Type =	Close Mesh Grate		
Debris Clogging % =	50%		%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	7.75		feet
Overflow Weir Slope Length =	12.65		feet
Grate Open Area / 100-yr Orifice Area =	8.42		
Overflow Grate Open Area w/o Debris =	200.11		ft²
Overflow Grate Open Area w/ Debris =	100.05		ft²

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 2 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	4.89		ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	66.00		inches
Restrictor Plate Height Above Pipe Invert =	66.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Restrictor	Not Selected	
Outlet Orifice Area =	23.76		ft²
Outlet Orifice Centroid =	2.75		feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 9.00 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 60.00 feet

Spillway End Slopes = 4.00 H:V

Freeboard above Max Water Surface = 0.50 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 1.64 feet

Stage at Top of Freeboard = 11.14 feet

Basin Area at Top of Freeboard = 1.87 acres

Basin Volume at Top of Freeboard = 13.46 acre-ft

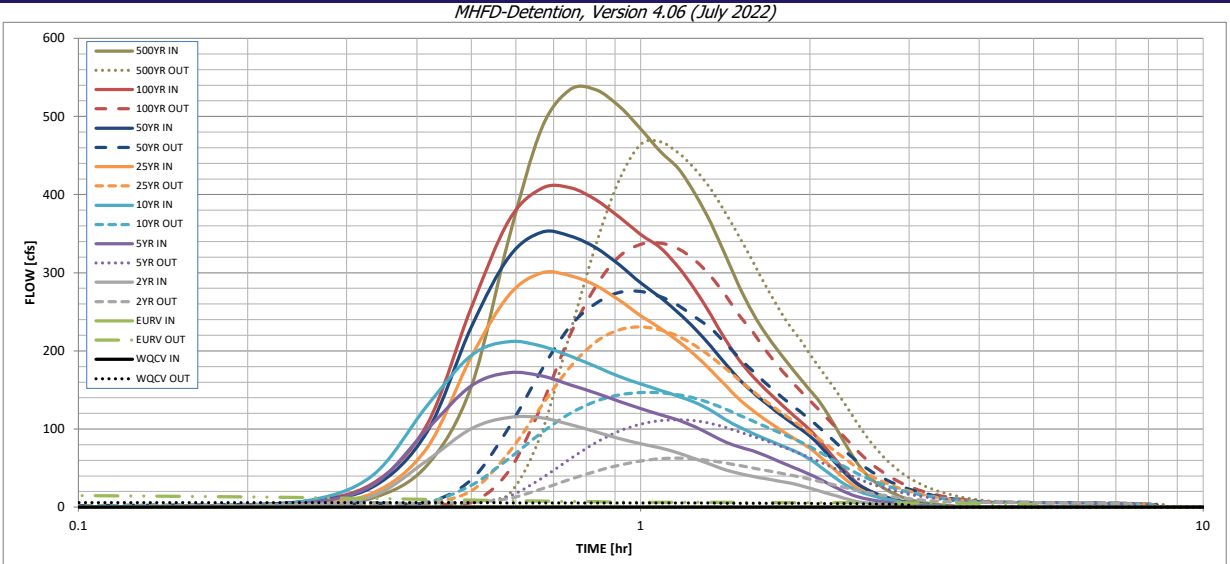
Routed Hydrograph Results

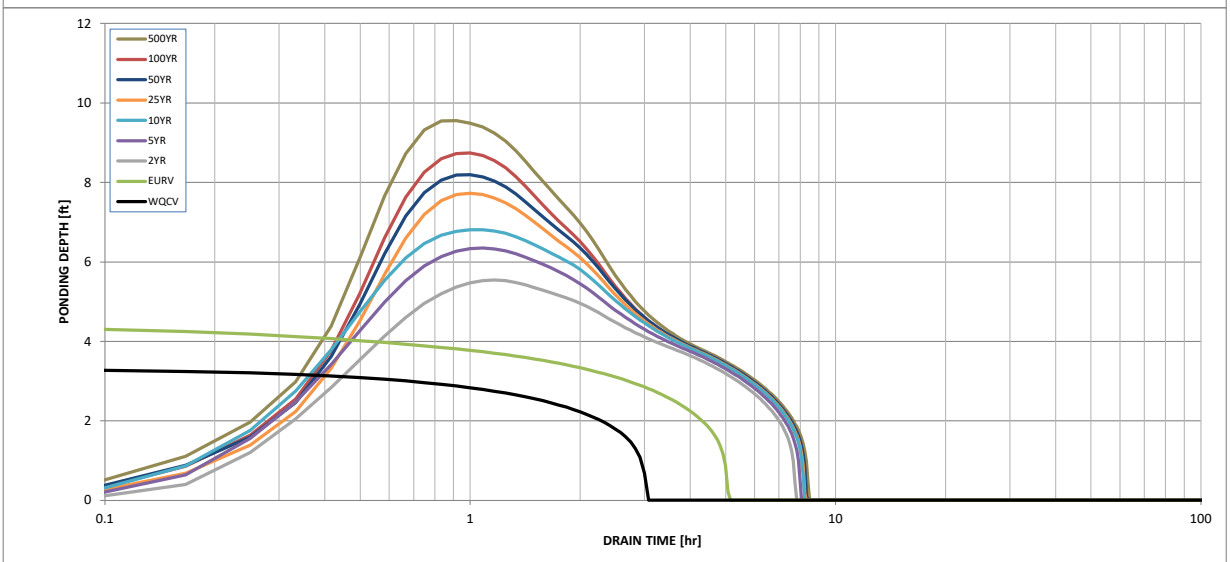
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

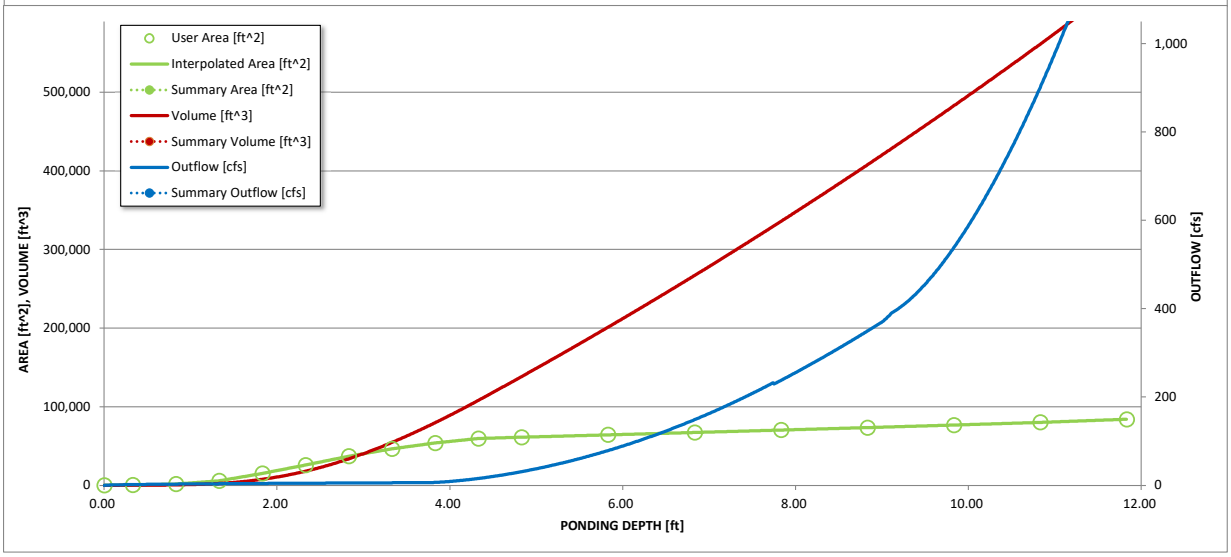
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.93	2.59	3.10	3.78	4.30	4.82	6.07
CUHP Runoff Volume (acre-ft) =	1.262	2.644	9.771	15.783	20.569	27.237	32.298	37.480	49.746
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	9.771	15.783	20.569	27.237	32.298	37.480	49.746
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	81.7	129.2	162.0	239.8	284.1	335.3	442.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.79	1.24	1.56	2.30	2.73	3.22	4.26
Peak Inflow Q (cfs) =	N/A	N/A	114.8	172.1	211.9	299.8	351.8	408.7	534.5
Peak Outflow Q (cfs) =	5.8	17.5	62.7	111.8	146.7	230.5	275.9	337.9	467.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.9	1.0	1.0	1.0	1.1
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.06	0.28	0.5	0.7	1.1	1.3	1.6	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	3	5	7	7	7	6	6	6	5
Time to Drain 99% of Inflow Volume (hours) =	**3**	5	8	8	8	7	7	7	7
Maximum Ponding Depth (ft) =	3.34	4.45	5.54	6.34	6.81	7.72	8.19	8.73	9.55
Area at Maximum Ponding Depth (acres) =	1.07	1.38	1.46	1.51	1.54	1.61	1.64	1.68	1.74
Maximum Volume Stored (acre-ft) =	1.265	2.648	4.193	5.379	6.081	7.530	8.293	9.190	10.593

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

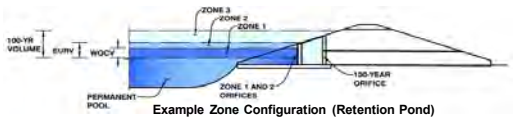
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.25	0.75	1.22	1.31	1.72	1.50	2.33
	0:15:00	0.00	0.00	2.88	4.76	7.23	5.00	7.21	6.95	11.66
	0:20:00	0.00	0.00	13.86	27.73	40.17	17.75	25.62	29.93	53.12
	0:25:00	0.00	0.00	59.59	99.33	129.38	75.45	95.74	105.41	154.59
	0:30:00	0.00	0.00	100.47	155.41	194.23	192.48	230.69	255.66	345.06
	0:35:00	0.00	0.00	114.84	172.08	211.92	271.43	320.39	367.32	484.85
	0:40:00	0.00	0.00	114.31	167.90	205.92	299.75	351.84	408.02	534.54
	0:45:00	0.00	0.00	105.70	156.62	193.18	296.13	346.88	408.73	533.91
	0:50:00	0.00	0.00	96.32	146.06	179.82	283.41	331.76	393.11	512.85
	0:55:00	0.00	0.00	87.84	135.22	167.19	264.74	309.92	371.04	484.08
	1:00:00	0.00	0.00	81.11	126.17	157.68	244.96	286.97	349.06	455.48
	1:05:00	0.00	0.00	75.86	118.58	149.74	229.18	268.65	332.02	433.26
	1:10:00	0.00	0.00	69.20	111.32	141.97	212.15	248.81	307.12	400.89
	1:15:00	0.00	0.00	61.81	102.72	133.97	194.64	228.38	278.13	363.28
	1:20:00	0.00	0.00	54.48	92.69	123.72	174.95	205.53	245.61	321.49
	1:25:00	0.00	0.00	47.69	83.30	111.86	155.52	183.24	214.01	281.40
	1:30:00	0.00	0.00	42.90	76.90	102.34	137.74	163.01	187.55	248.04
	1:35:00	0.00	0.00	39.40	72.02	94.42	123.67	146.91	167.35	222.43
	1:40:00	0.00	0.00	36.44	65.98	87.44	111.90	133.39	150.92	201.47
	1:45:00	0.00	0.00	33.77	59.53	81.08	101.59	121.49	136.32	182.74
	1:50:00	0.00	0.00	31.18	53.36	75.18	92.23	110.69	123.07	165.70
	1:55:00	0.00	0.00	27.91	47.61	68.88	83.57	100.63	110.67	149.69
	2:00:00	0.00	0.00	24.38	42.01	61.24	75.29	91.02	98.93	134.50
	2:05:00	0.00	0.00	20.66	35.72	52.13	64.94	78.58	84.92	115.57
	2:10:00	0.00	0.00	16.99	29.35	42.89	53.87	65.12	70.19	95.36
	2:15:00	0.00	0.00	13.49	23.31	34.32	43.17	52.14	55.95	75.96
	2:20:00	0.00	0.00	10.21	17.90	26.97	33.30	40.28	42.91	58.66
	2:25:00	0.00	0.00	7.47	13.86	21.70	25.10	30.59	32.10	44.56
	2:30:00	0.00	0.00	5.75	11.13	17.88	19.52	24.07	24.70	34.70
	2:35:00	0.00	0.00	4.59	9.09	14.78	15.46	19.21	19.30	27.38
	2:40:00	0.00	0.00	3.70	7.44	12.14	12.30	15.37	15.00	21.50
	2:45:00	0.00	0.00	2.99	6.03	9.88	9.71	12.20	11.57	16.75
	2:50:00	0.00	0.00	2.40	4.84	7.96	7.66	9.68	8.85	12.96
	2:55:00	0.00	0.00	1.93	3.83	6.37	5.99	7.62	6.72	9.97
	3:00:00	0.00	0.00	1.55	3.00	5.07	4.69	6.00	5.17	7.80
	3:05:00	0.00	0.00	1.25	2.33	4.00	3.72	4.79	4.15	6.30
	3:10:00	0.00	0.00	1.01	1.79	3.11	2.92	3.77	3.31	5.05
	3:15:00	0.00	0.00	0.80	1.34	2.39	2.28	2.95	2.65	4.02
	3:20:00	0.00	0.00	0.61	0.98	1.82	1.74	2.26	2.06	3.11
	3:25:00	0.00	0.00	0.45	0.68	1.34	1.31	1.70	1.54	2.32
	3:30:00	0.00	0.00	0.31	0.46	0.93	0.94	1.21	1.10	1.64
	3:35:00	0.00	0.00	0.20	0.30	0.60	0.64	0.81	0.73	1.08
	3:40:00	0.00	0.00	0.11	0.19	0.34	0.39	0.49	0.44	0.64
	3:45:00	0.00	0.00	0.05	0.10	0.16	0.20	0.25	0.22	0.31
	3:50:00	0.00	0.00	0.02	0.04	0.05	0.07	0.08	0.07	0.10
	3:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Yap International Airport

Basin ID: Outfall 4 Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	87.03	acres
Watershed Length =	3,191	ft
Watershed Length to Centroid =	1,329	ft
Watershed Slope =	0.059	ft/ft
Watershed Imperviousness =	15.09%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	2.0	hours
Location for 1-hr Rainfall Depths =	User Input	

Drain Time Too Short

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.680	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.129	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.93 in.) =	6.990	acre-feet	1.93 inches
5-yr Runoff Volume (P1 = 2.59 in.) =	11.958	acre-feet	2.59 inches
10-yr Runoff Volume (P1 = 3.1 in.) =	15.927	acre-feet	3.10 inches
25-yr Runoff Volume (P1 = 3.78 in.) =	21.517	acre-feet	3.78 inches
50-yr Runoff Volume (P1 = 4.3 in.) =	25.757	acre-feet	4.30 inches
100-yr Runoff Volume (P1 = 4.82 in.) =	30.114	acre-feet	4.82 inches
500-yr Runoff Volume (P1 = 6.07 in.) =	40.399	acre-feet	6.07 inches
Approximate 2-yr Detention Volume =	1.515	acre-feet	
Approximate 5-yr Detention Volume =	3.289	acre-feet	
Approximate 10-yr Detention Volume =	4.212	acre-feet	
Approximate 25-yr Detention Volume =	5.310	acre-feet	
Approximate 50-yr Detention Volume =	5.611	acre-feet	
Approximate 100-yr Detention Volume =	7.483	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.680	acre-feet
Zone 2 Volume (100-year - Zone 1) =	6.803	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	7.483	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

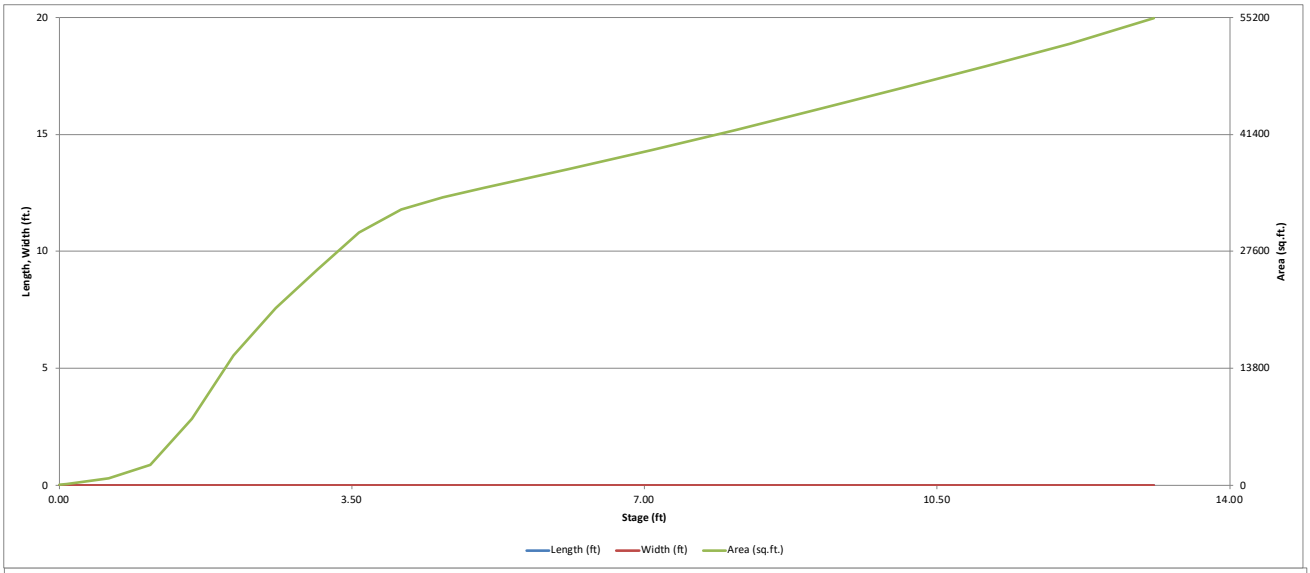
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

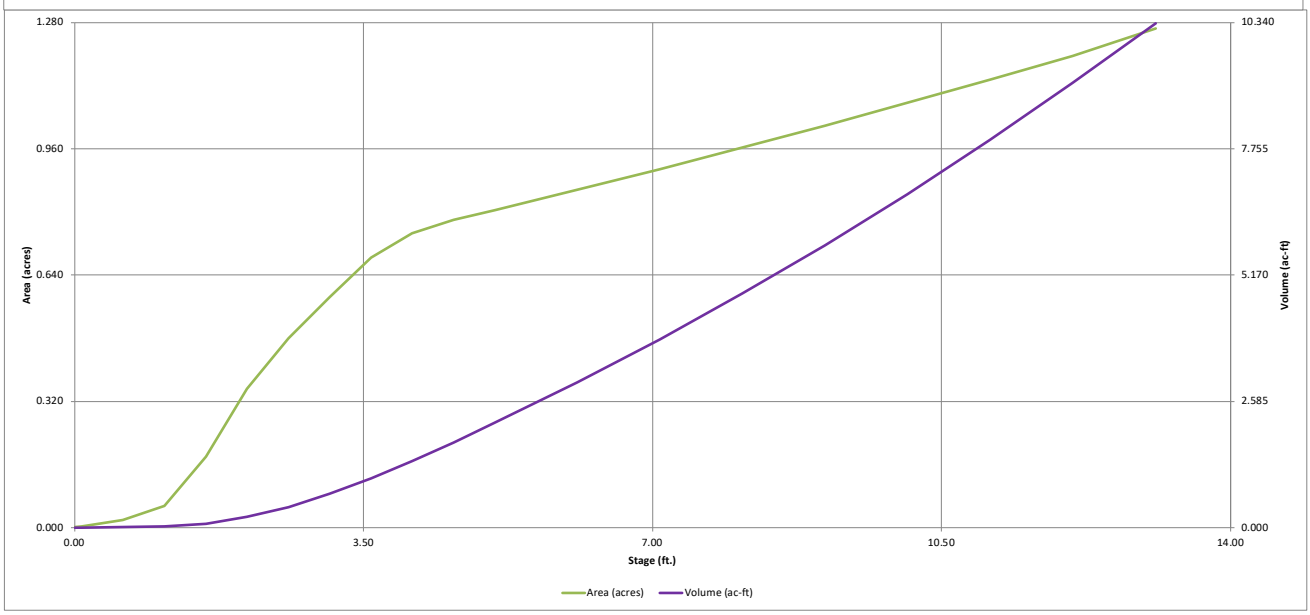
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	106	0.002		
16	--	0.09	--	--	--	132	0.003	11	0.000
16.5	--	0.59	--	--	--	819	0.019	248	0.006
17	--	1.09	--	--	--	2,399	0.055	1,029	0.024
17.5	--	1.59	--	--	--	7,835	0.180	3,533	0.081
18	--	2.09	--	--	--	15,323	0.352	9,400	0.216
18.5	--	2.59	--	--	--	20,886	0.479	18,453	0.424
19	--	3.09	--	--	--	25,459	0.584	30,039	0.690
19.5	--	3.59	--	--	--	29,835	0.685	43,863	1.007
20	--	4.09	--	--	--	32,524	0.747	59,452	1.365
20.5	--	4.59	--	--	--	33,978	0.780	76,078	1.747
21	--	5.09	--	--	--	35,064	0.805	93,338	2.143
22	--	6.09	--	--	--	37,284	0.856	129,512	2.973
23	--	7.09	--	--	--	39,569	0.908	167,939	3.855
24	--	8.09	--	--	--	41,929	0.963	208,688	4.791
25	--	9.09	--	--	--	44,374	1.019	251,840	5.781
26	--	10.09	--	--	--	46,877	1.076	297,465	6.829
27	--	11.09	--	--	--	49,443	1.135	345,625	7.934
28	--	12.09	--	--	--	52,072	1.195	396,383	9.100
29	--	13.09	--	--	--	55,115	1.265	449,977	10.330

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



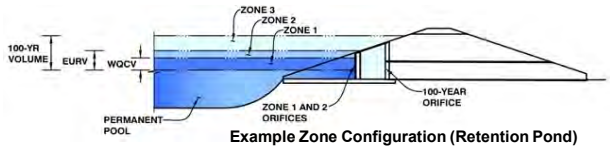


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Yap International Airport**

Basin ID: **Outfall 4 Pond**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.08	0.680	Orifice Plate
Zone 2 (100-year)	10.69	6.803	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)		7.483	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	6.667E-01	ft^2
Depth at top of Zone using Orifice Plate =	3.09	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	96.00	sq. inches (use rectangular openings)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00							
Orifice Area (sq. inches)	96.00							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected					
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft^2
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 2 Weir	Not Selected					
Overflow Weir Front Edge Height, Ho =	3.09		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.09		feet
Overflow Weir Front Edge Length =	20.00		feet	Overflow Weir Slope Length =	12.65		feet
Overflow Weir Grate Slope =	3.00		H:V	Grate Open Area / 100-yr Orifice Area =	7.08		
Horiz. Length of Weir Sides =	12.00		feet	Overflow Grate Open Area w/o Debris =	200.11		ft^2
Overflow Grate Type =	Close Mesh Grate			Overflow Grate Open Area w/ Debris =	100.05		ft^2
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 2 Restrictor	Not Selected					
Depth to Invert of Outlet Pipe =	0.50		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	28.27		ft^2
Outlet Pipe Diameter =	72.00		inches	Outlet Orifice Centroid =	3.00		feet
Restrictor Plate Height Above Pipe Invert =	72.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	10.22	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.42	feet
Spillway Crest Length =	62.00	feet	Stage at Top of Freeboard =	12.64	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.23	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	9.77	acre-ft

Calculated Parameters for Spillway

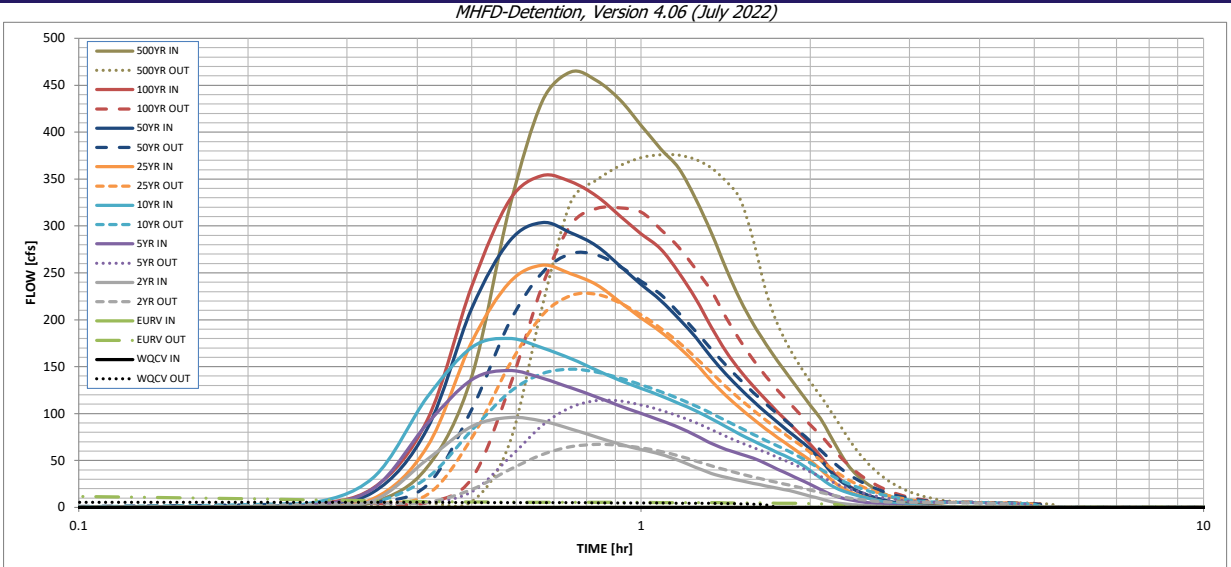
Routed Hydrograph Results

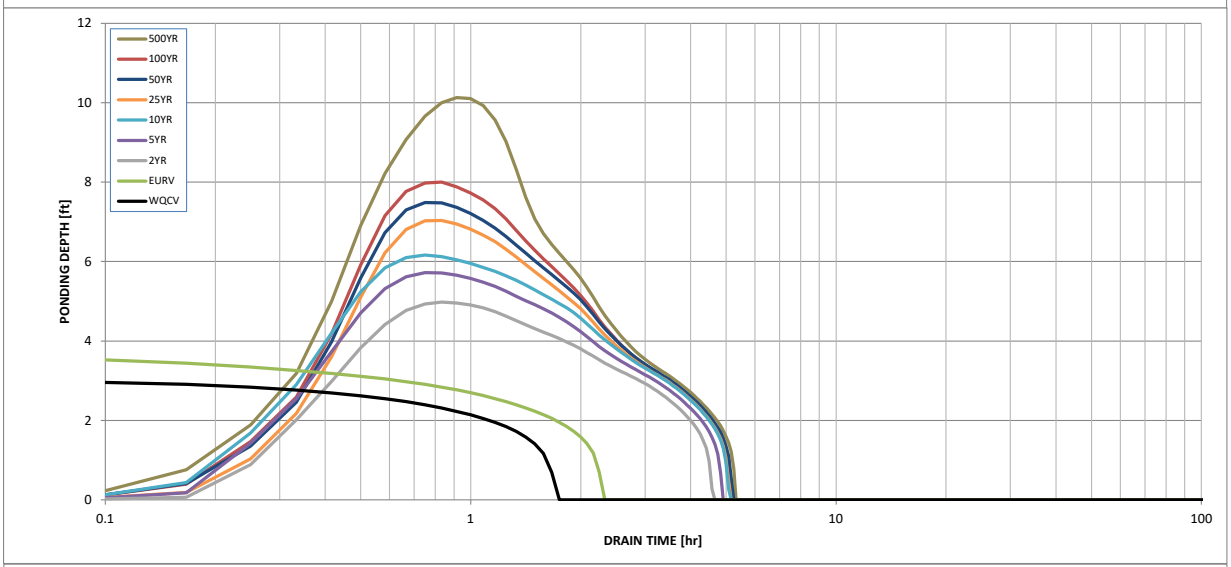
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

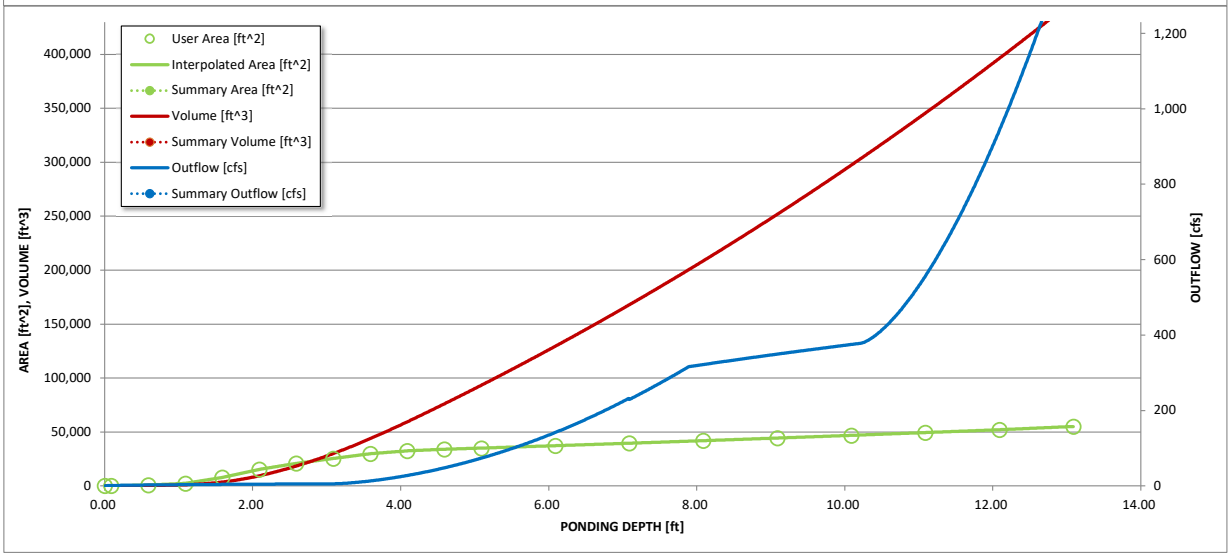
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.93	2.59	3.10	3.78	4.30	4.82	6.07
CUHP Runoff Volume (acre-ft) =	0.680	1.129	6.990	11.958	15.927	21.517	25.757	30.114	40.399
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	6.990	11.958	15.927	21.517	25.757	30.114	40.399
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	83.7	133.2	166.7	242.4	287.1	336.4	443.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.96	1.53	1.92	2.78	3.30	3.87	5.10
Peak Inflow Q (cfs) =	N/A	N/A	95.8	145.8	180.1	258.1	303.6	353.6	464.4
Peak Outflow Q (cfs) =	5.6	15.6	67.1	113.7	147.3	227.1	270.3	319.1	375.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	0.9	0.9	0.9	0.9	0.8
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.06	0.30	0.5	0.7	1.1	1.3	1.5	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	2	2	4	4	4	4	3	3	3
Time to Drain 99% of Inflow Volume (hours) =	**2**	2	4	5	5	5	5	4	4
Maximum Ponding Depth (ft) =	3.08	3.77	4.97	5.72	6.16	7.03	7.48	7.99	10.13
Area at Maximum Ponding Depth (acres) =	0.58	0.71	0.80	0.84	0.86	0.91	0.93	0.96	1.08
Maximum Volume Stored (acre-ft) =	0.684	1.132	2.047	2.652	3.025	3.801	4.214	4.695	6.861

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

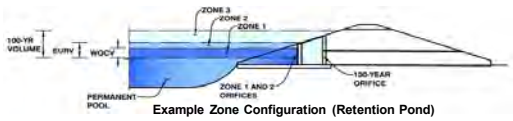
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.07	0.23	0.37	0.39	0.51	0.44	0.69
	0:15:00	0.00	0.00	0.86	1.52	2.99	1.53	2.85	2.73	5.54
	0:20:00	0.00	0.00	7.13	19.75	31.49	9.01	15.88	20.42	42.81
	0:25:00	0.00	0.00	51.17	89.24	117.50	64.64	83.89	92.98	139.30
	0:30:00	0.00	0.00	86.14	136.02	170.48	176.25	211.96	235.82	319.21
	0:35:00	0.00	0.00	95.78	145.82	180.12	239.88	283.71	327.38	432.53
	0:40:00	0.00	0.00	92.02	137.72	170.00	258.08	303.61	353.60	464.35
	0:45:00	0.00	0.00	83.62	127.42	158.67	248.88	292.50	347.09	454.82
	0:50:00	0.00	0.00	74.91	117.74	146.23	237.34	278.80	331.76	434.50
	0:55:00	0.00	0.00	67.35	108.13	135.40	219.05	257.57	310.76	407.28
	1:00:00	0.00	0.00	61.70	100.10	126.87	201.92	237.70	291.52	382.26
	1:05:00	0.00	0.00	56.66	92.64	119.00	187.23	220.57	275.71	361.49
	1:10:00	0.00	0.00	49.93	85.32	110.98	170.69	201.30	250.48	328.76
	1:15:00	0.00	0.00	42.73	76.69	103.07	153.47	181.32	222.46	292.77
	1:20:00	0.00	0.00	36.26	68.09	94.41	134.84	159.92	192.07	254.25
	1:25:00	0.00	0.00	31.86	61.83	85.83	119.07	141.88	165.96	221.16
	1:30:00	0.00	0.00	28.50	56.91	77.89	105.63	126.47	145.65	195.34
	1:35:00	0.00	0.00	25.60	52.53	70.78	93.98	113.09	129.21	174.36
	1:40:00	0.00	0.00	22.96	46.73	64.39	83.67	101.22	114.79	155.90
	1:45:00	0.00	0.00	20.39	40.69	58.44	74.40	90.52	101.72	139.11
	1:50:00	0.00	0.00	17.89	34.94	52.81	65.85	80.61	89.58	123.48
	1:55:00	0.00	0.00	14.98	29.62	46.70	57.70	71.16	78.11	108.66
	2:00:00	0.00	0.00	12.02	24.43	39.33	49.91	62.10	67.31	94.66
	2:05:00	0.00	0.00	9.08	19.07	31.29	40.52	50.69	54.61	77.27
	2:10:00	0.00	0.00	6.33	14.17	24.10	30.96	39.03	41.82	59.82
	2:15:00	0.00	0.00	4.47	10.84	19.19	22.88	29.22	30.91	44.91
	2:20:00	0.00	0.00	3.37	8.60	15.67	17.51	22.64	23.43	34.60
	2:25:00	0.00	0.00	2.61	6.87	12.82	13.64	17.81	18.02	26.98
	2:30:00	0.00	0.00	2.04	5.50	10.43	10.72	14.11	13.85	21.03
	2:35:00	0.00	0.00	1.59	4.38	8.39	8.36	11.12	10.57	16.31
	2:40:00	0.00	0.00	1.21	3.44	6.65	6.51	8.73	7.97	12.52
	2:45:00	0.00	0.00	0.93	2.65	5.21	5.00	6.77	5.92	9.49
	2:50:00	0.00	0.00	0.72	2.00	4.04	3.80	5.21	4.41	7.22
	2:55:00	0.00	0.00	0.57	1.48	3.11	2.92	4.05	3.44	5.69
	3:00:00	0.00	0.00	0.45	1.09	2.38	2.26	3.17	2.73	4.55
	3:05:00	0.00	0.00	0.35	0.79	1.81	1.75	2.47	2.18	3.64
	3:10:00	0.00	0.00	0.26	0.54	1.37	1.34	1.89	1.70	2.84
	3:15:00	0.00	0.00	0.18	0.35	0.99	1.00	1.42	1.28	2.14
	3:20:00	0.00	0.00	0.12	0.22	0.67	0.72	1.02	0.92	1.53
	3:25:00	0.00	0.00	0.07	0.14	0.42	0.49	0.69	0.62	1.03
	3:30:00	0.00	0.00	0.03	0.08	0.22	0.30	0.42	0.38	0.62
	3:35:00	0.00	0.00	0.01	0.04	0.09	0.15	0.22	0.19	0.32
	3:40:00	0.00	0.00	0.00	0.02	0.02	0.06	0.08	0.07	0.11
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Yap International Airport

Basin ID: Outfall 5 Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	87.43	acres
Watershed Length =	3,832	ft
Watershed Length to Centroid =	1,589	ft
Watershed Slope =	0.041	ft/ft
Watershed Imperviousness =	26.61%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	3.0	hours
Location for 1-hr Rainfall Depths =	User Input	

Drain Time Too Short

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	1.023	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	2.093	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.93 in.) =	8.067	acre-feet	1.93	inches
5-yr Runoff Volume (P1 = 2.59 in.) =	13.117	acre-feet	2.59	inches
10-yr Runoff Volume (P1 = 3.1 in.) =	17.134	acre-feet	3.10	inches
25-yr Runoff Volume (P1 = 3.78 in.) =	22.735	acre-feet	3.78	inches
50-yr Runoff Volume (P1 = 4.3 in.) =	26.986	acre-feet	4.30	inches
100-yr Runoff Volume (P1 = 4.82 in.) =	31.339	acre-feet	4.82	inches
500-yr Runoff Volume (P1 = 6.07 in.) =	41.643	acre-feet	6.07	inches
Approximate 2-yr Detention Volume =	2.895	acre-feet		
Approximate 5-yr Detention Volume =	5.312	acre-feet		
Approximate 10-yr Detention Volume =	6.379	acre-feet		
Approximate 25-yr Detention Volume =	7.728	acre-feet		
Approximate 50-yr Detention Volume =	8.180	acre-feet		
Approximate 100-yr Detention Volume =	10.185	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	1.023	acre-feet
Zone 2 Volume (100-year - Zone 1) =	9.162	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	10.185	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

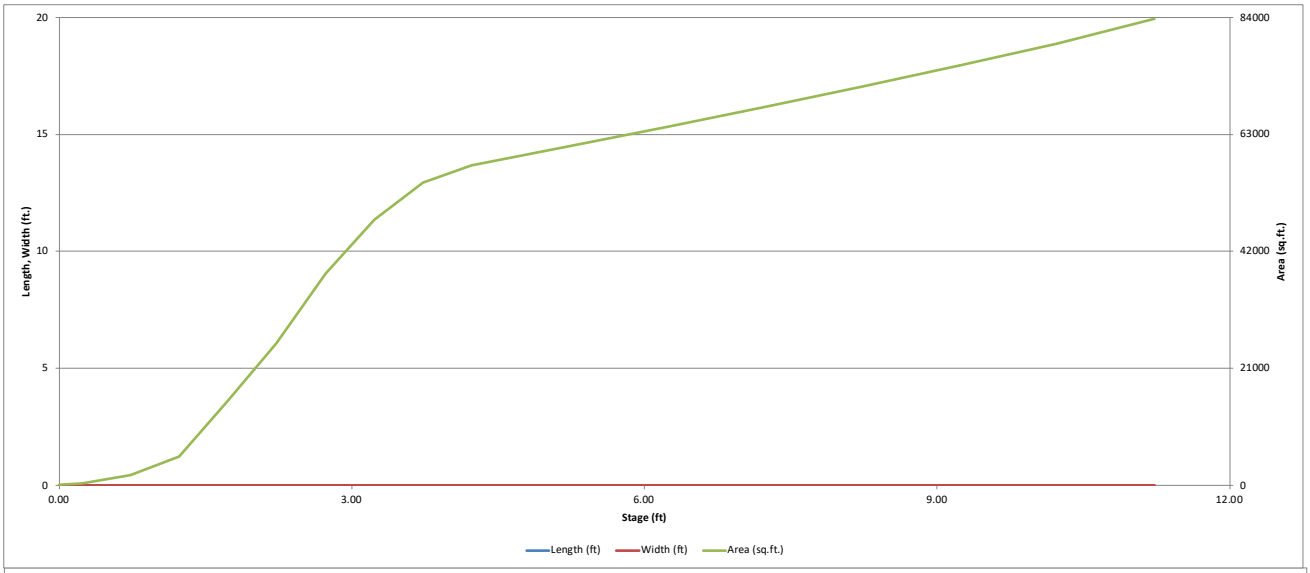
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

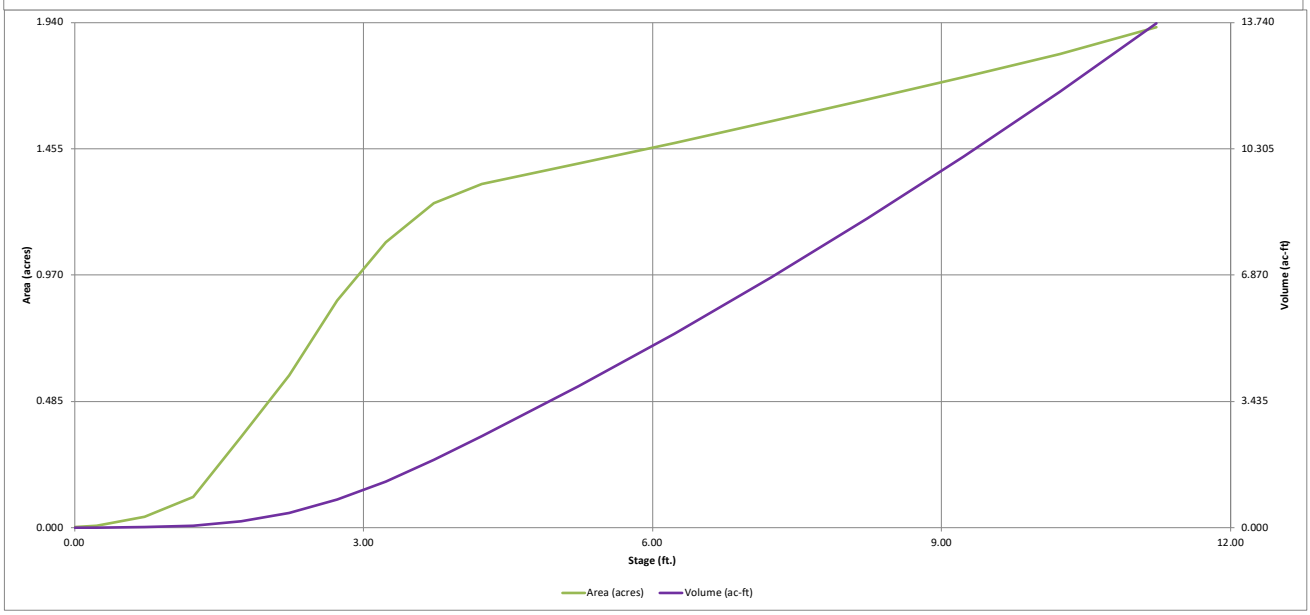
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	111	0.003		
47	--	0.23	--	--	--	317	0.007	49	0.001
47.5	--	0.73	--	--	--	1,785	0.041	575	0.013
48	--	1.23	--	--	--	5,175	0.119	2,315	0.053
48.5	--	1.73	--	--	--	15,176	0.348	7,403	0.170
49	--	2.23	--	--	--	25,447	0.584	17,558	0.403
49.5	--	2.73	--	--	--	37,957	0.871	33,409	0.767
50	--	3.23	--	--	--	47,710	1.095	54,826	1.259
50.5	--	3.73	--	--	--	54,294	1.246	80,327	1.844
51	--	4.23	--	--	--	57,442	1.319	108,261	2.485
52	--	5.23	--	--	--	60,861	1.397	167,413	3.843
53	--	6.23	--	--	--	64,360	1.478	230,024	5.281
54	--	7.23	--	--	--	67,937	1.560	296,172	6.799
55	--	8.23	--	--	--	71,596	1.644	365,939	8.401
56	--	9.23	--	--	--	75,340	1.730	439,407	10.087
57	--	10.23	--	--	--	79,239	1.819	516,696	11.862
58	--	11.23	--	--	--	83,750	1.923	598,191	13.733

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



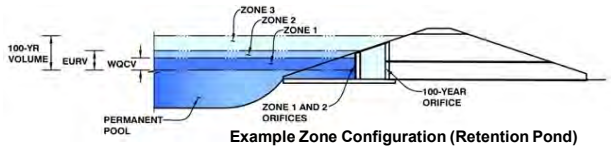


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Yap International Airport

Basin ID: Outfall 5 Pond



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.01	1.023	Orifice Plate
Zone 2 (100-year)	9.29	9.162	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)		10.185	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	sq. inches	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00							
Orifice Area (sq. inches)	96.00							

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected					
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft^2
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

Calculated Parameters for Vertical Orifice

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 2 Weir	Not Selected					
Overflow Weir Front Edge Height, Ho =	3.50		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	7.50		feet
Overflow Weir Front Edge Length =	16.00		feet	Overflow Weir Slope Length =	12.65		feet
Overflow Weir Grate Slope =	3.00		H:V	Grate Open Area / 100-yr Orifice Area =	6.74		
Horiz. Length of Weir Sides =	12.00		feet	Overflow Grate Open Area w/o Debris =	160.09		ft^2
Overflow Grate Type =	Close Mesh Grate			Overflow Grate Open Area w/ Debris =	80.04		ft^2
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 2 Restrictor	Not Selected					
Depth to Invert of Outlet Pipe =	3.53		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	23.76		ft^2
Outlet Pipe Diameter =	66.00		inches	Outlet Orifice Centroid =	2.75		feet
Restrictor Plate Height Above Pipe Invert =	66.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	8.50	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	1.31	feet
Spillway Crest Length =	65.00	feet	Stage at Top of Freeboard =	10.81	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	1.88	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	12.93	acre-ft

Calculated Parameters for Spillway

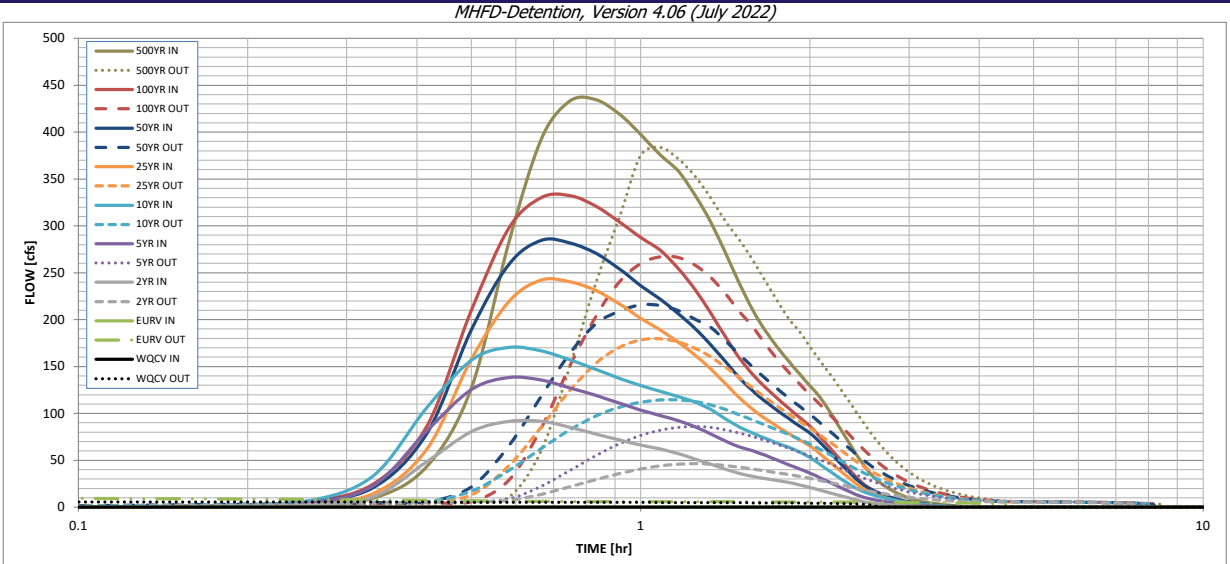
Routed Hydrograph Results

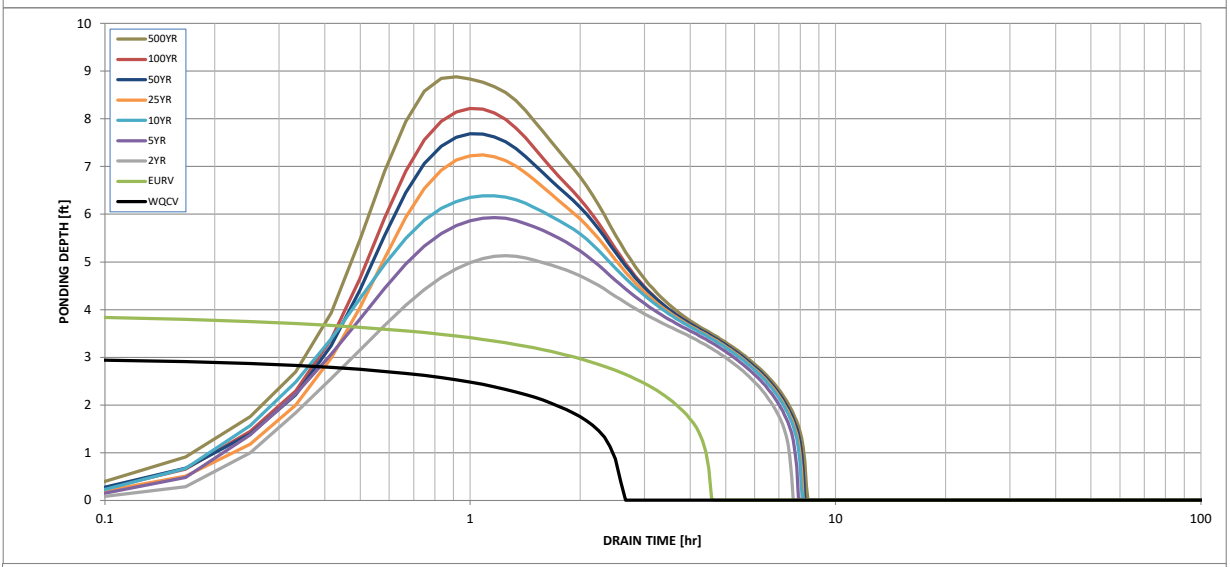
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

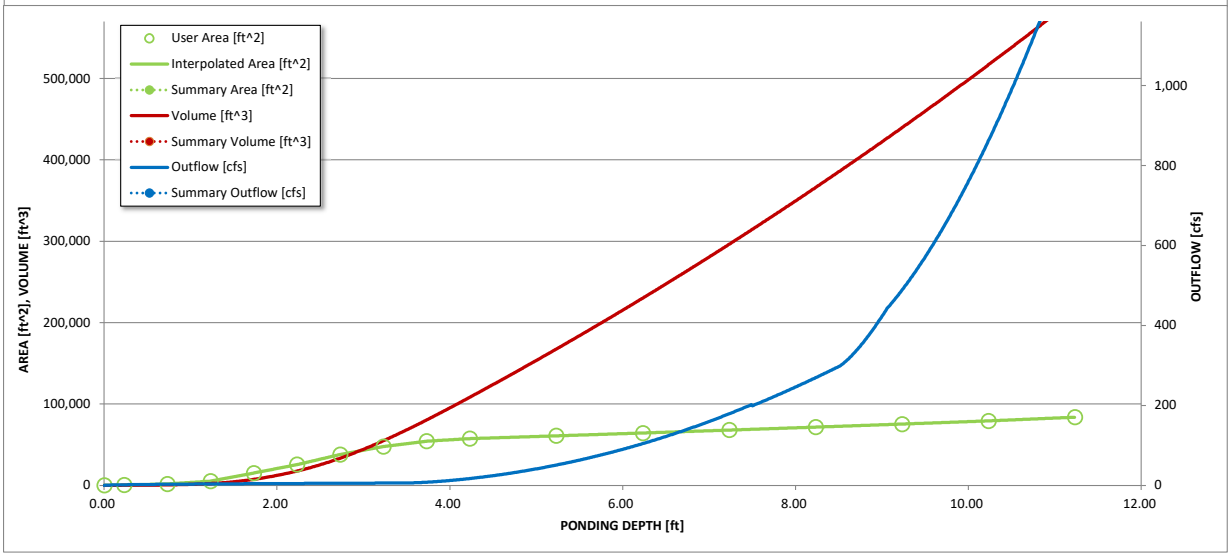
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.93	2.59	3.10	3.78	4.30	4.82	6.07
CUHP Runoff Volume (acre-ft) =	1.023	2.093	8.067	13.117	17.134	22.735	26.986	31.339	41.643
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	8.067	13.117	17.134	22.735	26.986	31.339	41.643
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	69.1	108.9	136.6	202.3	239.6	282.5	373.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.79	1.25	1.56	2.31	2.74	3.23	4.28
Peak Inflow Q (cfs) =	N/A	N/A	91.6	138.2	170.5	242.3	284.7	332.2	434.6
Peak Outflow Q (cfs) =	5.5	10.4	46.4	86.1	114.4	179.6	215.6	267.1	383.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.8	0.9	0.9	0.9	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	0.25	0.5	0.7	1.1	1.3	1.6	2.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	3	4	7	7	7	6	6	6	5
Time to Drain 99% of Inflow Volume (hours) =	**3**	5	7	8	8	7	7	7	7
Maximum Ponding Depth (ft) =	3.01	3.93	5.13	5.93	6.38	7.24	7.68	8.21	8.87
Area at Maximum Ponding Depth (acres) =	1.00	1.28	1.39	1.45	1.49	1.56	1.60	1.64	1.70
Maximum Volume Stored (acre-ft) =	1.029	2.096	3.690	4.826	5.503	6.799	7.510	8.368	9.470

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

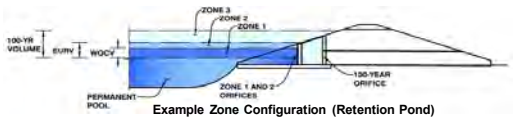
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.19	0.57	0.93	0.99	1.30	1.14	1.76
	0:15:00	0.00	0.00	2.15	3.65	5.61	3.80	5.56	5.37	9.12
	0:20:00	0.00	0.00	10.80	22.33	32.65	13.90	20.35	24.02	43.32
	0:25:00	0.00	0.00	48.44	81.39	106.12	61.79	78.54	86.49	126.92
	0:30:00	0.00	0.00	80.44	125.24	156.68	157.73	189.13	209.85	283.39
	0:35:00	0.00	0.00	91.51	138.16	170.50	219.39	259.24	297.83	393.68
	0:40:00	0.00	0.00	91.59	135.48	166.52	242.27	284.69	330.27	433.30
	0:45:00	0.00	0.00	85.01	126.95	156.96	240.18	281.66	332.19	434.57
	0:50:00	0.00	0.00	77.96	119.11	146.93	230.96	270.67	320.80	419.15
	0:55:00	0.00	0.00	71.60	110.84	137.34	216.80	254.07	304.27	397.48
	1:00:00	0.00	0.00	66.19	103.54	129.68	201.56	236.37	287.61	375.81
	1:05:00	0.00	0.00	62.10	97.68	123.61	189.01	221.82	274.18	358.31
	1:10:00	0.00	0.00	56.99	92.26	117.89	175.71	206.33	254.42	332.65
	1:15:00	0.00	0.00	51.37	85.72	111.98	162.27	190.64	232.04	303.57
	1:20:00	0.00	0.00	45.80	78.00	103.98	147.00	172.86	206.52	270.55
	1:25:00	0.00	0.00	40.45	70.36	94.06	131.51	154.95	181.13	238.14
	1:30:00	0.00	0.00	35.92	64.34	85.52	116.42	137.67	158.78	209.78
	1:35:00	0.00	0.00	32.77	60.10	78.93	104.17	123.78	141.45	188.01
	1:40:00	0.00	0.00	30.36	55.21	73.37	94.42	112.62	127.83	170.75
	1:45:00	0.00	0.00	28.23	50.10	68.38	86.09	103.05	116.05	155.69
	1:50:00	0.00	0.00	26.26	45.27	63.76	78.64	94.44	105.45	142.10
	1:55:00	0.00	0.00	23.73	40.77	58.85	71.79	86.53	95.66	129.49
	2:00:00	0.00	0.00	21.03	36.40	52.85	65.33	79.03	86.41	117.54
	2:05:00	0.00	0.00	18.19	31.50	45.71	57.17	69.20	75.25	102.42
	2:10:00	0.00	0.00	15.39	26.55	38.51	48.53	58.67	63.73	86.57
	2:15:00	0.00	0.00	12.75	21.85	31.74	40.19	48.50	52.57	71.22
	2:20:00	0.00	0.00	10.19	17.41	25.54	32.32	38.96	42.02	56.86
	2:25:00	0.00	0.00	7.77	13.40	20.15	25.02	30.20	32.26	43.97
	2:30:00	0.00	0.00	5.60	10.32	16.18	18.87	22.95	24.07	33.36
	2:35:00	0.00	0.00	4.25	8.28	13.34	14.65	18.05	18.53	26.02
	2:40:00	0.00	0.00	3.38	6.79	11.04	11.58	14.38	14.45	20.50
	2:45:00	0.00	0.00	2.72	5.56	9.08	9.20	11.50	11.22	16.08
	2:50:00	0.00	0.00	2.21	4.52	7.42	7.26	9.14	8.65	12.53
	2:55:00	0.00	0.00	1.78	3.63	6.01	5.74	7.27	6.62	9.71
	3:00:00	0.00	0.00	1.44	2.89	4.84	4.52	5.75	5.05	7.52
	3:05:00	0.00	0.00	1.15	2.27	3.87	3.56	4.58	3.92	5.94
	3:10:00	0.00	0.00	0.93	1.76	3.05	2.82	3.65	3.14	4.80
	3:15:00	0.00	0.00	0.75	1.35	2.37	2.21	2.87	2.51	3.85
	3:20:00	0.00	0.00	0.60	1.01	1.83	1.73	2.25	2.01	3.07
	3:25:00	0.00	0.00	0.46	0.74	1.39	1.32	1.72	1.56	2.37
	3:30:00	0.00	0.00	0.34	0.52	1.03	1.00	1.30	1.17	1.77
	3:35:00	0.00	0.00	0.24	0.34	0.72	0.72	0.93	0.83	1.26
	3:40:00	0.00	0.00	0.15	0.22	0.46	0.49	0.62	0.56	0.83
	3:45:00	0.00	0.00	0.09	0.14	0.27	0.30	0.38	0.33	0.49
	3:50:00	0.00	0.00	0.04	0.08	0.13	0.16	0.19	0.17	0.24
	3:55:00	0.00	0.00	0.02	0.03	0.04	0.06	0.07	0.06	0.07
	4:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Yap International Airport

Basin ID: Outfall 6 Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	36.86	acres
Watershed Length =	2,563	ft
Watershed Length to Centroid =	799	ft
Watershed Slope =	0.016	ft/ft
Watershed Imperviousness =	28.66%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.452	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.956	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.93 in.) =	3.476	acre-feet	1.93	inches
5-yr Runoff Volume (P1 = 2.59 in.) =	5.604	acre-feet	2.59	inches
10-yr Runoff Volume (P1 = 3.1 in.) =	7.297	acre-feet	3.10	inches
25-yr Runoff Volume (P1 = 3.78 in.) =	9.656	acre-feet	3.78	inches
50-yr Runoff Volume (P1 = 4.3 in.) =	11.448	acre-feet	4.30	inches
100-yr Runoff Volume (P1 = 4.82 in.) =	13.280	acre-feet	4.82	inches
500-yr Runoff Volume (P1 = 6.07 in.) =	17.617	acre-feet	6.07	inches
Approximate 2-yr Detention Volume =	1.328	acre-feet		
Approximate 5-yr Detention Volume =	2.390	acre-feet		
Approximate 10-yr Detention Volume =	2.854	acre-feet		
Approximate 25-yr Detention Volume =	3.437	acre-feet		
Approximate 50-yr Detention Volume =	3.636	acre-feet		
Approximate 100-yr Detention Volume =	4.483	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.452	acre-feet
Zone 2 Volume (100-year - Zone 1) =	4.030	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	4.483	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

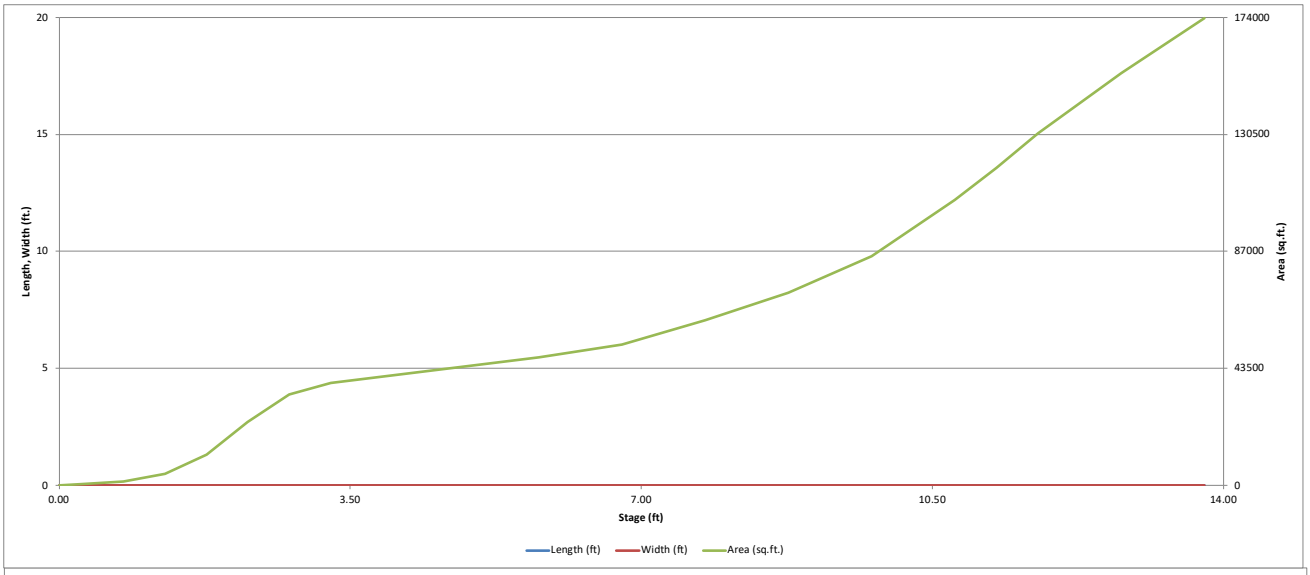
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

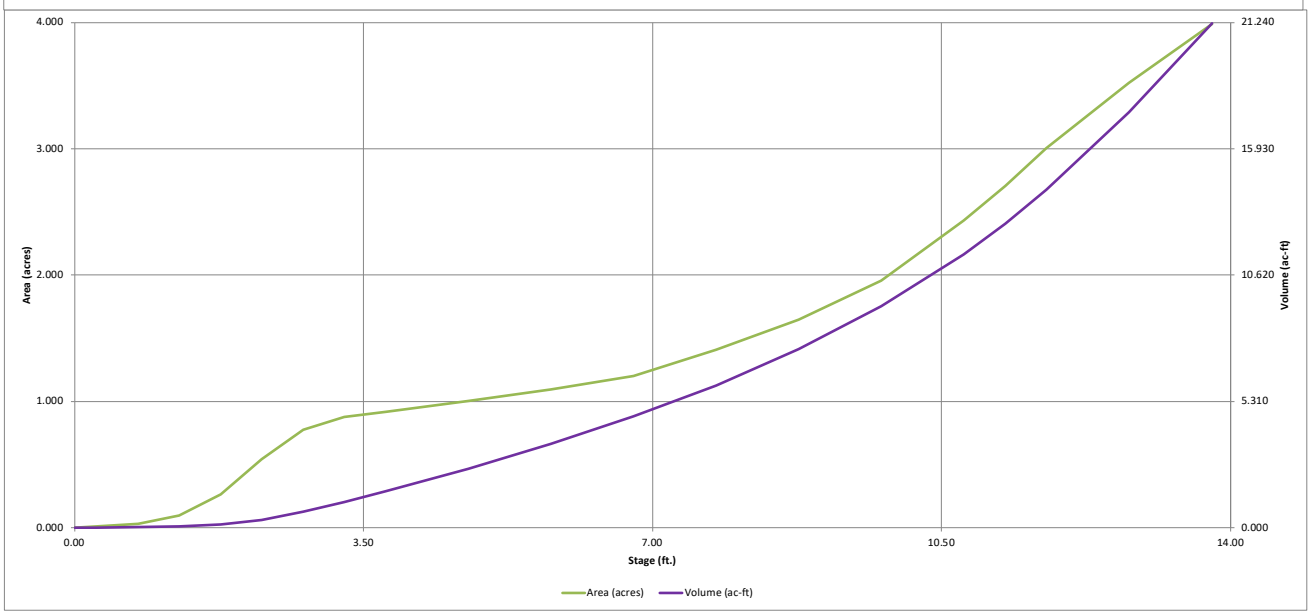
Depth Increment = ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	57	0.001		
67.5	--	0.27	--	--	--	310	0.007	50	0.001
68	--	0.77	--	--	--	1,333	0.031	460	0.011
68.5	--	1.27	--	--	--	4,127	0.095	1,825	0.042
69	--	1.77	--	--	--	11,455	0.263	5,721	0.131
69.5	--	2.27	--	--	--	23,544	0.541	14,471	0.332
70	--	2.77	--	--	--	33,823	0.776	28,813	0.661
70.5	--	3.27	--	--	--	38,093	0.874	46,792	1.074
71	--	3.77	--	--	--	39,904	0.916	66,291	1.522
72	--	4.77	--	--	--	43,628	1.002	108,057	2.481
73	--	5.77	--	--	--	47,548	1.092	153,645	3.527
74	--	6.77	--	--	--	52,345	1.202	203,592	4.674
75	--	7.77	--	--	--	61,247	1.406	260,388	5.978
76	--	8.77	--	--	--	71,657	1.645	326,839	7.503
77	--	9.77	--	--	--	85,136	1.954	405,235	9.303
78	--	10.77	--	--	--	106,008	2.434	500,807	11.497
78.5	--	11.27	--	--	--	117,941	2.708	556,794	12.782
79	--	11.77	--	--	--	130,919	3.005	619,009	14.210
80	--	12.77	--	--	--	153,365	3.521	761,151	17.474
81	--	13.77	--	--	--	173,757	3.989	924,712	21.228

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



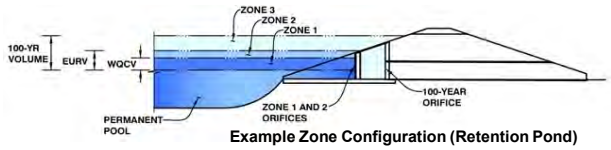


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Yap International Airport**

Basin ID: **Outfall 6 Pond**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.48	0.452	Orifice Plate
Zone 2 (100-year)	6.61	4.030	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)		4.483	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A	ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdrain

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	1.007E-02	ft²
Depth at top of Zone using Orifice Plate =	2.50	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	1.45	sq. inches (diameter = 1-3/8 inches)	Elliptical Slot Area =	N/A	ft²

Calculated Parameters for Plate

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.83	1.67					
Orifice Area (sq. inches)	1.45	1.45	1.45					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected					
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =			ft²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =			feet
Vertical Orifice Diameter =			inches				

Calculated Parameters for Vertical Orifice

Not Selected	Not Selected

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 2 Weir	Not Selected					
Overflow Weir Front Edge Height, Ho =	2.50		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.50		feet
Overflow Weir Front Edge Length =	10.00		feet	Overflow Weir Slope Length =	8.25		feet
Overflow Weir Grate Slope =	4.00		H:V	Grate Open Area / 100-yr Orifice Area =	6.78		
Horiz. Length of Weir Sides =	8.00		feet	Overflow Grate Open Area w/o Debris =	65.23		ft²
Overflow Grate Type =	Close Mesh Grate			Overflow Grate Open Area w/ Debris =	32.61		ft²
Debris Clogging % =	50%		%				

Calculated Parameters for Overflow Weir

Zone 2 Weir	Not Selected

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 2 Restrictor	Not Selected					
Depth to Invert of Outlet Pipe =	2.50		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	9.62		ft²
Outlet Pipe Diameter =	42.00		inches	Outlet Orifice Centroid =	1.75		feet
Restrictor Plate Height Above Pipe Invert =	42.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

Zone 2 Restrictor	Not Selected

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	11.67	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.71	feet
Spillway Crest Length =	50.00	feet	Stage at Top of Freeboard =	13.38	feet
Spillway End Slopes =	50.00	H:V	Basin Area at Top of Freeboard =	3.80	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	19.67	acre-ft

Calculated Parameters for Spillway

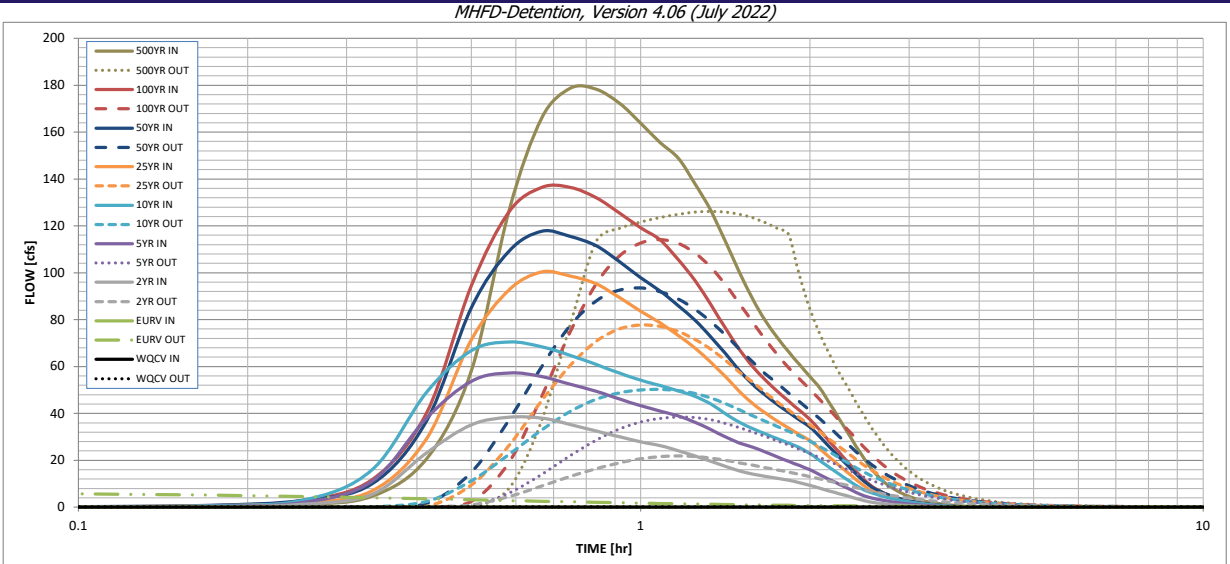
Routed Hydrograph Results

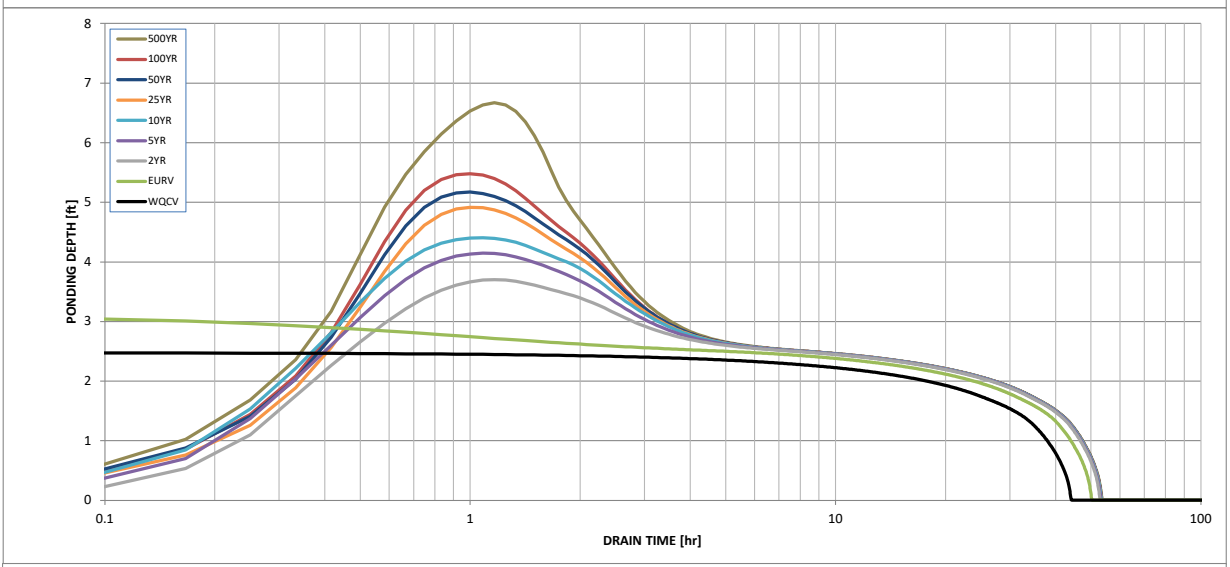
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

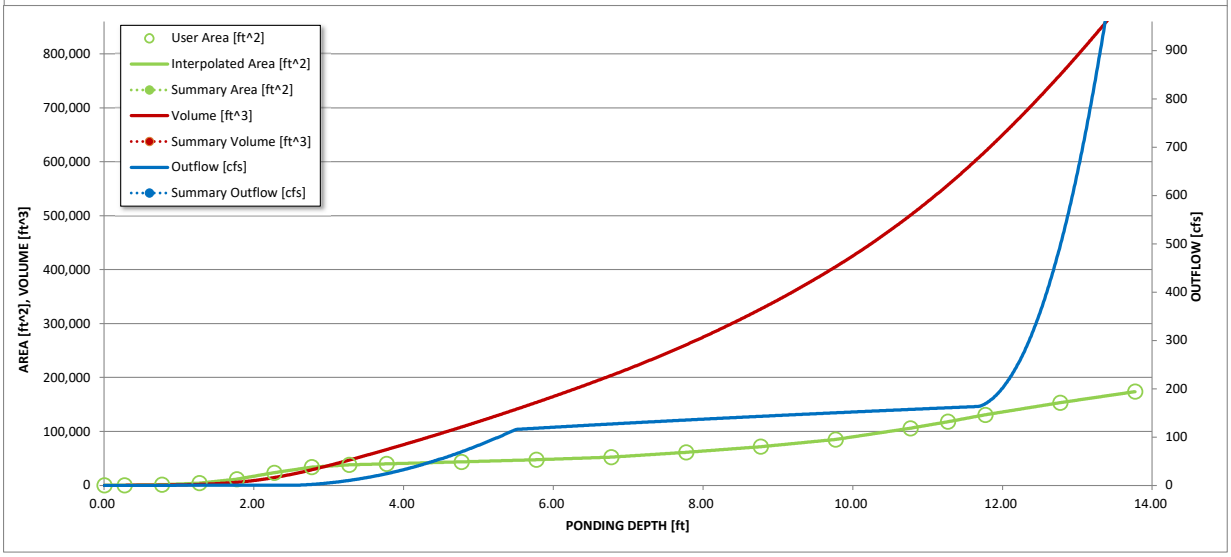
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.93	2.59	3.10	3.78	4.30	4.82	6.07
CUHP Runoff Volume (acre-ft) =	0.452	0.956	3.476	5.604	7.297	9.656	11.448	13.280	17.617
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.476	5.604	7.297	9.656	11.448	13.280	17.617
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	26.7	42.1	52.8	78.5	93.1	110.1	145.7
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.73	1.14	1.43	2.13	2.52	2.99	3.95
Peak Inflow Q (cfs) =	N/A	N/A	38.4	57.3	70.4	100.3	117.7	136.4	178.7
Peak Outflow Q (cfs) =	0.2	6.9	21.9	38.4	50.3	77.7	93.5	114.1	126.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.9	1.0	1.0	1.0	1.0	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	0.11	0.33	0.6	0.8	1.2	1.4	1.7	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	43	36	30	26	21	17	13	6
Time to Drain 99% of Inflow Volume (hours) =	**42**	47	45	42	40	37	35	34	30
Maximum Ponding Depth (ft) =	2.48	3.14	3.70	4.14	4.40	4.91	5.17	5.48	6.67
Area at Maximum Ponding Depth (acres) =	0.64	0.85	0.91	0.95	0.97	1.01	1.04	1.06	1.19
Maximum Volume Stored (acre-ft) =	0.456	0.962	1.458	1.867	2.116	2.622	2.878	3.204	4.542

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

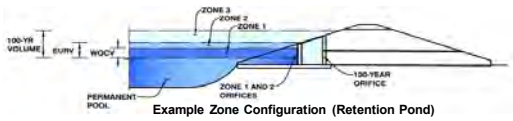
	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.11	0.32	0.53	0.56	0.74	0.65	1.00
	0:15:00	0.00	0.00	1.21	1.93	2.91	1.96	2.84	2.76	4.63
	0:20:00	0.00	0.00	5.52	11.07	15.94	6.93	9.95	11.75	20.80
	0:25:00	0.00	0.00	23.29	38.12	49.14	29.44	36.97	40.42	58.14
	0:30:00	0.00	0.00	35.14	53.72	66.72	71.42	85.12	94.47	126.55
	0:35:00	0.00	0.00	38.37	57.25	70.43	92.68	109.24	126.03	166.03
	0:40:00	0.00	0.00	38.03	55.73	68.38	100.30	117.68	136.41	178.66
	0:45:00	0.00	0.00	35.23	52.42	64.78	98.57	115.49	136.44	178.29
	0:50:00	0.00	0.00	32.49	49.48	60.86	95.31	111.60	132.04	172.35
	0:55:00	0.00	0.00	30.00	46.16	57.17	89.43	104.73	125.50	163.81
	1:00:00	0.00	0.00	27.88	43.30	54.19	83.53	97.89	119.15	155.55
	1:05:00	0.00	0.00	26.27	41.01	51.84	78.65	92.23	114.01	148.87
	1:10:00	0.00	0.00	24.08	38.88	49.60	73.23	85.93	105.54	137.91
	1:15:00	0.00	0.00	21.81	36.20	47.30	67.92	79.74	96.67	126.41
	1:20:00	0.00	0.00	19.56	33.06	43.97	61.71	72.52	86.30	113.01
	1:25:00	0.00	0.00	17.39	29.97	39.79	55.55	65.40	76.22	100.12
	1:30:00	0.00	0.00	15.47	27.39	36.15	49.28	58.22	67.15	88.62
	1:35:00	0.00	0.00	14.15	25.62	33.45	44.10	52.34	59.86	79.47
	1:40:00	0.00	0.00	13.16	23.52	31.22	40.10	47.76	54.23	72.33
	1:45:00	0.00	0.00	12.29	21.45	29.23	36.71	43.87	49.44	66.22
	1:50:00	0.00	0.00	11.49	19.52	27.38	33.71	40.41	45.16	60.73
	1:55:00	0.00	0.00	10.40	17.71	25.37	30.95	37.22	41.21	55.66
	2:00:00	0.00	0.00	9.29	15.94	22.87	28.36	34.23	37.50	50.87
	2:05:00	0.00	0.00	8.08	13.87	19.89	24.88	30.02	32.77	44.44
	2:10:00	0.00	0.00	6.91	11.84	16.96	21.36	25.75	28.07	38.01
	2:15:00	0.00	0.00	5.81	9.91	14.20	17.98	21.64	23.58	31.84
	2:20:00	0.00	0.00	4.75	8.08	11.65	14.79	17.78	19.32	26.03
	2:25:00	0.00	0.00	3.73	6.36	9.31	11.79	14.17	15.30	20.63
	2:30:00	0.00	0.00	2.79	4.85	7.33	9.04	10.93	11.67	15.85
	2:35:00	0.00	0.00	2.07	3.83	5.99	6.86	8.40	8.80	12.16
	2:40:00	0.00	0.00	1.61	3.13	4.98	5.39	6.65	6.81	9.53
	2:45:00	0.00	0.00	1.29	2.58	4.12	4.28	5.31	5.31	7.50
	2:50:00	0.00	0.00	1.05	2.11	3.39	3.40	4.25	4.12	5.88
	2:55:00	0.00	0.00	0.86	1.71	2.77	2.69	3.39	3.18	4.59
	3:00:00	0.00	0.00	0.70	1.37	2.26	2.14	2.70	2.45	3.57
	3:05:00	0.00	0.00	0.56	1.10	1.82	1.70	2.16	1.89	2.81
	3:10:00	0.00	0.00	0.46	0.86	1.45	1.35	1.73	1.49	2.24
	3:15:00	0.00	0.00	0.37	0.67	1.14	1.07	1.37	1.20	1.81
	3:20:00	0.00	0.00	0.30	0.51	0.88	0.84	1.08	0.96	1.45
	3:25:00	0.00	0.00	0.23	0.38	0.68	0.65	0.84	0.76	1.14
	3:30:00	0.00	0.00	0.18	0.27	0.51	0.49	0.64	0.58	0.88
	3:35:00	0.00	0.00	0.13	0.19	0.37	0.37	0.48	0.43	0.64
	3:40:00	0.00	0.00	0.09	0.12	0.25	0.26	0.34	0.30	0.45
	3:45:00	0.00	0.00	0.05	0.08	0.16	0.17	0.22	0.20	0.29
	3:50:00	0.00	0.00	0.03	0.05	0.08	0.10	0.13	0.11	0.16
	3:55:00	0.00	0.00	0.01	0.02	0.04	0.05	0.06	0.05	0.07
	4:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.02
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Yap International Airport

Basin ID: Outfall 6A Pond



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	14.82	acres
Watershed Length =	1,261	ft
Watershed Length to Centroid =	468	ft
Watershed Slope =	0.043	ft/ft
Watershed Imperviousness =	14.09%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

		Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.110 acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.179 acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.93 in.) =	1.166 acre-feet	1.93	inches
5-yr Runoff Volume (P1 = 2.59 in.) =	2.005 acre-feet	2.59	inches
10-yr Runoff Volume (P1 = 3.1 in.) =	2.675 acre-feet	3.10	inches
25-yr Runoff Volume (P1 = 3.78 in.) =	3.619 acre-feet	3.78	inches
50-yr Runoff Volume (P1 = 4.3 in.) =	4.336 acre-feet	4.30	inches
100-yr Runoff Volume (P1 = 4.82 in.) =	5.072 acre-feet	4.82	inches
500-yr Runoff Volume (P1 = 6.07 in.) =	6.810 acre-feet	6.07	inches
Approximate 2-yr Detention Volume =	0.239 acre-feet		
Approximate 5-yr Detention Volume =	0.531 acre-feet		
Approximate 10-yr Detention Volume =	0.686 acre-feet		
Approximate 25-yr Detention Volume =	0.868 acre-feet		
Approximate 50-yr Detention Volume =	0.916 acre-feet		
Approximate 100-yr Detention Volume =	1.231 acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.110	acre-feet
Zone 2 Volume (100-year - Zone 1) =	1.122	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	1.231	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

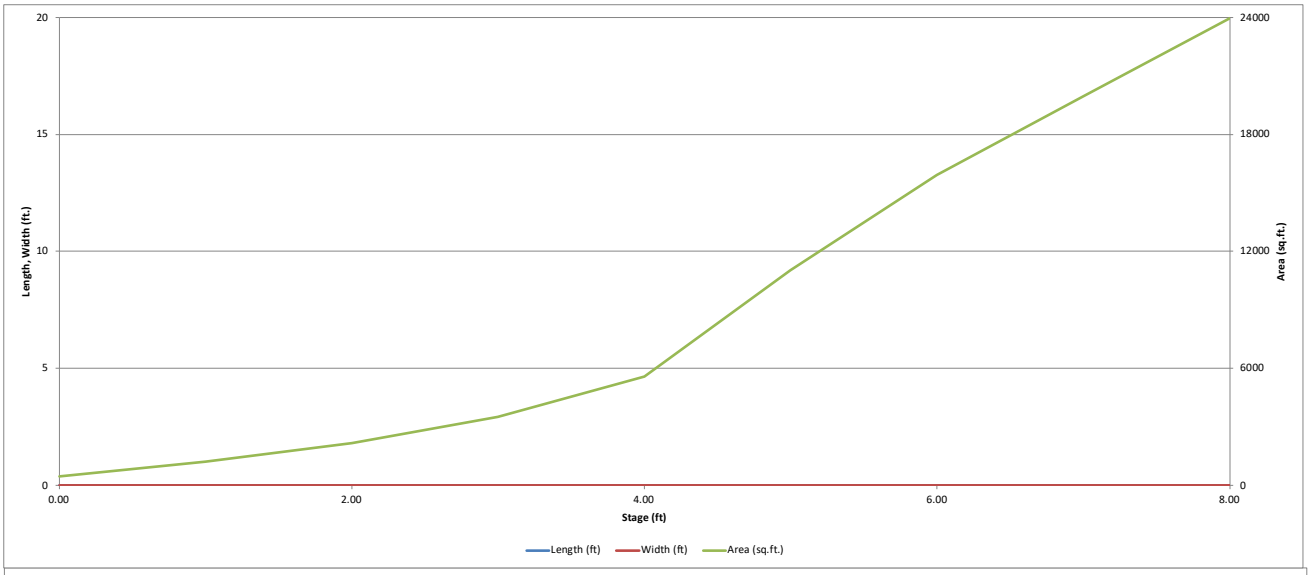
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

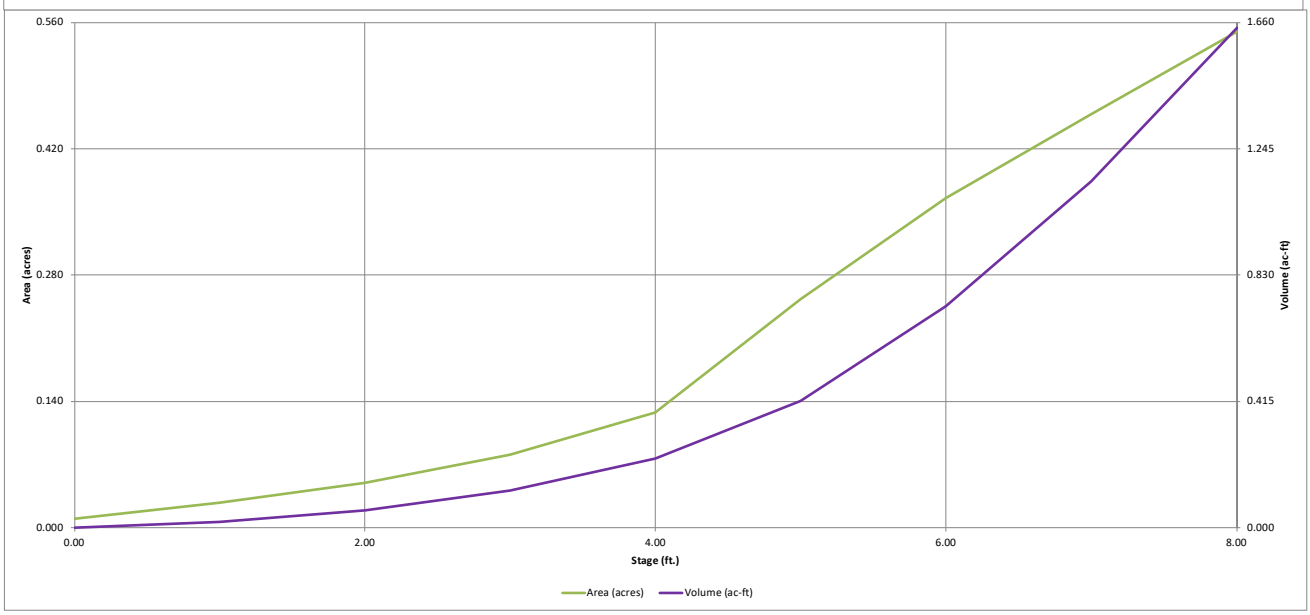
Depth Increment = 1.00 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	450	0.010		
50	--	1.00	--	--	--	1,195	0.027	823	0.019
51	--	2.00	--	--	--	2,155	0.049	2,498	0.057
52	--	3.00	--	--	--	3,507	0.080	5,329	0.122
53	--	4.00	--	--	--	5,570	0.128	9,867	0.227
54	--	5.00	--	--	--	11,039	0.253	18,171	0.417
55	--	6.00	--	--	--	15,912	0.365	31,647	0.727
56	--	7.00	--	--	--	19,962	0.458	49,583	1.138
57	--	8.00	--	--	--	23,961	0.550	71,545	1.642

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)



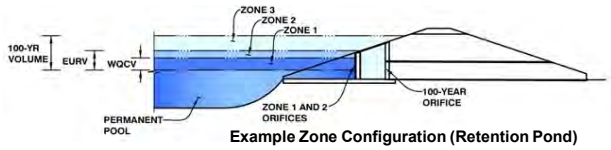


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Yap International Airport**

Basin ID: **Outfall 6A Pond**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.84	0.110	Orifice Plate
Zone 2 (100-year)	7.20	1.122	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)		1.231	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth = ft (distance below the filtration media surface)

Underdrain Orifice Diameter = inches

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²

Underdrain Orifice Centroid = feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)

Depth at top of Zone using Orifice Plate = 3.25 ft (relative to basin bottom at Stage = 0 ft)

Orifice Plate: Orifice Vertical Spacing = N/A inches

Orifice Plate: Orifice Area per Row = 0.57 sq. inches (diameter = 13/16 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row = 3.958E-03 ft²

Elliptical Half-Width = N/A feet

Elliptical Slot Centroid = N/A feet

Elliptical Slot Area = N/A ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.08	2.17					
Orifice Area (sq. inches)	0.57	0.57	0.57					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =			inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =			ft²
Vertical Orifice Centroid =			feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 2 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.25		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	7.00		feet
Overflow Weir Grate Slope =	0.00		H:V
Horiz. Length of Weir Sides =	7.00		feet
Overflow Grate Type =	Close Mesh Grate		
Debris Clogging % =	50%		%

Calculated Parameters for Overflow Weir

	Zone 2 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.25		feet
Overflow Weir Slope Length =	7.00		feet
Grate Open Area / 100-yr Orifice Area =	6.16		
Overflow Grate Open Area w/o Debris =	38.76		ft²
Overflow Grate Open Area w/ Debris =	19.38		ft²

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 2 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.00		ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	36.00		inches
Restrictor Plate Height Above Pipe Invert =	30.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 2 Restrictor	Not Selected	
Outlet Orifice Area =	6.29		ft²
Outlet Orifice Centroid =	1.35		feet
Half-Central Angle of Restrictor Plate on Pipe =	2.30	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage= 4.94 ft (relative to basin bottom at Stage = 0 ft)

Spillway Crest Length = 20.00 feet

Spillway End Slopes = 50.00 H:V

Freeboard above Max Water Surface = 1.00 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth= 0.59 feet

Stage at Top of Freeboard = 6.53 feet

Basin Area at Top of Freeboard = 0.41 acres

Basin Volume at Top of Freeboard = 0.93 acre-ft

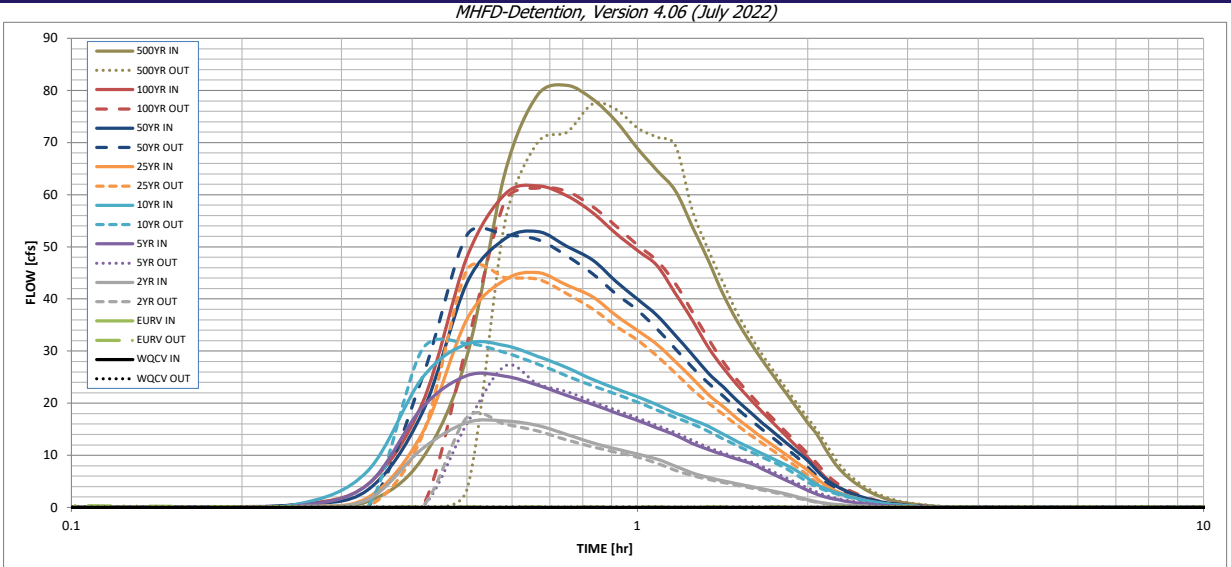
Routed Hydrograph Results

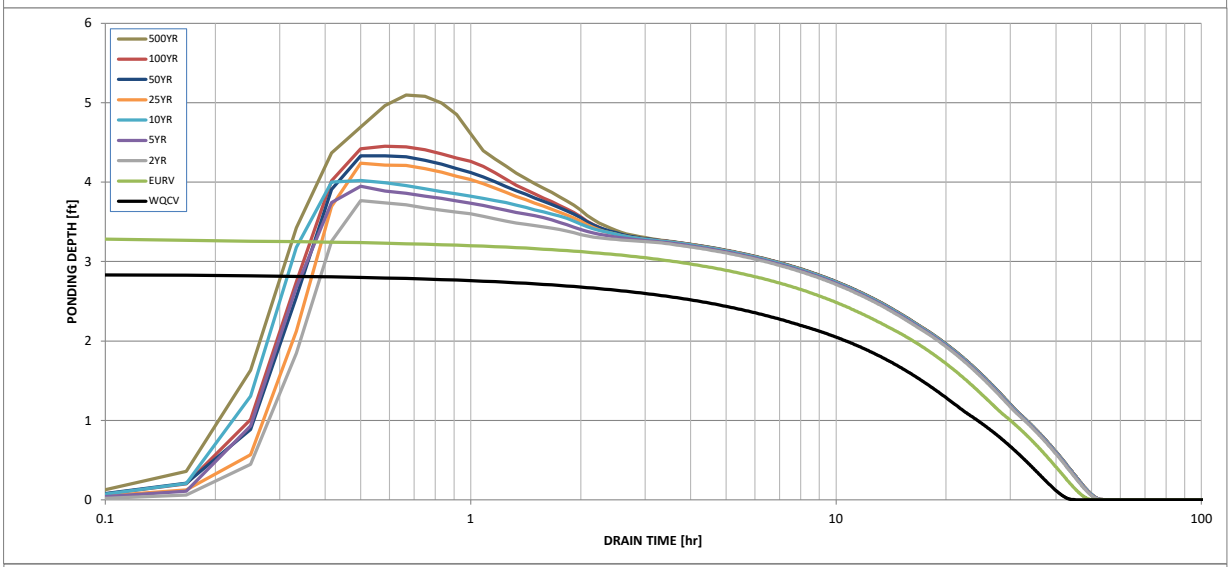
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

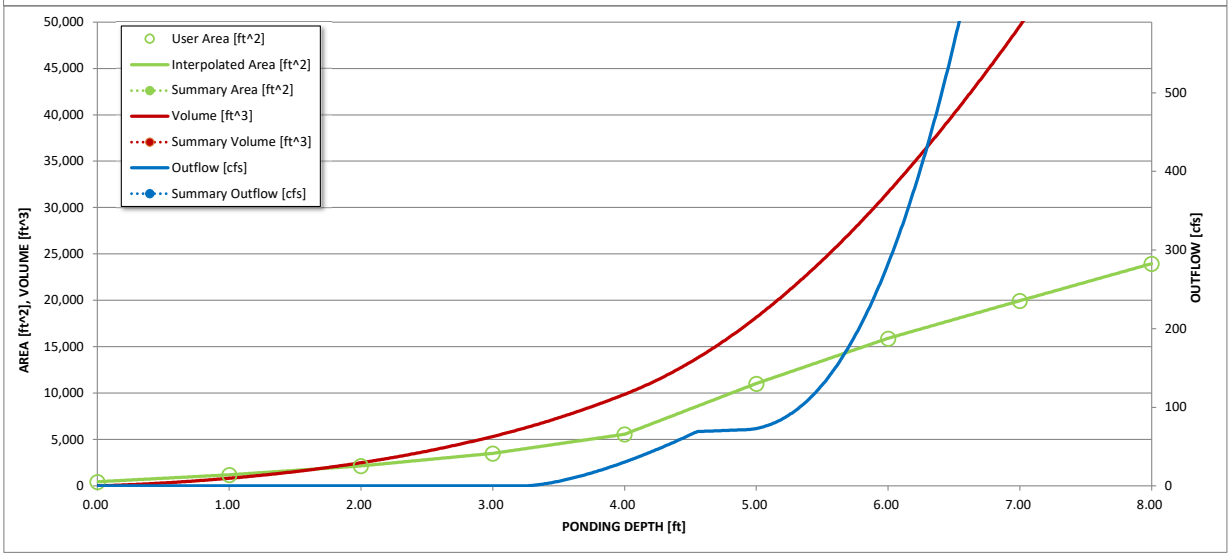
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.93	2.59	3.10	3.78	4.30	4.82	6.07
CUHP Runoff Volume (acre-ft) =	0.110	0.179	1.166	2.005	2.675	3.619	4.336	5.072	6.810
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.166	2.005	2.675	3.619	4.336	5.072	6.810
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	14.9	23.4	29.1	42.8	50.7	59.3	78.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	1.00	1.58	1.97	2.89	3.42	4.00	5.28
Peak Inflow Q (cfs) =	N/A	N/A	16.6	25.3	31.4	45.0	52.9	61.7	81.0
Peak Outflow Q (cfs) =	0.1	4.4	17.2	27.1	31.4	45.6	52.2	61.3	77.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	1.1	1.1	1.0	1.0	1.0
Structure Controlling Flow =	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.25	0.44	0.7	0.8	1.2	1.3	1.6	1.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	41	26	19	14	9	6	3	2
Time to Drain 99% of Inflow Volume (hours) =	**41**	45	38	32	29	26	24	21	17
Maximum Ponding Depth (ft) =	2.85	3.60	3.76	3.95	4.02	4.23	4.33	4.45	5.09
Area at Maximum Ponding Depth (acres) =	0.08	0.11	0.12	0.13	0.13	0.16	0.17	0.18	0.26
Maximum Volume Stored (acre-ft) =	0.111	0.179	0.197	0.219	0.228	0.259	0.274	0.297	0.440

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)







S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.02	0.05	0.07	0.08	0.10	0.09	0.14
	0:15:00	0.00	0.00	0.17	0.28	0.59	0.27	0.55	0.53	1.13
	0:20:00	0.00	0.00	1.48	4.33	6.93	1.84	3.32	4.38	9.33
	0:25:00	0.00	0.00	11.24	19.14	24.83	14.16	18.13	19.90	29.03
	0:30:00	0.00	0.00	16.28	25.26	31.37	36.12	43.08	47.99	64.21
	0:35:00	0.00	0.00	16.59	25.16	31.05	43.68	51.55	60.08	79.15
	0:40:00	0.00	0.00	15.71	23.47	28.99	45.03	52.95	61.71	80.96
	0:45:00	0.00	0.00	13.97	21.48	26.83	42.64	50.11	59.80	78.32
	0:50:00	0.00	0.00	12.40	19.75	24.53	40.39	47.46	56.55	74.08
	0:55:00	0.00	0.00	11.21	18.13	22.79	36.83	43.34	52.53	68.88
	1:00:00	0.00	0.00	10.23	16.68	21.24	33.93	39.95	49.30	64.64
	1:05:00	0.00	0.00	9.27	15.25	19.69	31.28	36.85	46.38	60.78
	1:10:00	0.00	0.00	7.91	13.85	18.13	27.98	33.01	41.06	53.93
	1:15:00	0.00	0.00	6.63	12.31	16.85	24.81	29.36	35.97	47.46
	1:20:00	0.00	0.00	5.75	11.09	15.58	21.68	25.78	30.77	40.88
	1:25:00	0.00	0.00	5.10	10.12	14.06	19.37	23.13	26.79	35.81
	1:30:00	0.00	0.00	4.53	9.26	12.67	17.09	20.51	23.52	31.64
	1:35:00	0.00	0.00	4.02	8.47	11.41	15.09	18.21	20.72	28.05
	1:40:00	0.00	0.00	3.53	7.32	10.25	13.27	16.11	18.18	24.78
	1:45:00	0.00	0.00	3.05	6.22	9.15	11.62	14.20	15.84	21.77
	1:50:00	0.00	0.00	2.58	5.18	8.11	10.04	12.37	13.62	18.90
	1:55:00	0.00	0.00	2.03	4.20	6.94	8.55	10.62	11.54	16.20
	2:00:00	0.00	0.00	1.50	3.28	5.56	7.11	8.97	9.59	13.70
	2:05:00	0.00	0.00	1.02	2.44	4.30	5.38	6.86	7.28	10.55
	2:10:00	0.00	0.00	0.74	1.89	3.45	4.01	5.18	5.41	7.98
	2:15:00	0.00	0.00	0.56	1.50	2.81	3.08	4.02	4.12	6.16
	2:20:00	0.00	0.00	0.44	1.19	2.29	2.40	3.17	3.16	4.80
	2:25:00	0.00	0.00	0.34	0.95	1.85	1.88	2.50	2.42	3.72
	2:30:00	0.00	0.00	0.26	0.75	1.48	1.46	1.96	1.84	2.88
	2:35:00	0.00	0.00	0.20	0.58	1.16	1.13	1.53	1.38	2.19
	2:40:00	0.00	0.00	0.15	0.44	0.90	0.86	1.18	1.02	1.66
	2:45:00	0.00	0.00	0.12	0.33	0.69	0.65	0.90	0.76	1.26
	2:50:00	0.00	0.00	0.09	0.24	0.53	0.50	0.69	0.59	0.99
	2:55:00	0.00	0.00	0.07	0.18	0.40	0.38	0.54	0.47	0.79
	3:00:00	0.00	0.00	0.05	0.12	0.30	0.30	0.42	0.37	0.63
	3:05:00	0.00	0.00	0.04	0.08	0.23	0.22	0.32	0.29	0.48
	3:10:00	0.00	0.00	0.03	0.05	0.16	0.17	0.24	0.21	0.36
	3:15:00	0.00	0.00	0.02	0.03	0.10	0.12	0.17	0.15	0.25
	3:20:00	0.00	0.00	0.01	0.02	0.06	0.08	0.11	0.10	0.16
	3:25:00	0.00	0.00	0.00	0.01	0.03	0.04	0.06	0.06	0.09
	3:30:00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.04
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Pond Spillway Riprap

Pond	S	C_f	Undetained Q_{100}	Spillway Width	q_{100}	Calculated D_{50}	D_{50}
	(ft/ft)		(cfs)	(ft)	(cfs/ft)	(in)	(in)
Outfall 3	0.333	2.0	408.7	60	6.81	16.65	18
Outfall 4	0.333	2.0	332.7	62	5.37	14.57	18
Outfall 5	0.333	2.0	345.4	65	5.31	14.49	18

$$D_{50} = 5.23\ S^{0.43}\ (1.35 C_f\, q)^{0.56}$$

Where:

D_{50} = median rock size (in)

S = longitudinal slope (ft/ft)

C_f = concentration factor (1.0 to 3.0)

q = unit discharge (cfs/ft)

When:

η (porosity) = 0.0 (i.e., for buried soil riprap)

Equation from *Development of Riprap Testing in Flumes: Phase II Follow-up Investigations* (Apt et al. 1988)

DITCH CALCULATIONS

CLIN BA01 AWARDED

Yap International Airport - CLIN BA01 Awarded (Parallel Taxiway Included)
Ditch Flow Parameters

	From		To					
Basin	Station	Offset (ft)	Station	Offset (ft)	Flow, Q5 (cfs)	Flow, Q10 (cfs)	Flow, Q50 (cfs)	Flow, Q100 (cfs)
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)								
A-1-1s	309+70.38	86.44 L	306+72.50	12.00 R	1.25	2.08	5.01	6.46
A-2-3	309+70.38	86.44 L	330+00.00	97.60 L	11.41	19.72	49.22	63.97
A-3-5	330+00.00	97.60 L	342+70.76	97.60 L	8.88	15.19	37.51	48.66
A-3-5	344+52.17	97.60 L	342+70.76	97.60 L	*	*	*	*
A-3-4	351+50.00	97.60 L	346+05.00	97.60 L	6.65	10.59	24.18	30.87
A-3-4	344+52.17	97.60 L	346+05.00	97.60 L	*	*	*	*
A-3-8	351+50.00	97.60 L	352+48.17	97.60 L	*	*	*	*
A-3-8	360+71.50	97.60 L	352+48.17	97.60 L	7.18	12.46	31.37	40.76
A-3-15	362+05.00	97.60 L	360+71.50	97.60 L	1.31	1.95	4.04	5.07
A-3-10	365+40.00	97.60 L	362+05.00	97.60 L	2.60	4.34	10.46	13.51
A-3-12	365+40.00	97.60 L	366+70.00	97.60 L	*	*	*	*
A-3-12	373+10.00	97.60 L	366+70.00	97.60 L	6.40	9.93	21.89	27.75
A-4-16	373+70.00	97.60 L	374+78.15	97.60 L	*	*	*	*
A-4-16	379+08.56	97.60 L	374+78.15	97.60 L	4.56	6.47	12.52	15.45
A-4-14	379+08.56	97.60 L	380+12.13	97.50 L	*	*	*	*
A-4-14	386+27.40	187.50 L	380+12.13	97.50 L	5.50	7.46	13.28	16.13
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)								
A-2-5	111+64.00	254.90 L	120+00.00	254.90 L	18.93	25.44	44.34	53.61
A-2-4	120+00.00	254.90 L	130+80.00	254.90 L	15.82	21.80	39.77	48.63
A-3-14	131+30.00	254.90 L	139+80.00	254.90 L	12.29	17.14	31.99	39.31
A-3-7	139+80.00	254.90 L	144+50.00	254.90 L	8.50	11.81	21.93	26.91
A-3-7	152+49.22	254.90 L	144+50.00	254.90 L	12.74	17.71	32.89	40.36
A-3-9	158+20.84	254.90 L	152+49.22	254.90 L	13.17	17.77	31.19	37.78
A-3-11	167+44.00	255.00 L	162+10.00	255.00 L	12.72	17.13	30.02	36.34
A-3-13	172+90.00	255.00 L	167+44.00	255.00 L	7.67	10.74	20.19	24.85
A-4-12	172+90.00	255.00 L	174+86.29	252.84 L	*	*	*	*
A-4-12	180+10.00	255.00 L	174+86.29	252.84 L	12.15	16.67	30.26	36.94
A-4-15	183+74.42	255.00 L	180+10.00	255.00 L	11.03	14.60	24.77	29.73
A-5-19	186+90.00	255.00 L	189+27.00	255.00 L	29.57	37.48	57.80	67.59
A-5-19	190+79.20	255.00 L	189+27.00	255.00 L	29.57	37.48	57.80	67.59
A-5-17	194+84.00	255.00 L	190+79.20	255.00 L	23.10	29.44	46.01	54.01
A-5-20	198+09.20	255.00 L	194+84.00	255.00 L	23.65	30.01	46.44	54.30
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)								
A-1-2	101+53.72	255.00 R	111+64.00	255.00 R	5.06	9.98	28.19	37.33
A-O2A	111+64.00	255.00 R	120+00.00	255.00 R	11.95	17.97	37.82	47.66
A-4-13s	177+38.56	255.00 R	172+53.84	255.00 R	6.78	9.82	19.56	24.37
A-4-18s	186+30.10	255.00 R	180+21.64	255.00 R	7.00	10.74	23.20	29.40
A-5-18	200+00.00	255.00 R	186+30.10	255.00 R	8.48	13.91	32.82	42.20
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)								
A-O6AP-s	823+37.96	23.97 R	830+70.68	49.98 R	2.95	5.14	12.95	16.85
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)								
A-7-1s1	386+89.55	465.50 L	396+39.17	497.07 L	30.87	41.92	74.60	90.63

Yap International Airport - CLIN BA01 Awarded (Parallel Taxiway Included)
Ditch Flow Parameters

	From		To					
Basin	Station	Offset (ft)	Station	Offset (ft)	Flow, Q5 (cfs)	Flow, Q10 (cfs)	Flow, Q50 (cfs)	Flow, Q100 (cfs)
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)								
A-5-16	386+27.40	401.50	386+27.40	187.50 L	1.75	2.70	5.91	7.48
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)								
A-O6P-s1	902+68.08	51.79 L	400+37.30	306.19 L	35.57	49.59	92.62	113.79
	400+37.30	306.19 L	400+64.36	252.86 L	35.57	49.59	92.62	113.79
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)								
A-O6P-s2	407+95.59	75.37 R	403+12.75	50.80 L	4.70	9.49	27.31	36.25
	403+12.75	50.80 L	402+94.58	87.55 L	4.70	9.49	27.31	36.25
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)								
A-4-13	172+77.89	325.40 R	174+90.22	450.50 R	8.60	13.19	28.53	36.16
A-4-18	179+41.91	315.30 R	177+00.55	451.44 R	7.60	12.09	27.40	35.03
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)								
A-O6AP	202+62.27	404.55 R	205+27.77	462.69 R	8.85	16.64	45.09	59.36
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)								
A-6-4	830+76.45	32.32 L	829+97.98	153.55 L	0.08	0.27	1.04	1.43
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)								
A-6-1s3	816+46.78	78.31 L	814+20.05	143.46 L	0.45	1.55	5.90	8.09
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)								
A-5-24	382+99.95	608.19 L	386+30.00	464.00 L	4.58	8.32	21.96	28.69
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)								
A-4-1s	375+39.04	262.25 L	373+56.59	296.96 L	0.71	2.41	9.18	12.59
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)								
A-6-1s1	800+25.00	20.79 L	813+07.45	195.25 L	2.74	6.39	20.30	27.29
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)								
A-6-1s2	809+19.51	24.14 L	813+60.10	140.00 L	0.40	1.22	4.49	6.12
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)								
A-7-1s2	900+22.00	151.15 R	902+53.66	35.01 R	3.21	4.99	11.03	14.03
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)								
A-6-2	824+19.16	45.77 L	829+55.89	144.48 L	0.45	1.54	5.88	8.07
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)								
A-6-3	824+99.06	86.42 L	829+31.25	192.93 L	1.25	1.93	4.19	5.32

* A portion of the overall basin with no separate hydrologic calculations.

Yap International Airport - CLIN BA01 Awarded
Ditch Characteristics

Basin	End Station	Offset	Flow, Q5 (cfs)	Flow, Q10 (cfs)	Flow, Q50 (cfs)	Flow, Q100 (cfs)	Max. Longitudinal slope (ft/ft)	Min. Longitudinal slope (ft/ft)	Bottom Width (ft)	Left Slope	Right Slope	Left H:V	Right H:V	Required 5-Yr Ditch Depth with 1' of Freeboard (ft)	Required 10-Yr Ditch Depth with 1' of Freeboard (ft)	Required 50-Yr Ditch Depth with 1' of Freeboard (ft)	Required 100-Yr Ditch Depth with 1' of Freeboard (ft)
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																	
A-1-1s	306+72.50	12.00 R	1.25	2.08	5.01	6.46	0.0136	0.0020	8	25%	25%	4	4	1.12	1.16	1.28	1.32
A-2-3	330+00.00	97.60 L	11.41	19.72	49.22	63.97	0.0070	0.0032	8	25%	25%	4	4	1.39	1.53	1.87	2.00
A-3-5	342+70.76	97.60 L	8.88	15.19	37.51	48.66	0.0050	0.0032	8	25%	25%	4	4	1.33	1.45	1.75	1.87
A-3-5	342+70.76	97.60 L	*	*	*	*	0.0020	0.0020	8	25%	25%	4	4				
A-3-4	346+05.00	97.60 L	6.65	10.59	24.18	30.87	0.0020	0.0020	8	25%	25%	4	4	1.32	1.42	1.67	1.77
A-3-4	346+05.00	97.60 L	*	*	*	*	0.0030	0.0030	8	25%	25%	4	4				
A-3-8	352+48.17	97.60 L	*	*	*	*	0.0020	0.0020	8	25%	25%	4	4				
A-3-8	352+48.17	97.60 L	7.18	12.46	31.37	40.76	0.0023	0.0020	8	25%	25%	4	4	1.34	1.46	1.78	1.89
A-3-15	360+71.50	97.60 L	1.31	1.95	4.04	5.07	0.0023	0.0023	8	25%	25%	4	4	1.12	1.15	1.23	1.27
A-3-10	362+05.00	97.60 L	2.60	4.34	10.46	13.51	0.0027	0.0027	8	25%	25%	4	4	1.17	1.23	1.39	1.45
A-3-12	366+70.00	97.60 L	*	*	*	*	0.0020	0.0020	8	25%	25%	4	4				
A-3-12	366+70.00	97.60 L	6.40	9.93	21.89	27.75	0.0020	0.0020	8	25%	25%	4	4	1.32	1.41	1.64	1.73
A-4-16	374+78.15	97.60 L	*	*	*	*	0.0022	0.0022	8	25%	25%	4	4				
A-4-16	374+78.15	97.60 L	4.56	6.47	12.52	15.45	0.0020	0.0020	8	25%	25%	4	4	1.26	1.32	1.47	1.52
A-4-14	380+12.13	97.50 L	*	*	*	*	0.0020	0.0020	8	25%	25%	4	4				
A-4-14	380+12.13	97.50 L	5.50	7.46	13.28	16.13	0.0128	0.0029	8	25%	25%	4	4	1.26	1.31	1.43	1.48
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																	
A-2-5	120+00.00	254.90 L	18.93	25.44	44.34	53.61	0.0032	0.0032	0	2.5%	5%	40	20	1.68	1.76	1.93	2.00
A-2-4	130+80.00	254.90 L	15.82	21.80	39.77	48.63	0.0080	0.0032	0	2.5%	5%	40	20	1.64	1.72	1.90	1.97
A-3-14	139+80.00	254.90 L	12.29	17.14	31.99	39.31	0.0032	0.0032	0	2.5%	5%	40	20	1.58	1.65	1.83	1.89
A-3-7	144+50.00	254.90 L	8.50	11.81	21.93	26.91	0.0032	0.0024	0	2.5%	5%	40	20	1.58	1.65	1.83	1.89
A-3-7	144+50.00	254.90 L	12.74	17.71	32.89	40.36	0.0032	0.0024	0	2.5%	5%	40	20	1.62	1.70	1.88	1.95
A-3-9	152+49.22	254.90 L	13.17	17.77	31.19	37.78	0.0024	0.0024	0	2.5%	5%	40	20	1.63	1.70	1.86	1.93
A-3-11	162+10.00	255.00 L	12.72	17.13	30.02	36.34	0.0020	0.0020	0	2.5%	5%	40	20	1.64	1.71	1.88	1.95
A-3-13	167+44.00	255.00 L	7.67	10.74	20.19	24.85	0.0020	0.0020	0	2.5%	5%	40	20	1.53	1.60	1.76	1.82
A-4-12	174+86.29	252.84 L	*	*	*	*	0.0020	0.0020	0	2.5%	5%	40	20				
A-4-12	174+86.29	252.84 L	12.15	16.67	30.26	36.94	0.0020	0.0020	0	2.5%	5%	40	20	1.61	1.67	1.82	1.88
A-4-15	180+10.00	255.00 L	11.03	14.60	24.77	29.73	0.0020	0.0020	0	2.5%	5%	40	20	1.61	1.67	1.82	1.88
A-5-19	189+27.00	255.00 L	29.57	37.48	57.80	67.59	0.0020	0.0020	0	2.5%	5%	40	20	1.88	1.96	2.13	2.20
A-5-17	190+79.20	255.00 L	23.10	29.44	46.01	54.01	0.0020	0.0020	0	2.5%	5%	40	20	1.80	1.88	2.04	2.10
A-5-20	194+84.00	255.00 L	23.65	30.01	46.44	54.30	0.0020	0.0020	0	2.5%	5%	40	20	1.81	1.88	2.04	2.10
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																	
A-1-2	111+64.00	255.00 R	5.06	9.98	28.19	37.33	0.0400	0.0023	0	2.0%	1%	50	100	1.31	1.40	1.60	1.66
A-O2A	120+00.00	255.00 R	11.95	17.97	37.82	47.66	0.0032	0.0032	0	2.0%	1%	50	100	1.41	1.47	1.62	1.68
A-4-13s	172+53.84	255.00 R	6.78	9.82	19.56	24.37	0.4199	0.0020	0	2.0%	1%	50	100	1.36	1.41	1.53	1.58
A-4-18s	180+21.64	255.00 R	7.00	10.74	23.20	29.40	0.0020	0.0020	0	2.0%	1%	50	100	1.36	1.43	1.57	1.62
A-5-18	186+30.10	255.00 R	8.48	13.91	32.82	42.20	0.0020	0.0020	0	2.0%	1%	50	100	1.39	1.47	1.65	1.71
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																	
A-O6AP-s	830+70.68	49.98 R	2.95	5.14	12.95	16.85	0.0512	0.0020	0	33%	25%	3	4	1.84	2.03	2.45	2.61
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																	
A-7-1s1	396+39.17	497.07 L	30.87	41.92	74.60	90.63	0.0904	0.0020	8	25%	10%	4	10	1.72	1.84	2.12	2.23
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																	
A-5-16	386+27.40	187.50 L	1.75	2.70	5.91	7.48	0.0100	0.0088	8	25%	10%	4	10	1.09	1.12	1.19	1.22
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																	
A-O6P-s1	400+37.30	306.19 L	35.57	49.59	92.62	113.79	0.0250	0.0250	8	25%	10%	4	10	1.62	1.74	2.01	2.12
A-O6P-s1	400+64.36	252.86 L	35.57	49.59	92.62	113.79	0.1108	0.1108	8	25%	10%	4	10	1.42	1.50	1.69	1.77

Yap International Airport - CLIN BA01 Awarded
Ditch Characteristics

Basin	End Station	Offset	Flow, Q5 (cfs)	Flow, Q10 (cfs)	Flow, Q50 (cfs)	Flow, Q100 (cfs)	Max. Longitudinal slope (ft/ft)	Min. Longitudinal slope (ft/ft)	Bottom Width (ft)	Left Slope	Right Slope	Left H:V	Right H:V	Required 5-Yr Ditch Depth with 1' of Freeboard (ft)	Required 10-Yr Ditch Depth with 1' of Freeboard (ft)	Required 50-Yr Ditch Depth with 1' of Freeboard (ft)	Required 100-Yr Ditch Depth with 1' of Freeboard (ft)
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																	
A-O6P-s2	403+12.75	50.80 L	4.70	9.49	27.31	36.25	0.0649	0.0100	4	25%	25%	4	4	1.38	1.56	1.96	2.10
A-O6P-s2	402+94.58	87.55 L	4.70	9.49	27.31	36.25	0.1298	0.0969	4	25%	25%	4	4	1.20	1.30	1.54	1.62
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																	
A-4-13	174+90.22	450.50 R	8.60	13.19	28.53	36.16	0.2865	0.1119	0	33%	33%	3	3	1.62	1.73	1.98	2.07
A-4-18	177+00.55	451.44 R	7.60	12.09	27.40	35.03	0.3311	0.0926	0	33%	33%	3	3	1.62	1.73	2.00	2.09
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																	
A-O6AP	205+27.77	462.69 R	8.85	16.64	45.09	59.36	0.1383	0.0478	0	33%	33%	3	3	1.74	1.94	2.36	2.51
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																	
A-6-4	829+97.98	153.55 L	0.08	0.27	1.04	1.43	0.2413	0.1424	0	33%	33%	3	3	1.10	1.16	1.27	1.30
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																	
A-6-1s3	814+20.05	143.46 L	0.45	1.55	5.90	8.09	0.1625	0.0265	0	33%	33%	3	3	1.27	1.43	1.71	1.80
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																	
A-5-24	386+30.00	464.00 L	4.58	8.32	21.96	28.69	0.2388	0.0704	0	33%	33%	3	3	1.54	1.67	1.97	2.07
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																	
A-4-1s	373+56.59	296.96 L	0.71	2.41	9.18	12.59	0.0654	0.0653	0	33%	33%	3	3	1.27	1.43	1.71	1.80
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																	
A-6-1s1	813+07.45	195.25 L	2.74	6.39	20.30	27.29	0.2160	0.0200	0	33%	33%	3	3	1.56	1.77	2.19	2.33
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																	
A-6-1s2	813+60.10	140.00 L	0.40	1.22	4.49	6.12	0.1230	0.0200	0	33%	33%	3	3	1.27	1.41	1.67	1.76
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																	
A-7-1s2	902+53.66	35.01 R	3.21	4.99	11.03	14.03	0.1030	0.0062	0	33%	33%	3	3	1.74	1.87	2.18	2.29
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																	
A-6-2	829+55.89	144.48 L	0.45	1.54	5.88	8.07	0.1003	0.0274	0	25%	25%	4	4	1.24	1.38	1.63	2.16
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																	
A-6-3	829+31.25	192.93 L	1.25	1.93	4.19	5.32	0.1040	0.0274	0	25%	25%	4	4	1.35	1.41	1.55	1.61

* A portion of the overall basin with no separate hydrologic calculations.

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 5-year Ditch Capacity Analysis Solver for Shear

Station	Offset	Recurrence (years)	Flow, Q5 (cfs)	**Max. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	Water Depth, D (ft)	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q5 (cfs)	Velocity, V5 (fps)	Top Width, T (ft)	Froude Number, F	Check	**Shear Stress (lb/sf)**	Ditch Lining
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																			
306+72.50	12.00 R	5	1.25	**0.0136**	0.013	4	4	8	0.07	0.57	8.57	0.07	1.25	2.19	8.55	1.50	OK	**0.06**	Concrete
330+00.00	97.60 L	5	11.41	**0.0070**	0.013	4	4	8	0.31	2.85	10.54	0.27	11.41	4.01	10.47	1.35	OK	**0.14**	Concrete
342+70.76	97.60 L	5	8.88	**0.0050**	0.013	4	4	8	0.29	2.70	10.43	0.26	8.88	3.29	10.35	1.14	OK	**0.09**	Concrete
342+70.76	97.60 L	5	*	**0.0020**	0.013	4	4	8											Concrete
346+05.00	97.60 L	5	6.65	**0.0020**	0.013	4	4	8	0.32	3.01	10.67	0.28	6.65	2.21	10.59	0.73	OK	**0.04**	Concrete
346+05.00	97.60 L	5	*	**0.0030**	0.013	4	4	8											Concrete
352+48.17	97.60 L	5	*	**0.0020**	0.013	4	4	8											Concrete
352+48.17	97.60 L	5	7.18	**0.0023**	0.013	4	4	8	0.33	3.03	10.68	0.28	7.18	2.37	10.60	0.78	OK	**0.05**	Concrete
362+05.00	97.60 L	5	2.60	**0.0023**	0.013	4	4	8	0.18	1.57	9.48	0.17	2.60	1.66	9.44	0.72	OK	**0.03**	Concrete
366+70.00	97.60 L	5	*	**0.0027**	0.013	4	4	8											Concrete
366+70.00	97.60 L	5	6.40	**0.0020**	0.013	4	4	8	0.32	2.94	10.62	0.28	6.40	2.18	10.54	0.73	OK	**0.04**	Concrete
374+78.15	97.60 L	5	*	**0.0020**	0.013	4	4	8											Concrete
374+78.15	97.60 L	5	1.31	**0.0022**	0.013	4	4	8	0.12	1.03	9.00	0.11	1.31	1.27	8.97	0.66	OK	**0.02**	Concrete
374+78.15	97.60 L	5	4.56	**0.0020**	0.013	4	4	8	0.26	2.36	10.15	0.23	4.56	1.94	10.08	0.71	OK	**0.03**	Concrete
380+12.13	97.50 L	5	*	**0.0020**	0.013	4	4	8											Concrete
380+12.13	97.50 L	5	5.50	**0.0128**	0.013	4	4	8	0.17	1.46	9.39	0.16	5.50	3.75	9.35	1.67	OK	**0.14**	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																			
120+00.00	254.90 L	5	18.93	**0.0032**	0.030	40	20	0	0.68	13.85	40.79	0.34	18.93	1.37	40.77	0.41	OK	**0.14**	Grass w/ 4' concrete pan
130+80.00	254.90 L	5	15.82	**0.0080**	0.030	40	20	0	0.53	8.59	32.12	0.27	15.82	1.84	32.10	0.63	OK	**0.28**	Grass w/ 4' concrete pan
139+80.00	254.90 L	5	12.29	**0.0032**	0.030	40	20	0	0.58	10.02	34.69	0.29	12.29	1.23	34.67	0.40	OK	**0.12**	Grass w/ 4' concrete pan
144+50.00	254.90 L	5	8.50	**0.0032**	0.030	40	20	0	0.50	7.59	30.21	0.25	8.50	1.12	30.19	0.39	OK	**0.10**	Grass w/ 4' concrete pan
144+50.00	254.90 L	5	12.74	**0.0032**	0.030	40	20	0	0.59	10.29	35.17	0.29	12.74	1.24	35.14	0.40	OK	**0.12**	Grass w/ 4' concrete pan
152+49.22	254.90 L	5	13.17	**0.0024**	0.030	40	20	0	0.63	11.75	37.58	0.31	13.17	1.12	37.55	0.35	OK	**0.10**	Grass w/ 4' concrete pan
162+10.00	255.00 L	5	12.72	**0.0020**	0.030	40	20	0	0.64	12.26	38.38	0.32	12.72	1.04	38.36	0.32	OK	**0.08**	Grass w/ 4' concrete pan
167+44.00	255.00 L	5	7.67	**0.0020**	0.030	40	20	0	0.53	8.39	31.75	0.26	7.67	0.91	31.73	0.31	OK	**0.07**	Grass w/ 4' concrete pan
174+86.29	252.84 L	5	*	**0.0020**	0.030	40	20	0											Grass w/ 4' concrete pan
174+86.29	252.84 L	5	12.15	**0.0020**	0.030	40	20	0	0.63	11.85	37.73	0.31	12.15	1.03	37.70	0.32	OK	**0.08**	Grass w/ 4' concrete pan
180+10.00	255.00 L	5	11.03	**0.0020**	0.030	40	20	0	0.61	11.02	36.38	0.30	11.03	1.00	36.36	0.32	OK	**0.08**	Grass w/ 4' concrete pan
189+27.00	255.00 L	5	29.57	**0.0020**	0.030	40	20	0	0.88	23.08	52.66	0.44	29.57	1.28	52.63	0.34	OK	**0.11**	Grass w/ 4' concrete pan
190+79.20	255.00 L	5	23.10	**0.0020**	0.030	40	20	0	0.80	19.18	48.00	0.40	23.10	1.20	47.97	0.34	OK	**0.10**	Grass w/ 4' concrete pan
194+84.00	255.00 L	5	23.65	**0.0020**	0.030	40	20	0	0.81	19.52	48.43	0.40	23.65	1.21	48.40	0.34	OK	**0.10**	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																			
111+64.00	255.00 R	5	5.06	**0.0400**	0.030	50	100	0	0.18	2.51	27.45	0.09	5.06	2.02	27.45	1.17	OK	**0.47**	Grass w/ 4' concrete pan
120+00.00	255.00 R	5	11.95	**0.0032**	0.030	50	100	0	0.41	12.33	60.83	0.20	11.95	0.97	60.82	0.38	OK	**0.08**	Grass w/ 4' concrete pan
172+53.84	255.00 R	5	6.78	**0.4199**	0.030	50	100	0	0.13	1.29	19.71	0.07	6.78	5.24	19.71	3.60	OK	**3.55**	Grass w/ 4' concrete pan
180+21.64	255.00 R	5	7.00	**0.0020**	0.030	50	100	0	0.36	9.85	54.36	0.18	7.00	0.71	54.36	0.29	OK	**0.05**	Grass w/ 4' concrete pan
186+30.10	255.00 R	5	8.48	**0.0020**	0.030	50	100	0	0.39	11.37	58.42	0.19	8.48	0.75	58.41	0.30	OK	**0.05**	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																			
830+70.68	49.98 R	5	2.95	**0.0512**	0.030	3	4	0	0.45	0.72	3.31	0.22	2.95	4.07	3.18	1.51	OK	**1.50**	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																			
396+39.17	497.07 L	5	30.87	**0.0904**	0.013	4	10	8	0.26	2.50	11.62	0.21	30.87	12.36	11.57	4.69	OK	**1.49**	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																			
386+27.40	187.50 L	5	1.75	**0.0020**	0.013	4	10	8	0.15	1.32	10.08	0.13	1.75	1.32	10.05	0.64	OK	**0.02**	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																			
400+37.30	306.19 L	5	35.57	**0.0250**	0.030	4	10	8	0.62	7.65	16.79	0.46	35.57	4.65	16.68	1.21	OK	**1.00**	TRM/Grass
400+37.30	306.19 L	5	35.57	**0.1108**	0.030	4	10	8	0.42	4.54	13.89	0.33	35.57	7.84	13.82	2.41	OK	**2.97**	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																			
403+12.75	50.80 L	5	4.70	**0.0649**	0.030	4	4	4	0.23	1.12	5.88	0.19	4.70	4.19	5.83	1.68	OK	**0.95**	TRM/Grass
403+12.75	50.80 L	5	4.70	**0.1298**	0.030	4	4	4	0.19	0.89	5.55	0.16	4.70	5.28	5.50	2.31	OK	**1.57**	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																			
174+90.22	450.50 R	5	8.60	**0.2865**	0.030	3	3	0	0.52	0.82	3.31	0.25	8.60	10.49	3.14	3.62	OK	**9.65**	TRM/Grass
177+00.55	451.44 R	5	7.60	**0.3311**	0.030	3	3	0	0.49	0.71	3.07	0.23	7.60	10.74	2.91	3.84	OK	**10.36**	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																			
205+27.77	462.69 R	5	8.85	**0.1383**	0.030	3	3	0	0.61	1.10	3.83	0.29	8.85	8.04	3.63	2.57	OK	**5.40**	TRM/Grass

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 5-year Ditch Capacity Analysis Solver for Shear

Station	Offset	Recurrence (years)	Flow, Q5 (cfs)	**Max. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	Water Depth, D (ft)	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q5 (cfs)	Velocity, V5 (fps)	Top Width, T (ft)	Froude Number, F	Check	**Shear Stress (lb/sf)**	Ditch Lining
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																			
829+97.98	153.55 L	5	0.08	**0.2413**	0.030	3	3	0	0.09	0.03	0.59	0.04	0.08	3.05	0.56	2.49	OK	**1.45**	TRM/Grass
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																			
814+20.05	143.46 L	5	0.45	**0.1625**	0.030	3	3	0	0.19	0.11	1.22	0.09	0.45	4.05	1.15	2.30	OK	**2.01**	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																			
386+30.00	464.00 L	5	4.58	**0.2388**	0.030	3	3	0	0.43	0.55	2.70	0.20	4.58	8.37	2.56	3.19	OK	**6.57**	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																			
373+56.59	296.96 L	5	0.71	**0.0654**	0.030	3	3	0	0.27	0.22	1.71	0.13	0.71	3.23	1.62	1.55	OK	**1.14**	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																			
813+07.45	195.25 L	5	2.74	**0.2160**	0.030	3	3	0	0.36	0.39	2.27	0.17	2.74	7.09	2.15	2.95	OK	**4.99**	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																			
813+60.10	140.00 L	5	0.40	**0.1230**	0.030	3	3	0	0.19	0.11	1.23	0.09	0.40	3.55	1.16	2.01	OK	**1.54**	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																			
902+53.66	35.01 R	5	3.21	**0.1030**	0.030	3	3	0	0.44	0.57	2.77	0.21	3.21	5.59	2.63	2.10	OK	**2.90**	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																			
829+55.89	144.48 L	5	0.45	**0.1003**	0.030	4	4	0	0.19	0.14	1.55	0.09	0.45	3.18	1.50	1.83	OK	**1.21**	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																			
829+31.25	192.93 L	5	1.25	**0.1040**	0.030	4	4	0	0.27	0.30	2.26	0.13	1.25	4.17	2.19	1.98	OK	**1.83**	TRM/Grass

* A portion of the overall basin with no separate hydrologic calculations.

Lining	MHFD Table RECP-1 and Table RECP-2		Manning's n, HEC-15 Tables 2.1 & 2.2
RECP Type 3.B	< 2	(lb/sf)	0.025
TRM 5.A	2 to 5.9	(lb/sf)	0.030
TRM 5.B	6 to 7.9	(lb/sf)	0.030
TRM 5.C	8 to 10	(lb/sf)	0.030
Riprap	S>=5%, SS>10		0.080

Concrete or TRM is recommended to be used in place of Riprap for this project

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 5-year Ditch Capacity Analysis Solve for Max Depth

Station	Offset	Recurrence (years)	Flow, Q5 (cfs)	**Min. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	**Max.Water Depth, D (ft)**	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q5 (cfs)	Velocity, V5 (fps)	Top Width, T (ft)	Froude Number, F	Check	Shear Stress (lb/sf)	Ditch Lining
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																			
306+72.50	12.00 R	5	1.25	**0.0020**	0.013	4	4	8	**0.12**	1.03	9.00	0.11	1.25	1.21	8.97	0.63	OK	0.02	Concrete
330+00.00	97.60 L	5	11.41	**0.0032**	0.013	4	4	8	**0.39**	3.69	11.19	0.33	11.41	3.09	11.09	0.95	OK	0.08	Concrete
342+70.76	97.60 L	5	8.88	**0.0032**	0.013	4	4	8	**0.33**	3.12	10.76	0.29	8.88	2.84	10.68	0.93	OK	0.07	Concrete
342+70.76	97.60 L	5	*	**0.0020**	0.013	4	4	8											Concrete
346+05.00	97.60 L	5	6.65	**0.0020**	0.013	4	4	8	**0.32**	3.02	10.67	0.28	6.65	2.21	10.59	0.73	OK	0.04	Concrete
346+05.00	97.60 L	5	*	**0.0030**	0.013	4	4	8											Concrete
352+48.17	97.60 L	5	*	**0.0020**	0.013	4	4	8											Concrete
352+48.17	97.60 L	5	7.18	**0.0020**	0.013	4	4	8	**0.34**	3.17	10.79	0.29	7.18	2.26	10.71	0.73	OK	0.04	Concrete
362+05.00	97.60 L	5	1.31	**0.0023**	0.013	4	4	8	**0.12**	1.02	8.99	0.11	1.31	1.29	8.96	0.67	OK	0.02	Concrete
366+70.00	97.60 L	5	2.60	**0.0027**	0.013	4	4	8	**0.17**	1.49	9.42	0.16	2.60	1.74	9.37	0.77	OK	0.03	Concrete
366+70.00	97.60 L	5	*	**0.0020**	0.013	4	4	8											Concrete
374+78.15	97.60 L	5	6.40	**0.0020**	0.013	4	4	8	**0.32**	2.94	10.62	0.28	6.40	2.18	10.54	0.73	OK	0.04	Concrete
374+78.15	97.60 L	5	*	**0.0022**	0.013	4	4	8											Concrete
374+78.15	97.60 L	5	4.56	**0.0020**	0.013	4	4	8	**0.26**	2.36	10.15	0.23	4.56	1.94	10.08	0.71	OK	0.03	Concrete
380+12.13	97.50 L	5	*	**0.0020**	0.013	4	4	8											Concrete
380+12.13	97.50 L	5	5.50	**0.0029**	0.013	4	4	8	**0.26**	2.36	10.15	0.23	5.50	2.33	10.09	0.85	OK	0.05	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																			
120+00.00	254.90 L	5	18.93	**0.0032**	0.030	40	20	0	**0.68**	13.85	40.79	0.34	18.93	1.37	40.77	0.41	OK	0.14	Grass w/ 4' concrete pan
130+80.00	254.90 L	5	15.82	**0.0032**	0.030	40	20	0	**0.64**	12.11	38.14	0.32	15.82	1.31	38.11	0.41	OK	0.13	Grass w/ 4' concrete pan
139+80.00	254.90 L	5	12.29	**0.0032**	0.030	40	20	0	**0.58**	10.02	34.69	0.29	12.29	1.23	34.67	0.40	OK	0.12	Grass w/ 4' concrete pan
144+50.00	254.90 L	5	8.50	**0.0024**	0.030	40	20	0	**0.53**	8.46	31.88	0.27	8.50	1.00	31.86	0.34	OK	0.08	Grass w/ 4' concrete pan
144+50.00	254.90 L	5	12.74	**0.0024**	0.030	40	20	0	**0.62**	11.47	37.12	0.31	12.74	1.11	37.09	0.35	OK	0.10	Grass w/ 4' concrete pan
152+49.22	254.90 L	5	13.17	**0.0024**	0.030	40	20	0	**0.63**	11.75	37.58	0.31	13.17	1.12	37.55	0.35	OK	0.10	Grass w/ 4' concrete pan
162+10.00	255.00 L	5	12.72	**0.0020**	0.030	40	20	0	**0.64**	12.26	38.38	0.32	12.72	1.04	38.36	0.32	OK	0.08	Grass w/ 4' concrete pan
167+44.00	255.00 L	5	7.67	**0.0020**	0.030	40	20	0	**0.53**	8.39	31.75	0.26	7.67	0.91	31.73	0.31	OK	0.07	Grass w/ 4' concrete pan
174+86.29	252.84 L	5	*	**0.0020**	0.030	40	20	0											Grass w/ 4' concrete pan
174+86.29	252.84 L	5	12.15	**0.0020**	0.030	40	20	0	**0.63**	11.85	37.73	0.31	12.15	1.03	37.70	0.32	OK	0.08	Grass w/ 4' concrete pan
180+10.00	255.00 L	5	11.03	**0.0020**	0.030	40	20	0	**0.61**	11.02	36.38	0.30	11.03	1.00	36.36	0.32	OK	0.08	Grass w/ 4' concrete pan
189+27.00	255.00 L	5	29.57	**0.0020**	0.030	40	20	0	**0.88**	23.08	52.66	0.44	29.57	1.28	52.63	0.34	OK	0.11	Grass w/ 4' concrete pan
190+79.20	255.00 L	5	23.10	**0.0020**	0.030	40	20	0	**0.80**	19.18	48.00	0.40	23.10	1.20	47.97	0.34	OK	0.10	Grass w/ 4' concrete pan
194+84.00	255.00 L	5	23.65	**0.0020**	0.030	40	20	0	**0.81**	19.52	48.43	0.40	23.65	1.21	48.40	0.34	OK	0.10	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																			
111+64.00	255.00 R	5	5.06	**0.0023**	0.030	50	100	0	**0.31**	7.33	46.89	0.16	5.06	0.69	46.88	0.31	OK	0.05	Grass w/ 4' concrete pan
120+00.00	255.00 R	5	11.95	**0.0032**	0.030	50	100	0	**0.41**	12.33	60.83	0.20	11.95	0.97	60.82	0.38	OK	0.08	Grass w/ 4' concrete pan
172+53.84	255.00 R	5	6.78	**0.0020**	0.030	50	100	0	**0.36**	9.62	53.72	0.18	6.78	0.71	53.71	0.29	OK	0.05	Grass w/ 4' concrete pan
180+21.64	255.00 R	5	7.00	**0.0020**	0.030	50	100	0	**0.36**	9.85	54.36	0.18	7.00	0.71	54.36	0.29	OK	0.05	Grass w/ 4' concrete pan
186+30.10	255.00 R	5	8.48	**0.0020**	0.030	50	100	0	**0.39**	11.37	58.42	0.19	8.48	0.75	58.41	0.30	OK	0.05	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																			
830+70.68	49.98 R	5	2.95	**0.0020**	0.030	3	4	0	**0.84**	2.44	6.08	0.40	2.95	1.21	5.85	0.33	OK	0.11	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																			
396+39.17	497.07 L	5	30.87	**0.0020**	0.013	4	10	8	**0.72**	9.37	18.19	0.52	30.87	3.29	18.07	0.81	OK	0.09	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																			
386+27.40	187.50 L	5	1.75	**0.0088**	0.013	4	10	8	**0.09**	0.82	9.35	0.09	1.75	2.13	9.33	1.26	OK	0.05	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																			
400+37.30	306.19 L	5	35.57	**0.0250**	0.030	4	10	8	**0.62**	7.65	16.79	0.46	35.57	4.65	16.68	1.21	OK	1.00	TRM/Grass
400+37.30	306.19 L	5	35.57	**0.1108**	0.030	4	10	8	**0.42**	4.54	13.89	0.33	35.57	7.84	13.82	2.41	OK	2.97	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																			
403+12.75	50.80 L	5	4.70	**0.0100**	0.030	4	4	4	**0.38**	2.13	7.17	0.30	4.70	2.21	7.07	0.71	OK	0.25	TRM/Grass
403+12.75	50.80 L	5	4.70	**0.0969**	0.030	4	4	4	**0.20**	0.98	5.68	0.17	4.70	4.79	5.63	2.02	OK	1.27	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																			
174+90.22	450.50 R	5	8.60	**0.1119**	0.030	3	3	0	**0.62**	1.17	3.94	0.30	8.60	7.37	3.74	2.33	OK	4.49	TRM/Grass
177+00.55	451.44 R	5	7.60	**0.0926**	0.030	3	3	0	**0.62**	1.14	3.90	0.29	7.60	6.66	3.70	2.11	OK	3.68	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																			
205+27.77	462.69 R	5	8.85	**0.0478**	0.030	3	3	0	**0.74**	1.64	4.68	0.35	8.85	5.40	4.44	1.56	OK	2.28	TRM/Grass

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 5-year Ditch Capacity Analysis Solve for Max Depth

Station	Offset	Recurrence (years)	Flow, Q5 (cfs)	**Min. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	**Max.Water Depth, D (ft)**	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q5 (cfs)	Velocity, V5 (fps)	Top Width, T (ft)	Froude Number, F	Check	Shear Stress (lb/sf)	Ditch Lining
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																			
829+97.98	153.55 L	5	0.08	**0.1424**	0.030	3	3	0	**0.10**	0.03	0.65	0.05	0.08	2.51	0.62	1.94	OK	0.95	TRM/Grass
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																			
814+20.05	143.46 L	5	0.45	**0.0265**	0.030	3	3	0	**0.27**	0.22	1.71	0.13	0.45	2.05	1.62	0.98	OK	0.46	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																			
386+30.00	464.00 L	5	4.58	**0.0704**	0.030	3	3	0	**0.54**	0.87	3.40	0.25	4.58	5.29	3.22	1.80	OK	2.43	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																			
373+56.59	296.96 L	5	0.71	**0.0653**	0.030	3	3	0	**0.27**	0.22	1.71	0.13	0.71	3.23	1.62	1.55	OK	1.14	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																			
813+07.45	195.25 L	5	2.74	**0.0200**	0.030	3	3	0	**0.56**	0.94	3.55	0.27	2.74	2.90	3.37	0.97	OK	0.72	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																			
813+60.10	140.00 L	5	0.40	**0.0200**	0.030	3	3	0	**0.27**	0.22	1.73	0.13	0.40	1.80	1.64	0.86	OK	0.35	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																			
902+53.66	35.01 R	5	3.21	**0.0062**	0.030	3	3	0	**0.74**	1.65	4.69	0.35	3.21	1.95	4.45	0.56	OK	0.30	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																			
829+55.89	144.48 L	5	0.45	**0.0274**	0.030	4	4	0	**0.24**	0.23	1.98	0.12	0.45	1.96	1.92	1.00	OK	0.42	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																			
829+31.25	192.93 L	5	1.25	**0.0274**	0.030	4	4	0	**0.35**	0.49	2.90	0.17	1.25	2.53	2.81	1.06	OK	0.62	TRM/Grass

* A portion of the overall basin with no separate hydrologic calculations.

Lining	MHFD Table RECP-1 and Table RECP-2		Manning's n, HEC-15 Tables 2.1 & 2.2
RECP Type 3.B	< 2	(lb/sf)	0.025
TRM 5.A	2 to 5.9	(lb/sf)	0.030
TRM 5.B	6 to 7.9	(lb/sf)	0.030
TRM 5.C	8 to 10	(lb/sf)	0.030
Riprap	S>=5%, SS>10		0.080

Concrete or TRM is recommended to be used in place of Riprap for this project

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 10-year Ditch Capacity Analysis Solving for Shear

Station	Offset	Recurrence (years)	Flow, Q10 (cfs)	**Max. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	Water Depth, D (ft)	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q10 (cfs)	Velocity, V10 (fps)	Top Width, T (ft)	Froude Number, F	Check	**Shear Stress (lb/sf)**	Ditch Lining
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																			
306+72.50	12.00 R	10	2.08	**0.0136**	0.013	4	4	8	0.09	0.78	8.77	0.09	2.08	2.66	8.75	1.57	OK	**0.08**	Concrete
330+00.00	97.60 L	10	19.72	**0.0070**	0.013	4	4	8	0.42	4.09	11.48	0.36	19.72	4.82	11.38	1.42	OK	**0.19**	Concrete
342+70.76	97.60 L	10	15.19	**0.0050**	0.013	4	4	8	0.40	3.85	11.30	0.34	15.19	3.95	11.20	1.19	OK	**0.13**	Concrete
342+70.76	97.60 L	10	*	**0.0020**	0.013	4	4	8											Concrete
346+05.00	97.60 L	10	10.59	**0.0020**	0.013	4	4	8	0.42	4.11	11.49	0.36	10.59	2.58	11.39	0.76	OK	**0.05**	Concrete
346+05.00	97.60 L	10	*	**0.0030**	0.013	4	4	8											Concrete
352+48.17	97.60 L	10	*	**0.0020**	0.013	4	4	8											Concrete
352+48.17	97.60 L	10	12.46	**0.0023**	0.013	4	4	8	0.45	4.37	11.68	0.37	12.46	2.85	11.57	0.82	OK	**0.07**	Concrete
360+71.50	97.60 L	10	1.95	**0.0023**	0.013	4	4	8	0.15	1.31	9.25	0.14	1.95	1.49	9.22	0.70	OK	**0.02**	Concrete
362+05.00	97.60 L	10	4.34	**0.0027**	0.013	4	4	8	0.23	2.07	9.91	0.21	4.34	2.10	9.86	0.81	OK	**0.04**	Concrete
366+70.00	97.60 L	10	*	**0.0020**	0.013	4	4	8											Concrete
366+70.00	97.60 L	10	9.93	**0.0020**	0.013	4	4	8	0.41	3.93	11.37	0.35	9.93	2.53	11.27	0.75	OK	**0.05**	Concrete
374+78.15	97.60 L	10	*	**0.0022**	0.013	4	4	8											Concrete
374+78.15	97.60 L	10	6.47	**0.0020**	0.013	4	4	8	0.32	2.96	10.63	0.28	6.47	2.19	10.55	0.73	OK	**0.04**	Concrete
380+12.13	97.50 L	10	*	**0.0020**	0.013	4	4	8											Concrete
380+12.13	97.50 L	10	7.46	**0.0128**	0.013	4	4	8	0.20	1.78	9.67	0.18	7.46	4.19	9.62	1.72	OK	**0.17**	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																			
120+00.00	254.90 L	10	25.44	**0.0032**	0.030	20	40	0	0.76	17.29	45.57	0.38	25.44	1.47	45.54	0.42	OK	**0.16**	Grass w/ 4' concrete pan
130+80.00	254.90 L	10	21.80	**0.0080**	0.030	20	40	0	0.60	10.92	36.22	0.30	21.80	2.00	36.20	0.64	OK	**0.31**	Grass w/ 4' concrete pan
139+80.00	254.90 L	10	17.14	**0.0032**	0.030	20	40	0	0.65	12.85	39.30	0.33	17.14	1.33	39.28	0.41	OK	**0.13**	Grass w/ 4' concrete pan
144+50.00	254.90 L	10	11.81	**0.0032**	0.030	20	40	0	0.57	9.72	34.18	0.28	11.81	1.21	34.15	0.40	OK	**0.12**	Grass w/ 4' concrete pan
144+50.00	254.90 L	10	17.71	**0.0032**	0.030	20	40	0	0.66	13.18	39.79	0.33	17.71	1.34	39.76	0.41	OK	**0.14**	Grass w/ 4' concrete pan
152+49.22	254.90 L	10	17.77	**0.0024**	0.030	20	40	0	0.70	14.71	42.04	0.35	17.77	1.21	42.02	0.36	OK	**0.11**	Grass w/ 4' concrete pan
162+10.00	255.00 L	10	17.13	**0.0020**	0.030	20	40	0	0.71	15.33	42.91	0.36	17.13	1.12	42.89	0.33	OK	**0.09**	Grass w/ 4' concrete pan
167+44.00	255.00 L	10	10.74	**0.0020**	0.030	20	40	0	0.60	10.80	36.02	0.30	10.74	0.99	36.00	0.32	OK	**0.08**	Grass w/ 4' concrete pan
174+86.29	252.84 L	10	*	**0.0020**	0.030	20	40	0											Grass w/ 4' concrete pan
174+86.29	252.84 L	10	16.67	**0.0020**	0.030	20	40	0	0.71	15.02	42.48	0.35	16.67	1.11	42.45	0.33	OK	**0.09**	Grass w/ 4' concrete pan
180+10.00	255.00 L	10	14.60	**0.0020**	0.030	20	40	0	0.67	13.59	40.42	0.34	14.60	1.07	40.39	0.33	OK	**0.09**	Grass w/ 4' concrete pan
189+27.00	255.00 L	10	37.48	**0.0020**	0.030	20	40	0	0.96	27.57	57.55	0.48	37.48	1.36	57.52	0.35	OK	**0.12**	Grass w/ 4' concrete pan
190+79.20	255.00 L	10	29.44	**0.0020**	0.030	20	40	0	0.88	23.00	52.57	0.44	29.44	1.28	52.54	0.34	OK	**0.11**	Grass w/ 4' concrete pan
194+84.00	255.00 L	10	30.01	**0.0020**	0.030	20	40	0	0.88	23.34	52.95	0.44	30.01	1.29	52.92	0.34	OK	**0.11**	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																			
111+64.00	255.00 R	10	9.98	**0.0400**	0.030	50	100	0	0.24	4.18	35.41	0.12	9.98	2.39	35.41	1.23	OK	**0.61**	Grass w/ 4' concrete pan
120+00.00	255.00 R	10	17.97	**0.0032**	0.030	50	100	0	0.47	16.75	70.88	0.24	17.97	1.07	70.88	0.39	OK	**0.10**	Grass w/ 4' concrete pan
172+53.84	255.00 R	10	9.82	**0.4199**	0.030	50	100	0	0.15	1.71	22.65	0.08	9.82	5.74	22.65	3.68	OK	**4.08**	Grass w/ 4' concrete pan
180+21.64	255.00 R	10	10.74	**0.0020**	0.030	50	100	0	0.43	13.58	63.83	0.21	10.74	0.79	63.82	0.30	OK	**0.05**	Grass w/ 4' concrete pan
186+30.10	255.00 R	10	13.91	**0.0020**	0.030	50	100	0	0.47	16.48	70.33	0.23	13.91	0.84	70.32	0.31	OK	**0.06**	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																			
830+70.68	49.98 R	10	5.14	**0.0512**	0.030	3	4	0	0.56	1.10	4.08	0.27	5.14	4.68	3.92	1.56	OK	**1.85**	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																			
396+39.17	497.07 L	10	41.92	**0.0904**	0.013	4	10	8	0.30	3.07	12.30	0.25	41.92	13.66	12.25	4.81	OK	**1.77**	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																			
386+27.40	187.50 L	10	2.70	**0.0100**	0.013	4	10	8	0.12	1.04	9.67	0.11	2.70	2.59	9.65	1.39	OK	**0.08**	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																			
400+37.30	306.19 L	10	49.59	**0.0250**	0.030	4	10	8	0.74	9.70	18.44	0.53	49.59	5.11	18.32	1.24	OK	**1.19**	TRM/Grass
400+37.30	306.19 L	10	49.59	**0.1108**	0.030	4	10	8	0.50	5.72	15.06	0.38	49.59	8.67	14.97	2.47	OK	**3.55**	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																			
403+12.75	50.80 L	10	9.49	**0.0649**	0.030	4	4	4	0.34	1.81	6.79	0.27	9.49	5.24	6.71	1.78	OK	**1.41**	TRM/Grass
403+12.75	50.80 L	10	9.49	**0.1298**	0.030	4	4	4	0.28	1.43	6.30	0.23	9.49	6.65	6.23	2.45	OK	**2.33**	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																			
174+90.22	450.50 R	10	13.19	**0.2865**	0.030	3	3	0	0.61	1.13	3.88	0.29	13.19	11.67	3.68	3.71	OK	**11.32**	TRM/Grass
177+00.55	451.44 R	10	12.09	**0.3311**	0.030	3	3	0	0.58	1.00	3.66	0.27	12.09	12.06	3.47	3.95	OK	**12.33**	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																			
205+27.77	462.69 R	10	16.64	**0.1383**	0.030	3	3	0	0.77	1.77	4.85	0.36	16.64	9.41	4.61	2.68	OK	**6.84**	TRM/Grass

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 10-year Ditch Capacity Analysis Solving for Shear

Station	Offset	Recurrence (years)	Flow, Q10 (cfs)	**Max. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	Water Depth, D (ft)	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q10 (cfs)	Velocity, V10 (fps)	Top Width, T (ft)	Froude Number, F	Check	**Shear Stress (lb/sf)**	Ditch Lining
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																			
829+97.98	153.55 L	10	0.27	**0.2413**	0.030	3	3	0	0.15	0.07	0.93	0.07	0.27	4.14	0.88	2.69	OK	**2.29**	TRM/Grass
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																			
814+20.05	143.46 L	10	1.55	**0.1625**	0.030	3	3	0	0.31	0.28	1.93	0.15	1.55	5.52	1.83	2.49	OK	**3.20**	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																			
386+30.00	464.00 L	10	8.32	**0.2388**	0.030	3	3	0	0.53	0.86	3.38	0.25	8.32	9.72	3.21	3.31	OK	**8.22**	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																			
373+56.59	296.96 L	10	2.41	**0.0654**	0.030	3	3	0	0.43	0.55	2.71	0.20	2.41	4.39	2.57	1.67	OK	**1.80**	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																			
813+07.45	195.25 L	10	6.39	**0.2160**	0.030	3	3	0	0.49	0.73	3.12	0.23	6.39	8.76	2.96	3.11	OK	**6.86**	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																			
813+60.10	140.00 L	10	1.22	**0.1230**	0.030	3	3	0	0.29	0.26	1.86	0.14	1.22	4.69	1.77	2.15	OK	**2.33**	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																			
902+53.66	35.01 R	10	4.99	**0.1030**	0.030	3	3	0	0.52	0.80	3.27	0.24	4.99	6.24	3.10	2.16	OK	**3.43**	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																			
829+55.89	144.48 L	10	1.54	**0.1003**	0.030	4	4	0	0.30	0.36	2.46	0.14	1.54	4.33	2.38	1.98	OK	**1.93**	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																			
829+31.25	192.93 L	10	1.93	**0.1040**	0.030	4	4	0	0.32	0.42	2.66	0.16	1.93	4.65	2.58	2.04	OK	**2.16**	TRM/Grass

* A portion of the overall basin with no separate hydrologic calculations.

Lining	MHFD Table RECP-1 and Table RECP-2		Manning's n, HEC-15 Tables 2.1 & 2.2
RECP Type 3.B	< 2	(lb/sf)	0.025
TRM 5.A	2 to 5.9	(lb/sf)	0.030
TRM 5.B	6 to 7.9	(lb/sf)	0.030
TRM 5.C	8 to 10	(lb/sf)	0.030
Riprap	S>=5%, SS>10		0.080

Concrete or TRM is recommended to be used in place of Riprap for this project

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 10-year Ditch Capacity Analysis Solve for Max Depth

Station	Offset	Recurrence (years)	Flow, Q10 (cfs)	**Min. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	**Water Depth, D (ft)**	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q10 (cfs)	Velocity, V10 (fps)	Top Width, T (ft)	Froude Number, F	Check	Shear Stress (lb/sf)	Ditch Lining
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																			
306+72.50	12.00 R	10	2.08	**0.0020**	0.013	4	4	8	**0.16**	1.42	9.36	0.15	2.08	1.46	9.32	0.66	OK	0.02	Concrete
330+00.00	97.60 L	10	19.72	**0.0032**	0.013	4	4	8	**0.53**	5.33	12.35	0.43	19.72	3.70	12.22	0.99	OK	0.11	Concrete
342+70.76	97.60 L	10	15.19	**0.0032**	0.013	4	4	8	**0.45**	4.47	11.75	0.38	15.19	3.40	11.64	0.97	OK	0.09	Concrete
342+70.76	97.60 L	10	*	**0.0020**	0.013	4	4	8											Concrete
346+05.00	97.60 L	10	10.59	**0.0020**	0.013	4	4	8	**0.42**	4.11	11.49	0.36	10.59	2.58	11.39	0.76	OK	0.05	Concrete
346+05.00	97.60 L	10	*	**0.0030**	0.013	4	4	8											Concrete
352+48.17	97.60 L	10	*	**0.0020**	0.013	4	4	8											Concrete
352+48.17	97.60 L	10	12.46	**0.0020**	0.013	4	4	8	**0.46**	4.58	11.83	0.39	12.46	2.72	11.72	0.77	OK	0.06	Concrete
360+71.50	97.60 L	10	1.95	**0.0023**	0.013	4	4	8	**0.15**	1.31	9.25	0.14	1.95	1.49	9.22	0.70	OK	0.02	Concrete
362+05.00	97.60 L	10	4.34	**0.0027**	0.013	4	4	8	**0.23**	2.07	9.91	0.21	4.34	2.10	9.86	0.81	OK	0.04	Concrete
366+70.00	97.60 L	10	*	**0.0020**	0.013	4	4	8											Concrete
366+70.00	97.60 L	10	9.93	**0.0020**	0.013	4	4	8	**0.41**	3.93	11.37	0.35	9.93	2.53	11.27	0.75	OK	0.05	Concrete
374+78.15	97.60 L	10	*	**0.0022**	0.013	4	4	8											Concrete
374+78.15	97.60 L	10	6.47	**0.0020**	0.013	4	4	8	**0.32**	2.96	10.63	0.28	6.47	2.19	10.55	0.73	OK	0.04	Concrete
380+12.13	97.50 L	10	*	**0.0020**	0.013	4	4	8											Concrete
380+12.13	97.50 L	10	7.46	**0.0029**	0.013	4	4	8	**0.31**	2.88	10.57	0.27	7.46	2.59	10.49	0.87	OK	0.06	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																			
120+00.00	254.90 L	10	25.44	**0.0032**	0.030	20	40	0	**0.76**	17.29	45.57	0.38	25.44	1.47	45.54	0.42	OK	0.16	Grass w/ 4' concrete pan
130+80.00	254.90 L	10	21.80	**0.0032**	0.030	20	40	0	**0.72**	15.40	43.01	0.36	21.80	1.42	42.98	0.42	OK	0.15	Grass w/ 4' concrete pan
139+80.00	254.90 L	10	17.14	**0.0032**	0.030	20	40	0	**0.65**	12.85	39.30	0.33	17.14	1.33	39.28	0.41	OK	0.13	Grass w/ 4' concrete pan
144+50.00	254.90 L	10	11.81	**0.0024**	0.030	20	40	0	**0.60**	10.83	36.07	0.30	11.81	1.09	36.05	0.35	OK	0.09	Grass w/ 4' concrete pan
144+50.00	254.90 L	10	17.71	**0.0024**	0.030	20	40	0	**0.70**	14.68	41.99	0.35	17.71	1.21	41.97	0.36	OK	0.11	Grass w/ 4' concrete pan
152+49.22	254.90 L	10	17.77	**0.0024**	0.030	20	40	0	**0.70**	14.71	42.04	0.35	17.77	1.21	42.02	0.36	OK	0.11	Grass w/ 4' concrete pan
162+10.00	255.00 L	10	17.13	**0.0020**	0.030	20	40	0	**0.71**	15.33	42.91	0.36	17.13	1.12	42.89	0.33	OK	0.09	Grass w/ 4' concrete pan
167+44.00	255.00 L	10	10.74	**0.0020**	0.030	20	40	0	**0.60**	10.80	36.02	0.30	10.74	0.99	36.00	0.32	OK	0.08	Grass w/ 4' concrete pan
174+86.29	252.84 L	10	*	**0.0020**	0.030	20	40	0											Grass w/ 4' concrete pan
174+86.29	252.84 L	10	16.67	**0.0020**	0.030	20	40	0	**0.71**	15.02	42.48	0.35	16.67	1.11	42.45	0.33	OK	0.09	Grass w/ 4' concrete pan
180+10.00	255.00 L	10	14.60	**0.0020**	0.030	20	40	0	**0.67**	13.59	40.42	0.34	14.60	1.07	40.39	0.33	OK	0.09	Grass w/ 4' concrete pan
189+27.00	255.00 L	10	37.48	**0.0020**	0.030	20	40	0	**0.96**	27.57	57.55	0.48	37.48	1.36	57.52	0.35	OK	0.12	Grass w/ 4' concrete pan
190+79.20	255.00 L	10	29.44	**0.0020**	0.030	20	40	0	**0.88**	23.00	52.57	0.44	29.44	1.28	52.54	0.34	OK	0.11	Grass w/ 4' concrete pan
194+84.00	255.00 L	10	30.01	**0.0020**	0.030	20	40	0	**0.88**	23.34	52.95	0.44	30.01	1.29	52.92	0.34	OK	0.11	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																			
111+64.00	255.00 R	10	9.98	**0.0023**	0.030	50	100	0	**0.40**	12.19	60.49	0.20	9.98	0.82	60.48	0.32	OK	0.06	Grass w/ 4' concrete pan
120+00.00	255.00 R	10	17.97	**0.0032**	0.030	50	100	0	**0.47**	16.75	70.88	0.24	17.97	1.07	70.88	0.39	OK	0.10	Grass w/ 4' concrete pan
172+53.84	255.00 R	10	9.82	**0.0020**	0.030	50	100	0	**0.41**	12.69	61.72	0.21	9.82	0.77	61.71	0.30	OK	0.05	Grass w/ 4' concrete pan
180+21.64	255.00 R	10	10.74	**0.0020**	0.030	50	100	0	**0.43**	13.58	63.83	0.21	10.74	0.79	63.82	0.30	OK	0.05	Grass w/ 4' concrete pan
186+30.10	255.00 R	10	13.91	**0.0020**	0.030	50	100	0	**0.47**	16.48	70.33	0.23	13.91	0.84	70.32	0.31	OK	0.06	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																			
830+70.68	49.98 R	10	5.14	**0.0020**	0.030	3	4	0	**1.03**	3.70	7.49	0.49	5.14	1.39	7.20	0.34	OK	0.13	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																			
396+39.17	497.07 L	10	41.92	**0.0020**	0.013	4	10	8	**0.84**	11.68	19.92	0.59	41.92	3.59	19.77	0.82	OK	0.11	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																			
386+27.40	187.50 L	10	2.70	**0.0088**	0.013	4	10	8	**0.12**	1.09	9.74	0.11	2.70	2.49	9.72	1.31	OK	0.07	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																			
400+37.30	306.19 L	10	49.59	**0.0250**	0.030	4	10	8	**0.74**	9.70	18.44	0.53	49.59	5.11	18.32	1.24	OK	1.19	TRM/Grass
400+37.30	306.19 L	10	49.59	**0.1108**	0.030	4	10	8	**0.50**	5.72	15.06	0.38	49.59	8.67	14.97	2.47	OK	3.55	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																			
403+12.75	50.80 L	10	9.49	**0.0100**	0.030	4	4	4	**0.56**	3.49	8.61	0.41	9.49	2.72	8.48	0.75	OK	0.36	TRM/Grass
403+12.75	50.80 L	10	9.49	**0.0969**	0.030	4	4	4	**0.30**	1.58	6.50	0.24	9.49	6.02	6.42	2.14	OK	1.89	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																			
174+90.22	450.50 R	10	13.19	**0.1119**	0.030	3	3	0	**0.73**	1.61	4.63	0.35	13.19	8.20	4.39	2.39	OK	5.28	TRM/Grass
177+00.55	451.44 R	10	12.09	**0.0926**	0.030	3	3	0	**0.73**	1.62	4.64	0.35	12.09	7.48	4.40	2.18	OK	4.38	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																			
205+27.77	462.69 R	10	16.64	**0.0478**	0.030	3	3	0	**0.94**	2.63	5.92	0.44	16.64	6.32	5.62	1.63	OK	2.88	TRM/Grass

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 10-year Ditch Capacity Analysis Solve for Max Depth

Station	Offset	Recurrence (years)	Flow, Q10 (cfs)	**Min. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	**Water Depth, D (ft)**	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q10 (cfs)	Velocity, V10 (fps)	Top Width, T (ft)	Froude Number, F	Check	Shear Stress (lb/sf)	Ditch Lining
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																			
829+97.98	153.55 L	10	0.27	**0.1424**	0.030	3	3	0	**0.16**	0.08	1.03	0.08	0.27	3.39	0.98	2.10	OK	1.49	TRM/Grass
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																			
814+20.05	143.46 L	10	1.55	**0.0265**	0.030	3	3	0	**0.43**	0.55	2.72	0.20	1.55	2.80	2.58	1.06	OK	0.73	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																			
386+30.00	464.00 L	10	8.32	**0.0704**	0.030	3	3	0	**0.67**	1.35	4.25	0.32	8.32	6.15	4.03	1.87	OK	3.05	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																			
373+56.59	296.96 L	10	2.41	**0.0653**	0.030	3	3	0	**0.43**	0.55	2.71	0.20	2.41	4.38	2.57	1.67	OK	1.80	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																			
813+07.45	195.25 L	10	6.39	**0.0200**	0.030	3	3	0	**0.77**	1.78	4.87	0.37	6.39	3.59	4.62	1.02	OK	0.99	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																			
813+60.10	140.00 L	10	1.22	**0.0200**	0.030	3	3	0	**0.41**	0.51	2.62	0.20	1.22	2.37	2.48	0.92	OK	0.53	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																			
902+53.66	35.01 R	10	4.99	**0.0062**	0.030	3	3	0	**0.87**	2.29	5.53	0.41	4.99	2.17	5.25	0.58	OK	0.35	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																			
829+55.89	144.48 L	10	1.54	**0.0274**	0.030	4	4	0	**0.38**	0.58	3.14	0.18	1.54	2.66	3.04	1.08	OK	0.67	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																			
829+31.25	192.93 L	10	1.93	**0.0274**	0.030	4	4	0	**0.41**	0.68	3.41	0.20	1.93	2.82	3.31	1.09	OK	0.73	TRM/Grass

* A portion of the overall basin with no separate hydrologic calculations.

Lining	MHFD Table RECP-1 and Table RECP-2		Manning's n, HEC-15 Tables 2.1 & 2.2
RECP Type 3.B	< 2	(lb/sf)	0.025
TRM 5.A	2 to 5.9	(lb/sf)	0.030
TRM 5.B	6 to 7.9	(lb/sf)	0.030
TRM 5.C	8 to 10	(lb/sf)	0.030
Riprap	S>=5%, SS>10		0.080

Concrete or TRM is recommended to be used in place of Riprap for this project

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 50-year Ditch Capacity Analysis Solve for Shear

Station	Offset	Recurrence (years)	Flow, Q50 (cfs)	**Max. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	Water Depth, D (ft)	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q50 (cfs)	Velocity, V50 (fps)	Top Width, T (ft)	Froude Number, F	Check	**Shear Stress (lb/sf)**	Ditch Lining
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																			
306+72.50	12.00 R	50	5.01	**0.0136**	0.013	4	4	8	0.16	1.35	9.29	0.15	5.01	3.70	9.26	1.70	OK	**0.14**	Concrete
330+00.00	97.60 L	50	49.22	**0.0070**	0.013	4	4	8	0.70	7.63	13.81	0.55	49.22	6.45	13.64	1.52	OK	**0.32**	Concrete
342+70.76	97.60 L	50	37.51	**0.0050**	0.013	4	4	8	0.67	7.10	13.49	0.53	37.51	5.28	13.33	1.28	OK	**0.21**	Concrete
342+70.76	97.60 L	50	*	**0.0020**	0.013	4	4	8											Concrete
346+05.00	97.60 L	50	24.18	**0.0020**	0.013	4	4	8	0.67	7.20	13.55	0.53	24.18	3.36	13.38	0.81	OK	**0.09**	Concrete
346+05.00	97.60 L	50	*	**0.0030**	0.013	4	4	8											Concrete
352+48.17	97.60 L	50	*	**0.0020**	0.013	4	4	8											Concrete
352+48.17	97.60 L	50	31.37	**0.0023**	0.013	4	4	8	0.75	8.21	14.16	0.58	31.37	3.82	13.98	0.88	OK	**0.11**	Concrete
360+71.50	97.60 L	50	4.04	**0.0023**	0.013	4	4	8	0.23	2.08	9.92	0.21	4.04	1.94	9.86	0.74	OK	**0.03**	Concrete
362+05.00	97.60 L	50	10.46	**0.0027**	0.013	4	4	8	0.39	3.68	11.18	0.33	10.46	2.84	11.09	0.87	OK	**0.07**	Concrete
366+70.00	97.60 L	50	*	**0.0020**	0.013	4	4	8											Concrete
366+70.00	97.60 L	50	21.89	**0.0020**	0.013	4	4	8	0.64	6.72	13.25	0.51	21.89	3.26	13.10	0.80	OK	**0.08**	Concrete
374+78.15	97.60 L	50	*	**0.0022**	0.013	4	4	8											Concrete
374+78.15	97.60 L	50	12.52	**0.0020**	0.013	4	4	8	0.47	4.59	11.84	0.39	12.52	2.73	11.73	0.77	OK	**0.06**	Concrete
380+12.13	97.50 L	50	*	**0.0020**	0.013	4	4	8											Concrete
380+12.13	97.50 L	50	13.28	**0.0128**	0.013	4	4	8	0.28	2.58	10.33	0.25	13.28	5.14	10.26	1.81	OK	**0.23**	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																			
120+00.00	254.90 L	50	44.34	**0.0032**	0.030	40	20	0	0.93	26.22	56.13	0.47	44.34	1.69	56.09	0.44	OK	**0.19**	Grass w/ 4' concrete pan
130+80.00	254.90 L	50	39.77	**0.0080**	0.030	40	20	0	0.76	17.14	45.38	0.38	39.77	2.32	45.35	0.67	OK	**0.39**	Grass w/ 4' concrete pan
139+80.00	254.90 L	50	31.99	**0.0032**	0.030	40	20	0	0.83	20.53	49.66	0.41	31.99	1.56	49.63	0.43	OK	**0.17**	Grass w/ 4' concrete pan
144+50.00	254.90 L	50	21.93	**0.0032**	0.030	40	20	0	0.72	15.46	43.10	0.36	21.93	1.42	43.08	0.42	OK	**0.15**	Grass w/ 4' concrete pan
144+50.00	254.90 L	50	32.89	**0.0032**	0.030	40	20	0	0.84	20.96	50.18	0.42	32.89	1.57	50.15	0.43	OK	**0.17**	Grass w/ 4' concrete pan
152+49.22	254.90 L	50	31.19	**0.0024**	0.030	40	20	0	0.86	22.43	51.92	0.43	31.19	1.39	51.89	0.37	OK	**0.13**	Grass w/ 4' concrete pan
162+10.00	255.00 L	50	30.02	**0.0020**	0.030	40	20	0	0.88	23.34	52.96	0.44	30.02	1.29	52.92	0.34	OK	**0.11**	Grass w/ 4' concrete pan
167+44.00	255.00 L	50	20.19	**0.0020**	0.030	40	20	0	0.76	17.34	45.64	0.38	20.19	1.16	45.61	0.33	OK	**0.10**	Grass w/ 4' concrete pan
174+86.29	252.84 L	50	*	**0.0020**	0.030	40	20	0											Grass w/ 4' concrete pan
174+86.29	252.84 L	50	30.26	**0.0020**	0.030	40	20	0	0.88	23.48	53.12	0.44	30.26	1.29	53.08	0.34	OK	**0.11**	Grass w/ 4' concrete pan
180+10.00	255.00 L	50	24.77	**0.0020**	0.030	40	20	0	0.82	20.21	49.28	0.41	24.77	1.23	49.24	0.34	OK	**0.11**	Grass w/ 4' concrete pan
189+27.00	255.00 L	50	57.80	**0.0020**	0.030	40	20	0	1.13	38.15	67.70	0.56	57.80	1.52	67.66	0.36	OK	**0.15**	Grass w/ 4' concrete pan
190+79.20	255.00 L	50	46.01	**0.0020**	0.030	40	20	0	1.04	32.15	62.15	0.52	46.01	1.43	62.11	0.35	OK	**0.13**	Grass w/ 4' concrete pan
194+84.00	255.00 L	50	46.44	**0.0020**	0.030	40	20	0	1.04	32.38	62.37	0.52	46.44	1.43	62.33	0.35	OK	**0.13**	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																			
111+64.00	255.00 R	50	28.19	**0.0400**	0.030	50	100	0	0.35	9.10	52.27	0.17	28.19	3.10	52.26	1.31	OK	**0.90**	Grass w/ 4' concrete pan
120+00.00	255.00 R	50	37.82	**0.0032**	0.030	50	100	0	0.62	29.26	93.70	0.31	37.82	1.29	93.69	0.41	OK	**0.13**	Grass w/ 4' concrete pan
172+53.84	255.00 R	50	19.56	**0.4199**	0.030	50	100	0	0.20	2.87	29.33	0.10	19.56	6.82	29.32	3.85	OK	**5.29**	Grass w/ 4' concrete pan
180+21.64	255.00 R	50	23.20	**0.0020**	0.030	50	100	0	0.57	24.19	85.20	0.28	23.20	0.96	85.19	0.32	OK	**0.07**	Grass w/ 4' concrete pan
186+30.10	255.00 R	50	32.82	**0.0020**	0.030	50	100	0	0.65	31.38	97.03	0.32	32.82	1.05	97.02	0.32	OK	**0.08**	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																			
830+70.68	49.98 R	50	12.95	**0.0512**	0.030	3	4	0	0.79	2.20	5.77	0.38	12.95	5.90	5.54	1.65	OK	**2.61**	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																			
396+39.17	497.07 L	50	74.60	**0.0904**	0.013	4	10	8	0.42	4.56	13.91	0.33	74.60	16.37	13.84	5.03	OK	**2.43**	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																			
386+27.40	187.50 L	50	5.91	**0.0100**	0.013	4	10	8	0.19	1.73	10.64	0.16	5.91	3.41	10.60	1.49	OK	**0.12**	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																			
400+37.30	306.19 L	50	92.62	**0.0250**	0.030	4	10	8	1.01	15.22	22.32	0.68	92.62	6.08	22.14	1.29	OK	**1.63**	TRM/Grass
400+37.30	306.19 L	50	92.62	**0.1108**	0.030	4	10	8	0.69	8.90	17.82	0.50	92.62	10.41	17.70	2.59	OK	**4.94**	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																			
403+12.75	50.80 L	50	27.31	**0.0649**	0.030	4	4	4	0.60	3.81	8.92	0.43	27.31	7.17	8.77	1.92	OK	**2.49**	TRM/Grass
403+12.75	50.80 L	50	27.31	**0.1298**	0.030	4	4	4	0.50	2.98	8.10	0.37	27.31	9.18	7.98	2.65	OK	**4.15**	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																			
174+90.22	450.50 R	50	28.53	**0.2865**	0.030	3	3	0	0.82	2.02	5.18	0.39	28.53	14.16	4.92	3.90	OK	**15.12**	TRM/Grass
177+00.55	451.44 R	50	27.40	**0.3311**	0.030	3	3	0	0.79	1.85	4.97	0.37	27.40	14.80	4.71	4.16	OK	**16.75**	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																			
205+27.77	462.69 R	50	45.09	**0.1383**	0.030	3	3	0	1.12	3.73	7.05	0.53	45.09	12.08	6.69	2.85	OK	**9.93**	TRM/Grass

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 50-year Ditch Capacity Analysis Solve for Shear

Station	Offset	Recurrence (years)	Flow, Q50 (cfs)	**Max. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	Water Depth, D (ft)	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q50 (cfs)	Velocity, V50 (fps)	Top Width, T (ft)	Froude Number, F	Check	**Shear Stress (lb/sf)**	Ditch Lining
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																			
829+97.98	153.55 L	50	1.04	**0.2413**	0.030	3	3	0	0.24	0.18	1.55	0.12	1.04	5.80	1.47	2.92	OK	**3.80**	TRM/Grass
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																			
814+20.05	143.46 L	50	5.90	**0.1625**	0.030	3	3	0	0.50	0.76	3.19	0.24	5.90	7.72	3.03	2.71	OK	**5.28**	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																			
386+30.00	464.00 L	50	21.96	**0.2388**	0.030	3	3	0	0.77	1.77	4.86	0.36	21.96	12.38	4.61	3.52	OK	**11.82**	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																			
373+56.59	296.96 L	50	9.18	**0.0654**	0.030	3	3	0	0.71	1.50	4.47	0.34	9.18	6.13	4.24	1.82	OK	**2.98**	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																			
813+07.45	195.25 L	50	20.30	**0.2160**	0.030	3	3	0	0.76	1.74	4.81	0.36	20.30	11.69	4.56	3.34	OK	**10.58**	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																			
813+60.10	140.00 L	50	4.49	**0.1230**	0.030	3	3	0	0.48	0.69	3.04	0.23	4.49	6.49	2.88	2.34	OK	**3.80**	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																			
902+53.66	35.01 R	50	11.03	**0.1030**	0.030	3	3	0	0.70	1.45	4.40	0.33	11.03	7.61	4.17	2.27	OK	**4.61**	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																			
829+55.89	144.48 L	50	5.88	**0.1003**	0.030	4	4	0	0.49	0.97	4.06	0.24	5.88	6.05	3.94	2.15	OK	**3.18**	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																			
829+31.25	192.93 L	50	4.19	**0.1040**	0.030	4	4	0	0.43	0.74	3.55	0.21	4.19	5.64	3.45	2.14	OK	**2.89**	TRM/Grass

* A portion of the overall basin with no separate hydrologic calculations.

Lining	MHFD Table RECP-1 and Table RECP-2		Manning's n, HEC-15 Tables 2.1 & 2.2
RECP Type 3.B	< 2	(lb/sf)	0.025
TRM 5.A	2 to 5.9	(lb/sf)	0.030
TRM 5.B	6 to 7.9	(lb/sf)	0.030
TRM 5.C	8 to 10	(lb/sf)	0.030
Riprap	S>=5%, SS>10		0.080

Concrete or TRM is recommended to be used in place of Riprap for this project

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 50-year Ditch Capacity Analysis Solve for Max Depth

Station	Offset	Recurrence (years)	Flow, Q50 (cfs)	**Min. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	**Water Depth, D (ft)**	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q50 (cfs)	Velocity, V50 (fps)	Top Width, T (ft)	Froude Number, F	Check	Shear Stress (lb/sf)	Ditch Lining
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																			
306+72.50	12.00 R	50	5.01	**0.0020**	0.013	4	4	8	**0.28**	2.51	10.27	0.24	5.01	2.00	10.20	0.71	OK	0.04	Concrete
330+00.00	97.60 L	50	49.22	**0.0032**	0.013	4	4	8	**0.87**	10.02	15.19	0.66	49.22	4.91	14.98	1.06	OK	0.18	Concrete
342+70.76	97.60 L	50	37.51	**0.0032**	0.013	4	4	8	**0.75**	8.29	14.21	0.58	37.51	4.53	14.02	1.04	OK	0.16	Concrete
342+70.76	97.60 L	50	*	**0.0020**	0.013	4	4	8											Concrete
346+05.00	97.60 L	50	24.18	**0.0020**	0.013	4	4	8	**0.67**	7.20	13.55	0.53	24.18	3.36	13.38	0.81	OK	0.09	Concrete
346+05.00	97.60 L	50	*	**0.0030**	0.013	4	4	8											Concrete
352+48.17	97.60 L	50	*	**0.0020**	0.013	4	4	8											Concrete
352+48.17	97.60 L	50	31.37	**0.0020**	0.013	4	4	8	**0.78**	8.62	14.40	0.60	31.37	3.64	14.21	0.82	OK	0.10	Concrete
360+71.50	97.60 L	50	4.04	**0.0023**	0.013	4	4	8	**0.23**	2.08	9.92	0.21	4.04	1.94	9.86	0.74	OK	0.03	Concrete
362+05.00	97.60 L	50	10.46	**0.0027**	0.013	4	4	8	**0.39**	3.68	11.18	0.33	10.46	2.84	11.09	0.87	OK	0.07	Concrete
366+70.00	97.60 L	50	*	**0.0020**	0.013	4	4	8											Concrete
366+70.00	97.60 L	50	21.89	**0.0020**	0.013	4	4	8	**0.64**	6.72	13.25	0.51	21.89	3.26	13.10	0.80	OK	0.08	Concrete
374+78.15	97.60 L	50	*	**0.0022**	0.013	4	4	8											Concrete
374+78.15	97.60 L	50	12.52	**0.0020**	0.013	4	4	8	**0.47**	4.59	11.84	0.39	12.52	2.73	11.73	0.77	OK	0.06	Concrete
380+12.13	97.50 L	50	*	**0.0020**	0.013	4	4	8											Concrete
380+12.13	97.50 L	50	13.28	**0.0029**	0.013	4	4	8	**0.43**	4.22	11.57	0.36	13.28	3.15	11.47	0.91	OK	0.08	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																			
120+00.00	254.90 L	50	44.34	**0.0032**	0.030	40	20	0	**0.93**	26.22	56.13	0.47	44.34	1.69	56.09	0.44	OK	0.19	Grass w/ 4' concrete pan
130+80.00	254.90 L	50	39.77	**0.0032**	0.030	40	20	0	**0.90**	24.17	53.88	0.45	39.77	1.65	53.85	0.43	OK	0.18	Grass w/ 4' concrete pan
139+80.00	254.90 L	50	31.99	**0.0032**	0.030	40	20	0	**0.83**	20.53	49.66	0.41	31.99	1.56	49.63	0.43	OK	0.17	Grass w/ 4' concrete pan
144+50.00	254.90 L	50	21.93	**0.0024**	0.030	40	20	0	**0.76**	17.23	45.49	0.38	21.93	1.27	45.46	0.36	OK	0.12	Grass w/ 4' concrete pan
144+50.00	254.90 L	50	32.89	**0.0024**	0.030	40	20	0	**0.88**	23.35	52.96	0.44	32.89	1.41	52.93	0.37	OK	0.14	Grass w/ 4' concrete pan
152+49.22	254.90 L	50	31.19	**0.0024**	0.030	40	20	0	**0.86**	22.43	51.92	0.43	31.19	1.39	51.89	0.37	OK	0.13	Grass w/ 4' concrete pan
162+10.00	255.00 L	50	30.02	**0.0020**	0.030	40	20	0	**0.88**	23.34	52.96	0.44	30.02	1.29	52.92	0.34	OK	0.11	Grass w/ 4' concrete pan
167+44.00	255.00 L	50	20.19	**0.0020**	0.030	40	20	0	**0.76**	17.34	45.64	0.38	20.19	1.16	45.61	0.33	OK	0.10	Grass w/ 4' concrete pan
174+86.29	252.84 L	50	*	**0.0020**	0.030	40	20	0											Grass w/ 4' concrete pan
174+86.29	252.84 L	50	30.26	**0.0020**	0.030	40	20	0	**0.88**	23.48	53.12	0.44	30.26	1.29	53.08	0.34	OK	0.11	Grass w/ 4' concrete pan
180+10.00	255.00 L	50	24.77	**0.0020**	0.030	40	20	0	**0.82**	20.21	49.28	0.41	24.77	1.23	49.24	0.34	OK	0.11	Grass w/ 4' concrete pan
189+27.00	255.00 L	50	57.80	**0.0020**	0.030	40	20	0	**1.13**	38.15	67.70	0.56	57.80	1.52	67.66	0.36	OK	0.15	Grass w/ 4' concrete pan
190+79.20	255.00 L	50	46.01	**0.0020**	0.030	40	20	0	**1.04**	32.15	62.15	0.52	46.01	1.43	62.11	0.35	OK	0.13	Grass w/ 4' concrete pan
194+84.00	255.00 L	50	46.44	**0.0020**	0.030	40	20	0	**1.04**	32.38	62.37	0.52	46.44	1.43	62.33	0.35	OK	0.13	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																			
111+64.00	255.00 R	50	28.19	**0.0023**	0.030	50	100	0	**0.60**	26.56	89.28	0.30	28.19	1.06	89.27	0.34	OK	0.09	Grass w/ 4' concrete pan
120+00.00	255.00 R	50	37.82	**0.0032**	0.030	50	100	0	**0.62**	29.26	93.70	0.31	37.82	1.29	93.69	0.41	OK	0.13	Grass w/ 4' concrete pan
172+53.84	255.00 R	50	19.56	**0.0020**	0.030	50	100	0	**0.53**	21.28	79.91	0.27	19.56	0.92	79.90	0.31	OK	0.07	Grass w/ 4' concrete pan
180+21.64	255.00 R	50	23.20	**0.0020**	0.030	50	100	0	**0.57**	24.19	85.20	0.28	23.20	0.96	85.19	0.32	OK	0.07	Grass w/ 4' concrete pan
186+30.10	255.00 R	50	32.82	**0.0020**	0.030	50	100	0	**0.65**	31.38	97.03	0.32	32.82	1.05	97.02	0.32	OK	0.08	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																			
830+70.68	49.98 R	50	12.95	**0.0020**	0.030	3	4	0	**1.45**	7.40	10.60	0.70	12.95	1.75	10.18	0.36	OK	0.19	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																			
396+39.17	497.07 L	50	74.60	**0.0020**	0.013	4	10	8	**1.12**	17.74	23.87	0.74	74.60	4.20	23.68	0.86	OK	0.14	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																			
386+27.40	187.50 L	50	5.91	**0.0088**	0.013	4	10	8	**0.19**	1.81	10.74	0.17	5.91	3.27	10.70	1.40	OK	0.11	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																			
400+37.30	306.19 L	50	92.62	**0.0250**	0.030	4	10	8	**1.01**	15.22	22.32	0.68	92.62	6.08	22.14	1.29	OK	1.63	TRM/Grass
400+37.30	306.19 L	50	92.62	**0.1108**	0.030	4	10	8	**0.69**	8.90	17.82	0.50	92.62	10.41	17.70	2.59	OK	4.94	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																			
403+12.75	50.80 L	50	27.31	**0.0100**	0.030	4	4	4	**0.96**	7.49	11.89	0.63	27.31	3.65	11.65	0.80	OK	0.62	TRM/Grass
403+12.75	50.80 L	50	27.31	**0.0969**	0.030	4	4	4	**0.54**	3.30	8.43	0.39	27.31	8.27	8.30	2.31	OK	3.35	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																			
174+90.22	450.50 R	50	28.53	**0.1119**	0.030	3	3	0	**0.98**	2.87	6.18	0.46	28.53	9.95	5.87	2.51	OK	7.04	TRM/Grass
177+00.55	451.44 R	50	27.40	**0.0926**	0.030	3	3	0	**1.00**	2.99	6.31	0.47	27.40	9.18	5.99	2.29	OK	5.95	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																			
205+27.77	462.69 R	50	45.09	**0.0478**	0.030	3	3	0	**1.36**	5.56	8.61	0.65	45.09	8.11	8.17	1.73	OK	4.19	TRM/Grass

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 50-year Ditch Capacity Analysis Solve for Max Depth

Station	Offset	Recurrence (years)	Flow, Q50 (cfs)	**Min. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	**Water Depth, D (ft)**	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q50 (cfs)	Velocity, V50 (fps)	Top Width, T (ft)	Froude Number, F	Check	Shear Stress (lb/sf)	Ditch Lining
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																			
829+97.98	153.55 L	50	1.04	**0.1424**	0.030	3	3	0	**0.27**	0.22	1.71	0.13	1.04	4.76	1.62	2.28	OK	2.47	TRM/Grass
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																			
814+20.05	143.46 L	50	5.90	**0.0265**	0.030	3	3	0	**0.71**	1.51	4.49	0.34	5.90	3.91	4.26	1.16	OK	1.21	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																			
386+30.00	464.00 L	50	21.96	**0.0704**	0.030	3	3	0	**0.97**	2.80	6.11	0.46	21.96	7.83	5.80	1.99	OK	4.38	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																			
373+56.59	296.96 L	50	9.18	**0.0653**	0.030	3	3	0	**0.71**	1.50	4.47	0.34	9.18	6.12	4.24	1.82	OK	2.97	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																			
813+07.45	195.25 L	50	20.30	**0.0200**	0.030	3	3	0	**1.19**	4.24	7.52	0.56	20.30	4.79	7.13	1.10	OK	1.53	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																			
813+60.10	140.00 L	50	4.49	**0.0200**	0.030	3	3	0	**0.67**	1.37	4.27	0.32	4.49	3.29	4.05	1.00	OK	0.87	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																			
902+53.66	35.01 R	50	11.03	**0.0062**	0.030	3	3	0	**1.18**	4.16	7.45	0.56	11.03	2.65	7.07	0.61	OK	0.47	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																			
829+55.89	144.48 L	50	5.88	**0.0274**	0.030	4	4	0	**0.63**	1.58	5.18	0.30	5.88	3.72	5.03	1.17	OK	1.11	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																			
829+31.25	192.93 L	50	4.19	**0.0274**	0.030	4	4	0	**0.55**	1.23	4.56	0.27	4.19	3.42	4.43	1.15	OK	0.98	TRM/Grass

* A portion of the overall basin with no separate hydrologic calculations.

Lining	MHFD Table RECP-1 and Table RECP-2		Manning's n, HEC-15 Tables 2.1 & 2.2
RECP Type 3.B	< 2	(lb/sf)	0.025
TRM 5.A	2 to 5.9	(lb/sf)	0.030
TRM 5.B	6 to 7.9	(lb/sf)	0.030
TRM 5.C	8 to 10	(lb/sf)	0.030
Riprap	S>=5%, SS>10		0.080

Concrete or TRM is recommended to be used in place of Riprap for this project

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 100-year Ditch Capacity Analysis Solve for Shear

Station	Offset	Recurrence (years)	Flow, Q100 (cfs)	**Max. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	Water Depth, D (ft)	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q100 (cfs)	Velocity, V100 (fps)	Top Width, T (ft)	Froude Number, F	Check	**Shear Stress (lb/sf)**	Ditch Lining
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																			
306+72.50	12.00 R	100	6.46	**0.0136**	0.013	4	4	8	0.18	1.59	9.50	0.17	6.46	4.06	9.46	1.74	OK	**0.16**	Concrete
330+00.00	97.60 L	100	63.97	**0.0070**	0.013	4	4	8	0.81	9.15	14.71	0.62	63.97	6.99	14.51	1.55	OK	**0.37**	Concrete
342+70.76	97.60 L	100	48.66	**0.0050**	0.013	4	4	8	0.77	8.50	14.33	0.59	48.66	5.72	14.14	1.30	OK	**0.25**	Concrete
342+70.76	97.60 L	100	*	**0.0020**	0.013	4	4	8											Concrete
346+05.00	97.60 L	100	30.87	**0.0020**	0.013	4	4	8	0.77	8.52	14.34	0.59	30.87	3.62	14.16	0.82	OK	**0.10**	Concrete
346+05.00	97.60 L	100	*	**0.0030**	0.013	4	4	8											Concrete
352+48.17	97.60 L	100	*	**0.0020**	0.013	4	4	8											Concrete
352+48.17	97.60 L	100	40.76	**0.0023**	0.013	4	4	8	0.86	9.86	15.10	0.65	40.76	4.14	14.89	0.90	OK	**0.13**	Concrete
360+71.50	97.60 L	100	5.07	**0.0023**	0.013	4	4	8	0.27	2.41	10.19	0.24	5.07	2.10	10.13	0.76	OK	**0.04**	Concrete
362+05.00	97.60 L	100	13.51	**0.0027**	0.013	4	4	8	0.45	4.37	11.68	0.37	13.51	3.09	11.57	0.89	OK	**0.08**	Concrete
366+70.00	97.60 L	100	*	**0.0020**	0.013	4	4	8											Concrete
366+70.00	97.60 L	100	27.75	**0.0020**	0.013	4	4	8	0.73	7.91	13.99	0.57	27.75	3.51	13.81	0.82	OK	**0.09**	Concrete
374+78.15	97.60 L	100	*	**0.0022**	0.013	4	4	8											Concrete
374+78.15	97.60 L	100	15.45	**0.0020**	0.013	4	4	8	0.52	5.30	12.32	0.43	15.45	2.92	12.20	0.78	OK	**0.07**	Concrete
380+12.13	97.50 L	100	*	**0.0020**	0.013	4	4	8											Concrete
380+12.13	97.50 L	100	16.13	**0.0128**	0.013	4	4	8	0.32	2.93	10.61	0.28	16.13	5.50	10.53	1.84	OK	**0.26**	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																			
120+00.00	254.90 L	100	53.61	**0.0032**	0.030	40	20	0	1.00	30.23	60.27	0.50	53.61	1.77	60.23	0.44	OK	**0.21**	Grass w/ 4' concrete pan
130+80.00	254.90 L	100	48.63	**0.0080**	0.030	40	20	0	0.82	19.93	48.93	0.41	48.63	2.44	48.90	0.67	OK	**0.42**	Grass w/ 4' concrete pan
139+80.00	254.90 L	100	39.31	**0.0032**	0.030	40	20	0	0.89	23.96	53.65	0.45	39.31	1.64	53.62	0.43	OK	**0.18**	Grass w/ 4' concrete pan
144+50.00	254.90 L	100	26.91	**0.0032**	0.030	40	20	0	0.78	18.03	46.54	0.39	26.91	1.49	46.51	0.42	OK	**0.16**	Grass w/ 4' concrete pan
144+50.00	254.90 L	100	40.36	**0.0032**	0.030	40	20	0	0.90	24.44	54.18	0.45	40.36	1.65	54.15	0.43	OK	**0.19**	Grass w/ 4' concrete pan
152+49.22	254.90 L	100	37.78	**0.0024**	0.030	40	20	0	0.93	25.90	55.79	0.46	37.78	1.46	55.75	0.38	OK	**0.14**	Grass w/ 4' concrete pan
162+10.00	255.00 L	100	36.34	**0.0020**	0.030	40	20	0	0.95	26.94	56.89	0.47	36.34	1.35	56.86	0.35	OK	**0.12**	Grass w/ 4' concrete pan
167+44.00	255.00 L	100	24.85	**0.0020**	0.030	40	20	0	0.82	20.26	49.33	0.41	24.85	1.23	49.30	0.34	OK	**0.11**	Grass w/ 4' concrete pan
174+86.29	252.84 L	100	*	**0.0020**	0.030	40	20	0											Grass w/ 4' concrete pan
174+86.29	252.84 L	100	36.94	**0.0020**	0.030	40	20	0	0.95	27.27	57.24	0.48	36.94	1.35	57.21	0.35	OK	**0.12**	Grass w/ 4' concrete pan
180+10.00	255.00 L	100	29.73	**0.0020**	0.030	40	20	0	0.88	23.17	52.77	0.44	29.73	1.28	52.73	0.34	OK	**0.11**	Grass w/ 4' concrete pan
189+27.00	255.00 L	100	67.59	**0.0020**	0.030	40	20	0	1.20	42.90	71.79	0.60	67.59	1.58	71.75	0.36	OK	**0.15**	Grass w/ 4' concrete pan
190+79.20	255.00 L	100	54.01	**0.0020**	0.030	40	20	0	1.10	36.26	66.00	0.55	54.01	1.49	65.96	0.35	OK	**0.14**	Grass w/ 4' concrete pan
194+84.00	255.00 L	100	54.30	**0.0020**	0.030	40	20	0	1.10	36.41	66.14	0.55	54.30	1.49	66.10	0.35	OK	**0.14**	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																			
111+64.00	255.00 R	100	37.33	**0.0400**	0.030	50	100	0	0.39	11.24	58.07	0.19	37.33	3.32	58.06	1.33	OK	**1.00**	Grass w/ 4' concrete pan
120+00.00	255.00 R	100	47.66	**0.0032**	0.030	50	100	0	0.68	34.80	102.18	0.34	47.66	1.37	102.17	0.41	OK	**0.14**	Grass w/ 4' concrete pan
172+53.84	255.00 R	100	24.37	**0.4199**	0.030	50	100	0	0.21	3.38	31.85	0.11	24.37	7.21	31.84	3.90	OK	**5.74**	Grass w/ 4' concrete pan
180+21.64	255.00 R	100	29.40	**0.0020**	0.030	50	100	0	0.62	28.89	93.11	0.31	29.40	1.02	93.10	0.32	OK	**0.08**	Grass w/ 4' concrete pan
186+30.10	255.00 R	100	42.20	**0.0020**	0.030	50	100	0	0.71	37.88	106.62	0.36	42.20	1.11	106.61	0.33	OK	**0.09**	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																			
830+70.68	49.98 R	100	16.85	**0.0512**	0.030	3	4	0	0.87	2.67	6.37	0.42	16.85	6.30	6.12	1.68	OK	**2.88**	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																			
396+39.17	497.07 L	100	90.63	**0.0904**	0.013	4	10	8	0.46	5.22	14.58	0.36	90.63	17.37	14.49	5.10	OK	**2.70**	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																			
386+27.40	187.50 L	100	7.48	**0.0100**	0.013	4	10	8	0.21	2.02	11.02	0.18	7.48	3.70	10.98	1.52	OK	**0.14**	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																			
400+37.30	306.19 L	100	113.79	**0.0250**	0.030	4	10	8	1.12	17.68	23.84	0.74	113.79	6.43	23.65	1.31	OK	**1.80**	TRM/Grass
400+37.30	306.19 L	100	113.79	**0.1108**	0.030	4	10	8	0.77	10.31	18.92	0.55	113.79	11.03	18.78	2.62	OK	**5.50**	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																			
403+12.75	50.80 L	100	36.25	**0.0649**	0.030	4	4	4	0.69	4.67	9.69	0.48	36.25	7.77	9.52	1.96	OK	**2.88**	TRM/Grass
403+12.75	50.80 L	100	36.25	**0.1298**	0.030	4	4	4	0.58	3.64	8.76	0.42	36.25	9.96	8.62	2.70	OK	**4.82**	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																			
174+90.22	450.50 R	100	36.16	**0.2865**	0.030	3	3	0	0.90	2.41	5.67	0.42	36.16	15.02	5.37	3.96	OK	**16.53**	TRM/Grass
177+00.55	451.44 R	100	35.03	**0.3311**	0.030	3	3	0	0.86	2.23	5.45	0.41	35.03	15.73	5.17	4.22	OK	**18.37**	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																			
205+27.77	462.69 R	100	59.36	**0.1383**	0.030	3	3	0	1.24	4.59	7.82	0.59	59.36	12.94	7.42	2.90	OK	**11.01**	TRM/Grass

Project: Yap International Airport - CLIN BA01 Awarded
Description: 100-year Ditch Capacity Analysis Solve for Shear

Station	Offset	Recurrence (years)	Flow, Q100 (cfs)	**Max. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	Water Depth, D (ft)	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q100 (cfs)	Velocity, V100 (fps)	Top Width, T (ft)	Froude Number, F	Check	**Shear Stress (lb/sf)**	Ditch Lining
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																			
829+97.98	153.55 L	100	1.43	**0.2413**	0.030	3	3	0	0.28	0.23	1.74	0.13	1.43	6.28	1.65	2.98	OK	**4.28**	TRM/Grass
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																			
814+20.05	143.46 L	100	8.09	**0.1625**	0.030	3	3	0	0.57	0.97	3.59	0.27	8.09	8.35	3.41	2.76	OK	**5.95**	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																			
386+30.00	464.00 L	100	28.69	**0.2388**	0.030	3	3	0	0.85	2.17	5.37	0.40	28.69	13.24	5.10	3.58	OK	**13.07**	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																			
373+56.59	296.96 L	100	12.59	**0.0654**	0.030	3	3	0	0.80	1.90	5.03	0.38	12.59	6.63	4.77	1.85	OK	**3.35**	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																			
813+07.45	195.25 L	100	27.29	**0.2160**	0.030	3	3	0	0.85	2.17	5.38	0.40	27.29	12.59	5.10	3.40	OK	**11.82**	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																			
813+60.10	140.00 L	100	6.12	**0.1230**	0.030	3	3	0	0.54	0.87	3.41	0.26	6.12	7.02	3.24	2.38	OK	**4.27**	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																			
902+53.66	35.01 R	100	14.03	**0.1030**	0.030	3	3	0	0.76	1.74	4.81	0.36	14.03	8.08	4.57	2.31	OK	**5.05**	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																			
829+55.89	144.48 L	100	8.07	**0.1003**	0.030	4	4	0	0.55	1.23	4.58	0.27	8.07	6.55	4.44	2.19	OK	**3.58**	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																			
829+31.25	192.93 L	100	5.32	**0.1040**	0.030	4	4	0	0.47	0.89	3.89	0.23	5.32	5.99	3.77	2.17	OK	**3.16**	TRM/Grass

* A portion of the overall basin with no separate hydrologic calculations.

Lining	MHFD Table RECP-1 and Table RECP-2		Manning's n, HEC-15 Tables 2.1 & 2.2
RECP Type 3.B	< 2	(lb/sf)	0.025
TRM 5.A	2 to 5.9	(lb/sf)	0.030
TRM 5.B	6 to 7.9	(lb/sf)	0.030
TRM 5.C	8 to 10	(lb/sf)	0.030
Riprap	S>=5%, SS>10		0.080

Concrete or TRM is recommended to be used in place of Riprap for this project

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 100-year Ditch Capacity Analysis Solve for Max Depth

Station	Offset	Recurrence (years)	Flow, Q100 (cfs)	**Min. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	**Water Depth, D (ft)**	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q100 (cfs)	Velocity, V100 (fps)	Top Width, T (ft)	Froude Number, F	Check	Shear Stress (lb/sf)	Ditch Lining
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																			
306+72.50	12.00 R	100	6.46	**0.0020**	0.013	4	4	8	**0.32**	2.96	10.63	0.28	6.46	2.18	10.55	0.73	OK	0.04	Concrete
330+00.00	97.60 L	100	63.97	**0.0032**	0.013	4	4	8	**1.00**	12.05	16.27	0.74	63.97	5.31	16.03	1.08	OK	0.21	Concrete
342+70.76	97.60 L	100	48.66	**0.0032**	0.013	4	4	8	**0.87**	9.94	15.15	0.66	48.66	4.90	14.93	1.06	OK	0.18	Concrete
342+70.76	97.60 L	100	*	**0.0020**	0.013	4	4	8											Concrete
346+05.00	97.60 L	100	30.87	**0.0020**	0.013	4	4	8	**0.77**	8.52	14.34	0.59	30.87	3.62	14.16	0.82	OK	0.10	Concrete
346+05.00	97.60 L	100	*	**0.0030**	0.013	4	4	8											Concrete
352+48.17	97.60 L	100	*	**0.0020**	0.013	4	4	8											Concrete
352+48.17	97.60 L	100	40.76	**0.0020**	0.013	4	4	8	**0.89**	10.35	15.37	0.67	40.76	3.94	15.15	0.84	OK	0.12	Concrete
360+71.50	97.60 L	100	5.07	**0.0023**	0.013	4	4	8	**0.27**	2.41	10.19	0.24	5.07	2.10	10.13	0.76	OK	0.04	Concrete
362+05.00	97.60 L	100	13.51	**0.0027**	0.013	4	4	8	**0.45**	4.37	11.68	0.37	13.51	3.09	11.57	0.89	OK	0.08	Concrete
366+70.00	97.60 L	100	*	**0.0020**	0.013	4	4	8											Concrete
366+70.00	97.60 L	100	27.75	**0.0020**	0.013	4	4	8	**0.73**	7.91	13.99	0.57	27.75	3.51	13.81	0.82	OK	0.09	Concrete
374+78.15	97.60 L	100	*	**0.0022**	0.013	4	4	8											Concrete
374+78.15	97.60 L	100	15.45	**0.0020**	0.013	4	4	8	**0.52**	5.30	12.32	0.43	15.45	2.92	12.20	0.78	OK	0.07	Concrete
380+12.13	97.50 L	100	*	**0.0020**	0.013	4	4	8											Concrete
380+12.13	97.50 L	100	16.13	**0.0029**	0.013	4	4	8	**0.48**	4.81	11.99	0.40	16.13	3.36	11.87	0.93	OK	0.09	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																			
120+00.00	254.90 L	100	53.61	**0.0032**	0.030	40	20	0	**1.00**	30.23	60.27	0.50	53.61	1.77	60.23	0.44	OK	0.21	Grass w/ 4' concrete pan
130+80.00	254.90 L	100	48.63	**0.0032**	0.030	40	20	0	**0.97**	28.10	58.11	0.48	48.63	1.73	58.07	0.44	OK	0.20	Grass w/ 4' concrete pan
139+80.00	254.90 L	100	39.31	**0.0032**	0.030	40	20	0	**0.89**	23.96	53.65	0.45	39.31	1.64	53.62	0.43	OK	0.18	Grass w/ 4' concrete pan
144+50.00	254.90 L	100	26.91	**0.0024**	0.030	40	20	0	**0.82**	20.08	49.12	0.41	26.91	1.34	49.09	0.37	OK	0.13	Grass w/ 4' concrete pan
144+50.00	254.90 L	100	40.36	**0.0024**	0.030	40	20	0	**0.95**	27.22	57.19	0.48	40.36	1.48	57.15	0.38	OK	0.15	Grass w/ 4' concrete pan
152+49.22	254.90 L	100	37.78	**0.0024**	0.030	40	20	0	**0.93**	25.90	55.79	0.46	37.78	1.46	55.75	0.38	OK	0.14	Grass w/ 4' concrete pan
162+10.00	255.00 L	100	36.34	**0.0020**	0.030	40	20	0	**0.95**	26.94	56.89	0.47	36.34	1.35	56.86	0.35	OK	0.12	Grass w/ 4' concrete pan
167+44.00	255.00 L	100	24.85	**0.0020**	0.030	40	20	0	**0.82**	20.26	49.33	0.41	24.85	1.23	49.30	0.34	OK	0.11	Grass w/ 4' concrete pan
174+86.29	252.84 L	100	*	**0.0020**	0.030	40	20	0											Grass w/ 4' concrete pan
174+86.29	252.84 L	100	36.94	**0.0020**	0.030	40	20	0	**0.95**	27.27	57.24	0.48	36.94	1.35	57.21	0.35	OK	0.12	Grass w/ 4' concrete pan
180+10.00	255.00 L	100	29.73	**0.0020**	0.030	40	20	0	**0.88**	23.17	52.77	0.44	29.73	1.28	52.73	0.34	OK	0.11	Grass w/ 4' concrete pan
189+27.00	255.00 L	100	67.59	**0.0020**	0.030	40	20	0	**1.20**	42.90	71.79	0.60	67.59	1.58	71.75	0.36	OK	0.15	Grass w/ 4' concrete pan
190+79.20	255.00 L	100	54.01	**0.0020**	0.030	40	20	0	**1.10**	36.26	66.00	0.55	54.01	1.49	65.96	0.35	OK	0.14	Grass w/ 4' concrete pan
194+84.00	255.00 L	100	54.30	**0.0020**	0.030	40	20	0	**1.10**	36.41	66.14	0.55	54.30	1.49	66.10	0.35	OK	0.14	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																			
111+64.00	255.00 R	100	37.33	**0.0023**	0.030	50	100	0	**0.66**	32.79	99.19	0.33	37.33	1.14	99.18	0.35	OK	0.10	Grass w/ 4' concrete pan
120+00.00	255.00 R	100	47.66	**0.0032**	0.030	50	100	0	**0.68**	34.80	102.18	0.34	47.66	1.37	102.17	0.41	OK	0.14	Grass w/ 4' concrete pan
172+53.84	255.00 R	100	24.37	**0.0020**	0.030	50	100	0	**0.58**	25.10	86.78	0.29	24.37	0.97	86.77	0.32	OK	0.07	Grass w/ 4' concrete pan
180+21.64	255.00 R	100	29.40	**0.0020**	0.030	50	100	0	**0.62**	28.89	93.11	0.31	29.40	1.02	93.10	0.32	OK	0.08	Grass w/ 4' concrete pan
186+30.10	255.00 R	100	42.20	**0.0020**	0.030	50	100	0	**0.71**	37.88	106.62	0.36	42.20	1.11	106.61	0.33	OK	0.09	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																			
830+70.68	49.98 R	100	16.85	**0.0020**	0.030	3	4	0	**1.61**	9.02	11.70	0.77	16.85	1.87	11.24	0.37	OK	0.21	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																			
396+39.17	497.07 L	100	90.63	**0.0020**	0.013	4	10	8	**1.23**	20.45	25.45	0.80	90.63	4.43	25.23	0.87	OK	0.16	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																			
386+27.40	187.50 L	100	7.48	**0.0088**	0.013	4	10	8	**0.22**	2.11	11.13	0.19	7.48	3.55	11.09	1.43	OK	0.13	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																			
400+37.30	306.19 L	100	113.79	**0.0250**	0.030	4	10	8	**1.12**	17.68	23.84	0.74	113.79	6.43	23.65	1.31	OK	1.80	TRM/Grass
400+37.30	306.19 L	100	113.79	**0.1108**	0.030	4	10	8	**0.77**	10.31	18.92	0.55	113.79	11.03	18.78	2.62	OK	5.50	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																			
403+12.75	50.80 L	100	36.25	**0.0100**	0.030	4	4	4	**1.10**	9.21	13.05	0.71	36.25	3.94	12.78	0.82	OK	0.71	TRM/Grass
403+12.75	50.80 L	100	36.25	**0.0969**	0.030	4	4	4	**0.62**	4.04	9.13	0.44	36.25	8.97	8.98	2.36	OK	3.88	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																			
174+90.22	450.50 R	100	36.16	**0.1119**	0.030	3	3	0	**1.07**	3.42	6.76	0.51	36.16	10.56	6.41	2.55	OK	7.70	TRM/Grass
177+00.55	451.44 R	100	35.03	**0.0926**	0.030	3	3	0	**1.09**	3.59	6.92	0.52	35.03	9.76	6.56	2.32	OK	6.52	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																			
205+27.77	462.69 R	100	59.36	**0.0478**	0.030	3	3	0	**1.51**	6.83	9.54	0.72	59.36	8.69	9.05	1.76	OK	4.65	TRM/Grass

DITCH CALCULATIONS

Project: Yap International Airport - CLIN BA01 Awarded
Description: 100-year Ditch Capacity Analysis Solve for Max Depth

Station	Offset	Recurrence (years)	Flow, Q100 (cfs)	**Min. Longitudinal Slope, S (ft/ft)**	Manning's n	Left Slope, (H:1V)	Right Slope, (H:1V)	Bottom Width, W (ft)	**Water Depth, D (ft)**	Area, A (sf)	Wetted Perimeter, P (ft)	Hydraulic Radius, R (ft)	Estimated Flow, Q100 (cfs)	Velocity, V100 (fps)	Top Width, T (ft)	Froude Number, F	Check	Shear Stress (lb/sf)	Ditch Lining
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																			
829+97.98	153.55 L	100	1.43	**0.1424**	0.030	3	3	0	**0.30**	0.28	1.92	0.14	1.43	5.15	1.82	2.33	OK	2.79	TRM/Grass
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																			
814+20.05	143.46 L	100	8.09	**0.0265**	0.030	3	3	0	**0.80**	1.91	5.05	0.38	8.09	4.23	4.79	1.18	OK	1.36	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																			
386+30.00	464.00 L	100	28.69	**0.0704**	0.030	3	3	0	**1.07**	3.43	6.76	0.51	28.69	8.38	6.41	2.02	OK	4.84	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																			
373+56.59	296.96 L	100	12.59	**0.0653**	0.030	3	3	0	**0.80**	1.90	5.03	0.38	12.59	6.63	4.77	1.85	OK	3.35	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																			
813+07.45	195.25 L	100	27.29	**0.0200**	0.030	3	3	0	**1.33**	5.29	8.40	0.63	27.29	5.16	7.97	1.12	OK	1.71	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																			
813+60.10	140.00 L	100	6.12	**0.0200**	0.030	3	3	0	**0.76**	1.72	4.79	0.36	6.12	3.55	4.55	1.02	OK	0.98	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																			
902+53.66	35.01 R	100	14.03	**0.0062**	0.030	3	3	0	**1.29**	4.98	8.15	0.61	14.03	2.82	7.73	0.62	OK	0.51	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																			
829+55.89	144.48 L	100	8.07	**0.0020**	0.030	4	4	0	**1.16**	5.34	9.53	0.56	8.07	1.51	9.25	0.35	OK	0.15	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																			
829+31.25	192.93 L	100	5.32	**0.0274**	0.030	4	4	0	**0.61**	1.47	4.99	0.29	5.32	3.63	4.84	1.16	OK	1.07	TRM/Grass

* A portion of the overall basin with no separate hydrologic calculations.

Lining	MHFD Table RECP-1 and Table RECP-2		Manning's n, HEC-15 Tables 2.1 & 2.2
RECP Type 3.B	< 2	(lb/sf)	0.025
TRM 5.A	2 to 5.9	(lb/sf)	0.030
TRM 5.B	6 to 7.9	(lb/sf)	0.030
TRM 5.C	8 to 10	(lb/sf)	0.030
Riprap	S>=5%, SS>10		0.080

Concrete or TRM is recommended to be used in place of Riprap for this project

SECTION	DITCH NUMBER	BEGIN STATION	OFFSET	BEGIN ELEVATION	END STATION	OFFSET	END ELEVATION	ALIGNMENT	B (FT)	Z (LT)	Z (RT)	MIN. LINING DEPTH (FT) (1 + 5-yr Flow Max. Depth)	LINING DEPTH PER PLAN (FT)	MIN LONG. SLOPE (FT/FT)	MAX LONG. SLOPE (FT/FT)	DITCH LINING
Ditch 1 - Concrete Trapezoidal Ditch North of Taxiway (Sta. 306+72.50 to 386+32.08)																
Trapezoidal	1	309+70.38	86.44 L	89.79	306+72.50	12.00 R	87.28	TW B	8	4	4	*	2.0	0.002	0.014	Concrete
Trapezoidal	1	309+70.38	86.44 L	89.79	330+00.00	97.60 L	82.66	TW B	8	4	4	1.4	2.0	0.003	0.007	Concrete
Trapezoidal	1	330+00.00	97.60 L	82.66	342+70.76	97.60 L	78.56	TW B	8	4	4	1.3	2.0	0.003	0.005	Concrete
Trapezoidal	1	344+52.17	97.60 L	78.56	342+70.76	97.60 L	78.20	TW B	8	4	4	*	2.0	0.002	0.002	Concrete
Trapezoidal	1	351+50.00	97.60 L	79.62	346+05.00	97.60 L	78.56	TW B	8	4	4	1.3	2.0	0.002	0.002	Concrete
Trapezoidal	1	344+52.17	97.60 L	78.56	346+05.00	97.60 L	78.26	TW B	8	4	4	*	2.0	0.003	0.003	Concrete
Trapezoidal	1	351+50.00	97.60 L	79.82	352+48.17	97.60 L	79.62	TW B	8	4	4	*	2.0	0.002	0.002	Concrete
Trapezoidal	1	360+71.50	97.60 L	81.51	352+48.17	97.60 L	79.62	TW B	8	4	4	1.3	2.0	0.002	0.002	Concrete
Trapezoidal	1	362+05.00	97.60 L	81.81	360+71.50	97.60 L	81.51	TW B	8	4	4	1.1	2.0	0.002	0.002	Concrete
Trapezoidal	1	365+40.00	97.60 L	82.72	362+05.00	97.60 L	81.81	TW B	8	4	4	1.2	2.0	0.003	0.003	Concrete
Trapezoidal	1	365+40.00	97.60 L	83.72	366+70.00	97.60 L	82.46	TW B	8	4	4	*	2.0	0.002	0.002	Concrete
Trapezoidal	1	373+10.00	97.60 L	83.74	366+70.00	97.60 L	82.46	TW B	8	4	4	1.3	2.0	0.002	0.002	Concrete
Trapezoidal	1	373+70.00	97.60 L	83.74	374+78.15	97.60 L	83.58	TW B	8	4	4	*	2.0	0.002	0.002	Concrete
Trapezoidal	1	379+08.56	97.60 L	84.45	374+78.15	97.60 L	83.58	TW B	8	4	4	1.3	2.0	0.002	0.002	Concrete
Trapezoidal	1	379+08.56	97.60 L	84.45	380+12.13	97.50 L	84.26	TW B	8	4	4	*	2.0	0.002	0.002	Concrete
Trapezoidal	1	386+27.40	187.50 L	87.95	380+12.13	97.50 L	84.26	TW B	8	4	4	1.3	2.0	0.003	0.013	Concrete
Ditch 2 - Infield Swale Between Runway and Taxiway (Sta. 111+64.00 to Sta. 198+10.00)																
Triangular	2	111+64.00	254.90 L	87.63	120+00.00	254.90 L	84.96	RW 07-25	0	40	20	1.7	N/A	0.003	0.003	Grass w/ 4' concrete pan
Triangular	2	120+00.00	254.90 L	84.96	130+80.00	254.90 L	82.37	RW 07-25	0	40	20	1.6	N/A	0.003	0.008	Grass w/ 4' concrete pan
Triangular	2	131+30.00	254.90 L	81.35	139+80.00	254.90 L	78.64	RW 07-25	0	40	20	1.6	N/A	0.003	0.003	Grass w/ 4' concrete pan
Triangular	2	139+80.00	254.90 L	78.64	144+50.00	254.90 L	77.14	RW 07-25	0	40	20	1.6	N/A	0.003	0.003	Grass w/ 4' concrete pan
Triangular	2	152+49.22	254.90 L	79.04	144+50.00	254.90 L	77.14	RW 07-25	0	40	20	1.6	N/A	0.002	0.003	Grass w/ 4' concrete pan
Triangular	2	158+20.84	254.90 L	80.40	152+49.22	254.90 L	79.04	RW 07-25	0	40	20	1.6	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	2	167+44.00	255.00 L	82.64	162+10.00	255.00 L	81.57	RW 07-25	0	40	20	1.6	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	2	172+90.00	255.00 L	83.74	167+44.00	255.00 L	82.64	RW 07-25	0	40	20	1.5	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	2	172+90.00	255.00 L	83.74	174+86.29	252.84 L	83.54	RW 07-25	0	40	20	*	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	2	180+10.00	255.00 L	84.42	174+86.29	252.84 L	83.54	RW 07-26	0	40	20	1.6	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	2	183+74.42	255.00 L	85.15	180+10.00	255.00 L	84.42	RW 07-25	0	40	20	1.6	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	2	186+90.00	255.00 L	84.99	189+27.00	255.00 L	84.53	RW 07-25	0	40	20	*	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	2	194+84.00	255.00 L	85.64	190+79.20	255.00 L	84.83	RW 07-25	0	40	20	1.8	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	2	198+09.20	255.00 L	86.29	194+84.00	255.00 L	85.64	RW 07-25	0	0	0	1.8	N/A	0.002	0.002	Grass w/ 4' concrete pan
Ditch 3a,b,c - Infield Swale South of Runway (Sta. 101+53.75 to Sta. 200+00.00)																
Triangular	3a	101+53.72	255.00 R	105.31	111+64.00	255.00 R	88.00	RW 07-25	0	50	100	1.3	N/A	0.002	0.040	Grass w/ 4' concrete pan
Triangular	3a	111+64.00	255.00 R	88.00	120+00.00	255.00 R	85.31	RW 07-25	0	50	100	1.4	N/A	0.003	0.003	Grass w/ 4' concrete pan
Triangular	3b	177+38.56	255.00 R	82.23	172+53.84	255.00 R	81.26	RW 07-25	0	50	100	1.4	N/A	0.002	0.420	Grass w/ 4' concrete pan
Triangular	3c	186+30.10	255.00 R	84.02	180+21.64	255.00 R	82.80	RW 07-25	0	50	100	1.4	N/A	0.002	0.002	Grass w/ 4' concrete pan
Triangular	3c	200+00.00	255.00 R	86.76	186+30.10	255.00 R	84.02	RW 07-25	0	50	100	1.4	N/A	0.002	0.002	Grass w/ 4' concrete pan
Ditch 4 - East Perimeter Road V-ditch (Sta. 823+49.77 to Sta. 830+70.68)																
Triangular	4	823+37.96	23.97 R	79.02	830+70.68	49.98 R	48.59	Public Access Road	0	3	4	1.8	1.5**	0.002	0.051	TRM/Grass
Ditch 5 - Concrete Trapazoidal Ditch North of Apron (Sta. 386+89.55 to Sta.396+61.22)																
Trapezoidal	5	386+89.55	465.50 L	91.05	396+39.17	497.07 L	87.19	TW B	8	4	10	1.7	2.0	0.002	0.090	Concrete
Ditch 6 - Concrete Trapazoidal Ditch West of Apron (Sta. 386+29.94 to Sta. 386+32.08)																
Trapezoidal	6	386+27.40	401.50	89.96	386+27.40	187.50 L	87.84	TW B	8	4	10	1.1	2.0	0.009	0.010	Concrete
Ditch 7 - Basin A-O6P-s1 Ditch to Pond from West (Sta. 902+68.00 to Sta. 400+64.36)																
Trapezoidal	7	902+68.08	51.79 L	85.46	400+37.30	306.19 L	76.38	TW B	8	4	10	1.6	2.0	0.025	0.025	TRM/Grass
Trapezoidal	7	400+37.30	306.19 L	76.38	400+64.36	252.86 L	69.75	TW B	8	4	10	1.4	2.0	0.111	0.111	TRM/Grass
Ditch 8 - Basin A-O6P-s2 Ditch to Pond from East (Sta. 402+94.58 to Sta. 407+90.77)																
Trapezoidal	8	407+95.59	75.37 R	80.70	403+12.75	50.80 L	72.83	TW B	4	4	4	1.4	1.5	0.010	0.065	TRM/Grass
Trapezoidal	8	403+12.75	50.80 L	72.83	402+94.58	87.55 L	68.65	TW B	4	4	4	1.2	1.5	0.097	0.130	TRM/Grass
Ditch 9a and 9b - Pond 4 Riprap Ditches (Sta. 172+77.89 to Sta. 179+41.91)																
Triangular	9a	172+77.89	325.40 R	78.58	174+90.22	450.50 R	35.00	RW 07-25	0	3	3	1.6	2.0	0.112	0.287	TRM/Grass
Triangular	9b	179+41.91	315.30 R	80.36	177+00.55	451.44 R	35.00	RW 07-25	0	3	3	1.6	1.5**	0.093	0.331	TRM/Grass
Ditch 10 - Toe of Slope Riprap Ditch to Pond 6A (Sta. 202+62.27 to Sta. 205+30.14)																
Triangular	10	202+62.27	404.55 R	82.03	205+27.77	462.69 R	60.00	RW 07-25	0	3	3	1.7	2.0	0.048	0.138	TRM/Grass
Ditch 11 - Toe of Slope Riprap Ditch to Outfall 6 (Sta. 829+97.12 to Sta. 830+73.62)																
Triangular	11	830+76.45	32.32 L	53.06	829+97.98	153.55 L	20.88	Public Access Road	0	3	3	1.1	1.5	0.142	0.241	TRM/Grass

SECTION	DITCH NUMBER	BEGIN STATION	OFFSET	BEGIN ELEVATION	END STATION	OFFSET	END ELEVATION	ALIGNMENT	B (FT)	Z (LT)	Z (RT)	MIN. LINING DEPTH (FT) (1 + 5-yr Flow Max. Depth)	LINING DEPTH PER PLAN (FT)	MIN LONG. SLOPE (FT/FT)	MAX LONG. SLOPE (FT/FT)	DITCH LINING
Ditch 12 - Toe of Slope Riprap Ditch to Headwall 6-1 (Sta. 814+13.63 to Sta. 816+46.57)																
Triangular	12	816+46.78	78.31 L	76.43	814+20.05	143.46 L	49.98	Public Access Road	0	3	3	1.3	1.5	0.027	0.163	TRM/Grass
Ditch 13 - Toe of Slope Riprap Ditch to NW Corner of Parking Apron (Sta. 382+99.95 to Sta. 386+25.00)																
Triangular	13	382+99.95	608.19 L	138.26	386+30.00	464.00 L	89.92	TW B	0	3	3	1.5	2.0	0.070	0.239	TRM/Grass
Ditch 14 - Ditch to Headwall 4-1 (Sta. 373+56.69 to Sta. 375+39.04)																
Triangular	14	375+39.04	262.25 L	71.66	373+56.59	296.96 L	58.91	TW B	0	3	3	1.3	1.5	0.065	0.065	TRM/Grass
Ditch 15 - North side of maintenance road for inlet to Outfall 6 (Sta. 810+60.36 to Sta. 813+07.37)																
Triangular	15	800+25.00	20.79 L	72.95	813+07.45	195.25 L	53.92	Public Access Road	0	3	3	1.6	1.0**	0.020	0.216	TRM/Grass
Ditch 16 - South side of maintenance road for inlet to Outfall 6 (Sta. 809+19.49 to Sta. 813+59.76)																
Triangular	16	809+19.51	24.14 L	93.93	813+60.10	140.00 L	49.58	Public Access Road	0	3	3	1.3	1.0**	0.020	0.123	TRM/Grass
Ditch 17 - West side of maintenance road for inlet to Outfall 7 (Sta. 900+21.26 to Sta. 902+54.07)																
Triangular	17	900+22.00	151.15 R	103.04	902+53.66	35.01 R	86.70	Connector Road	0	3	3	1.7	2.0	0.006	0.103	TRM/Grass
Ditch 18 - West side of maintenance road for Outfall 6 (Sta 824+19.25 to Sta. 829+55.91)																
Triangular	18	824+19.16	45.77 L	73.00	829+55.89	144.48 L	23.21	Public Access Road	0	4	4	1.2	1.0**	0.027	0.100	TRM/Grass
Ditch 19 - East side of maintenance road for Outfall 6 (Sta. 824+99.15 to Sta. 829+31.29)																
Triangular	19	824+99.06	86.42 L	64.00	829+31.25	192.93 L	25.00	Public Access Road	0	4	4	1.4	1.0**	0.027	0.104	TRM/Grass

* No separate hydrologic calculations for lining depth evaluation. Use adjacent depth.

** Freeboard in ditch is less than 1.0'

INLET CALCULATIONS

CLIN BA01 AWARDED

Project Name **Yap International Airport - CLIN BA01 Awarded** Project No.: WFXO6323

Revised Date **10/30/2025** Calculated By: Douglas P. Stewart, PE

Inlet Summary

Inlet ID	Basin ID	Number of Grates	Aircraft Rated	Inlet Depth (ft)	Box Depth (ft)	Inside Box Dimensions	Chimney Depth (ft)	Chimney Dimensions	T1	Pipe 1	Pipe 2	Pipe 3	Notes
IN-1-1	A-1-1	4	No	5.51		8'-0" x 5'-6"			18"	36" HP			
IN-1-2	A-1-2	4	No	43.00	6.00	7'-0" x 8'-0"	37.00	4'-0" x 8'-0"	36"	48" RCP	48" RCP		Deep Chimney
IN-2-3	A-2-3	4	No	5.51		8'-0" x 5'-8"			18"	36" RCP			
IN-2-4	A-2-4	4	Yes	10.40	6.00	5'-8" x 8'-0"	4.40	2'-8" x 8'-0"	12"	36" RCP	36" RCP	60" CMP (Ex)	
IN-2-5	A-2-5	4	Yes	6.19		5'-8" x 8'-0"			12"	36" RCP			
IN-3-4	A-3-4	4	No	5.51		8'-0" x 2'-8"			18"	36" HP			
IN-3-5	A-3-5	4	No	5.22		8'-0" x 2'-8"			18"	36" HP			
IN-3-6	N/A	1	No	7.25	6.25	8'-0" x 7'-0"	1.00	2'-8" x 2'-0"	12"	36" HP	48" RCP	36" HP	Junction structure, no tributary basin
IN-3-7	A-3-7	4	Yes	8.37		9'-0" x 8'-0"			12"	36" RCP	48" RCP	60" RCP	
IN-3-8	A-3-8	4	No	7.06		8'-0" x 7'-0"			12"	48" RCP			
IN-3-9	A-3-9	4	Yes	9.24		2'-8" x 8'-0"			12"	48" RCP	60" CMP EX		
IN-3-10	A-3-10	4	No	7.61		8'-0" x 7'-0"			12"	36" HP	48" HP	48" RCP	
IN-3-11	A-3-11	4	Yes	10.14	6.00	7'-0" x 8'-0"	4.14	2'-8" x 8'-0"	12"	36" RCP	48" RCP	48" RCP	
IN-3-12	A-3-12	4	No	6.25		8'-0" x 2'-8"			12"	48" HP			
IN-3-13	A-3-13	2	Yes	5.64		6'-0" x 6'-0"			15"	36" RCP			
IN-3-14	A-3-14	4	Yes	6.02		5'-8" x 8'-0"			12"	36" RCP			
IN-3-15	A-3-15	4	No	5.65		8'-0" x 6'-0"			12"	36" HP	36" HP		
IN-3-16	A-3-16	4	No	10.13	6.00	8'-0" x 5'-6"	4.13	8'-0" x 2'-8"	12"	36" HP			
IN-3-17	A-3-17	2	No	8.24		4'-6" x 2'-8"			12"	24" HP			
IN-3-18	A-3-18	4	No	8.22		8'-0" x 4'-7"			12"	EX 2'X3' RCP BOX	24" HP		Tie existing 2'x3' box culvert to new inlet
IN-4-12	A-4-12	4	Yes	44.20	16.00	7'-0" x 9'-0"	28.20	4'-0" x 9'-0"	36"	48" RCP	48" RCP	78" CMP (Ex)	Deep Chimney
IN-4-13	A-4-13	4	No	13.00		8'-0" x 2'- 8"			12"	36" RCP			
IN-4-14	A-4-14	4	No	9.20		8'-0" x 11'-3"			12"	48" HP	48" RCP		
IN-4-15	A-4-15	4	Yes	10.95		7'-0" x 8'-2"			12"	48" RCP	48" RCP		
IN-4-16	A-4-16	4	No	27.71	6.00	8'-0" x 10'-8"	21.71	8'-0" x 4'-0"	27"	48" HP	48" RCP		Deep Chimney
IN-4-17	A-4-17	3	No	7.25		2'-8" x 6'-6"			12"	48" HP			
IN-4-18	A-4-18	4	No	13.00		8'-0" x 2'-8"			12"	24" RCP			
IN-5-16	A-5-16	4	No	12.38		2'-8" x 8'-2"			12"	60" RCP	60" RCP		
IN-5-17	A-5-17	4	Yes	8.16		8'-0" x 4'-0"			12"	48" RCP	48" RCP		
IN-5-18	A-5-18	4	No	25.52	7.00	4'-0" x 8'-2"	18.52	2'-8" x 8'-2"	12"	60" RCP	60" RCP		
IN-5-19	A-5-19	4	Yes	10.20	6.00	7'-0" x 8'-0"	4.20	2'-8" x 8'-0"	12"	48" RCP	48" RCP		
IN-5-20	A-5-20	4	Yes	7.19		7'-0" x 8'-0"			12"	48" RCP			
IN-5-21	A-5-21	1	No	4.52		3'-9" x 2'-8"			12"	18" HP			
IN-5-22	A-5-22	2	No	9.00		4'-6" x 2'-8"			12"	24" HP			
IN-5-23	A-5-23	1	No	6.94		2'-8" x 4'-6"			12"	24" HP			
IN-5-24	A-5-24	4	No	7.71		4'-0" x 8'-0"			12"	60" RCP	60" RCP		
IN-5-25	A-5-25	1	No	5.70		4'-6" x 2'-8"			12"	24" HP			

Yap Island
Inlet Weir/Orifice Calculations

		(Neenah)			Orifice		Weir		
Inlet	Q (cfs)	Grate type	# of grates	$(Q/CA^{1})^2$	Depth (ft)		Depth (ft)		Notes:
A	5	R-3475-E	1	38.67	0.60		0.49		orifice
B	10	R-3475-E	1	154.70	2.40		0.77		orifice
C	15	R-3475-E	1	348.07	5.41		1.01		orifice
D	20	R-3475-E	1	618.80	9.62		1.23		orifice
A	5	R-3475-F	2	9.67	0.15		0.39		weir
B	10	R-3475-F	2	38.67	0.60		0.62		weir
C	15	R-3475-F	2	87.02	1.35		0.81		orifice
D	20	R-3475-F	2	154.70	2.40		0.98		orifice
A	5	R-3475-G	3	4.30	0.07		0.33		weir
B	10	R-3475-G	3	17.19	0.27		0.52		weir
C	15	R-3475-G	3	38.67	0.60		0.68		weir
D	20	R-3475-G	3	68.76	1.07		0.82		orifice
A	5	R-3475-H	4	2.42	0.04		0.29		weir
B	10	R-3475-H	4	9.67	0.15		0.45		weir
C	15	R-3475-H	4	21.75	0.34		0.59		weir
D	20	R-3475-H	4	38.67	0.60		0.72		weir

1 Assumes clogging factor shown below

Constants:

Cd	0.67	
Clogging	50%	
g	32.17	ft/s^2
Cw	3.00	

Catalog Number	Grate Type	SQ.FT. Open	Weir Perimeter (l.f.)		No. of Grates
R-3475-E	A	2.4	9.8		1
R-3475-F	C	4.8	13.8		2
R-3475-G	C	7.2	17.8		3
R-3475-H	C	9.6	21.8		4

Project Name	Yap INTL Airport - CLIN BA01 Awarded		Project No.	WFXO6323
Revised Date	10/30/2025		Calculated By	DPS

Inlet ID	Basin ID	Q5 (cfs)	R-3475-E			
			Orifice Depth (ft)	Weir Depth (ft)	Design Depth (ft)	Control Regime
IN-1-1	A-1-1	4.06	0.39	0.27	0.39	Orifice
IN-1-2	A-1-2	5.06	0.61	0.31	0.61	Orifice
IN-2-3	A-2-3	11.41	3.11	0.53	3.11	Orifice
IN-2-4	A-2-4	15.82	5.99	0.66	5.99	Orifice
IN-2-5	A-2-5	18.93	8.57	0.75	8.57	Orifice
IN-3-4	A-3-4	6.65	1.06	0.37	1.06	Orifice
IN-3-5	A-3-5	8.88	1.89	0.45	1.89	Orifice
IN-3-6	N/A	N/A				
IN-3-7	A-3-7	21.24	10.79	0.81	10.79	Orifice
IN-3-8	A-3-8	7.18	1.23	0.39	1.23	Orifice
IN-3-9	A-3-9	13.17	4.15	0.59	4.15	Orifice
IN-3-10	A-3-10	2.60	0.16	0.20	0.20	Weir
IN-3-11	A-3-11	12.72	3.87	0.57	3.87	Orifice
IN-3-12	A-3-12	6.40	0.98	0.36	0.98	Orifice
IN-3-13	A-3-13	7.67	1.41	0.41	1.41	Orifice
IN-3-14	A-3-14	12.29	3.61	0.56	3.61	Orifice
IN-3-15	A-3-15	1.31	0.04	0.13	0.13	Weir
IN-3-16	A-3-16	2.53	0.15	0.20	0.20	Weir
IN-3-17	A-3-17	5.75	0.79	0.34	0.79	Orifice
IN-3-18	A-3-18	9.35	2.09	0.47	2.09	Orifice
IN-4-12	A-4-12	12.15	3.53	0.56	3.53	Orifice
IN-4-13	A-4-13	8.60	1.77	0.44	1.77	Orifice
IN-4-14	A-4-14	5.50	0.72	0.33	0.72	Orifice
IN-4-15	A-4-15	11.03	2.91	0.52	2.91	Orifice
IN-4-16	A-4-16	4.56	0.50	0.29	0.50	Orifice
IN-4-17	A-4-17	1.32	0.04	0.13	0.13	Weir
IN-4-18	A-4-18	7.60	1.38	0.41	1.38	Orifice
IN-5-16	A-5-16	1.13	0.03	0.11	0.11	Weir
IN-5-17	A-5-17	23.10	12.76	0.85	12.76	Orifice
IN-5-18	A-5-18	8.48	1.72	0.44	1.72	Orifice
IN-5-19	A-5-19	29.57	20.91	1.00	20.91	Orifice
IN-5-20	A-5-20	23.65	13.38	0.87	13.38	Orifice
IN-5-21	A-5-21	1.27	0.04	0.12	0.12	Weir
IN-5-22	A-5-22	1.01	0.02	0.11	0.11	Weir
IN-5-23	A-5-23	0.34	0.00	0.05	0.05	Weir
IN-5-24	A-5-24	4.58	0.50	0.29	0.50	Orifice
IN-5-25	A-5-25	0.13	0.00	0.03	0.03	Weir

Design depth threshold for number of grates is 0.4 feet (green meets threshold requirement)

Project Name	Yap INTL Airport - CLIN BA01 Awarded	Project No.	WFXO6323
Revised Date	10/30/2025	Calculated By	DPS

Inlet ID	Basin ID	Q5 (cfs)	R-3475-F			
			Orifice Depth (ft)	Weir Depth (ft)	Design Depth (ft)	Control Regime
IN-1-1	A-1-1	4.06				
IN-1-2	A-1-2	5.06	0.15	0.25	0.25	Weir
IN-2-3	A-2-3	11.41	0.78	0.42	0.78	Orifice
IN-2-4	A-2-4	15.82	1.50	0.53	1.50	Orifice
IN-2-5	A-2-5	18.93	2.14	0.59	2.14	Orifice
IN-3-4	A-3-4	6.65	0.26	0.30	0.30	Weir
IN-3-5	A-3-5	8.88	0.47	0.36	0.47	Orifice
IN-3-6	N/A	N/A				
IN-3-7	A-3-7	21.24	2.70	0.64	2.70	Orifice
IN-3-8	A-3-8	7.18	0.31	0.31	0.31	Weir
IN-3-9	A-3-9	13.17	1.04	0.47	1.04	Orifice
IN-3-10	A-3-10	2.60				
IN-3-11	A-3-11	12.72	0.97	0.46	0.97	Orifice
IN-3-12	A-3-12	6.40	0.24	0.29	0.29	Weir
IN-3-13	A-3-13	7.67	0.35	0.33	0.35	Orifice
IN-3-14	A-3-14	12.29	0.90	0.45	0.90	Orifice
IN-3-15	A-3-15	1.31				
IN-3-16	A-3-16	2.53				
IN-3-17	A-3-17	5.75	0.20	0.27	0.27	Weir
IN-3-18	A-3-18	9.35	0.52	0.37	0.52	Orifice
IN-4-12	A-4-12	12.15	0.88	0.44	0.88	Orifice
IN-4-13	A-4-13	8.60	0.44	0.35	0.44	Orifice
IN-4-14	A-4-14	5.50	0.18	0.26	0.26	Weir
IN-4-15	A-4-15	11.03	0.73	0.41	0.73	Orifice
IN-4-16	A-4-16	4.56	0.12	0.23	0.23	Weir
IN-4-17	A-4-17	1.32				
IN-4-18	A-4-18	7.60	0.35	0.32	0.35	Orifice
IN-5-16	A-5-16	1.13				
IN-5-17	A-5-17	23.10	3.19	0.68	3.19	Orifice
IN-5-18	A-5-18	8.48	0.43	0.35	0.43	Orifice
IN-5-19	A-5-19	29.57	5.23	0.80	5.23	Orifice
IN-5-20	A-5-20	23.65	3.34	0.69	3.34	Orifice
IN-5-21	A-5-21	1.27				
IN-5-22	A-5-22	1.01				
IN-5-23	A-5-23	0.34				
IN-5-24	A-5-24	4.58	0.13	0.23	0.23	Weir
IN-5-25	A-5-25	0.13				

Design depth threshold for number

Project Name	Yap INTL Airport - CLIN BA01 Awarded	Project No.	WFXO6323
Revised Date	10/30/2025	Calculated By	DPS

Inlet ID	Basin ID	Q5 (cfs)	R-3475-G			
			Orifice Depth (ft)	Weir Depth (ft)	Design Depth (ft)	Control Regime
IN-1-1	A-1-1	4.06				
IN-1-2	A-1-2	5.06				
IN-2-3	A-2-3	11.41	0.35	0.36	0.36	Weir
IN-2-4	A-2-4	15.82	0.67	0.44	0.67	Orifice
IN-2-5	A-2-5	18.93	0.95	0.50	0.95	Orifice
IN-3-4	A-3-4	6.65				
IN-3-5	A-3-5	8.88	0.21	0.30	0.30	Weir
IN-3-6	N/A	N/A				
IN-3-7	A-3-7	21.24	1.20	0.54	1.20	Orifice
IN-3-8	A-3-8	7.18				
IN-3-9	A-3-9	13.17	0.46	0.39	0.46	Orifice
IN-3-10	A-3-10	2.60				
IN-3-11	A-3-11	12.72	0.43	0.38	0.43	Orifice
IN-3-12	A-3-12	6.40				
IN-3-13	A-3-13	7.67				
IN-3-14	A-3-14	12.29	0.40	0.38	0.40	Orifice
IN-3-15	A-3-15	1.31				
IN-3-16	A-3-16	2.53				
IN-3-17	A-3-17	5.75				
IN-3-18	A-3-18	9.35	0.23	0.31	0.31	Weir
IN-4-12	A-4-12	12.15	0.39	0.37	0.39	Orifice
IN-4-13	A-4-13	8.60	0.20	0.30	0.30	Weir
IN-4-14	A-4-14	5.50				
IN-4-15	A-4-15	11.03	0.32	0.35	0.35	Weir
IN-4-16	A-4-16	4.56				
IN-4-17	A-4-17	1.32				
IN-4-18	A-4-18	7.60				
IN-5-16	A-5-16	1.13				
IN-5-17	A-5-17	23.10	1.42	0.57	1.42	Orifice
IN-5-18	A-5-18	8.48	0.19	0.29	0.29	Weir
IN-5-19	A-5-19	29.57	2.32	0.67	2.32	Orifice
IN-5-20	A-5-20	23.65	1.49	0.58	1.49	Orifice
IN-5-21	A-5-21	1.27				
IN-5-22	A-5-22	1.01				
IN-5-23	A-5-23	0.34				
IN-5-24	A-5-24	4.58				
IN-5-25	A-5-25	0.13				

Design depth threshold for number

Project Name	Yap INTL Airport - CLIN BA01 Awarded	Project No.	WFXO6323
Revised Date	10/30/2025	Calculated By	DPS

Inlet ID	Basin ID	Q5 (cfs)	R-3475-H			
			Orifice Depth (ft)	Weir Depth (ft)	Design Depth (ft)	Control Regime
IN-1-1	A-1-1	4.06				
IN-1-2	A-1-2	5.06				
IN-2-3	A-2-3	11.41				
IN-2-4	A-2-4	15.82	0.37	0.39	0.39	Weir
IN-2-5	A-2-5	18.93	0.54	0.44	0.54	Orifice
IN-3-4	A-3-4	6.65				
IN-3-5	A-3-5	8.88				
IN-3-6	N/A	N/A				
IN-3-7	A-3-7	21.24	0.67	0.47	0.67	Orifice
IN-3-8	A-3-8	7.18				
IN-3-9	A-3-9	13.17	0.26	0.34	0.34	Weir
IN-3-10	A-3-10	2.60				
IN-3-11	A-3-11	12.72	0.24	0.34	0.34	Weir
IN-3-12	A-3-12	6.40				
IN-3-13	A-3-13	7.67				
IN-3-14	A-3-14	12.29	0.23	0.33	0.33	Weir
IN-3-15	A-3-15	1.31				
IN-3-16	A-3-16	2.53				
IN-3-17	A-3-17	5.75				
IN-3-18	A-3-18	9.35				
IN-4-12	A-4-12	12.15				
IN-4-13	A-4-13	8.60				
IN-4-14	A-4-14	5.50				
IN-4-15	A-4-15	11.03				
IN-4-16	A-4-16	4.56				
IN-4-17	A-4-17	1.32				
IN-4-18	A-4-18	7.60				
IN-5-16	A-5-16	1.13				
IN-5-17	A-5-17	23.10	0.80	0.50	0.80	Orifice
IN-5-18	A-5-18	8.48				
IN-5-19	A-5-19	29.57	1.31	0.59	1.31	Orifice
IN-5-20	A-5-20	23.65	0.84	0.51	0.84	Orifice
IN-5-21	A-5-21	1.27				
IN-5-22	A-5-22	1.01				
IN-5-23	A-5-23	0.34				
IN-5-24	A-5-24	4.58				
IN-5-25	A-5-25	0.13				

Design depth threshold for number

Project Name	Yap International Airport - CLIN BA01 Awarded		Check Q =	100-year				
Revised Date	10/30/2025							
	Inlet Weir/Orifice Calculations		Proposed Drainage Network					
			(Neenah)			Orifice	Weir	
Inlet	Basin	Q100 (cfs)	Grate type	# of grates	(Q/CA)^2	Depth (ft)	Depth (ft)	Notes:
IN-1-1	A-1-1	33.78	R-3475-E	1	1765.254	27.44487	1.741385	orifice
IN-1-2	A-1-2	37.33	R-3475-E	1	2155.777	33.51644	1.861346	orifice
IN-2-3	A-2-3	63.97	R-3475-E	1	6330.538	98.42254	2.665463	orifice
IN-2-4	A-2-4	48.63	R-3475-E	1	3658.444	56.8788	2.220196	orifice
IN-2-5	A-2-5	53.61	R-3475-E	1	4446.103	69.12474	2.369294	orifice
IN-3-4	A-3-4	30.87	R-3475-E	1	1474.216	22.92003	1.639883	orifice
IN-3-5	A-3-5	48.66	R-3475-E	1	3662.959	56.949	2.221109	orifice
IN-3-6	N/A	N/A	R-3475-E	1				
IN-3-7	A-3-7	67.27	R-3475-E	1	7000.527	108.839	2.756361	orifice
IN-3-8	A-3-8	40.76	R-3475-E	1	2570.137	39.9586	1.973685	orifice
IN-3-9	A-3-9	37.78	R-3475-E	1	2208.065	34.32937	1.876275	orifice
IN-3-10	A-3-10	13.51	R-3475-E	1	282.357	4.389879	0.945276	orifice
IN-3-11	A-3-11	36.34	R-3475-E	1	2042.95	31.76228	1.82829	orifice
IN-3-12	A-3-12	27.75	R-3475-E	1	1191.28	18.52115	1.527439	orifice
IN-3-13	A-3-13	24.85	R-3475-E	1	955.302	14.85233	1.419077	orifice
IN-3-14	A-3-14	39.31	R-3475-E	1	2390.529	37.16618	1.926595	orifice
IN-3-15	A-3-15	5.07	R-3475-E	1	39.76526	0.618241	0.491806	orifice
IN-3-16	A-3-16	45.33	R-3475-E	1	3178.772	49.4212	2.118584	orifice
IN-3-17	A-3-17	20.97	R-3475-E	1	680.2754	10.57642	1.267226	orifice
IN-3-18	A-3-18	32.99	R-3475-E	1	1683.653	26.17619	1.714128	orifice
IN-4-12	A-4-12	36.94	R-3475-E	1	2110.968	32.81978	1.848359	orifice
IN-4-13	A-4-13	36.16	R-3475-E	1	2022.762	31.44841	1.822248	orifice
IN-4-14	A-4-14	16.13	R-3475-E	1	402.4914	6.25764	1.063844	orifice
IN-4-15	A-4-15	29.73	R-3475-E	1	1367.344	21.25845	1.599257	orifice
IN-4-16	A-4-16	15.45	R-3475-E	1	369.2707	5.741149	1.033731	orifice
IN-4-17	A-4-17	23.53	R-3475-E	1	856.5087	13.31637	1.368368	orifice
IN-4-18	A-4-18	35.03	R-3475-E	1	1898.315	29.5136	1.784084	orifice
IN-5-16	A-5-16	7.48	R-3475-E	1	86.55479	1.34569	0.637367	orifice
IN-5-17	A-5-17	54.01	R-3475-E	1	4512.698	70.1601	2.381065	orifice
IN-5-18	A-5-18	42.20	R-3475-E	1	2754.944	42.83184	2.019901	orifice
IN-5-19	A-5-19	67.59	R-3475-E	1	7067.288	109.877	2.765095	orifice
IN-5-20	A-5-20	54.30	R-3475-E	1	4561.289	70.91556	2.38958	orifice
IN-5-21	A-5-21	3.61	R-3475-E	1	20.16055	0.313441	0.392157	weir
IN-5-22	A-5-22	18.06	R-3475-E	1	504.5723	7.844718	1.147097	orifice
IN-5-23	A-5-23	6.08	R-3475-E	1	57.1867	0.889097	0.555125	orifice
IN-5-24	A-5-24	28.69	R-3475-E	1	1273.354	19.79716	1.56174	orifice
IN-5-25	A-5-25	2.26	R-3475-E	1	7.901413	0.122845	0.286986	weir

Project Name	Yap International Airport - CLIN BA01 Awarded		Check Q =	100-year				
Revised Date	10/30/2025							
	Inlet Weir/Orifice Calculations		Proposed Drainage Network					
			(Neenah)			Orifice	Weir	
Inlet	Basin	Q100 (cfs)	Grate type	# of grates	(Q/CA)^2	Depth (ft)	Depth (ft)	Notes:
IN-1-1	A-1-1	33.78	R-3475-F	2	441.3135	6.861217	1.386095	orifice
IN-1-2	A-1-2	37.33	R-3475-F	2	538.9443	8.379109	1.48158	orifice
IN-2-3	A-2-3	63.97	R-3475-F	2	1582.634	24.60563	2.121635	orifice
IN-2-4	A-2-4	48.63	R-3475-F	2	914.6111	14.2197	1.767215	orifice
IN-2-5	A-2-5	53.61	R-3475-F	2	1111.526	17.28118	1.885893	orifice
IN-3-4	A-3-4	30.87	R-3475-F	2	368.554	5.730007	1.305302	orifice
IN-3-5	A-3-5	48.66	R-3475-F	2	915.7399	14.23725	1.767941	orifice
IN-3-6	N/A	N/A	R-3475-F	2				
IN-3-7	A-3-7	67.27	R-3475-F	2	1750.132	27.20976	2.193987	orifice
IN-3-8	A-3-8	40.76	R-3475-F	2	642.5342	9.989649	1.570999	orifice
IN-3-9	A-3-9	37.78	R-3475-F	2	552.0162	8.582341	1.493463	orifice
IN-3-10	A-3-10	13.51	R-3475-F	2	70.58926	1.09747	0.752414	orifice
IN-3-11	A-3-11	36.34	R-3475-F	2	510.7375	7.940571	1.455268	orifice
IN-3-12	A-3-12	27.75	R-3475-F	2	297.82	4.630286	1.215799	orifice
IN-3-13	A-3-13	24.85	R-3475-F	2	238.8255	3.713083	1.129546	orifice
IN-3-14	A-3-14	39.31	R-3475-F	2	597.6322	9.291546	1.533517	orifice
IN-3-15	A-3-15	5.07	R-3475-F	2	9.941315	0.15456	0.391464	weir
IN-3-16	A-3-16	45.33	R-3475-F	2	794.6929	12.3553	1.686334	orifice
IN-3-17	A-3-17	20.97	R-3475-F	2	170.0688	2.644105	1.008677	orifice
IN-3-18	A-3-18	32.99	R-3475-F	2	420.9132	6.544048	1.364399	orifice
IN-4-12	A-4-12	36.94	R-3475-F	2	527.742	8.204945	1.471243	orifice
IN-4-13	A-4-13	36.16	R-3475-F	2	505.6905	7.862103	1.450459	orifice
IN-4-14	A-4-14	16.13	R-3475-F	2	100.6229	1.56441	0.846791	orifice
IN-4-15	A-4-15	29.73	R-3475-F	2	341.8359	5.314614	1.272965	orifice
IN-4-16	A-4-16	15.45	R-3475-F	2	92.31768	1.435287	0.822821	orifice
IN-4-17	A-4-17	23.53	R-3475-F	2	214.1272	3.329091	1.089184	orifice
IN-4-18	A-4-18	35.03	R-3475-F	2	474.5786	7.378399	1.420081	orifice
IN-5-16	A-5-16	7.48	R-3475-F	2	21.6387	0.336423	0.507326	weir
IN-5-17	A-5-17	54.01	R-3475-F	2	1128.174	17.54003	1.895262	orifice
IN-5-18	A-5-18	42.20	R-3475-F	2	688.736	10.70796	1.607785	orifice
IN-5-19	A-5-19	67.59	R-3475-F	2	1766.822	27.46925	2.200939	orifice
IN-5-20	A-5-20	54.30	R-3475-F	2	1140.322	17.72889	1.90204	orifice
IN-5-21	A-5-21	3.61	R-3475-F	2	5.040137	0.07836	0.312146	weir
IN-5-22	A-5-22	18.06	R-3475-F	2	126.1431	1.96118	0.913058	orifice
IN-5-23	A-5-23	6.08	R-3475-F	2	14.29668	0.222274	0.441864	weir
IN-5-24	A-5-24	28.69	R-3475-F	2	318.3384	4.949291	1.243102	orifice
IN-5-25	A-5-25	2.26	R-3475-F	2	1.975353	0.030711	0.228433	weir

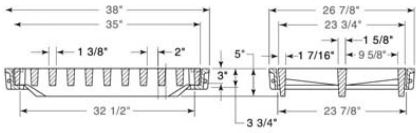
Project Name	Yap International Airport - CLIN BA01 Awarded		Check Q =	100-year				
Revised Date	10/30/2025							
	Inlet Weir/Orifice Calculations		Proposed Drainage Network					
			(Neenah)			Orifice	Weir	
Inlet	Basin	Q100 (cfs)	Grate type	# of grates	(Q/CA)^2	Depth (ft)	Depth (ft)	Notes:
IN-1-1	A-1-1	33.78	R-3475-G	3	196.1393	3.04943	1.169766	orifice
IN-1-2	A-1-2	37.33	R-3475-G	3	239.5308	3.724049	1.250349	orifice
IN-2-3	A-2-3	63.97	R-3475-G	3	703.3931	10.93584	1.79051	orifice
IN-2-4	A-2-4	48.63	R-3475-G	3	406.4938	6.319866	1.491404	orifice
IN-2-5	A-2-5	53.61	R-3475-G	3	494.0114	7.680526	1.59156	orifice
IN-3-4	A-3-4	30.87	R-3475-G	3	163.8018	2.54667	1.101582	orifice
IN-3-5	A-3-5	48.66	R-3475-G	3	406.9955	6.327666	1.492017	orifice
IN-3-6	N/A	N/A	R-3475-G	3				
IN-3-7	A-3-7	67.27	R-3475-G	3	777.8364	12.09323	1.85157	orifice
IN-3-8	A-3-8	40.76	R-3475-G	3	285.5708	4.439844	1.325812	orifice
IN-3-9	A-3-9	37.78	R-3475-G	3	245.3405	3.814374	1.260377	orifice
IN-3-10	A-3-10	13.51	R-3475-G	3	31.373	0.487764	0.634984	weir
IN-3-11	A-3-11	36.34	R-3475-G	3	226.9945	3.529143	1.228143	orifice
IN-3-12	A-3-12	27.75	R-3475-G	3	132.3645	2.057905	1.026048	orifice
IN-3-13	A-3-13	24.85	R-3475-G	3	106.1447	1.650259	0.953257	orifice
IN-3-14	A-3-14	39.31	R-3475-G	3	265.6143	4.129576	1.29418	orifice
IN-3-15	A-3-15	5.07	R-3475-G	3	4.418362	0.068693	0.330368	weir
IN-3-16	A-3-16	45.33	R-3475-G	3	353.1969	5.491245	1.423147	orifice
IN-3-17	A-3-17	20.97	R-3475-G	3	75.58616	1.175158	0.851252	orifice
IN-3-18	A-3-18	32.99	R-3475-G	3	187.0725	2.908466	1.151456	orifice
IN-4-12	A-4-12	36.94	R-3475-G	3	234.552	3.646642	1.241625	orifice
IN-4-13	A-4-13	36.16	R-3475-G	3	224.7513	3.494268	1.224085	orifice
IN-4-14	A-4-14	16.13	R-3475-G	3	44.72127	0.695293	0.714631	weir
IN-4-15	A-4-15	29.73	R-3475-G	3	151.9271	2.36205	1.074292	orifice
IN-4-16	A-4-16	15.45	R-3475-G	3	41.03008	0.637905	0.694403	weir
IN-4-17	A-4-17	23.53	R-3475-G	3	95.16763	1.479596	0.919194	orifice
IN-4-18	A-4-18	35.03	R-3475-G	3	210.9238	3.279289	1.198448	orifice
IN-5-16	A-5-16	7.48	R-3475-G	3	9.617199	0.149521	0.428148	weir
IN-5-17	A-5-17	54.01	R-3475-G	3	501.4109	7.795567	1.599467	orifice
IN-5-18	A-5-18	42.20	R-3475-G	3	306.1049	4.759094	1.356857	orifice
IN-5-19	A-5-19	67.59	R-3475-G	3	785.2542	12.20855	1.857437	orifice
IN-5-20	A-5-20	54.30	R-3475-G	3	506.8099	7.879506	1.605187	orifice
IN-5-21	A-5-21	3.61	R-3475-G	3	2.240061	0.034827	0.263429	weir
IN-5-22	A-5-22	18.06	R-3475-G	3	56.06359	0.871635	0.770556	orifice
IN-5-23	A-5-23	6.08	R-3475-G	3	6.354078	0.098789	0.372902	weir
IN-5-24	A-5-24	28.69	R-3475-G	3	141.4837	2.199685	1.04909	orifice
IN-5-25	A-5-25	2.26	R-3475-G	3	0.877935	0.013649	0.192781	weir

Project Name	Yap International Airport - CLIN BA01 Awarded		Check Q =	100-year				
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	Inlet Weir/Orifice Calculations		Proposed Drainage Network					
			(Neenah)			Orifice	Weir	
Inlet	Basin	Q100 (cfs)	Grate type	# of grates	(Q/CA)^2	Depth (ft)	Depth (ft)	Notes:
IN-1-1	A-1-1	33.78	R-3475-H	4	110.3284	1.715304	1.021899	orifice
IN-1-2	A-1-2	37.33	R-3475-H	4	134.7361	2.094777	1.092296	orifice
IN-2-3	A-2-3	63.97	R-3475-H	4	395.6586	6.151409	1.564176	orifice
IN-2-4	A-2-4	48.63	R-3475-H	4	228.6528	3.554925	1.30288	orifice
IN-2-5	A-2-5	53.61	R-3475-H	4	277.8814	4.320296	1.390375	orifice
IN-3-4	A-3-4	30.87	R-3475-H	4	92.13851	1.432502	0.962334	orifice
IN-3-5	A-3-5	48.66	R-3475-H	4	228.935	3.559312	1.303416	orifice
IN-3-6	N/A	N/A	R-3475-H	4				
IN-3-7	A-3-7	67.27	R-3475-H	4	437.533	6.80244	1.617518	orifice
IN-3-8	A-3-8	40.76	R-3475-H	4	160.6336	2.497412	1.15822	orifice
IN-3-9	A-3-9	37.78	R-3475-H	4	138.004	2.145585	1.101056	orifice
IN-3-10	A-3-10	13.51	R-3475-H	4	17.64731	0.274367	0.554717	weir
IN-3-11	A-3-11	36.34	R-3475-H	4	127.6844	1.985143	1.072897	orifice
IN-3-12	A-3-12	27.75	R-3475-H	4	74.455	1.157572	0.896348	orifice
IN-3-13	A-3-13	24.85	R-3475-H	4	59.70638	0.928271	0.832759	orifice
IN-3-14	A-3-14	39.31	R-3475-H	4	149.4081	2.322886	1.130586	orifice
IN-3-15	A-3-15	5.07	R-3475-H	4	2.485329	0.03864	0.288607	weir
IN-3-16	A-3-16	45.33	R-3475-H	4	198.6732	3.088825	1.243251	orifice
IN-3-17	A-3-17	20.97	R-3475-H	4	42.51721	0.661026	0.743647	weir
IN-3-18	A-3-18	32.99	R-3475-H	4	105.2283	1.636012	1.005904	orifice
IN-4-12	A-4-12	36.94	R-3475-H	4	131.9355	2.051236	1.084674	orifice
IN-4-13	A-4-13	36.16	R-3475-H	4	126.4226	1.965526	1.069351	orifice
IN-4-14	A-4-14	16.13	R-3475-H	4	25.15571	0.391103	0.624297	weir
IN-4-15	A-4-15	29.73	R-3475-H	4	85.45899	1.328653	0.938494	orifice
IN-4-16	A-4-16	15.45	R-3475-H	4	23.07942	0.358822	0.606625	weir
IN-4-17	A-4-17	23.53	R-3475-H	4	53.53179	0.832273	0.803001	orifice
IN-4-18	A-4-18	35.03	R-3475-H	4	118.6447	1.8446	1.046956	orifice
IN-5-16	A-5-16	7.48	R-3475-H	4	5.409674	0.084106	0.374027	weir
IN-5-17	A-5-17	54.01	R-3475-H	4	282.0436	4.385006	1.397283	orifice
IN-5-18	A-5-18	42.20	R-3475-H	4	172.184	2.67699	1.185341	orifice
IN-5-19	A-5-19	67.59	R-3475-H	4	441.7055	6.867312	1.622644	orifice
IN-5-20	A-5-20	54.30	R-3475-H	4	285.0805	4.432222	1.40228	orifice
IN-5-21	A-5-21	3.61	R-3475-H	4	1.260034	0.01959	0.23013	weir
IN-5-22	A-5-22	18.06	R-3475-H	4	31.53577	0.490295	0.673152	weir
IN-5-23	A-5-23	6.08	R-3475-H	4	3.574169	0.055569	0.325765	weir
IN-5-24	A-5-24	28.69	R-3475-H	4	79.5846	1.237323	0.916478	orifice
IN-5-25	A-5-25	2.26	R-3475-H	4	0.493838	0.007678	0.168412	weir

							5-yr size
		100-year Depths (ft)					Increase size
Inlet	Basin	1 grate	2 grates	3 grates	4 grates	Basin Spill?	100-yr basin spill
IN-1-1	A-1-1	27.44	6.86	3.05	1.72	N	
IN-1-2	A-1-2	33.52	8.38	3.72	2.09	N	
IN-2-3	A-2-3	98.42	24.61	10.94	6.15	Y	
IN-2-4	A-2-4	56.88	14.22	6.32	3.55	Y	
IN-2-5	A-2-5	69.12	17.28	7.68	4.32	Y	
IN-3-4	A-3-4	22.92	5.73	2.55	1.43	N	
IN-3-5	A-3-5	56.95	14.24	6.33	3.56	Y	
IN-3-6	N/A						
IN-3-7	A-3-7	108.84	27.21	12.09	6.80	Y	
IN-3-8	A-3-8	39.96	9.99	4.44	2.50	N	
IN-3-9	A-3-9	34.33	8.58	3.81	2.15	N	
IN-3-10	A-3-10	4.39	1.10	0.63	0.55	N	
IN-3-11	A-3-11	31.76	7.94	3.53	1.99	N	
IN-3-12	A-3-12	18.52	4.63	2.06	1.16	N	
IN-3-13	A-3-13	14.85	3.71	1.65	0.93	N	
IN-3-14	A-3-14	37.17	9.29	4.13	2.32	N	
IN-3-15	A-3-15	0.62	0.39	0.33	0.29	N	
IN-3-16	A-3-16	49.42	12.36	5.49	3.09	Y	
IN-3-17	A-3-17	10.58	2.64	1.18	0.74	N	
IN-3-18	A-3-18	26.18	6.54	2.91	1.64	N	
IN-4-12	A-4-12	32.82	8.20	3.65	2.05	N	
IN-4-13	A-4-13	31.45	7.86	3.49	1.97	N	
IN-4-14	A-4-14	6.26	1.56	0.71	0.62	N	
IN-4-15	A-4-15	21.26	5.31	2.36	1.33	N	
IN-4-16	A-4-16	5.74	1.44	0.69	0.61	N	
IN-4-17	A-4-17	13.32	3.33	1.48	0.83	N	
IN-4-18	A-4-18	29.51	7.38	3.28	1.84	N	
IN-5-16	A-5-16	1.35	0.51	0.43	0.37	N	
IN-5-17	A-5-17	70.16	17.54	7.80	4.39	Y	
IN-5-18	A-5-18	42.83	10.71	4.76	2.68	N	
IN-5-19	A-5-19	109.88	27.47	12.21	6.87	Y	
IN-5-20	A-5-20	70.92	17.73	7.88	4.43	Y	
IN-5-21	A-5-21	0.39	0.31	0.26	0.23	N	
IN-5-22	A-5-22	7.84	1.96	0.87	0.67	N	
IN-5-23	A-5-23	0.89	0.44	0.37	0.33	N	
IN-5-24	A-5-24	19.80	4.95	2.20	1.24	N	
IN-5-25	A-5-25	0.29	0.23	0.19	0.17	N	

Constants:

Cd	0.67	
Clogging	0.50	
Cw	3.00	





R-3475-E (Neenah)

total area	5.77	ft^2	
Single opening area	0.13	ft^2	9.625" x 2"
Number of opening	20.00		
Total open area (A)	2.67	ft^2	
P	9.79	ft	

Catalog Number	Grate Type	SQ.FT. Ope	Weir Perimeter (l.f.)	No. of Grates
R-3475-E	A	2.4	9.8	1
R-3475-F	C	4.8	13.8	2
R-3475-G	C	7.2	17.8	3
R-3475-H	C	9.6	21.8	4

Project Name **Yap International Airport - CLIN BA01 Awarded**
Revised Date **10/30/2025**

Inlet ID	Basin ID	# Grates for 5-year	# of Grates Upsize for 100-yr	Option for 5-year	Selected for 100-year
IN-1-1	A-1-1	*1	4	1 grate	4 grates
IN-1-2	A-1-2	*2	4	2 grates	4 grates
IN-2-3	A-2-3	*3	*4	3 grates	4 grates
IN-2-4	A-2-4	*4		4 grates	4 grates
IN-2-5	A-2-5	* **4		4 grates	4 grates
IN-3-4	A-3-4	*2	4	2 grates	4 grates
IN-3-5	A-3-5	*3	*4	3 grates	4 grates
IN-3-6	N/A	1		1 grate	1 grate
IN-3-7	A-3-7	* **4		4 grates	4 grates
IN-3-8	A-3-8	*2	4	2 grates	4 grates
IN-3-9	A-3-9	*4		4 grates	4 grates
IN-3-10	A-3-10	*1	2	1 grate	4 grates
IN-3-11	A-3-11	4		4 grates	4 grates
IN-3-12	A-3-12	*2	3	2 grates	4 grates
IN-3-13	A-3-13	2		2 grates	2 grates
IN-3-14	A-3-14	*4		4 grates	4 grates
IN-3-15	A-3-15	1		1 grate	4 grates
IN-3-16	A-3-16	1	*4	1 grate	4 grates
IN-3-17	A-3-17	2		2 grates	2 grates
IN-3-18	A-3-18	*3	4	3 grates	4 grates
IN-4-12	A-4-12	*3	4	3 grates	4 grates
IN-4-13	A-4-13	3	4	3 grates	4 grates
IN-4-14	A-4-14	2		2 grates	2 grates
IN-4-15	A-4-15	3	4	3 grates	4 grates
IN-4-16	A-4-16	2		2 grates	2 grates
IN-4-17	A-4-17	1	3	1 grate	3 grates
IN-4-18	A-4-18	2	4	2 grates	4 grates
IN-5-16	A-5-16	1		1 grate	1 grate
IN-5-17	A-5-17	* **4		4 grates	4 grates
IN-5-18	A-5-18	*3	4	3 grates	4 grates
IN-5-19	A-5-19	* **4		4 grates	4 grates
IN-5-20	A-5-20	* **4		4 grates	4 grates
IN-5-21	A-5-21	1		1 grate	1 grate
IN-5-22	A-5-22	*1	2	1 grate	2 grates
IN-5-23	A-5-23	1		1 grate	1 grate
IN-5-24	A-5-24	2	4	2 grates	4 grates
IN-5-25	A-5-25	1		1 grate	1 grate

	For 5-year	For 100-year
# of 1-grate inlets	11	5
# of 2-grate inlets	10	5
# of 3-grate inlets	7	1
# of 4-grate inlets	9	26
Total	37	37

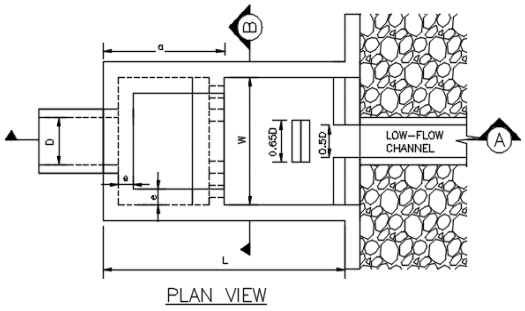
* Overtopping to adjacent basin for 100-year flow
** Exceeds 0.4-ft depth over grate

ENERGY DISSIPATOR CALCULATIONS

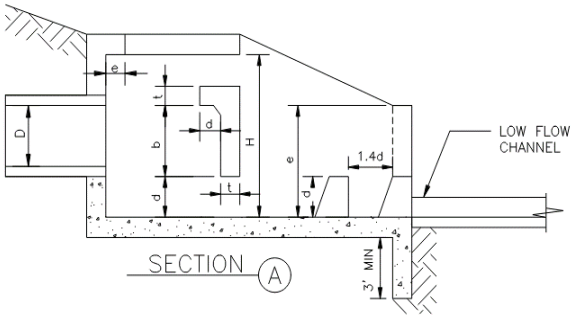
CLIN BA01 AWARDED

OUTFALL ENERGY DISSIPATORS - CLIN BA01 AWARDED

Outfall	D_{50} (in)	Length (ft)	Width (ft)	Thickness (ft)	Notes
1	9	21	11	1.5	Rip-Rap
2	24	35	18	4.0	Rip-Rap
3	Concrete Impact Stilling Basin				Outfall to pond 3
4	9	36	20.4	1.5	Outfall to pond 4
5	Concrete Impact Stilling Basin				Outfall to pond 5
6	18	45	22	3.0	Rip-Rap
7	9	23	11	1.5	Rip-Rap
POND INLET O3	9	15	8	1.5	Rip-Rap
Pond 3 Outlet	18	47	32.4	3.0	Rip-Rap
Pond 4 Outlet	18	46	35.2	3.0	Rip-Rap
POND INLET O5A	9	7	4	1.5	Rip-Rap
POND INLET O5B	9	11	6	1.5	Rip-Rap
POND INLET O5C	9	5	3	1.5	Rip-Rap
Pond 5 Outlet	18	43	32.0	3.0	Rip-Rap



PLAN VIEW



STILLING BASIN DIMENSIONS		
	Basin 3	***Basin 5***
W =	10.65 ft	9.88 ft
H =	7.99 ft	7.41 ft
L =	14.20 ft	13.17 ft
D =	5.00 ft	5.00 ft
a =	5.33 ft	4.94 ft
b =	4.00 ft	3.70 ft
c =	5.33 ft	4.94 ft
d =	1.78 ft	1.65 ft
e =	0.89 ft	0.82 ft
f =	1.33 ft	1.23 ft
t =	0.89 ft	0.82 ft

Yap International Airport - Outfall 1 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	2.51		
W_s	10.55		
L_s	21.20		
V_s	312.88		

R_c	0.57		Q10
Q	18.67	cfs	18.67
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	2.33	ft^2	
radius	2.0	ft	
angle	2.05	rad	
A from angle	2.32	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	0.96	ft	
Pw	4.10	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	0.61	ft	7.28 in
V=	8.03	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - Outfall 2 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	4.10		
W_s	17.73		
L_s	35.21		
V_s	1,384.26		

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \qquad (5.1)$$

R_c	0.86		Q10
Q	64.03		64.03
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	4.96	ft^2	
radius	2.5	ft	
angle	2.32	rad	
A from angle	4.96	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	1.50	ft	
Pw	5.80	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	1.57	ft	18.79 in
V=	12.90	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - POND INLET O3 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	1.83		
W_s	7.67		
L_s	15.43		
V_s	121.11		
R_c	0.42		Q10
Q	8.47	cfs	8.47
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	1.11	ft^2	
radius	1.0	ft	
angle	2.68	rad	
A from angle	1.11	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	0.77	ft	
Pw	2.68	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	0.54	ft	6.52 in
V=	7.60	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - Pond Outfall 3 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	5.74		
W_s	23.01		
L_s	47.21		
V_s	3,662.30		

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \qquad (5.1)$$

R_c	1.48		Q10
Q	146.70		146.70
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	13.94	ft^2	
radius	2.75	ft	
angle	3.42	rad	
A from angle	13.94	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	3.13	ft	
Pw	9.40	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	1.04	ft	12.50	in	
V=	10.52	ft/sec			Normal Depth Velocity for S=0.5%
g=	32.2	ft/sec/sec			
C=	1	(0.86 highly turbulent/1.2 low trubulence)			
S=	2.65				

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - Outfall 4 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	4.52		
W_s	16.79		
L_s	35.58		
V_s	1,718.54		

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \qquad (5.1)$$

R_c	1.44		Q10
Q	79.51		79.51
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	13.21	ft^2	
radius	3.25	ft	
angle	2.82	rad	
A from angle	13.21	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	2.73	ft	
Pw	9.16	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	0.34	ft	4.09 in
V=	6.02	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - Pond Outfall 4 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	5.61		
W_s	22.44		
L_s	46.07		
V_s	3,410.72		

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \qquad (5.1)$$

R_c	1.46		Q10
Q	138.30		138.30
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	13.32	ft^2	
radius	3.0	ft	
angle	3.05	rad	
A from angle	13.32	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	2.86	ft	
Pw	9.15	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	1.01	ft	12.17	in	
V=	10.38	ft/sec			Normal Depth Velocity for S=0.5%
g=	32.2	ft/sec/sec			
C=	1	(0.86 highly turbulent/1.2 low trubulence)			
S=	2.65				

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - POND INLET O5A Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	0.83		
W_s	3.77		
L_s	7.34		
V_s	11.86		

R_c	0.15		Q10
Q	1.20	cfs	1.20
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	0.22	ft^2	
radius	1.0	ft	
angle	1.43	rad	
A from angle	0.22	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	0.24	ft	
Pw	1.43	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation

α, β, θ are coefficients, see Table 5.1

- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	0.28	ft	3.39 in
V=	5.48	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - POND INLET O5B Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	1.29		
W_s	5.77		
L_s	11.29		
V_s	43.63		

R_c	0.24		Q10
Q	3.56	cfs	3.56
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	0.45	ft^2	
radius	1.0	ft	
angle	1.86	rad	
A from angle	0.45	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	0.40	ft	
Pw	1.86	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	0.58	ft	7.01 in
V=	7.88	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - POND INLET O5C Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	0.56		
W_s	2.66		
L_s	5.05		
V_s	3.62		

R_c	0.09		Q10
Q	0.44	cfs	0.44
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	0.09	ft^2	
radius	1.0	ft	
angle	1.06	rad	
A from angle	0.09	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	0.14	ft	
Pw	1.06	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \quad (5.1)$$

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	0.21	ft	2.55 in
V=	4.75	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - Pond Outfall 5 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	5.29		
W_s	21.14		
L_s	43.43		
V_s	2,861.08		

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \qquad (5.1)$$

R_c	1.38		Q10
Q	119.5		119.5
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	11.94	ft^2	
radius	2.75	ft	
angle	3.15	rad	
A from angle	11.94	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	2.76	ft	
Pw	8.66	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	0.94	ft	11.32	in
V=	10.01	ft/sec		Normal Depth Velocity for S=0.5%
g=	32.2	ft/sec/sec		
C=	1	(0.86 highly turbulent/1.2 low trubulence)		
S=	2.65			

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - Outfall 6 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	5.39		
W_s	22.14		
L_s	44.94		
V_s	3,062.57		

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \qquad (5.1)$$

R_c	1.30		Q10
Q	125.62		125.62
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	10.73	ft^2	
radius	3.0	ft	
angle	2.76	rad	
A from angle	10.73	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	2.43	ft	
Pw	8.27	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	1.29	ft	15.49 in
V=	11.71	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - Outfall 7 Culvert Scour
Estimating Scour at Culvert Outlets - Cohesionless Soils
HEC No. 14 - Hydraulic Design of Energy Dissipators for Culverts and Channels

hs	2.75
W_s	11.31
L_s	22.94
V_s	407.64

$$\left[\frac{h_s}{R_c}, \frac{W_s}{R_c}, \frac{L_s}{R_c}, \frac{V_s}{R_c^3}\right] = C_s C_h \left(\frac{\alpha}{\sigma^{1/3}}\right)\left(\frac{Q}{\sqrt{g(R_c^{2.5})}}\right)^{\beta}\left(\frac{t}{316}\right)^{\theta} \qquad (5.1)$$

R_c	0.661906	Q10	
Q	23.40	23.40	(Q for 1 of 2 pipes)
g	32.2	ft/s^2	
t	30	min	(Recommended in HEC-14)
σ	1.87		(2.10 for gravel/1.87 for sand)
D_{84}	0.4		
D_{16}	0.1		
C_s	1		
C_h	1		
A	2.79	ft^2	
radius	1.5	ft	
angle	2.81	rad	
A from angle	2.79	ft^2	
Goal Seek Target	0.00		Use Goal Seek to set B24 to 0 by changing B22.
depth	1.25	ft	
Pw	4.21	ft	

	h_s	W_s	L_s	V_s
α	2.27	6.94	17.1	127.08
β	0.39	0.53	0.47	1.24
θ	0.06	0.08	0.1	0.18

where,

- h_s = depth of scour, m (ft)
- W_s = width of scour, m (ft)
- L_s = length of scour, m (ft)
- V_s = volume of scour, m^3 (ft^3)
- R_c = hydraulic radius at the end of the culvert (assuming full flow)
- Q = discharge, m^3/s (ft^3/s)
- g = acceleration of gravity, 9.81 m/s^2 (32.2 ft/s^2)
- t = time in minutes
- σ = $(D_{84}/D_{16})^{0.5}$, material standard deviation
- α, β, θ are coefficients, see Table 5.1
- C_s = slope correction coefficient, see Table 5.2
- C_h = drop height adjustment coefficient, see Table 5.3

Isbach Equation for Riprap Sizing

D=	0.66	ft	7.97 in
V=	8.40	ft/sec	
g=	32.2	ft/sec/sec	
C=	1	(0.86 highly turbulent/1.2 low trubulence)	
S=	2.65		

$$D = \frac{V^2}{2gC^2(s-1)}$$

Yap International Airport - Pond 3 Stilling Basin

D =	5	ft									
g =	32.2	ft/sec/sec									
V_{10} =	11.37	ft/sec	Q_{10} =	137.98	cfs	A_{10} =	12.14	ft^2	D_{10} =	3.48	
V_{50} =	14.94	ft/sec	Q_{50} =	293.37	cfs	A_{50} =	19.64	ft^2	D_{50} =	4.43	
V_{100} =	18.89	ft/sec	Q_{100} =	370.82	cfs	A_{100} =	19.63	ft^2	D_{100} =	4.43	

	10 Yr	*50 Yr*	*100 Yr*
W =	10.65	14.75	16.81
H =	7.99	11.07	12.61
L =	14.20	19.67	22.41
a =	5.33	7.38	8.40
b =	4.00	5.53	6.30
c =	5.33	7.38	8.40
d =	1.78	2.46	2.80
e =	0.89	1.23	1.40
f =	1.33	1.84	2.10
t =	0.89	1.23	1.40

$W = 2.94D\left[\frac{V}{(gD)^{0.5}}\right]^{0.556}$

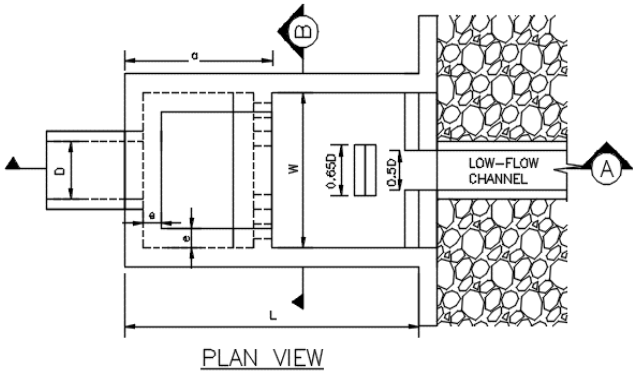
V=VELOCITY, [FT/S]

$D=(A)^{0.5}$

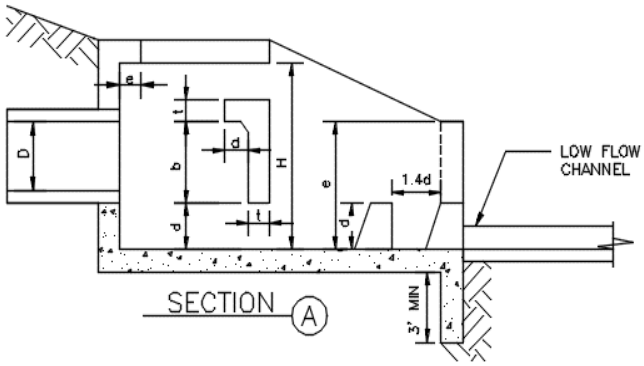
A=AREA OF FLOW [SF]

H=3/4 W
L=4/3 W
a=1/2 W
b=3/8 W
c=1/2 W
d=1/6 W
e=1/12 W
f=1/8 W

t=1/12 W (SUGGESTED MIN)



PLAN VIEW



Yap International Airport - Pond 5 Stilling Basin

D =	5 ft							
g =	32.2 ft/sec/sec							
V_{10} =	18.48 ft/sec	Q_{10} =	86.05 cfs	A_{10} =	4.66	ft^2	D_{10} =	2.16
V_{50} =	22.73 ft/sec	Q_{50} =	181.82 cfs	A_{50} =	8.00	ft^2	D_{50} =	2.83
V_{100} =	24.15 ft/sec	Q_{100} =	229.65 cfs	A_{100} =	9.51	ft^2	D_{100} =	3.08

	10 Yr	*50 Yr*	*100 Yr*
W =	9.88	13.47	14.83
H =	7.41	10.10	11.12
L =	13.17	17.96	19.77
a =	4.94	6.74	7.42
b =	3.70	5.05	5.56
c =	4.94	6.74	7.42
d =	1.65	2.25	2.47
e =	0.82	1.12	1.24
f =	1.23	1.68	1.85
t =	0.82	1.12	1.24

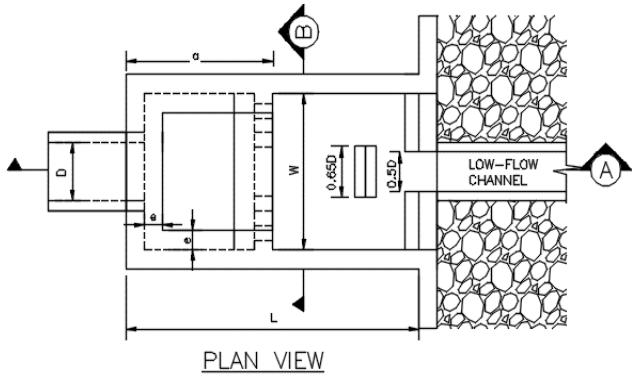
$W = 2.94D\left[\frac{V}{(gD)^{0.5}}\right]^{0.556}$

V=VELOCITY, [FT/S]

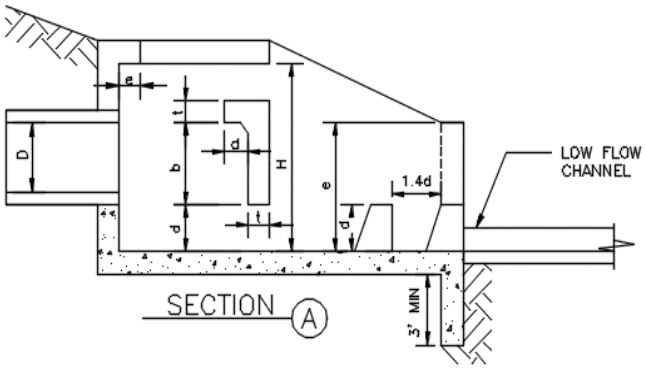
$D=(A)^{0.5}$

A=AREA OF FLOW [SF]

H=3/4 W
L=4/3 W
a=1/2 W
b=3/8 W
c=1/2 W
d=1/6 W
e=1/12 W
f=1/8 W
t=1/12 W (SUGGESTED MIN)



PLAN VIEW

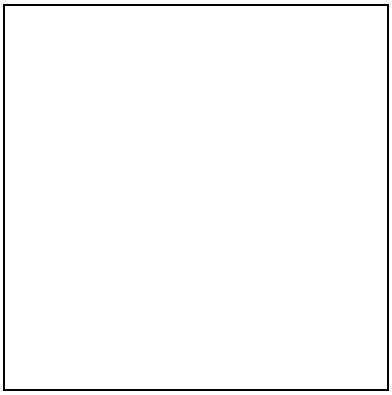


SECTION A

Structural Calculations

STRUCTURAL CALCULATIONS

The following calculation have been performed by, or under the direction of, Katrina Pearson



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1 GENERAL:

This calculation package covers design and analysis of the following civil drainage structures as part of the Yap Island Airport Improvement:

- Pipe Headwalls
- Inlets
- Manholes
- Stilling Basins
- Pond Outlets

1.1 Design Codes, Standards, and References

- ICC International Building Code (IBC) (2021)
- ASCE 7-16, Minimum Design Loads for Buildings and Other Structures (2016)
- ACI 318-19, Building Code Requirements for Structural Concrete (2019)
- UFC 3-260-01, Airfield and Heliport Planning and Design, with Change 1 (5 May 2020)
- FAA AC 150/5320-6G, Airport Pavement Design and Evaluation (7 June 2021)
- "Geotechnical Report for 100% Design" for "FY25 YAAD229010 Runway Extension" and "FY26 YAAD229020 Aircraft Parking Apron and Taxiway" by Jacobs Engineering (15 September 2025)

1.2 Material Specifications

- Concrete compressive strength: f'c = 5,000 psi
- Reinforcing steel tensile yield strength: fy = 60 ksi

1.3 Loading Criteria

1.3.1 Dead Loads

- Structure self-weight

1.3.2 Live Loads

- Where inlets and manholes do not see aircraft loading, the following loading per UFC 3-260-01 Section 2-12 (Airfield Utility Structures) is used:
  - Beyond the paved or unpaved shoulder areas of runways, taxiways, towways, helipads, aprons or overruns, underground structures are not designed to support aircraft wheel loads; however, they will be designed to support standard truck loads (AASHTO H20/HS20).

- Where inlets and manholes are required to be rated for aircraft loading, the following loading per UFC 3-260-01 Section 2-12 (Airfield Utility Structures) is used:

UFC 3-260-01
4 February 2019
Change 1, 5 May 2020

2-12.2 Unpaved Shoulder Areas.

- For manhole covers and inlet grates and frames, design for a 45,000 kg (100,000 lb) wheel load with 1.72 MPa (250 psi) tire pressure. Higher tire pressures should be assumed if the using aircraft will have tire pressure greater than 1.72 MPa (250 psi).
- For structures with their shortest span equal to or less than 0.6 m (2 ft), design based on a single wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1.72 MPa (250 psi), or a uniform live load over the entire structure of 1.72 MPa (250 psi), whichever is greater.
- For structures with their shortest span greater than 0.6 m (2 ft), design based on the maximum number of wheels that can fit onto the span, considering the most critical assigned aircraft operating at its maximum gross weight. In no case, however, should the design be based on computed stress conditions less than those created by a wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1.72 MPa (250 psi).

- Governing aircraft for wheels loads is C-17A Globemaster III.

TABLE 6. MILITARY GROUP

	Airplane Name	Gross Taxi Weight (lbs)	Gear Designation
1	C-5	769,000	Complex
2	C-17A	585,000	2T
3	C-123	60,000	S
4	C-130	155,000	2S
5	C-141	345,000	2D
6	F-15C	68,000	S
7	F-16C	42,300	S
8	F/A-18C	56,000	S
9	KC-10	583,000	2D/D1
10	P-3	142,000	D

1.3.3 Governing Surcharge Live Loads

Gross Total Weight x Impact Factor:

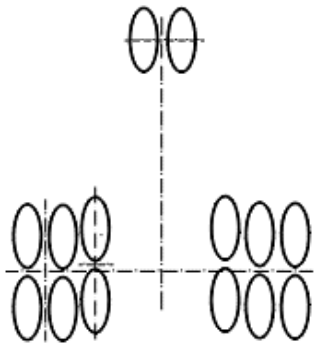
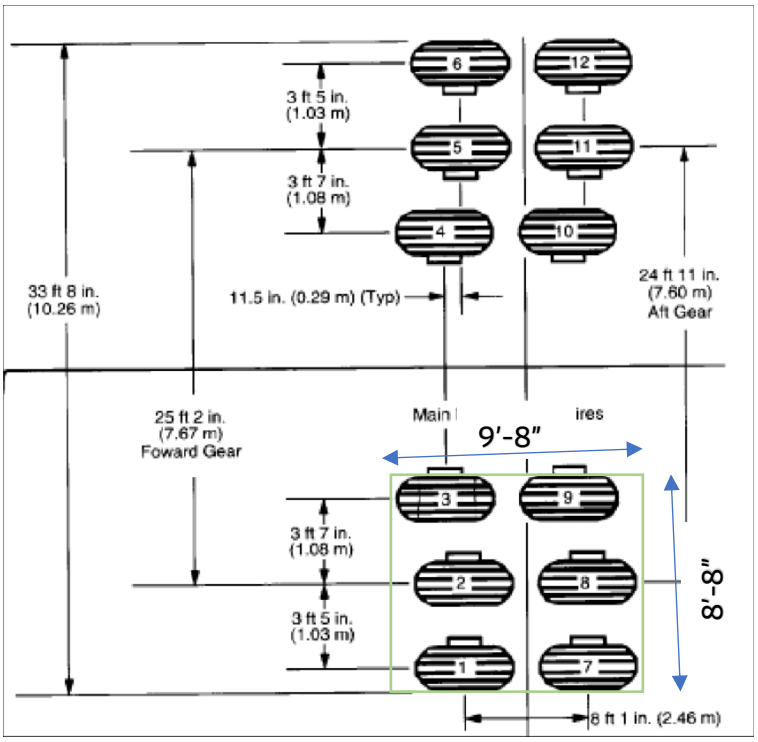


Figure 8. 2T - Two Triple wheels in Tandem Main Gear with Dual Wheel Nose Gear, Boeing C-17



Gross Weight / Area of Landing Wheels = 585,000lb / (8'8" * 9' 8") / 2 = 3491psf

Per FAA Pilot's Handbook, landing load factor can be between 3.8-1.52. For heavier aircrafts than 4000lbs, a lower factor can be used. Since this aircraft is considerably heavy, a factor of 2 is conservative.

--> 3491psf x 2 = **6982psf**

Pressure From Single Wheel Per UFC 3-260-01:

One wheel load = 50kips, per UFC 3-260-01

Wheel Load / One Tire Area = 50kips / ((20"+8"+8") * (20"+8")) = **7143psf**

Governing Live Surcharge Load:

Max (6982psf, 7143psf) = **7143psf**

1.3.4 Geotechnical Criteria

- Maximum Allowable Net Soil Bearing Pressure: 3,400 psf (1/3 increase allowed for transient loading)
- Lateral Earth Pressures for Structures Retaining Soil:
  - Static Loading:

Table 14 – Equivalent Fluid Pressures (psf/ft)

Backfill Materials	Fully Drained[1]			Saturated[2]		
	At-Rest	Active	Passive[3]	At-Rest	Active	Passive[3]
In-situ Soils	56	39	128	83	77	111
Engineered Fill	66	45	173	96	85	149
Well-Graded Stone	57	36	249	93	82	196
Free-Draining Crushed Stone (1-inch-clean)	54	35	186	87	79	148

1. The provided fluid pressures are based on material not being allowed to become saturated. See Section 6.6.3 for drainage details.
2. If the materials are permitted to saturate, these modified values should be used required to account for the hydrostatic load on the wall/footing.
3. Due to the large strains required to fully mobilize the passive earth pressure, a factor of safety of 2 has been applied to the recommended passive fluid pressure. If this value is considered a driving pressure the fluid pressures used should be doubled.

  - Dynamic (Seismic) – Yielding Wall:

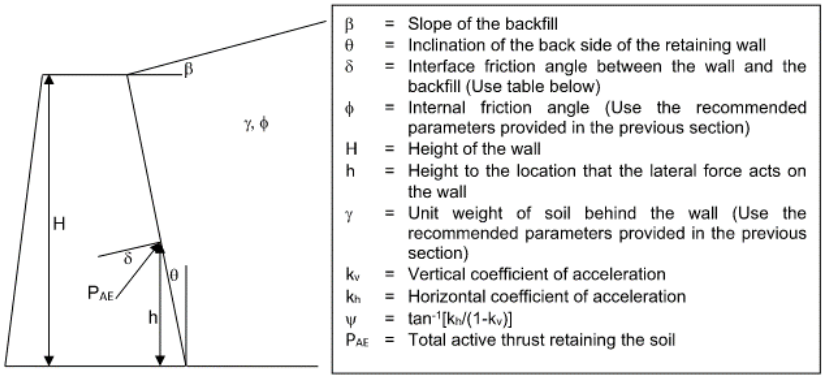


Figure 5 – Dynamic Retaining Wall Loading

Table 13 – Interface Friction and Seismic Coefficient of Conventional Retaining Walls

Wall Construction	Backfill Material	Interface Friction Angle, δ	Coefficient of Acceleration	
Mass Concrete Against:	Clean Crushed Rock	29°	Vertical	0.05
Formed Concrete Against:	Clean Crushed Rock	24°	Horizontal	0.50

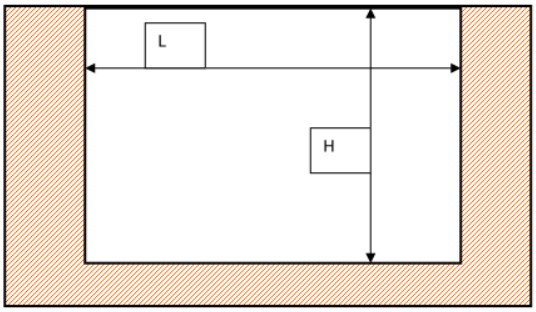
$$K_{AE} = \frac{\cos^2(\phi-\theta-\psi)}{\cos\psi * \cos^2\theta * \cos(\delta+\theta+\psi)\left[1+\sqrt{\frac{\sin(\delta+\phi)*\sin(\phi-\beta-\psi)}{\cos(\delta+\theta+\psi)*\cos(\beta-\theta)}}\right]^2}$$

$$P_{AE} = \tfrac{1}{2}K_{AE}\gamma H^2(1-k_v) \qquad P_A = \tfrac{1}{2}K_A\gamma H^2 \qquad \Delta P_{AE} = P_{AE} - P_A$$

$$h = \frac{P_A * H/3 + \Delta P_{AE} * (0.6*H)}{P_{AE}}$$

(Seed and Whitman 1970)

  - Dynamic (Seismic) – Non-yielding Wall:

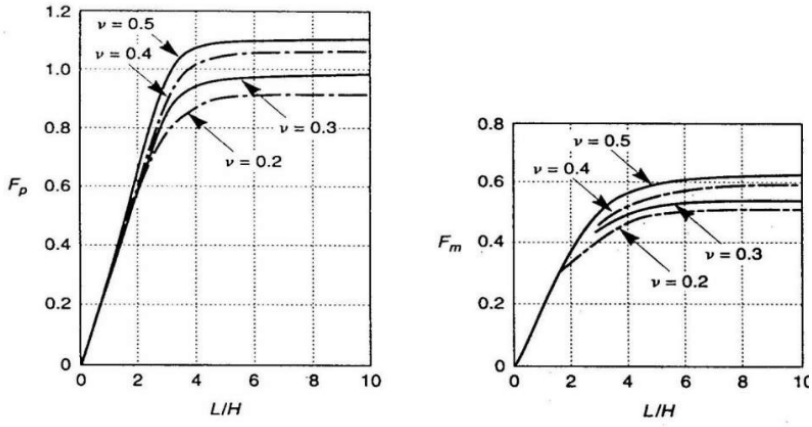


ΔP_{eq} = Dynamic thrust on the wall
ΔM_{eq} = Dynamic moment about the base of the wall
h_{eq} = Thrust application point from the base of the wall
L = Length of Material behind the wall
H = Height of Retaining Wall
a_h = Amplitude of the harmonic base acceleration (k_h*g)
g = Gravitational Constant
ν = Backfill Poisson's Ratio
γ = Unit Weight of Backfill
F_p = Dimensionless Thrust Factor
F_m = Dimensionless Moment Factor

Figure 6 – Non-Yielding Retaining Wall Seismic Configuration

Table 16 – Interface Friction and Seismic Coefficient of Non-Yielding Retaining Walls

Soil Type	Poisson's Ratio
On-Site Materials	0.3
Crushed Rock	0.35
Coefficient of Acceleration, k_h	0.99



$$\Delta P_{eq} = \gamma * H^2 * \frac{a_h}{g} F_p \qquad \Delta M_{eq} = \gamma * H^3 * \frac{a_h}{g} F_m \qquad h_{eq} = \frac{\Delta M_{eq}}{\Delta P_{eq}}$$

$P_{Total} = P_{Static} + \Delta P_{eq}$; Total Load on Wall with a properly drained backfill.

- Assume ground water level is below base of structures and soil behind retaining walls is drained.
- Live load surcharge due to aircraft loading is applied to wall assuming a uniformly loaded strip (assumed to be equal to aircraft wheel load conservatively applied continuous along structure) similar to AASHTO LRFD Bridge Design Specifications 3.11.6.2. See below for method used to calculate surcharge load on walls.

3.11.6.2—Point, Line, and Strip Loads (*ES*): Walls Restrained from Movement

The horizontal pressure, Δ_{ph} in ksf, on a wall resulting from a uniformly loaded strip parallel to the wall may be taken as:

$$\Delta_{ph} = \frac{2p}{\pi} [\delta - \sin\delta \cos(\delta + 2\alpha)] \qquad (3.11.6.2\text{-}1)$$

where:

p = uniform load intensity on strip parallel to wall (ksf)
α = angle specified in Figure 3.11.6.2-1 (rad)
δ = angle specified in Figure 3.11.6.2-1 (rad)

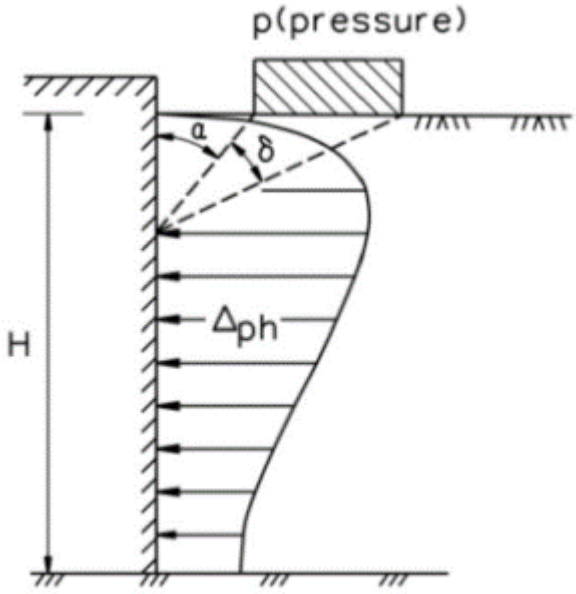
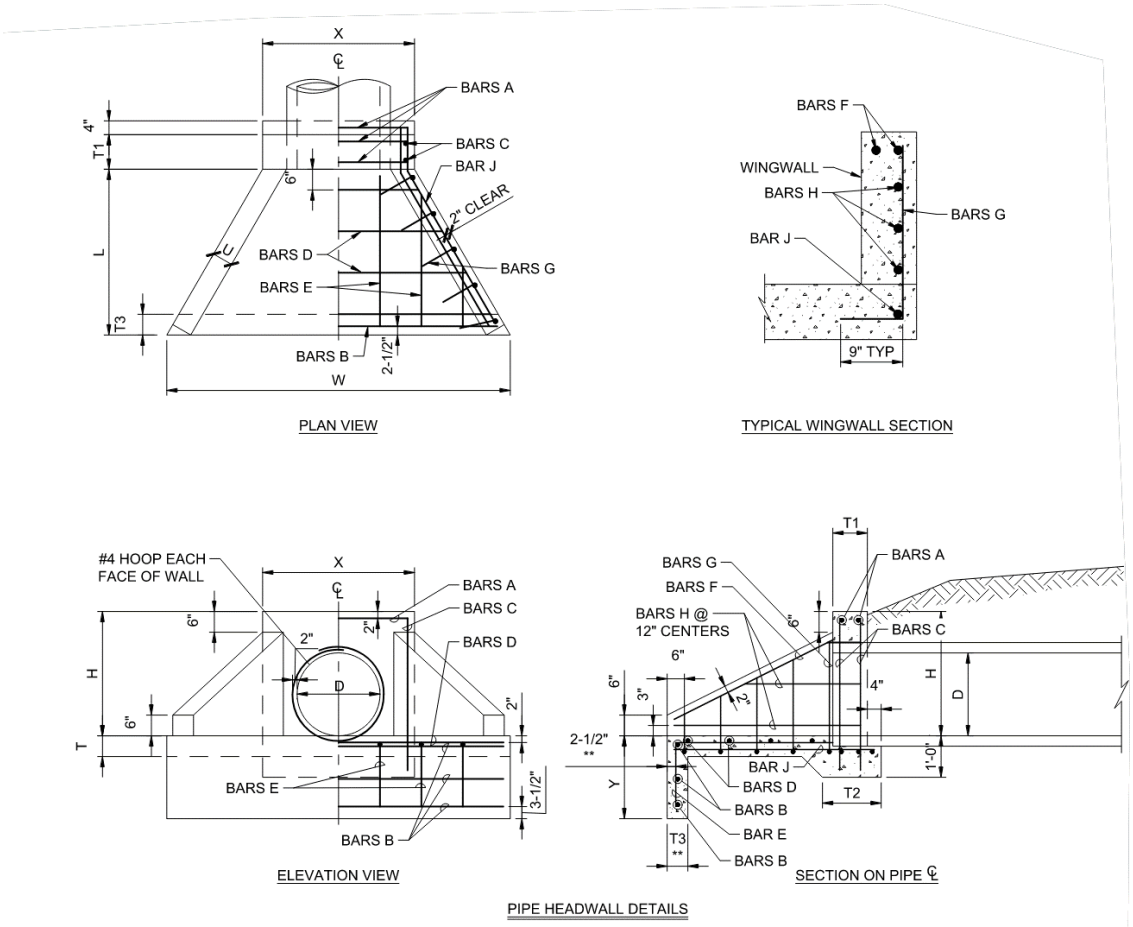


Figure 3.11.6.2-1—Horizontal Pressure on Wall Caused by a Uniformly Loaded Strip

2 Headwall Design

2.1 Design Summary

The following calculations are for the reinforced concrete Headwalls at Yap Island Airport. There are (6) different sizes of Headwalls planned for this project.



PIPE SIZE D	NUMBER OF PIPES*	H	L	W	X	Y	T/T3	T1	T2	U
36"	1	4'-0"	6'-0"	10'-8"	4'-8"	2'-0"	9"	10"	1'-5"	6"
48"	1	5'-0"	8'-0"	13'-8"	5'-8"	2'-0"	9"	10"	1'-5"	6"
60"	1	6'-0"	10'-0"	16'-8"	6'-8"	2'-0"	9"	10"	1'-5"	6"
66"	1	6'-6"	11'-0"	18'-2"	7'-2"	2'-0"	9"	10"	1'-5"	6"
72"	1	7'-0"	12'-0"	19'-8"	7'-8"	2'-6"	9"	10"	1'-5"	9"
78"	1	7'-6"	13'-0"	21'-2"	8'-2"	2'-6"	9"	10"	1'-5"	9"

2.2 Design Assumptions

- The headwall and wingwall for each pipe size and configuration are conservatively designed assuming retaining walls are cantilevered. See following Enercalc output at various wall height for analysis and design information.
- Wall designs assume retained soil is full height of wall with a backfill slope of 1:1 above the top of headwall.
- Base slab is designed using Enercalc cantilever retaining wall module, assuming width of footing is half the width or less of actual base slab.
- Sliding is resisted by key at edge of base slab. Due to angle of wingwall (30 degrees from longitudinal axis of pipe), half of total sliding force is resisted by the key, while the other half is balanced by soil load on the opposite wing wall.

2.3 Wall Analysis and Design

2.3.1 Wall Retaining 7ft of Soil

Cantilevered Retaining Wall Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 7ft Retained

Code Reference

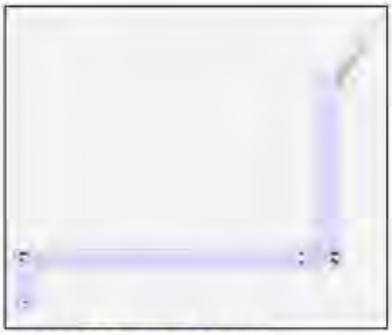
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	7.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Dead Load (D) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 7ft Retained

Design Summary

Wall Stability Ratios

Overturning	=	4.34	OK
Sliding	=	1.76	OK
Global Stability	=	1.23	

Total Bearing Load	=	3,152 lbs	
...resultant ecc.	=	1.33 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	222 psf	OK
Soil Pressure @ Heel	=	196 psf	OK
Allowable	=	3,400 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	311 psf	
ACI Factored @ Heel	=	275 psf	
Footing Shear @ Toe	=	23.1 psi	OK
Footing Shear @ Heel	=	1.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	1,380.6 lbs	
less 200% Passive Force	-	837.4 lbs	
less 200% Friction Force	-	1,586.9 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	9.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	6.75 i		
Design Data				
fb/FB + fa/Fa	=	**0.689**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,764.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	4,116.0		
Moment.....Allowable	=	5,968.8		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	21.8		
Shear.....Allowable	psi =	57.3		
Anet (Masonry)	in2 =			
Wall Weight	psf =	112.5		
Rebar Depth 'd'	in =	6.75		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 7ft Retained

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1418 in2/ft		
0.0018bh : 0.0018(12)(9) :	0.1944 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1944 in2/ft	#4@ 12.35 in	#4@ 24.69 in
Provided Area :	0.2 in2/ft	#5@ 19.14 in	#5@ 38.27 in
Maximum Area :	1.7213 in2/ft	#6@ 27.16 in	#6@ 54.32 in

Footing Data

Toe Width	=	10.00 ft
Heel Width	=	0.83
Total Footing Width	=	10.83
Footing Thickness	=	9.00 in
Key Width	=	9.00 in
Key Depth	=	20.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	311	275		psf
Mu' : Upward	=	14,995	1		ft-#
Mu' : Downward	=	6,750	4		ft-#
Mu: Design	=	8,245	3	755	ft-#
φ Mn	=	9,926	OK - Flush	3,944	
Actual 1-Way Shear	=	23.15	0.98	15.15	psi
Allow 1-Way Shear	=	76.21	54.63	65.64	psi

Toe Reinforcing = # 4 @ 6.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 6.81 in, #5@ 10.55 in, #6@ 14.98 in, #7@ 20.43 in, #8@ 26.90 in, #9@ 34.05 in, #10@ 43.25 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 12.34 in, #5@ 18 in, #6@ 18 in, #7@ 18 in

Min footing T&S reinf Area 2.11 in2
Min footing T&S reinf Area per foot 0.19 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@ 27.16 in	#6@ 54.32 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 7ft Retained

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,380.6	2.61	3,604.9			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
				Soil Over HL (ab. water tbl)	72.9	10.79	786.6
				Soil Over HL (bel. water tbl)		10.79	786.6
				Water Table			
				Sloped Soil Over Heel =	0.4	10.81	4.7
				Surcharge Over Heel =			
				Adjacent Footing Load =			
				Axial Dead Load on Stem =			
				* Axial Live Load on Stem =			
				Soil Over Toe =			
				Surcharge Over Toe =			
				Stem Weight(s) =	787.5	10.38	8,170.3
				Earth @ Stem Transitions =			
				Footing Weight =	1,218.7	5.42	6,601.5
				Key Weight =	187.5	0.38	70.3
				Vert. Component =			
Total =	1,380.6	**O.T.M.** =	3,604.9	**Total =**	2,267.1 lbs	**R.M.=**	15,633.4

Resisting/Overturning Ratio = **4.34**

Vertical Loads used for Soil Pressure = 3,152.2 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	200.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.005	in

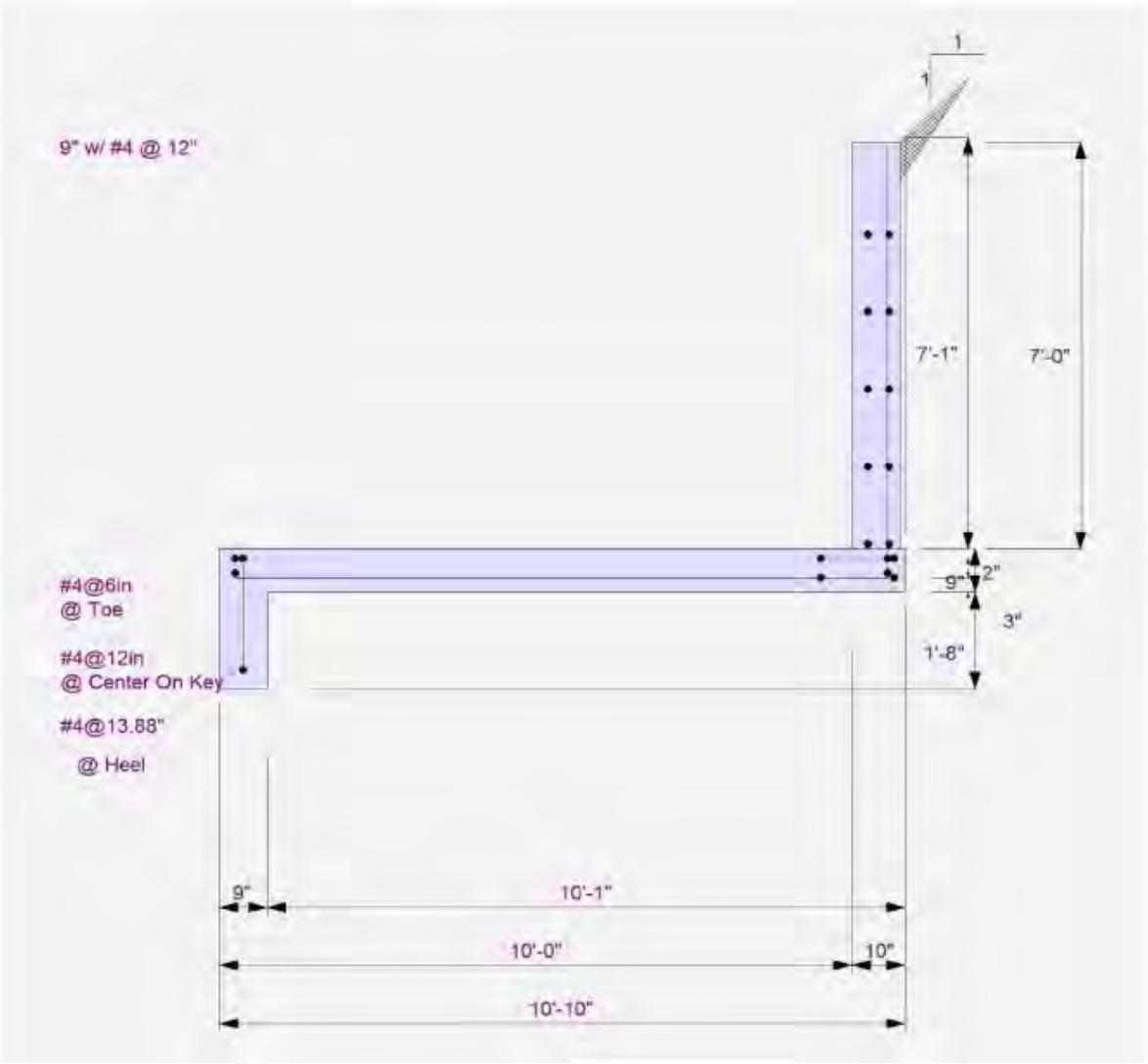
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 7ft Retained



2.3.2 Wall Retaining 6.5ft of Soil

Cantilevered Retaining Wall Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6.5ft Retained

Code Reference

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	6.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Dead Load (D) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6.5ft Retained

Design Summary

Wall Stability Ratios

Overturning	=	3.67	OK
Sliding	=	1.83	OK
Global Stability	=	1.34	

Total Bearing Load	=	2,661 lbs	
...resultant ecc.	=	4.31 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	271 psf	OK
Soil Pressure @ Heel	=	164 psf	OK
Allowable	=	3,400 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	379 psf	
ACI Factored @ Heel	=	230 psf	
Footing Shear @ Toe	=	20.6 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	1,182.7 lbs	
less 200% Passive Force	-	837.4 lbs	
less 200% Friction Force	-	1,332.2 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	9.00		
Rebar Size	=	# 4		
Rebar Spacing	=	10.00		
Rebar Placed at	=	6.75 i		
Design Data				
fb/FB + fa/Fa	=	**0.461**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,521.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	3,295.5		
Moment.....Allowable	=	7,137.1		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	18.8		
Shear.....Allowable	psi =	60.9		
Anet (Masonry)	in2 =			
Wall Weight	psf =	112.5		
Rebar Depth 'd'	in =	6.75		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6.5ft Retained

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1135 in2/ft		
0.0018bh : 0.0018(12)(9) :	0.1944 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1944 in2/ft	#4@ 12.35 in	#4@ 24.69 in
Provided Area :	0.24 in2/ft	#5@ 19.14 in	#5@ 38.27 in
Maximum Area :	1.7213 in2/ft	#6@ 27.16 in	#6@ 54.32 in

Footing Data

Toe Width	=	8.00 ft
Heel Width	=	0.75
Total Footing Width	=	8.75
Footing Thickness	=	9.00 in
Key Width	=	9.00 in
Key Depth	=	20.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	379	230		psf
Mu' : Upward	=	10,680	0		ft-#
Mu' : Downward	=	4,320	0		ft-#
Mu: Design	=	6,360	3	761	ft-#
φ Mn	=	7,524	OK - Flush	3,944	
Actual 1-Way Shear	=	20.55	0.00	15.22	psi
Allow 1-Way Shear	=	69.25	57.34	65.64	psi

Toe Reinforcing = # 4 @ 8.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.82 in, #5@ 13.68 in, #6@ 19.42 in, #7@ 26.48 in, #8@ 34.87 in, #9@ 44.14 in, #10@ 56.06 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 12.34 in, #5@ 18 in, #6@ 18 in, #7@ 18 in

Min footing T&S reinf Area 1.70 in2
Min footing T&S reinf Area per foot 0.19 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@ 27.16 in	#6@ 54.32 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6.5ft Retained

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,182.7	2.42	2,858.1	Soil Over HL (ab. water tbl)			
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)			
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=	8.75	
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	731.3	8.38	6,124.2
					Earth @ Stem Transitions	=			
					Footing Weight	=	984.4	4.38	4,306.6
					Key Weight	=	187.5	0.38	70.3
					Vert. Component	=			
Total	=	1,182.7	**O.T.M.** =	2,858.1	**Total =**		1,903.1 lbs	**R.M.=**	10,501.2

Resisting/Overturning Ratio = **3.67**

Vertical Loads used for Soil Pressure = 2,661.4 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	15.9	pci
Horizontal Defl @ Top of Wall (approximate only)	0.088	in

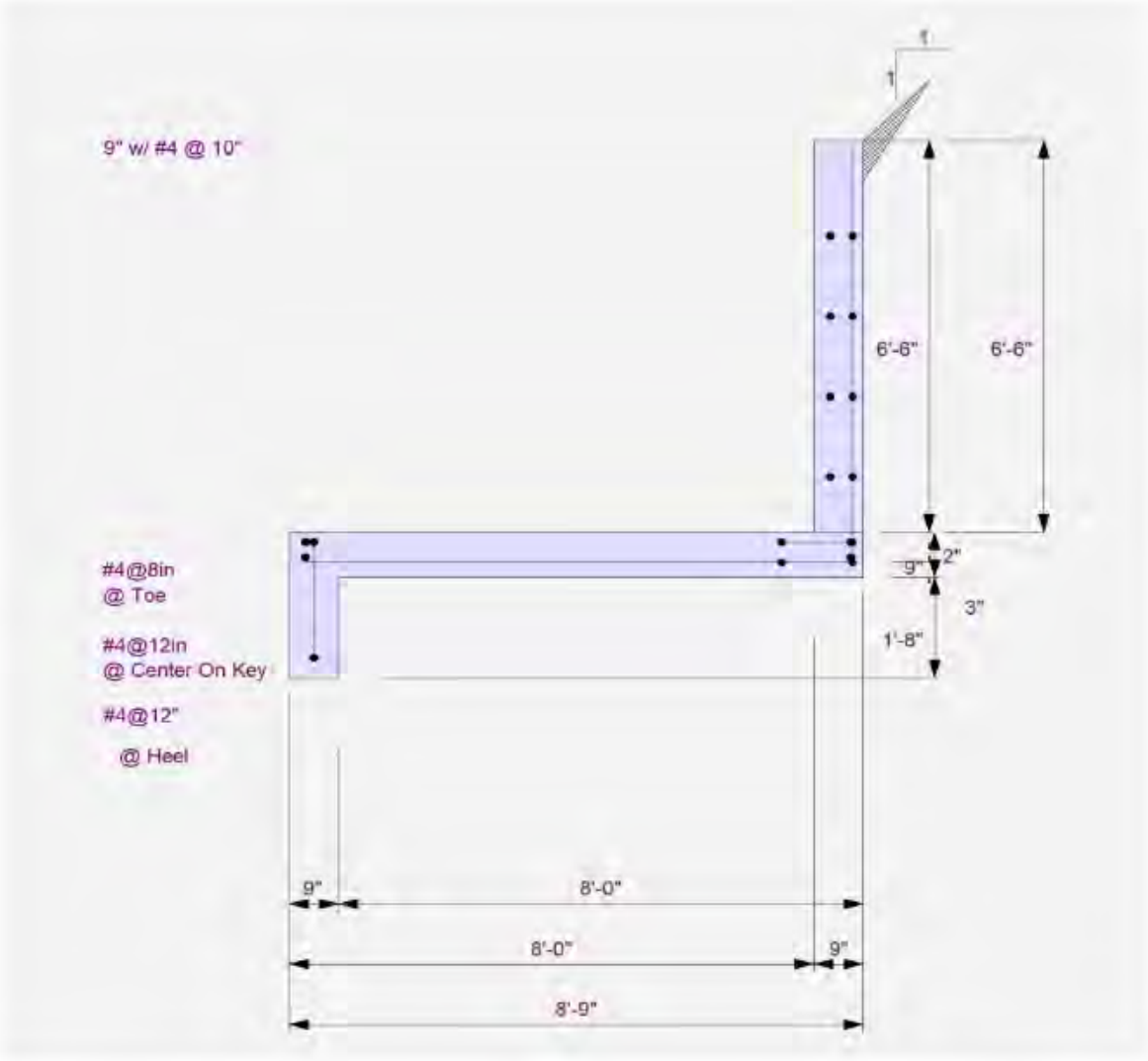
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6.5ft Retained



2.3.3 Wall Retaining 6ft of Soil

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6ft Retained

Code Reference

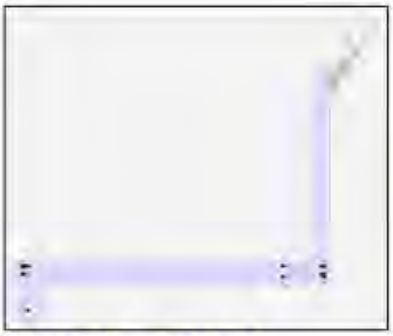
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Dead Load (D) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6ft Retained

Design Summary

Wall Stability Ratios

Overturning	=	3.39	OK
Sliding	=	1.50	OK
Global Stability	=	1.37	

Total Bearing Load	=	1,897 lbs	
...resultant ecc.	=	7.92 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	265 psf	OK
Soil Pressure @ Heel	=	97 psf	OK
Allowable	=	3,400 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	371 psf	
ACI Factored @ Heel	=	135 psf	
Footing Shear @ Toe	=	15.0 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	1,025.2 lbs	
less 200% Passive Force	-	462.5 lbs	
less 200% Friction Force	-	1,076.3 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	6.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	3.75 i		
Design Data				
fb/FB + fa/Fa	=	**0.792**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,296.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	2,592.0		
Moment.....Allowable	=	3,268.8		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	28.8		
Shear.....Allowable	psi =	69.8		
Anet (Masonry)	in2 =			
Wall Weight	psf =	75.0		
Rebar Depth 'd'	in =	3.75		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6ft Retained

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.167 in2/ft		
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.167 in2/ft	#4@ 18.52 in	#4@ 37.04 in
Provided Area :	0.2 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	0.9563 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Footing Data

Toe Width	=	8.00 ft
Heel Width	=	0.50
Total Footing Width	=	8.50
Footing Thickness	=	9.00 in
Key Width	=	9.00 in
Key Depth	=	14.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	371	135		psf
Mu' : Upward	=	9,511	0		ft-#
Mu' : Downward	=	4,320	0		ft-#
Mu: Design	=	5,191	30	340	ft-#
φ Mn	=	6,713	OK - Flush	3,944	
Actual 1-Way Shear	=	15.03	0.00	9.38	psi
Allow 1-Way Shear	=	66.58	57.34	65.64	psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 10.28 in, #5@ 15.94 in, #6@ 22.62 in, #7@ 30.85 in, #8@ 40.62 in, #9@ 51.42 in, #10@ 65.31 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 12.34 in, #5@ 18 in, #6@ 18 in, #7@ 18 in

Min footing T&S reinf Area 1.65 in2
Min footing T&S reinf Area per foot 0.19 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@ 27.16 in	#6@ 54.32 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6ft Retained

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,025.2	2.25	2,306.6			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)						
Soil Over HL (bel. water tbl)						
Water Table						
Sloped Soil Over Heel =					8.50	
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =						
Surcharge Over Toe =						
Stem Weight(s) =				450.0	8.25	3,712.5
Earth @ Stem Transitions =						
Footing Weight =				956.3	4.25	4,064.1
Key Weight =				131.3	0.38	49.2
Vert. Component =						
Total =	1,025.2	**O.T.M.** =	2,306.6	**Total =** 1,537.5 lbs	**R.M.=**	7,825.8

Resisting/Overturning Ratio = **3.39**

Vertical Loads used for Soil Pressure = 1,896.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	15.9	pci
Horizontal Defl @ Top of Wall (approximate only)	0.082	in

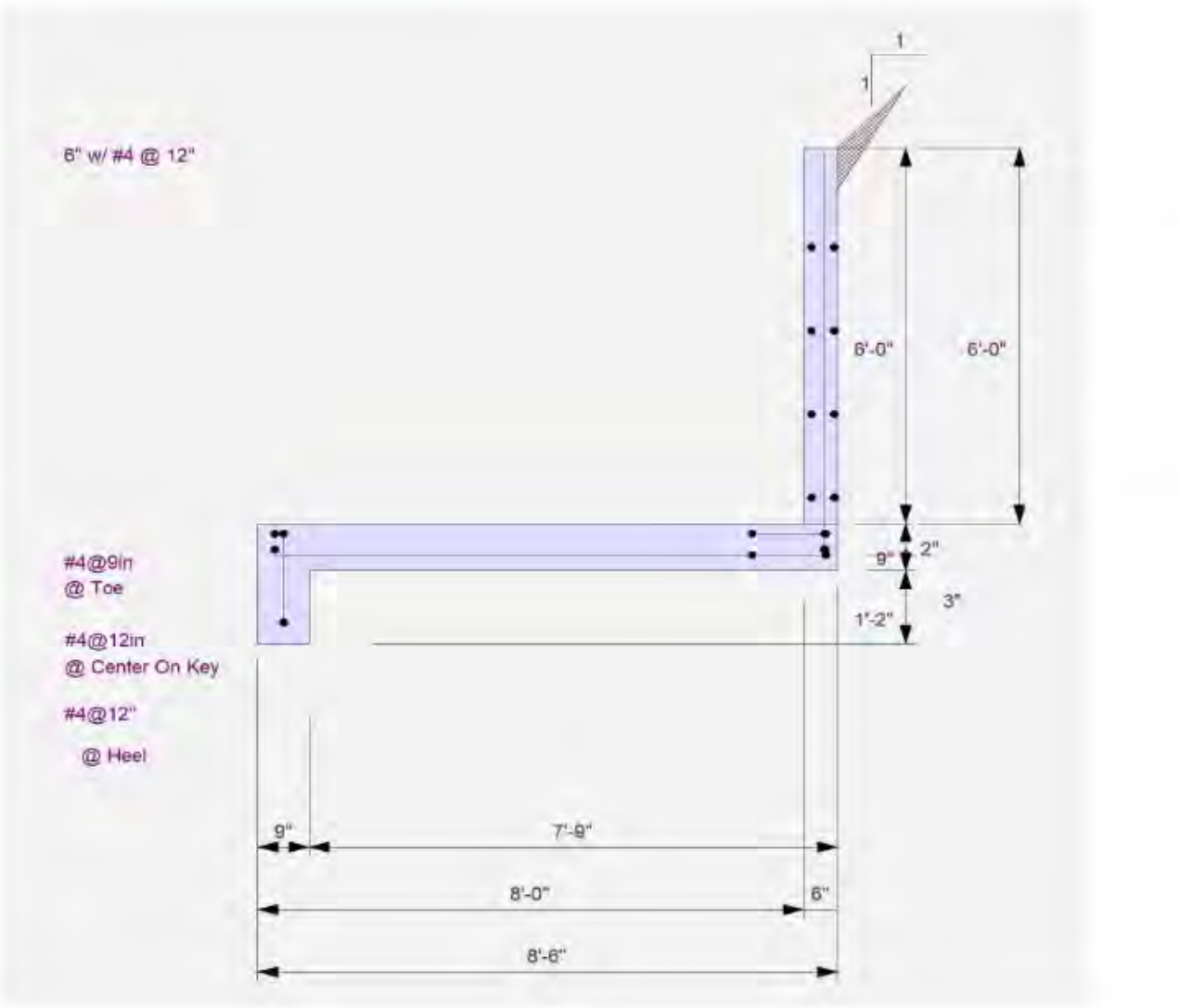
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 6ft Retained



2.3.4 Wall Retaining 5.5ft of Soil

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 5.5ft Retained

Code Reference

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	5.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Dead Load (D) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 5.5ft Retained

Design Summary

Wall Stability Ratios

Overturning	=	4.10	OK
Sliding	=	1.72	OK
Global Stability	=	1.47	
Total Bearing Load	=	1,808 lbs	
...resultant ecc.	=	5.52 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	234 psf	OK
Soil Pressure @ Heel	=	119 psf	OK
Allowable	=	3,400 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	327 psf	
ACI Factored @ Heel	=	167 psf	
Footing Shear @ Toe	=	13.8 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	878.9 lbs	
less 200% Passive Force	-	462.5 lbs	
less 200% Friction Force	-	1,050.0 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	6.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	3.75 i		
Design Data				
fb/FB + fa/Fa	=	**0.610**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,089.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	1,996.5		
Moment.....Allowable	=	3,268.8		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	24.2		
Shear.....Allowable	psi =	69.8		
Anet (Masonry)	in2 =			
Wall Weight	psf =	75.0		
Rebar Depth 'd'	in =	3.75		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 5.5ft Retained

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1286 in2/ft		
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 18.52 in	#4@ 37.04 in
Provided Area :	0.2 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	0.9563 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Footing Data

Toe Width	=	8.00 ft
Heel Width	=	0.50
Total Footing Width	=	8.50
Footing Thickness	=	9.00 in
Key Width	=	9.00 in
Key Depth	=	14.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	327	167		psf
Mu' : Upward	=	8,862	0		ft-#
Mu' : Downward	=	4,320	0		ft-#
Mu: Design	=	4,542	3	338	ft-#
φ Mn	=	6,058	OK - Flush	3,944	
Actual 1-Way Shear	=	13.84	0.00	9.35	psi
Allow 1-Way Shear	=	64.28	57.34	65.64	psi

Toe Reinforcing = # 4 @ 10.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 10.28 in, #5@ 15.94 in, #6@ 22.62 in, #7@ 30.85 in, #8@ 40.62 in, #9@ 51.42 in, #10@ 65.31 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 12.34 in, #5@ 18 in, #6@ 18 in, #7@ 18 in

Min footing T&S reinf Area 1.65 in2
Min footing T&S reinf Area per foot 0.19 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@ 27.16 in	#6@ 54.32 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 5.5ft Retained

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	878.9	2.08	1,831.1			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)						
Soil Over HL (bel. water tbl)						
Water Table						
Sloped Soil Over Heel =					8.50	
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =						
Surcharge Over Toe =						
Stem Weight(s) =				412.5	8.25	3,403.1
Earth @ Stem Transitions =						
Footing Weight =				956.3	4.25	4,064.1
Key Weight =				131.3	0.38	49.2
Vert. Component =						
Total =	878.9	**O.T.M.** =	1,831.1	**Total =**	1,500.0 lbs	**R.M.=** 7,516.4

Resisting/Overturning Ratio = **4.10**

Vertical Loads used for Soil Pressure = 1,808.0 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	15.9	pci
Horizontal Defl @ Top of Wall (approximate only)	0.066	in

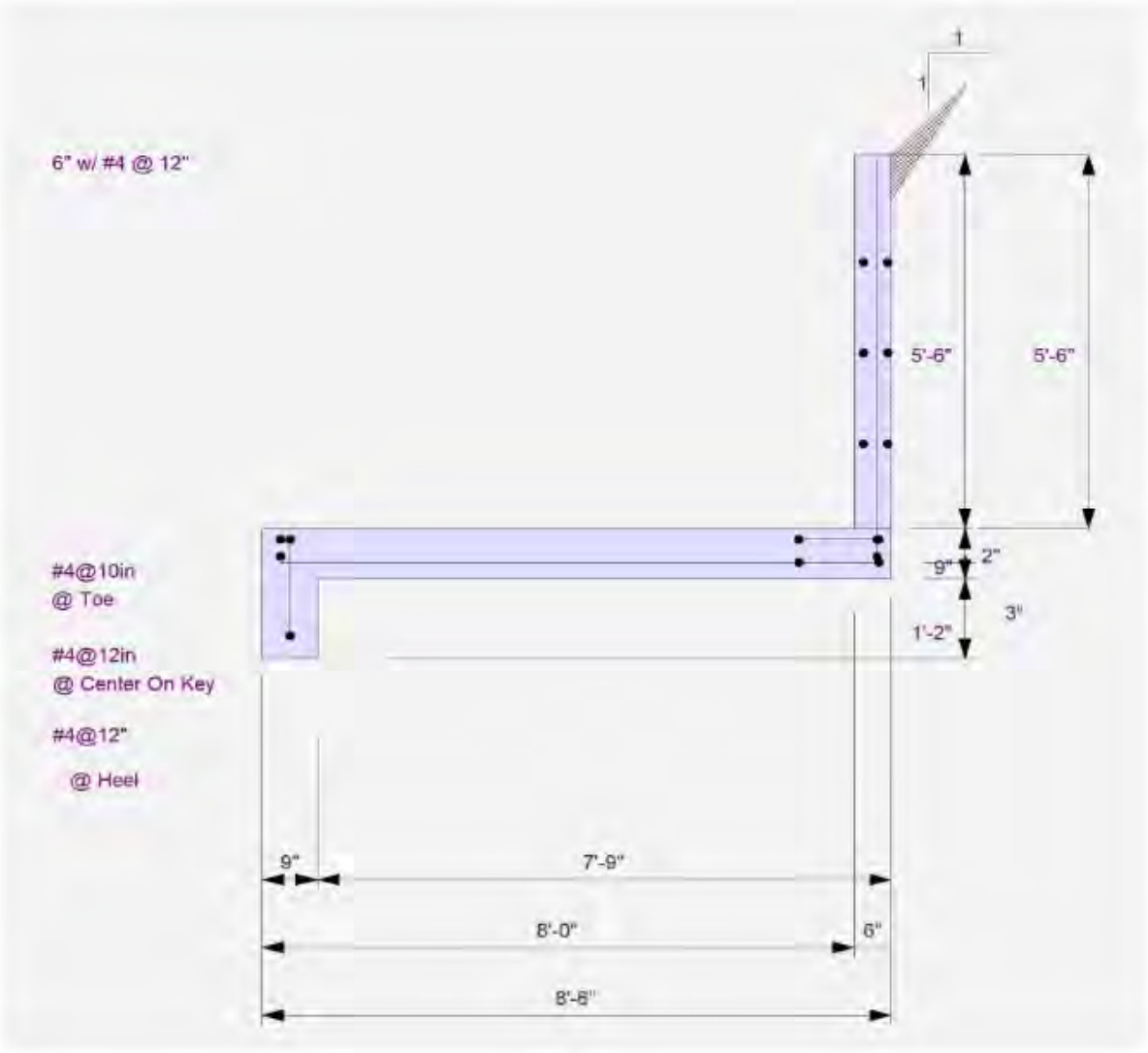
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 5.5ft Retained



2.3.5 Wall Retaining 4.5ft of Soil

Cantilevered Retaining Wall Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 4.5ft Retained

Code Reference

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	4.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Dead Load (D) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 4.5ft Retained

Design Summary

Wall Stability Ratios

Overturning	=	4.18	OK
Sliding	=	2.10	OK
Global Stability	=	1.72	

Total Bearing Load	=	1,417	lbs
...resultant ecc.	=	4.50	in

Eccentricity within middle third

Soil Pressure @ Toe	=	249 psf	OK
Soil Pressure @ Heel	=	121 psf	OK
Allowable	=	3,400 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	348 psf	
ACI Factored @ Heel	=	169 psf	
Footing Shear @ Toe	=	11.5 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	620.2 lbs	
less 200% Passive Force	-	462.5 lbs	
less 200% Friction Force	-	840.0 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	6.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	3.75 i		
Design Data				
fb/FB + fa/Fa	=	**0.334**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	729.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	1,093.5		
Moment.....Allowable	=	3,268.8		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	16.2		
Shear.....Allowable	psi =	69.8		
Anet (Masonry)	in2 =			
Wall Weight	psf =	75.0		
Rebar Depth 'd'	in =	3.75		
Masonry Data				
f'm	psi =			
Fs	psi =			
Solid Grouting	=			
Modular Ratio 'n'	=			
Equiv. Solid Thick.	=			
Masonry Block Type	=			
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =	5,000.0		
Fy	psi =	60,000.0		

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 4.5ft Retained

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0704 in2/ft		
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 18.52 in	#4@ 37.04 in
Provided Area :	0.2 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	0.9563 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Footing Data

Toe Width	=	6.00 ft
Heel Width	=	0.50
Total Footing Width	=	6.50
Footing Thickness	=	9.00 in
Key Width	=	9.00 in
Key Depth	=	14.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	348	169		psf
Mu' : Upward	=	5,272	0		ft-#
Mu' : Downward	=	2,430	0		ft-#
Mu: Design	=	2,842	3	342	ft-#
φ Mn	=	5,069	OK - Flush	3,944	
Actual 1-Way Shear	=	11.47	0.00	9.41	psi
Allow 1-Way Shear	=	60.49	57.34	65.64	psi

Toe Reinforcing = # 4 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 12.34 in, #5@ 19.13 in, #6@ 27.16 in, #7@ 37.03 in, #8@ 48.76 in, #9@ 61.72 in, #10@ 78.39 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 12.34 in, #5@ 18 in, #6@ 18 in, #7@ 18 in

Min footing T&S reinf Area 1.26 in2
Min footing T&S reinf Area per foot 0.19 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@ 27.16 in	#6@ 54.32 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 4.5ft Retained

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		620.2	1.75	1,085.3	Soil Over HL (ab. water tbl)			
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)			
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=	6.50	
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	337.5	6.25	2,109.4
					Earth @ Stem Transitions	=			
					Footing Weight	=	731.3	3.25	2,376.6
					Key Weight	=	131.3	0.38	49.2
					Vert. Component	=			
Total	=	620.2	**O.T.M.** =	1,085.3	**Total =**		1,200.0 lbs	**R.M.=**	4,535.2

Resisting/Overturning Ratio = **4.18**

Vertical Loads used for Soil Pressure = 1,417.3 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	15.9	pci
Horizontal Defl @ Top of Wall (approximate only)	0.075	in

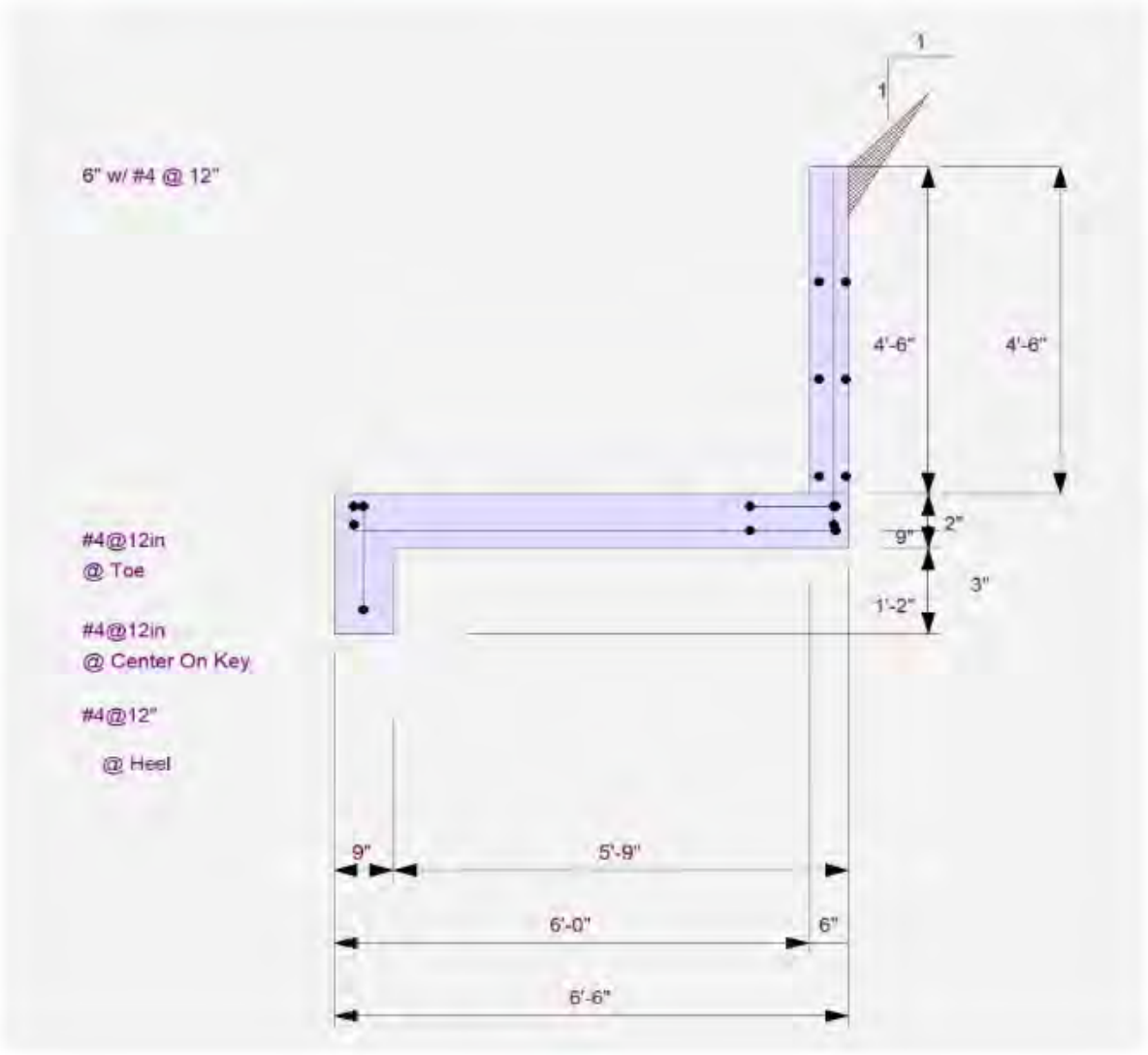
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 4.5ft Retained



2.3.6 Wall Retaining 3.5ft of Soil

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 3.5ft Retained

Code Reference

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	3.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Dead Load (D) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 3.5ft Retained

Design Summary

Wall Stability Ratios

Overturning	=	7.06	OK
Sliding	=	1.54	OK
Global Stability	=	1.62	

Total Bearing Load	=	1,267	lbs
...resultant ecc.	=	1.77	in

Eccentricity within middle third

Soil Pressure @ Toe	=	197 psf	OK
Soil Pressure @ Heel	=	150 psf	OK
Allowable	=	3,400 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	275 psf	
ACI Factored @ Heel	=	209 psf	
Footing Shear @ Toe	=	9.4 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	406.4 lbs	
less 100% Passive Force	-	231.3 lbs	
less 100% Friction Force	-	393.8 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD SD SD
Thickness	=	6.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	3.75 i
Design Data		
fb/FB + fa/Fa	=	0.157
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	441.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	514.5
Moment.....Allowable	=	3,268.8
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	9.8
Shear.....Allowable	psi =	69.8
Anet (Masonry)	in2 =	
Wall Weight	psf =	75.0
Rebar Depth 'd'	in =	3.75
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 3.5ft Retained

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0331 in2/ft		
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 18.52 in	#4@ 37.04 in
Provided Area :	0.2 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	0.9563 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Footing Data

Toe Width	=	6.00 ft
Heel Width	=	0.50
Total Footing Width	=	6.50
Footing Thickness	=	9.00 in
Key Width	=	9.00 in
Key Depth	=	14.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	275	209		psf
Mu' : Upward	=	4,589	0		ft-#
Mu' : Downward	=	2,430	0		ft-#
Mu: Design	=	2,159	30	336	ft-#
φ Mn	=	5,069	OK - Flush	3,944	
Actual 1-Way Shear	=	9.42	0.00	9.32	psi
Allow 1-Way Shear	=	60.49	57.34	65.64	psi

Toe Reinforcing = # 4 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 4 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 12.34 in, #5@ 19.13 in, #6@ 27.16 in, #7@ 37.03 in, #8@ 48.76 in, #9@ 61.72 in, #10@ 78.39 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 12.34 in, #5@ 18 in, #6@ 18 in, #7@ 18 in

Min footing T&S reinf Area 1.26 in2
Min footing T&S reinf Area per foot 0.19 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@ 27.16 in	#6@ 54.32 in

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 3.5ft Retained

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		406.4	1.42	575.7	Soil Over HL (ab. water tbl)			
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)			
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=	6.50	
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	262.5	6.25	1,640.6
					Earth @ Stem Transitions	=		
					Footing Weight	=	731.3	3.25	2,376.6
					Key Weight	=	131.3	0.38	49.2
					Vert. Component	=			
Total	=	406.4	**O.T.M.** =	575.7	**Total =**		1,125.0 lbs	**R.M.=**	4,066.4

Resisting/Overturning Ratio = **7.06**

Vertical Loads used for Soil Pressure = 1,267.4 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	15.9	pci
Horizontal Defl @ Top of Wall (approximate only)	0.046	in

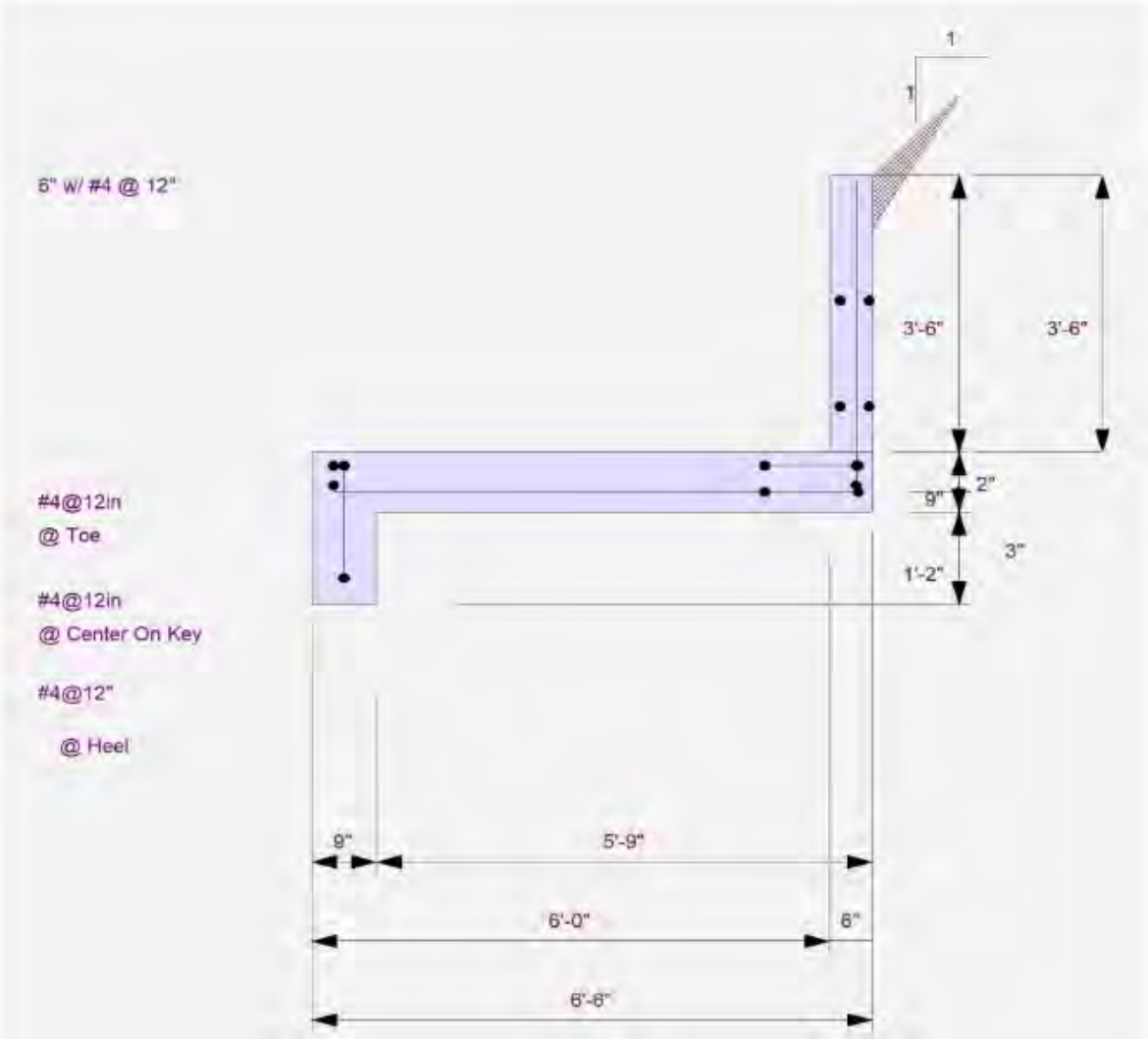
The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: Yap Island Airport - Drainage Structures.ec6

LIC# : KW-06015079, Build:20.24.05.02 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Wingwall Design - 3.5ft Retained



3 Inlet and Manhole Design

3.1 Design Summary

The following calculations are for the reinforced concrete Inlet and Manhole structures at Yap Island Airport.

Manhole and Inlet lids slabs are conservatively designed as a one-way, simply supported slab for the worst case clear span. Reinforcing based on the worst-case condition is provided in both directions. One design is provided for lids directly loaded by aircraft and another for lids that do not see aircraft loading.

Manhole and Inlet walls are assumed to span horizontally between perpendicular walls. Walls are designed based on clear span and loading at the deepest location where critical pressures are anticipated to occur.

3.2 Design Assumptions

Lid Slab

- Assumed to be one-way slab, simply supported.
- Due to one-way slab assumption, worst case loading for all cases is based on a single 50 kip wheel load. The wheel at center span results in the worst case design moment, while a wheel adjacent to the support results in the worst case design shear.
- Where 50 kip aircraft wheel load is considered, a 3ft wide section of slab is considered. This width is less than the distance between wheels on the governing aircraft.
- Analysis span length is from centerline of supporting walls
- Critical one-way shear section is taken at D/2 away from face of support. Critical wheel load location occurs where shear is maximized at D/2 away from face of support.

Walls

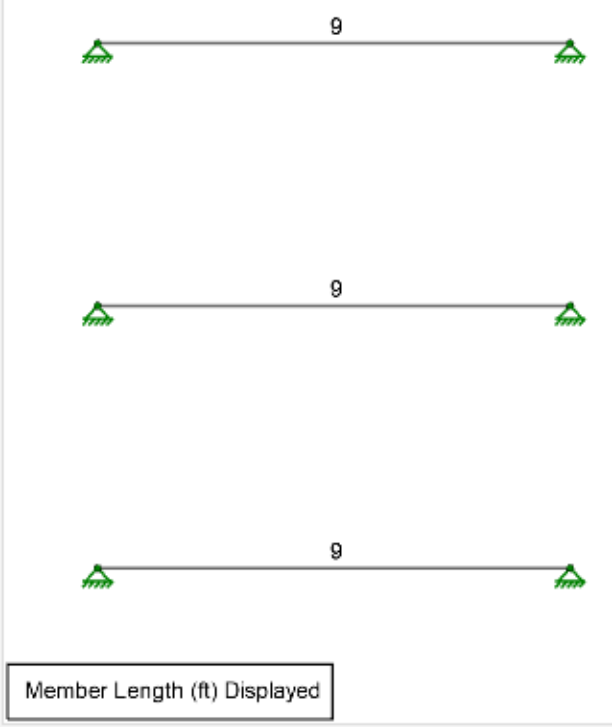
- Assumed span horizontally between perpendicular walls.
- Assumed to be one-way slab, simply supported at typical conditions.
- At top and bottom of walls, where horizontal slabs occur, two-way action is assumed to occur. Due to this action, critical moments are taken a distance from horizontal slabs equal to wall span divided by two.

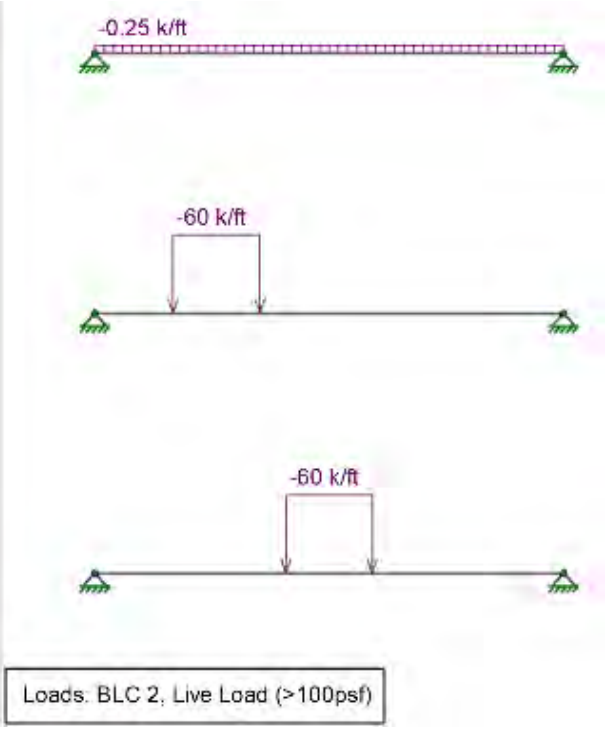
Load Combinations

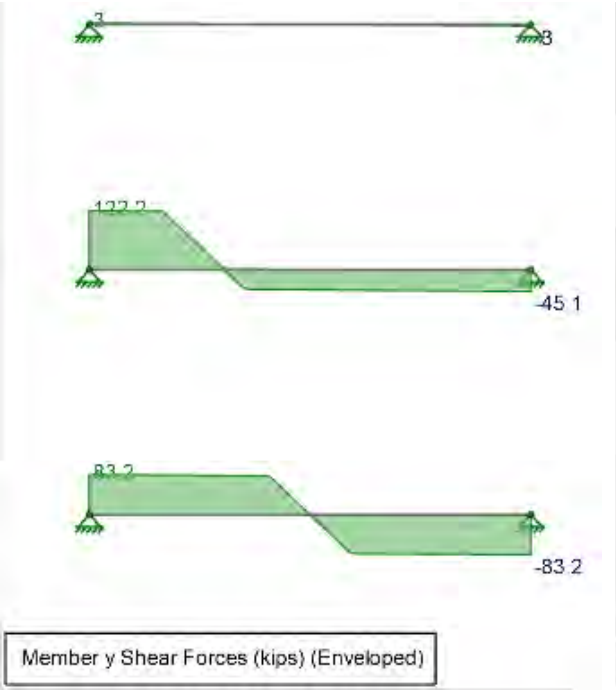
- IBC 21 / ASCE 7-16 Strength 2: $1.2*D + 1.6*L + 1.6*H_{at\text{-}rest}$
- IBC 21 / ASCE 7-16 Strength 6: $1.2*D + 1.4*E + 0*L + 1.6*H_{active}$
    - Factor of 1.4 is applied assumed earthquake lateral pressure provided in geotechnical report are service level (1/0.7 = 1.4)
    - Earthquake and plane landing (live load) assumed to not occur concurrently.
    - Per geotech's instructions, earthquake loads were combined with active soil pressure.

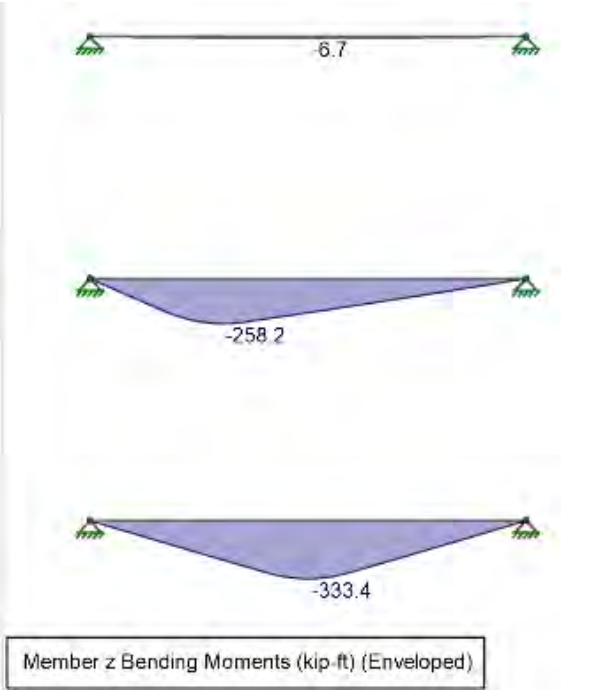
3.3 Lid Analysis and Design

Analysis of the lid slab is performed with the RISA3D structural analysis software. Three cases are considered for loading: no aircraft loading (assuming 250psf uniform area live load as conservative application of HS-20 loading), aircraft wheel (100 kip load) at center span, and aircraft wheel (100 kip load) near support. Figures below summarize the geometry, loading, and force output from the RISA3D model.









Design of Aircraft Rated Lid:

RC BEAM DESIGN (ACI318-2019 (22))

In accordance with ACI318-2019 (22)

Tedds calculation version 3.3.18

Concrete details

Compressive strength of concrete	f'_c = **5000** psi
Density of reinforced concrete	w_c = **150** lb / ft^3
Concrete type	Normal weight
Modulus of elasticity of concrete (cl.19.2.2.1)	$E = (w_c / 1\ lb/ft^3)^{1.5} \times 33\ psi \times (f'_c / 1\ psi)^{0.5}$ = **4286826** psi
Strength reduction factor for shear	ϕ_s = **0.75**

Reinforcement details

Yield strength of reinforcement	f_y = **60000** psi
Compression-controlled strain limit (cl.21.2.2.1)	ε_{ty} = **0.00200**

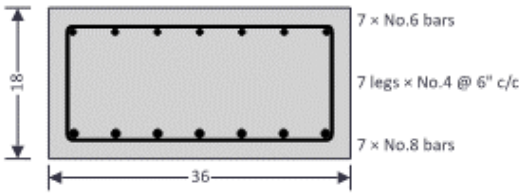
Nominal cover to reinforcement

Cover to top reinforcement	c_{nom_t} = **2** in
Cover to bottom reinforcement	c_{nom_b} = **2** in
Cover to side reinforcement	c_{nom_s} = **2** in

Section 1 - Lid Slab - Aircraft Loading

Rectangular section details

Section width	b = **36** in
Section depth	h = **18** in



Positive moment. Rectangular section in flexure (Section 9.5.2)

Factored bending moment at section	$M_u = M_{pos_s1}$ = **335.000** kip_ft
Effective depth to tension reinforcement	d = **15** in
Tension reinforcement provided	7 × No.8 bars
Area of tension reinforcement provided	$A_{s,prov}$ = **5.498** in^2
Minimum area of reinforcement (cl.9.6.1.2)	$A_{s,min} = \max(3\ psi \times \sqrt{(f'_c / 1\ psi)}, 200\ psi) \times b \times d / f_y$ = **1.909** in^2

PASS - Area of reinforcement provided is greater than minimum area of reinforcement required

Stress block depth factor (cl.22.2.2.4.3)	$\beta_1 = \min(\max(0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi, 0.65), 0.85)$ = **0.80**
Depth of equivalent rectangular stress block	$a = A_{s,prov} \times f_y / (0.85 \times f'_c \times b)$ = **2.156** in
Depth to neutral axis	$c = a / \beta_1$ = **2.695** in
Net tensile strain in extreme tension fibers	$\varepsilon_t = 0.003 \times (d_o - c) / \max(c, 0.001\ in)$ = **0.0137**

Net tensile strain in tension controlled zone

Strength reduction factor (cl.21.2.1)	$\phi_f = \min(\max(0.65 + 0.25 \times (\varepsilon_t - \varepsilon_{ty}) / (0.003), 0.65), 0.9)$ = **0.90**
Nominal moment strength	$M_n = A_{s,prov} \times f_y \times (d - a / 2)$ = **382.701** kip_ft
Design moment strength	$\phi M_n = M_n \times \phi_f$ = **344.431** kip_ft

PASS - Required moment strength is less than design moment strength

Flexural cracking

Max. center to center spacing of tension reinf.	$s_{b,max} = s_{bot} + \phi_{s1_b_L1}$ = **5.000** in
Service load stress in reinforcement (cl.24.3.2)	$f_s = 2/3 \times f_y$ = **40000** psi
Clear cover of reinforcement	$c_c = c_{nom_b} + \phi_v$ = **2.500** in
Maximum allowable bot bar spacing (Table 24.3.2)	$s_{max} = \min(15in \times 40000psi / f_s - 2.5 \times c_c, 12in \times 40000psi / f_s)$ = **8.750** in

PASS - Maximum allowable tension reinforcement spacing exceeds actual spacing

Spacing limits for reinforcement

Top bar clear spacing	$s_{top} = (b - (2 \times (c_{nom_s} + \phi_{s1_v}) + \phi_{s1_t_L1} \times N_{s1_t_L1})) / (N_{s1_t_L1} - 1)$ = **4.292** in
Min. allowable top bar clear spacing (cl.25.2.1)	$s_{top,min}$ = **1.000** in
Bottom bar clear spacing	$s_{bot} = (b - (2 \times (c_{nom_s} + \phi_{s1_v}) + \phi_{s1_b_L1} \times N_{s1_b_L1})) / (N_{s1_b_L1} - 1)$ = **4.000** in
Min. allowable bottom bar clear spacing (cl.25.2.1)	$s_{bot,min}$ = **1.000** in

PASS - Actual bar spacing exceeds minimum allowable

Rectangular section in shear

Design shear force	V_u = **121.000** kips
Concrete weight modification factor	λ = **1.00**
Size effect factor (cl. 22.5.5.1.3)	$\lambda_s = \min(\sqrt{(2 / (1 + (d / 1\ in) / 10))}, 1.0)$ = **0.89**
Area of longitudinal reinforcement	A_{st} = **5.498** in^2
Ratio of longitudinal reinforcement	$\rho_w = A_{st} / (b \times d)$ = **0.010**
Concrete shear strength (Table 22.5.5.1)	$\phi V_c = \phi_s \times \min(8 \times \lambda \times (\rho_w)^{1/3}, 5 \times \lambda) \times \sqrt{(f'_c \times 1\ psi)} \times b \times d$ = **49.655** kips
Reinforcement shear strength (eqn. 22.5.1.1)	$\phi V_s = \max(V_u - \phi V_c, 0\ kips)$ = **71.345** kips
Maximum reinforcement shear strength	$\phi V_{s,max} = \phi_s \times 8\ psi \times \sqrt{(\min(f'_c, 10000psi) / 1\ psi)} \times b \times d$ = **229.103** kips
Area of design shear reinf. reqd (eqn. 22.5.8.5.3)	$A_{sv,des} = \phi V_s / (\phi_s \times \min(f_y, 60000\ psi) \times d)$ = **1.268** in^2/ft
Min area of shear reinforcement (Table 9.6.3.4)	$A_{sv,min} = \max(50\ psi, 0.75\ psi \times \sqrt{(f'_c / 1\ psi)}) \times b / \min(f_y, 60000\ psi)$ = **0.382** in^2/ft

$\phi V_c < V_u$ - reinforcement required

Area of shear reinforcement required	$A_{sv,req} = \max(A_{sv,min}, A_{sv,des})$ = **1.268** in^2/ft
Shear reinforcement provided	7 legs × No.4 @ 6" c/c
Area of shear reinforcement provided	$A_{sv,prov}$ = **2.749** in^2/ft

PASS - Area of shear reinforcement provided exceeds area of shear reinforcement required

Maximum longitudinal spacing (Table 9.7.6.2.2)	$s_{vl,max} = d / 2$ = **7.5** in

PASS - longitudinal spacing of stirrups is less than the maximum allowable

Design of Non-Aircraft Rated Lid:

RC ONE-WAY SLAB DESIGN (ACI 318)

In accordance with ACI318-19 (22)

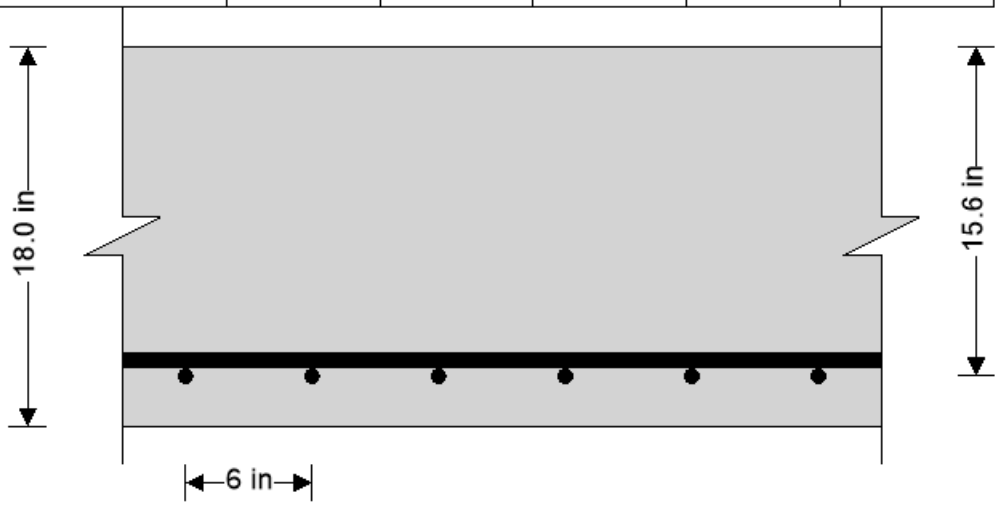
Tedds calculation version 1.2.05

Design summary

Overall design status PASS

Overall design utilization 0.255

Description	Unit	Capacity	Maximum	Utilization	Result
Moment	kip_ft/ft	60.060	6.700	0.112	PASS
Shear	kips/ft	11.782	3.000	0.255	PASS
Minimum thickness requirements are met					PASS



Slab definition

Slab type	**One-way simply supported**
Overall thickness of slab	h = **18.000** in
Span of slab	l_n = **9.00** ft
Clear cover to tension reinforcement	c_c = **2.00** in

Materials

Specified compressive strength of concrete	f'_c = **5000** psi
Specified yield strength of reinforcement	f_y = **60000** psi
Modulus of elasticity	E_{SACI} = **29000000** psi
Compression-controlled strain limit - 21.2.2.1	ε_{ty} = **0.002**
Minimum tensile strain - 7.3.3.1	$\varepsilon_{min} = \varepsilon_{ty} + 0.003$ = **0.005**
Concrete modification factor	λ = **1.00**

Maximum design moment and shear in span(per 12 in width of slab)

Maximum ultimate positive moment	M_{us} = **6.700** kip_ft/ft
Maximum ultimate shear force	V_u = **3.000** kips/ft

Reinforcement calculation - positive moments

Tension steel provided	**No. 6 @ 6 in o.c.**
Depth to tension steel	d = (h – c_c – D / 2) = **15.63** in

β_1 = if(f'c <= 4 ksi, 0.85, max(0.65, 0.85 - 0.05 × (f'c - 4 ksi) / 1 ksi)) = **0.80**	
Stress block depth factor	$\beta_1 = 0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi = 0.80$
Reinforcement ratio at strain of ε_{min}	$\rho_b = 0.85 \times \beta_1 \times f'_c / f_y \times (0.003 / (0.003 + \varepsilon_{min})) =$ **0.021**
Maximum reinforcement ratio	$\rho_{max} = \rho_b =$ **0.021**
Maximum area of tension steel	$A_{s_max} = \rho_{max} \times d =$ **3.984** in²/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	$\rho_t =$**0.0018**
Min area tension steel req'd – cl. 7.6.1.1	$A_{s_min} = \rho_t \times h =$ **0.389** in²/ft
Area required for bending	$A_{s_req} =$ **0.096** in²/ft
Area of tension steel provided	$A_{s_prov} =$ **0.884** in²/ft
	PASS - Area of steel provided - OK
Steel stress – cl. 24.3.2.1	$f_s = 2/3 \times f_y =$ **40000** psi
Max allowable spacing – cl. 7.7.2.3 & cl. 24.3.2	$s_{max} = \min(3\times h, 18in, 15in\times(40000\ psi/f_s) - 2.5\times c_c, 12in\times(40000\ psi/f_s))$
	$s_{max} =$ **10.000** in
Actual tensile bar spacing provided	s = **6.000** in
	PASS - Spacing of bars (+ve moment steel) less than maximum allowable
	Library item: Steel Calcs - SAGGING
Check for section - positive moments	
Depth of equivalent rectangular stress block	$a = (A_{s_prov} \times f_y) / (0.85 \times f'_c) =$ **1.04** in
Depth of neutral axis	$c = a / \beta_1 =$ **1.299** in
Net tensile strain in long. steel at nominal strength	$\varepsilon_t = 0.003 \times [(d - c) / c] =$ **0.0331**
	Tensile strain exceeds minimum required, design OK
Required nominal flexural strength	$M_{us} =$ **6.700** kip_ft/ft
Strength reduction factor	$\phi =$**0.9**
Nominal flexural strength	$M_{ns_prov} = A_{s_prov} \times f_y \times (d - a / 2) =$ **66.733** kip_ft/ft
Design flexural strength	$\phi M_{ns_prov} = \phi \times M_{ns_prov} =$ **60.060** kip_ft/ft
	PASS - Design flexural strength exceeds required flexural strength
Transverse reinforcement - (for shrinkage and temperature)	
Transverse reinforcement provided	**No. 6 @ 12 in o.c.**
Area of reinforcement provided	$A_{t_prov} =$ **0.442** in²/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	$\rho_t =$**0.0018**
Minimum area of transverse reinforcement required	$A_{t_req} = \rho_t \times h =$ **0.389** in²/ft
	PASS - Area of transverse steel provided OK
Maximum allowable spacing of bars	$s_{max_t} = \min (5 \times h, 18\ in) =$ **18.000** in
Actual transverse bar spacing provided	$s_t =$ **12.000** in
	PASS - Spacing of transverse bars is less than allowable
	Library item: Transverse steel calcs
Check for shear	
Required shear strength	$V_u =$ **3.000** kips/ft
Size effect factor – cl. 22.5.5.1.3	$\lambda_s = \min(\sqrt{(2 / (1 + (d / 1\ in) / 10))}, 1.0) =$ **0.88**
Ratio of longitudinal reinforcement	$\rho_w = A_{s_prov} / d =$ **0.005**
Shear strength provided by concrete	$V_c = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3}, 5 \times \lambda) \times \sqrt{(f'_c \times 1\ psi)} \times d =$ **15.710** kips/ft
Shear strength provided by shear steel (assumed)	$V_s = 0$ kips/ft
Shear capacity of section	$V = V_c + V_s =$ **15.710** kips/ft
Design shear capacity of section	$\phi V = 0.75 \times V =$ **11.782** kips/ft

PASS - One-way shear capacity

Check of clear cover – cl. 20.5.1.1

Permissible min nominal cover to all reinforcement c_{min} = 0.75 in

Clear cover to tension reinforcement (+ve mnt) $c_c = h - d - D/2$ = **2.000** in

PASS - Cover to steel resisting positive moment exceeds allowable minimum cover

Deflection

Support condition	**Simply supported**
Basic span-to-thickness ratio - Table 7.3.1.1	$ratio_{basic}$ = **20**
Type of concrete	**Normal weight**
Concrete density factor - Table 7.3.1.1	$f_{density}$ = **1.00**
Allowable span-to-thickness ratio	$ratio_{allow} = ratio_{basic} / (f_{density} \times (0.4 + f_y / 100000\ psi))$ = **20.000**
Actual span-to-thickness ratio	$ratio_{actual} = l_n / h$ = **6.000**

PASS - The slab thickness is adequate to control deflection

Design summary

Slab is 18.0 in thick in 5000 psi concrete

Tension steel provided - positive moment, No. 6 @ 6 in o.c. in 60000 psi steel

Transverse steel provided , No. 6 @ 12 in o.c. in 60000 psi steel

3.4 Wall Analysis and Design

Lateral Soil Pressure

Individual components of lateral soil pressure on the inlet and manhole walls are summarized below. See combined lateral soil pressure section for total soil pressures.

Static Soil Pressure

At-rest pressure assumed to be 66 psf / ft for on-site soils per geotechnical report.

Dynamic Seismic Pressure

The follow calculations are based on dynamic (seismic) pressures for non-yielding walls as outline required in the geotechnical report and outlined in the loading criteria section of these calculations.

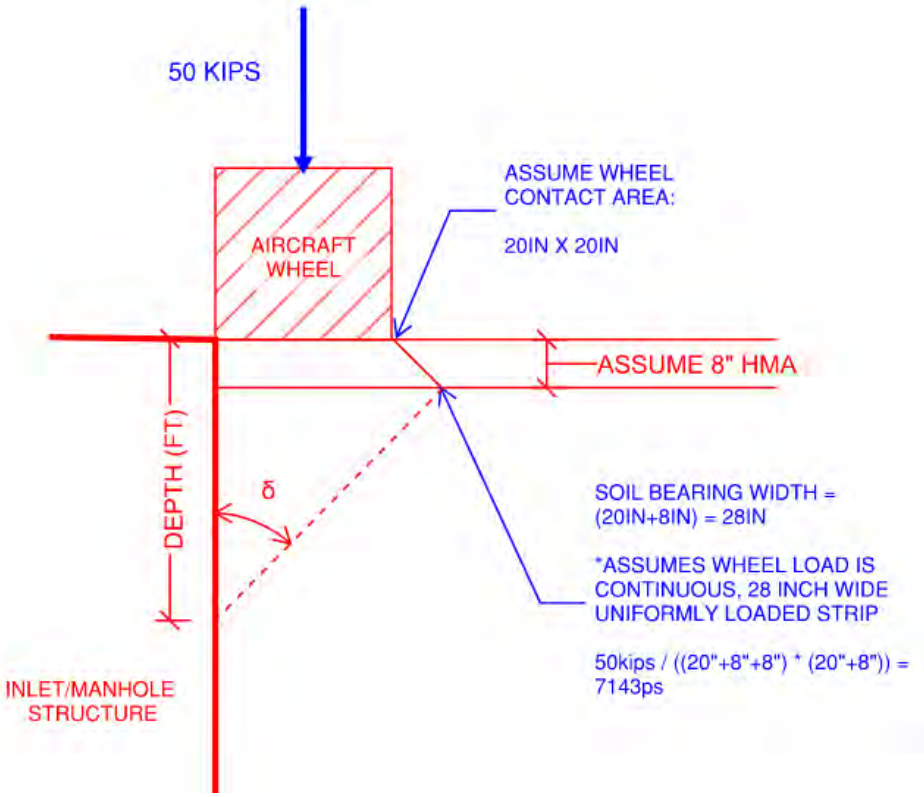
PGA, a =	0.99	
Gravitational constant, g =	32.2	ft/s2
Poisson's Ratio, v =	0.35	
ah = kh*g =	31.878	ft/s2
Soil Density =	125	pcf
L >	300	ft
H =	45	
Fp,max =	1	
Fm,max =	0.58	
ΔPeq =	124	*H^2 lb
peq,avg = ΔPeq / H	124	*H psf

Live Load Surcharge due to Aircraft Wheel Loading

Maximum aircraft wheel surcharge at wall occurs when wheel is directly adjacent to wall.

Surcharge applied to wall as outlined in load criteria section of these calculations.

A minimum of relatively rigid 8" HMA is assumed on all sides of inlet/manhole structure, which distributes wheel load to a greater bearing area at soil interface. The assumed load condition is outline below, with calculated horizontal pressures shown in the combined lateral soil pressures section.



Combined Lateral Soil Pressures

Lateral Pressure on Manhole and Inlet Walls (1ft Unit Width)

Depth ft	Static Soil Pressure plf/ft	Active Soil Pressure plf/ft	ΔPeq lbs	Seismic plf/ft	Surface surcharge, p psf	α rad	δ rad	Live Load Wall Surcharge plf/ft
0	0	0	0	0	7143	0	-1.29	0
1	66	45	124	124	7143	0	1.43	5859
2	132	90	495	248	7143	0	1.05	2819
3	198	135	1114	371	7143	0	0.78	1295
4	264	180	1980	495	7143	0	0.61	639
5	330	225	3094	619	7143	0	0.49	347
5.5	363	247.5	3743	681	7143	0	0.45	264
6	396	270	4455	743	7143	0	0.41	205
6.5	429	292.5	5228	804	7143	0	0.38	162
7	462	315	6064	866	7143	0	0.35	130
7.67	506.22	345.15	7280	949	7143	0	0.32	98
8	528	360	7920	990	7143	0	0.31	87
8.67	572.22	390.15	9302	1073	7143	0	0.28	68
9	594	405	10024	1114	7143	0	0.27	61
10	660	450	12375	1238	7143	0	0.24	44
11	726	495	14974	1361	7143	0	0.22	33
12	792	540	17820	1485	7143	0	0.20	25
13	858	585	20914	1609	7143	0	0.19	20
14	924	630	24255	1733	7143	0	0.17	16
15	990	675	27844	1856	7143	0	0.16	13
16	1056	720	31680	1980	7143	0	0.15	10
17	1122	765	35764	2104	7143	0	0.14	9
18	1188	810	40095	2228	7143	0	0.13	7
19	1254	855	44674	2351	7143	0	0.13	6
20	1320	900	49500	2475	7143	0	0.12	5
21	1386	945	54574	2599	7143	0	0.11	4
22	1452	990	59895	2723	7143	0	0.11	4
23	1518	1035	65464	2846	7143	0	0.10	3
24	1584	1080	71280	2970	7143	0	0.10	3
25	1650	1125	77344	3094	7143	0	0.10	3
26	1716	1170	83655	3218	7143	0	0.09	2
27	1782	1215	90214	3341	7143	0	0.09	2
28	1848	1260	97020	3465	7143	0	0.09	2
29	1914	1305	104074	3589	7143	0	0.08	2
30	1980	1350	111375	3713	7143	0	0.08	2
31	2046	1395	118924	3836	7143	0	0.08	1
32	2112	1440	126720	3960	7143	0	0.07	1
33	2178	1485	134764	4084	7143	0	0.07	1
34	2244	1530	143055	4208	7143	0	0.07	1
35	2310	1575	151594	4331	7143	0	0.07	1
36	2376	1620	160380	4455	7143	0	0.07	1
37	2442	1665	169414	4579	7143	0	0.06	1
38	2508	1710	178695	4703	7143	0	0.06	1
39	2574	1755	188224	4826	7143	0	0.06	1
40	2640	1800	198000	4950	7143	0	0.06	1
41	2706	1845	208024	5074	7143	0	0.06	1
42	2772	1890	218295	5198	7143	0	0.06	1
43	2838	1935	228814	5321	7143	0	0.05	1
44	2904	1980	239580	5445	7143	0	0.05	0
45	2970	2025	250594	5569	7143	0	0.05	0

Factored lateral earth pressures for depths up to 45ft are summarized in the table below:

1.2D + 1.6L + 1.6H

1.2D + 1.4E + 1.6H

Factored Distributed Load on One-way Slab (1ft unit width)			
Depth ft	IBC 21/ASCE Strength 2 plf/ft	IBC 21/ASCE Strength 6 plf/ft	Factored Envelope plf/ft
0	0	0	0
1	9481	245	9481
2	4722	491	4722
3	2388	736	2388
4	1445	981	1445
5	1083	1226	1226
5.5	1003	1349	1349
6	961	1472	1472
6.5	945	1594	1594
7	946	1717	1717
7.67	967	1881	1881
8	983	1962	1962
8.67	1024	2126	2126
9	1047	2207	2207
10	1126	2453	2453
11	1214	2698	2698
12	1307	2943	2943
13	1404	3188	3188
14	1503	3434	3434
15	1604	3679	3679
16	1706	3924	3924
17	1809	4169	4169
18	1912	4415	4415
19	2016	4660	4660
20	2120	4905	4905
21	2225	5150	5150
22	2329	5396	5396
23	2434	5641	5641
24	2539	5886	5886
25	2644	6131	6131
26	2749	6377	6377
27	2855	6622	6622
28	2960	6867	6867
29	3065	7112	7112
30	3170	7358	7358
31	3276	7603	7603
32	3381	7848	7848
33	3487	8093	8093
34	3592	8339	8339
35	3698	8584	8584
36	3803	8829	8829
37	3908	9074	9074
38	4014	9320	9320
39	4119	9565	9565
40	4225	9810	9810
41	4331	10055	10055
42	4436	10301	10301
43	4542	10546	10546
44	4647	10791	10791
45	4753	11036	11036

At each depth, the critical moment and shear is calculated for several span lengths. as summarized below:

	Clear Span (ft)											
	2.166666667		4.5		6		6.5		7		7.5	
Depth ft	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip
0	0	0	0	0	0	0	0	0	0	0	0	0
1	12	6	36	17	58	24	67	26	76	28	86	31
2	6	3	18	8	29	12	33	13	38	14	43	15
3	3	1	9	4	15	6	17	7	19	7	22	8
4	2	1	5	3	9	4	10	4	12	4	13	5
5	2	1	5	2	8	3	9	3	10	4	11	4
5.5	2	1	5	2	8	3	9	4	11	4	12	4
6	2	1	6	3	9	4	10	4	12	4	13	5
6.5	2	1	6	3	10	4	11	4	13	5	14	5
7	2	1	6	3	11	4	12	5	14	5	16	6
7.67	2	1	7	3	12	5	13	5	15	6	17	6
8	2	1	7	3	12	5	14	5	16	6	18	6
8.67	3	1	8	4	13	5	15	6	17	6	19	7
9	3	1	8	4	14	6	16	6	18	7	20	7
10	3	1	9	4	15	6	17	7	20	7	22	8
11	3	2	10	5	17	7	19	7	22	8	24	9
12	4	2	11	5	18	7	21	8	24	9	27	10
13	4	2	12	6	20	8	22	9	26	10	29	10
14	4	2	13	6	21	9	24	9	27	10	31	11
15	5	2	14	6	23	9	26	10	29	11	33	12
16	5	2	15	7	24	10	28	11	31	12	35	13
17	5	2	16	7	26	10	29	11	33	13	38	14
18	6	3	17	8	27	11	31	12	35	13	40	14
19	6	3	18	8	29	12	33	13	37	14	42	15
20	6	3	19	9	30	12	34	13	39	15	44	16
21	6	3	19	9	32	13	36	14	41	15	47	17
22	7	3	20	9	33	13	38	15	43	16	49	18
23	7	3	21	10	35	14	40	16	45	17	51	18
24	7	3	22	10	36	15	41	16	47	18	53	19
25	8	4	23	11	38	15	43	17	49	18	55	20
26	8	4	24	11	39	16	45	18	51	19	58	21
27	8	4	25	12	41	17	47	18	53	20	60	22
28	9	4	26	12	42	17	48	19	55	21	62	22
29	9	4	27	12	44	18	50	20	57	21	64	23
30	9	4	28	13	45	18	52	20	59	22	66	24
31	10	4	29	13	47	19	53	21	61	23	69	25
32	10	5	30	14	48	20	55	22	63	24	71	26
33	10	5	31	14	50	20	57	22	65	24	73	26
34	10	5	32	15	51	21	59	23	67	25	75	27
35	11	5	32	15	53	21	60	24	69	26	78	28
36	11	5	33	15	54	22	62	24	71	26	80	29
37	11	5	34	16	56	23	64	25	73	27	82	29
38	12	5	35	16	57	23	66	26	75	28	84	30
39	12	6	36	17	59	24	67	26	77	29	86	31
40	12	6	37	17	60	25	69	27	78	29	89	32
41	13	6	38	18	62	25	71	28	80	30	91	33
42	13	6	39	18	63	26	72	28	82	31	93	33
43	13	6	40	18	65	26	74	29	84	32	95	34
44	14	6	41	19	66	27	76	30	86	32	97	35
45	14	6	42	19	68	28	78	30	88	33	100	36

Note: values highlighted in grey are assumed to be in regions where two-way span action occurs

	Clear Span (ft)													
	8		8.5		9		10		10.67		11.25		13.33	
Depth ft	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip	Mu kip-ft	Vu kip
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	96	33	107	36	119	38	143	43	161	46	178	49	243	58
2	48	17	53	18	59	19	71	21	80	23	89	24	121	29
3	24	8	27	9	30	10	36	11	41	12	45	12	61	15
4	15	5	16	5	18	6	22	7	25	7	27	7	37	9
5	12	4	14	5	15	5	19	6	21	6	23.0	6	31	8
5.5	14	5	15	5	17	5	20	6	23	7	25	7	35	8
6	15	5	17	6	18	6	22	7	25	7	28	8	38	9
6.5	16	6	18	6	20	6	24	7	27	8	30	8	41	10
7	17	6	19	6	21	7	26	8	29	8	32	9	44	11
7.67	19	7	21	7	24	8	28	8	32	9	35	10	48	12
8	20	7	22	7	25	8	30	9	33	9	37	10	50	12
8.67	22	7	24	8	27	9	32	10	36	10	40	11	55	13
9	22	8	25	8	28	9	33	10	38	11	41	11	57	14
10	25	9	28	9	31	10	37	11	42	12	46	13	63	15
11	27	9	30	10	34	11	41	12	46	13	51	14	69	17
12	30	10	33	11	37	12	45	13	50	14	55	15	76	18
13	32	11	36	12	40	13	48	14	54	15	60	16	82	20
14	35	12	39	13	43	14	52	15	58	17	64	18	88	21
15	37	13	42	14	46	15	56	17	63	18	69	19	94	23
16	40	14	44	15	49	16	59	18	67	19	74	20	101	24
17	42	15	47	16	52	17	63	19	71	20	78	21	107	26
18	45	15	50	17	55	18	67	20	75	21	83	23	113	27
19	47	16	53	17	58	19	70	21	79	23	87	24	120	29
20	50	17	55	18	61	20	74	22	84	24	92	25	126	30
21	52	18	58	19	64	21	78	23	88	25	97	26	132	32
22	55	19	61	20	67	22	82	24	92	26	101	28	138	33
23	57	20	64	21	71	23	85.3	25.4	96	27	106	29	145	35
24	60	21	66	22	74	24	89	26	100	28	110	30	151	36
25	62	21	69	23	77	25	93	28	104	30	115	31	157	38
26	65	22	72	24	80	26	96	29	109	31	120	33	164	39
27	67	23	75	25	83	26	100	30	113	32	124	34	170	41
28	70	24	77	26	86	27	104	31	117	33	129	35	176	42
29	72	25	80	27	89	28	108	32	121	34	133	36	183	44
30	74	26	83	28	92	29	111	33	125	36	138	38	189	45
31	77	27	86	29	95	30	115	34	129	37	143	39	195	47
32	79	27	89	29	98	31	119	35	134	38	147	40	201	48
33	82	28	91	30	101	32	122	36	138	39	152	41	208	50
34	84	29	94	31	104	33	126	38	142	40	156	43	214	51
35	87	30	97	32	107	34	130	39	146	42	161	44	220	53
36	89	31	100	33	110	35	134	40	150	43	166	45	227	54
37	92	32	102	34	113	36	137	41	154	44	170	47	233	56
38	94	33	105	35	116	37	141	42	159	45	175	48	239	57
39	97	33	108	36	120	38	145	43	163	46	179	49	246	59
40	99	34	111	37	123	39	148	44	167	47	184	50	252	60
41	102	35	113	38	126	40	152	45	171	49	189	52	258	62
42	104	36	116	39	129	41	156	46	175	50	193	53	264	64
43	107	37	119	40	132	42	160	47	180	51	198	54	271	65
44	109	38	122	40	135	43	163	49	184	52	202	55	277	67
45	112	39	125	41	138	44	167	50	188	53	207	57	283	68

Note: values highlighted in grey are assumed to be in regions where two-way span action occurs

Shear and moment capacities for a range of wall thicknesses is calculated using the TEDDS 2023 structural design software. A summary of the design at each thickness is summarized below. The following sections include detailed calculations for each wall thickness.

Tie capacity PhiVs was hand calculated in the following sheets.

ACI 318-19						Ties	
Slab Thickness in	phiVn kip	phiMn kip-ft	Flexural Reinf Inside Face	Flexural Reinf Outside Face	phiVc kip	phiVs kip	#4 Tie spacing in
24	48.176	230.266	#8 @ 6"	#6 @ 6"	15.926	32.25	6
18	13.039	80.394	#7 @ 6"	#6 @ 12"	13.039	0	-
15	12.032	64.158	#7 @ 6"	#6 @ 12"	12.032	0	-
12	10.654	47.923	#7 @ 6"	#6 @ 12"	10.654	0	-
12	9.655	40	#6 @6"	#6 @ 12"	9.655	0	-

12" Thick Concrete Wall

RC ONE-WAY SLAB DESIGN (ACI 318)

In accordance with ACI318-19 (22)

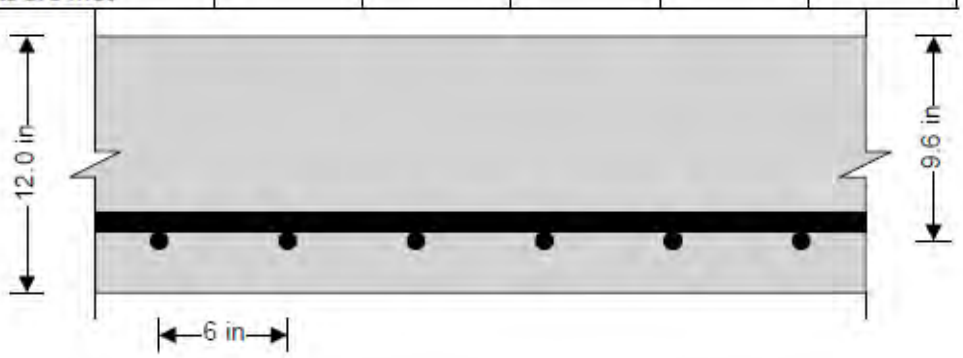
Tedds calculation version 1.2.05

Design summary

Overall design status PASS

Overall design utilization 0.939

Description	Unit	Capacity	Maximum	Utilization	Result
Moment	kip_ft/ft	47.923	28.900	0.603	PASS
Shear	kips/ft	10.654	10.000	0.939	PASS
Minimum thickness requirements are met					PASS



Slab definition

Slab type **One-way simply supported**

Overall thickness of slab h = **12.000** in

Span of slab l_n = **9.50** ft

Clear cover to tension reinforcement c_c = **2.00** in

Materials

Specified compressive strength of concrete f'_c = **5000** psi

Specified yield strength of reinforcement f_y = **60000** psi

Modulus of elasticity E_{SACI} = **29000000** psi

Compression-controlled strain limit - 21.2.2.1 ε_{ty} = **0.002**

Minimum tensile strain - 7.3.3.1 $\varepsilon_{min} = \varepsilon_{ty} + 0.003$ = **0.005**

Concrete modification factor λ = **1.00**

Maximum design moment and shear in span(per 12 in width of slab)

Maximum ultimate positive moment M_{us} = **28.900** kip_ft/ft

Maximum ultimate shear force V_u = **10.000** kips/ft

Reinforcement calculation - positive moments

Tension steel provided **No. 7 @ 6 in o.c.**

Depth to tension steel $d = (h - c_c - D / 2)$ = **9.56** in

$\beta_1 = if(f'_c <= 4\ ksi, 0.85, max(0.65, 0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi))$ = **0.80**

Stress block depth factor $\beta_1 = 0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi = 0.80$

Reinforcement ratio at strain of ε_{min} $\rho_b = 0.85 \times \beta_1 \times f'_c / f_y \times (0.003 / (0.003 + \varepsilon_{min}))$ = **0.021**

Maximum reinforcement ratio	$\rho_{max} = \rho_b =$ **0.021**
Maximum area of tension steel	$A_{s_max} = \rho_{max} \times d =$ **2.438** in²/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	$\rho_t =$**0.0018**
Min area tension steel req'd – cl. 7.6.1.1	$A_{s_min} = \rho_t \times h =$ **0.259** in²/ft
Area required for bending	$A_{s_req} =$ **0.702** in²/ft
Area of tension steel provided	$A_{s_prov} =$ **1.203** in²/ft
	PASS - Area of steel provided - OK
Steel stress – cl. 24.3.2.1	$f_s = 2/3 \times f_y =$ **40000** psi
Max allowable spacing – cl. 7.7.2.3 & cl. 24.3.2	$s_{max} = \min(3\times h, 18in, 15in\times(40000\ psi/f_s) - 2.5\times c_c, 12in\times(40000\ psi/f_s))$
	$s_{max} =$ **10.000** in
Actual tensile bar spacing provided	s = **6.000** in
	PASS - Spacing of bars (+ve moment steel) less than maximum allowable
	Library item: Steel Calcs - SAGGING

Check for section - positive moments

Depth of equivalent rectangular stress block	$a = (A_{s_prov} \times f_y) / (0.85 \times f'_c) =$ **1.41** in
Depth of neutral axis	$c = a / \beta_1 =$ **1.769** in
Net tensile strain in long. steel at nominal strength	$\varepsilon_t = 0.003 \times [(d - c) / c] =$ **0.0132**
	Tensile strain exceeds minimum required, design OK
Required nominal flexural strength	$M_{us} =$ **28.900** kip_ft/ft
Strength reduction factor	$\phi =$**0.9**
Nominal flexural strength	$M_{ns_prov} = A_{s_prov} \times f_y \times (d - a / 2) =$ **53.247** kip_ft/ft
Design flexural strength	$\phi M_{ns_prov} = \phi \times M_{ns_prov} =$ **47.923** kip_ft/ft
	PASS - Design flexural strength exceeds required flexural strength

Transverse reinforcement - (for shrinkage and temperature)

Transverse reinforcement provided	**No. 7 @ 12 in o.c.**
Area of reinforcement provided	$A_{t_prov} =$ **0.601** in²/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	$\rho_t =$**0.0018**
Minimum area of transverse reinforcement required	$A_{t_req} = \rho_t \times h =$ **0.259** in²/ft
	PASS - Area of transverse steel provided OK
Maximum allowable spacing of bars	$s_{max_t} = \min(5 \times h, 18\ in) =$ **18.000** in
Actual transverse bar spacing provided	$s_t =$ **12.000** in
	PASS - Spacing of transverse bars is less than allowable
	Library item: Transverse steel calcs

Check for shear

Required shear strength	$V_u =$ **10.000** kips/ft
Size effect factor – cl. 22.5.5.1.3	$\lambda_s = \min(\sqrt{(2 / (1 + (d / 1\ in) / 10))}, 1.0) =$ **1.00**
Ratio of longitudinal reinforcement	$\rho_w = A_{s_prov} / d =$ **0.010**
Shear strength provided by concrete	$V_c = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3}, 5 \times \lambda) \times \sqrt{(f'_c \times 1\ psi)} \times d =$ **14.205** kips/ft
Shear strength provided by shear steel (assumed)	$V_s = 0$ kips/ft
Shear capacity of section	$V = V_c + V_s =$ **14.205** kips/ft
Design shear capacity of section	$\phi V = 0.75 \times V =$ **10.654** kips/ft
	PASS - One-way shear capacity

Check of clear cover – cl. 20.5.1.1

Permissible min nominal cover to all reinforcement	$c_{min} = 0.75$ in

Clear cover to tension reinforcement (+ve mnt) $c_c = h - d - D/2 =$ **2.000** in

PASS - Cover to steel resisting positive moment exceeds allowable minimum cover

Deflection

Support condition	**Simply supported**
Basic span-to-thickness ratio - Table 7.3.1.1	$ratio_{basic} =$ **20**
Type of concrete	**Normal weight**
Concrete density factor - Table 7.3.1.1	$f_{density} =$ **1.00**
Allowable span-to-thickness ratio	$ratio_{allow} = ratio_{basic} / (f_{density} \times (0.4 + f_y / 100000\ psi)) =$ **20.000**
Actual span-to-thickness ratio	$ratio_{actual} = l_n / h =$ **9.500**

PASS - The slab thickness is adequate to control deflection

Design summary

Slab is 12.0 in thick in 5000 psi concrete

Tension steel provided - positive moment, No. 7 @ 6 in o.c. in 60000 psi steel

Transverse steel provided , No. 7 @ 12 in o.c. in 60000 psi steel

15" Thick Concrete Wall

RC ONE-WAY SLAB DESIGN (ACI 318)

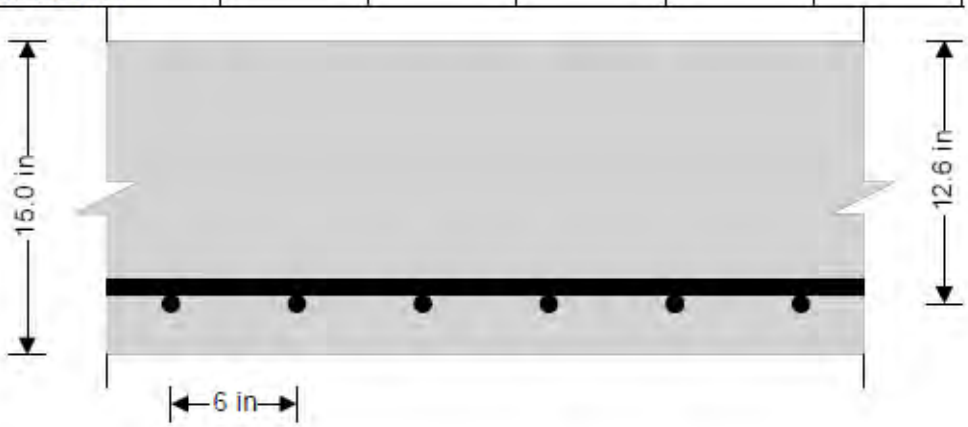
In accordance with ACI318-19 (22)

Tedds calculation version 1.2.05

Design summary

Overall design status	FAIL
Overall design utilization	1.164

Description	Unit	Capacity	Maximum	Utilization	Result
Moment	kip_ft/ft	64.158	47.300	0.737	PASS
Shear	kips/ft	12.032	14.000	1.164	FAIL
Minimum thickness requirements are met					PASS



Slab definition

Slab type	**One-way simply supported**
Overall thickness of slab	h = **15.000** in
Span of slab	l_n = **9.50** ft
Clear cover to tension reinforcement	c_c = **2.00** in

Materials

Specified compressive strength of concrete	f'_c = **5000** psi
Specified yield strength of reinforcement	f_y = **60000** psi
Modulus of elasticity	E_{SACI} = **29000000** psi
Compression-controlled strain limit - 21.2.2.1	ε_{ty} = **0.002**
Minimum tensile strain - 7.3.3.1	$\varepsilon_{min} = \varepsilon_{ty} + 0.003$ = **0.005**
Concrete modification factor	λ = **1.00**

Maximum design moment and shear in span(per 12 in width of slab)

Maximum ultimate positive moment	M_{us} = **47.300** kip_ft/ft
Maximum ultimate shear force	V_u = **14.000** kips/ft

Reinforcement calculation - positive moments

Tension steel provided	**No. 7 @ 6 in o.c.**
Depth to tension steel	d = (h – c_c – D / 2) = **12.56** in

$\beta_1 = if(f'_c <= 4\ ksi, 0.85, max(0.65, 0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi)) =$ **0.80**

Stress block depth factor	$\beta_1 = 0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi = 0.80$
Reinforcement ratio at strain of ε_{min}	$\rho_b = 0.85 \times \beta_1 \times f'_c / f_y \times (0.003 / (0.003 + \varepsilon_{min})) =$ **0.021**
Maximum reinforcement ratio	$\rho_{max} = \rho_b =$ **0.021**
Maximum area of tension steel	$A_{s_max} = \rho_{max} \times d =$ **3.203** in^2/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	$\rho_t =$**0.0018**
Min area tension steel req'd – cl. 7.6.1.1	$A_{s_min} = \rho_t \times h =$ **0.324** in^2/ft
Area required for bending	$A_{s_req} =$ **0.872** in^2/ft
Area of tension steel provided	$A_{s_prov} =$ **1.203** in^2/ft
	PASS - Area of steel provided - OK
Steel stress – cl. 24.3.2.1	$f_s = 2/3 \times f_y =$ **40000** psi
Max allowable spacing – cl. 7.7.2.3 & cl. 24.3.2	$s_{max} = \min(3\times h, 18in, 15in\times(40000\ psi/f_s) – 2.5\times c_c, 12in\times(40000\ psi/f_s))$
	$s_{max} =$ **10.000** in
Actual tensile bar spacing provided	s = **6.000** in
	PASS - Spacing of bars (+ve moment steel) less than maximum allowable
	Library item: Steel Calcs - SAGGING

Check for section - positive moments

Depth of equivalent rectangular stress block	$a = (A_{s_prov} \times f_y) / (0.85 \times f'_c) =$ **1.41** in
Depth of neutral axis	$c = a / \beta_1 =$ **1.769** in
Net tensile strain in long. steel at nominal strength	$\varepsilon_t = 0.003 \times [(d – c) / c] =$ **0.0183**
	Tensile strain exceeds minimum required, design OK
Required nominal flexural strength	$M_{us} =$ **47.300** kip_ft/ft
Strength reduction factor	$\phi =$**0.9**
Nominal flexural strength	$M_{ns_prov} = A_{s_prov} \times f_y \times (d – a / 2) =$ **71.287** kip_ft/ft
Design flexural strength	$\phi M_{ns_prov} = \phi \times M_{ns_prov} =$ **64.158** kip_ft/ft
	PASS - Design flexural strength exceeds required flexural strength

Transverse reinforcement - (for shrinkage and temperature)

Transverse reinforcement provided	**No. 6 @ 6 in o.c.**
Area of reinforcement provided	$A_{t_prov} =$ **0.884** in^2/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	$\rho_t =$**0.0018**
Minimum area of transverse reinforcement required	$A_{t_req} = \rho_t \times h =$ **0.324** in^2/ft
	PASS - Area of transverse steel provided OK
Maximum allowable spacing of bars	$s_{max_t} = \min (5 \times h, 18\ in) =$ **18.000** in
Actual transverse bar spacing provided	$s_t =$ **6.000** in
	PASS - Spacing of transverse bars is less than allowable
	Library item: Transverse steel calcs

Check for shear

Required shear strength	$V_u =$ **14.000** kips/ft
Size effect factor – cl. 22.5.5.1.3	$\lambda_s = \min(\sqrt{(2 / (1 + (d / 1\ in) / 10))}, 1.0) =$ **0.94**
Ratio of longitudinal reinforcement	$\rho_w = A_{s_prov} / d =$ **0.008**
Shear strength provided by concrete	$V_c = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3}, 5 \times \lambda) \times \sqrt{(f'_c \times 1\ psi)} \times d =$ **16.043** kips/ft
Shear strength provided by shear steel (assumed)	$V_s = 0$ kips/ft
Shear capacity of section	$V = V_c + V_s =$ **16.043** kips/ft
Design shear capacity of section	$\phi V = 0.75 \times V =$ **12.032** kips/ft
	FAIL - One-way shear capacity, revise the section properties

Check of clear cover – cl. 20.5.1.1

Permissible min nominal cover to all reinforcement c_{min} = 0.75 in

Clear cover to tension reinforcement (+ve mnt) $c_c = h - d - D/2$ = **2.000** in

PASS - Cover to steel resisting positive moment exceeds allowable minimum cover

Deflection

Support condition	**Simply supported**
Basic span-to-thickness ratio - Table 7.3.1.1	$ratio_{basic}$ = **20**
Type of concrete	**Normal weight**
Concrete density factor - Table 7.3.1.1	$f_{density}$ = **1.00**
Allowable span-to-thickness ratio	$ratio_{allow} = ratio_{basic} / (f_{density} \times (0.4 + f_y / 100000\ psi))$ = **20.000**
Actual span-to-thickness ratio	$ratio_{actual} = l_n / h$ = **7.600**

PASS - The slab thickness is adequate to control deflection

Design summary

Slab is 15.0 in thick in 5000 psi concrete

Tension steel provided - positive moment, No. 7 @ 6 in o.c. in 60000 psi steel

Transverse steel provided , No. 6 @ 6 in o.c. in 60000 psi steel

18" Thick Concrete Wall

RC ONE-WAY SLAB DESIGN (ACI 318)

In accordance with ACI318-19 (22)

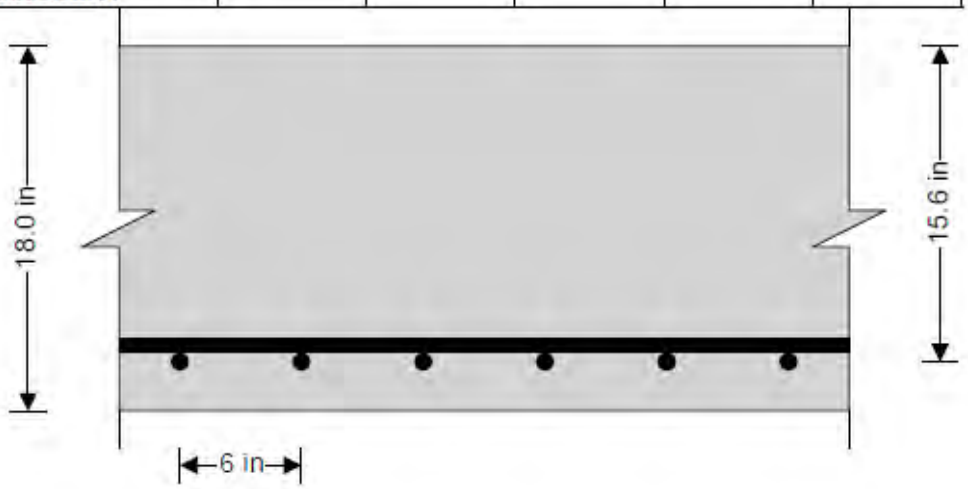
Tedds calculation version 1.2.05

Design summary

Overall design status FAIL

Overall design utilization 1.258

Description	Unit	Capacity	Maximum	Utilization	Result
Moment	kip_ft/ft	80.394	45.500	0.566	PASS
Shear	kips/ft	13.039	16.400	1.258	FAIL
Minimum thickness requirements are met					PASS



Slab definition

Slab type	**One-way simply supported**
Overall thickness of slab	h = **18.000** in
Span of slab	l_n = **9.50** ft
Clear cover to tension reinforcement	c_c = **2.00** in

Materials

Specified compressive strength of concrete	f'_c = **5000** psi
Specified yield strength of reinforcement	f_y = **60000** psi
Modulus of elasticity	E_{SACI} = **29000000** psi
Compression-controlled strain limit - 21.2.2.1	ε_{ty} = **0.002**
Minimum tensile strain - 7.3.3.1	$\varepsilon_{min} = \varepsilon_{ty} + 0.003$ = **0.005**
Concrete modification factor	λ = **1.00**

Maximum design moment and shear in span(per 12 in width of slab)

Maximum ultimate positive moment	M_{us} = **45.500** kip_ft/ft
Maximum ultimate shear force	V_u = **16.400** kips/ft

Reinforcement calculation - positive moments

Tension steel provided	**No. 7 @ 6 in o.c.**
Depth to tension steel	d = (h – c_c – D / 2) = **15.56** in

β_1 = if(f'_c <= 4 ksi, 0.85, max(0.65, 0.85 - 0.05 × (f'_c - 4 ksi) / 1 ksi)) = **0.80**	
Stress block depth factor	β_1 = 0.85 - 0.05 × (f'_c - 4 ksi) / 1 ksi = 0.80
Reinforcement ratio at strain of ε_{min}	ρ_b = 0.85 × β_1 × f'_c / f_y × (0.003 / (0.003 + ε_{min})) = **0.021**
Maximum reinforcement ratio	ρ_{max} = ρ_b = **0.021**
Maximum area of tension steel	A_{s_max} = ρ_{max} × d = **3.968** in²/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	ρ_t =**0.0018**
Min area tension steel req'd – cl. 7.6.1.1	A_{s_min} = ρ_t × h = **0.389** in²/ft
Area required for bending	A_{s_req} = **0.667** in²/ft
Area of tension steel provided	A_{s_prov} = **1.203** in²/ft
	PASS - Area of steel provided - OK
Steel stress – cl. 24.3.2.1	f_s = 2/3 × f_y = **40000** psi
Max allowable spacing – cl. 7.7.2.3 & cl. 24.3.2	s_{max} = min(3×h, 18in, 15in×(40000 psi/f_s) – 2.5×c_c, 12in×(40000 psi/f_s))
	s_{max} = **10.000** in
Actual tensile bar spacing provided	s = **6.000** in
	PASS - Spacing of bars (+ve moment steel) less than maximum allowable
	Library item: Steel Calcs - SAGGING

Check for section - positive moments

Depth of equivalent rectangular stress block	a = (A_{s_prov} × f_y) / (0.85 × f'_c) = **1.41** in
Depth of neutral axis	c = a / β_1 = **1.769** in
Net tensile strain in long. steel at nominal strength	ε_t = 0.003 × [(d – c) / c] = **0.0234**
	Tensile strain exceeds minimum required, design OK
Required nominal flexural strength	M_{us} = **45.500** kip_ft/ft
Strength reduction factor	ϕ =**0.9**
Nominal flexural strength	M_{ns_prov} = A_{s_prov} × f_y × (d – a / 2) = **89.327** kip_ft/ft
Design flexural strength	ϕM_{ns_prov} = ϕ × M_{ns_prov} = **80.394** kip_ft/ft
	PASS - Design flexural strength exceeds required flexural strength

Transverse reinforcement - (for shrinkage and temperature)

Transverse reinforcement provided	**No. 6 @ 6 in o.c.**
Area of reinforcement provided	A_{t_prov} = **0.884** in²/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	ρ_t =**0.0018**
Minimum area of transverse reinforcement required	A_{t_req} = ρ_t × h = **0.389** in²/ft
	PASS - Area of transverse steel provided OK
Maximum allowable spacing of bars	s_{max_t} = min (5 × h, 18 in) = **18.000** in
Actual transverse bar spacing provided	s_t = **6.000** in
	PASS - Spacing of transverse bars is less than allowable
	Library item: Transverse steel calcs

Check for shear

Required shear strength	V_u = **16.400** kips/ft
Size effect factor – cl. 22.5.5.1.3	λ_s = min($\sqrt{}$(2 / (1 + (d / 1 in) / 10)),1.0) = **0.88**
Ratio of longitudinal reinforcement	ρ_w = A_{s_prov} / d = **0.006**
Shear strength provided by concrete	V_c = min(8 × λ_s × λ × (ρ_w)$^{1/3}$, 5 × λ) × $\sqrt{}$(f'_c × 1 psi) × d = **17.385** kips/ft
Shear strength provided by shear steel (assumed)	V_s = 0 kips/ft
Shear capacity of section	V = V_c + V_s = **17.385** kips/ft
Design shear capacity of section	ϕV = 0.75 × V= **13.039** kips/ft

FAIL - One-way shear capacity, revise the section properties

Check of clear cover – cl. 20.5.1.1

Permissible min nominal cover to all reinforcement c_{min} = 0.75 in

Clear cover to tension reinforcement (+ve mnt) $c_c = h - d - D/2$ = **2.000** in

PASS - Cover to steel resisting positive moment exceeds allowable minimum cover

Deflection

Support condition	**Simply supported**
Basic span-to-thickness ratio - Table 7.3.1.1	$ratio_{basic}$ = **20**
Type of concrete	**Normal weight**
Concrete density factor - Table 7.3.1.1	$f_{density}$ = **1.00**
Allowable span-to-thickness ratio	$ratio_{allow} = ratio_{basic} / (f_{density} \times (0.4 + f_y / 100000\ psi))$ = **20.000**
Actual span-to-thickness ratio	$ratio_{actual} = l_n / h$ = **6.333**

PASS - The slab thickness is adequate to control deflection

Design summary

Slab is 18.0 in thick in 5000 psi concrete

Tension steel provided - positive moment, No. 7 @ 6 in o.c. in 60000 psi steel

Transverse steel provided , No. 6 @ 6 in o.c. in 60000 psi steel

24" Thick Concrete Wall

RC ONE-WAY SLAB DESIGN (ACI 318)

In accordance with ACI318-19 (22)

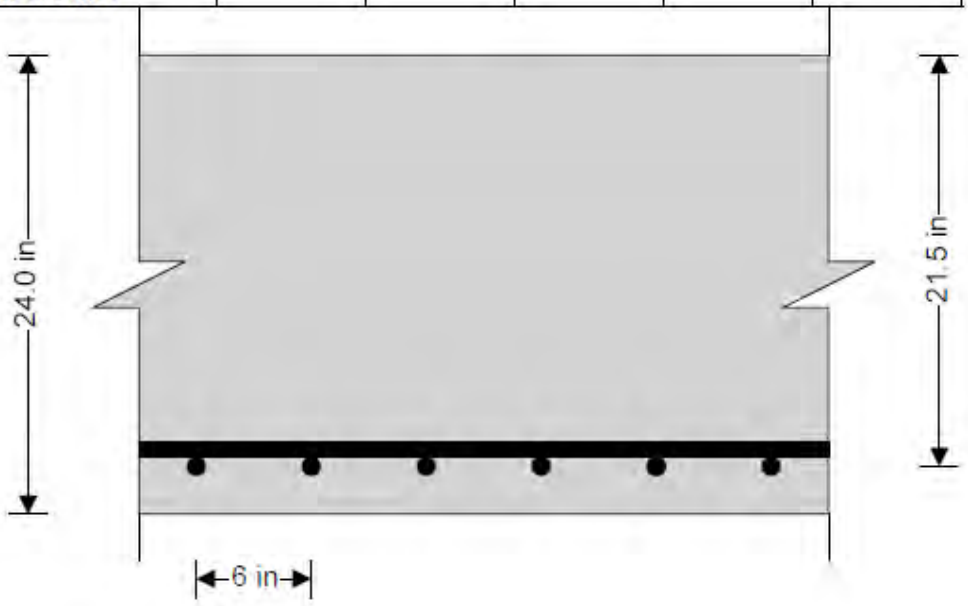
Tedds calculation version 1.2.05

Design summary

Overall design status FAIL

Overall design utilization 2.461

Description	Unit	Capacity	Maximum	Utilization	Result
Moment	kip_ft/ft	145.443	122.600	0.843	PASS
Shear	kips/ft	15.926	39.200	2.461	FAIL
Minimum thickness requirements are met					PASS



Slab definition

Slab type	**One-way simply supported**
Overall thickness of slab	h = **24.000** in
Span of slab	l_n = **9.00** ft
Clear cover to tension reinforcement	c_c = **2.00** in

Materials

Specified compressive strength of concrete	f'_c = **5000** psi
Specified yield strength of reinforcement	f_y = **60000** psi
Modulus of elasticity	E_{SACI} = **29000000** psi
Compression-controlled strain limit - 21.2.2.1	ε_{ty} = **0.002**
Minimum tensile strain - 7.3.3.1	$\varepsilon_{min} = \varepsilon_{ty} + 0.003$ = **0.005**
Concrete modification factor	λ = **1.00**

Maximum design moment and shear in span(per 12 in width of slab)

Maximum ultimate positive moment	M_{us} = **122.600** kip_ft/ft
Maximum ultimate shear force	V_u = **39.200** kips/ft

Reinforcement calculation - positive moments

Tension steel provided	**No. 8 @ 6 in o.c.**
Depth to tension steel	$d = (h - c_c - D / 2) =$ **21.50** in
$\beta_1 = if(f'_c <= 4\ ksi, 0.85, max(0.65, 0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi)) =$ **0.80**	
Stress block depth factor	$\beta_1 = 0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi = 0.80$
Reinforcement ratio at strain of ε_{min}	$\rho_b = 0.85 \times \beta_1 \times f'_c / f_y \times (0.003 / (0.003 + \varepsilon_{min})) =$ **0.021**
Maximum reinforcement ratio	$\rho_{max} = \rho_b =$ **0.021**
Maximum area of tension steel	$A_{s_max} = \rho_{max} \times d =$ **5.482** in^2/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	$\rho_t =$**0.0018**
Min area tension steel req'd – cl. 7.6.1.1	$A_{s_min} = \rho_t \times h =$ **0.518** in^2/ft
Area required for bending	$A_{s_req} =$ **1.314** in^2/ft
Area of tension steel provided	$A_{s_prov} =$ **1.571** in^2/ft
	PASS - Area of steel provided - OK
Steel stress – cl. 24.3.2.1	$f_s = 2/3 \times f_y =$ **40000** psi
Max allowable spacing – cl. 7.7.2.3 & cl. 24.3.2	$s_{max} = min(3 \times h, 18in, 15in \times (40000\ psi / f_s) - 2.5 \times c_c, 12in \times (40000\ psi / f_s))$
	$s_{max} =$ **10.000** in
Actual tensile bar spacing provided	$s =$ **6.000** in
	PASS - Spacing of bars (+ve moment steel) less than maximum allowable
	Library item: Steel Calcs - SAGGING

Check for section - positive moments

Depth of equivalent rectangular stress block	$a = (A_{s_prov} \times f_y) / (0.85 \times f'_c) =$ **1.85** in
Depth of neutral axis	$c = a / \beta_1 =$ **2.310** in
Net tensile strain in long. steel at nominal strength	$\varepsilon_t = 0.003 \times [(d - c) / c] =$ **0.0249**
	Tensile strain exceeds minimum required, design OK
Required nominal flexural strength	$M_{us} =$ **122.600** kip_ft/ft
Strength reduction factor	$\phi =$**0.9**
Nominal flexural strength	$M_{ns_prov} = A_{s_prov} \times f_y \times (d - a / 2) =$ **161.604** kip_ft/ft
Design flexural strength	$\phi M_{ns_prov} = \phi \times M_{ns_prov} =$ **145.443** kip_ft/ft
	PASS - Design flexural strength exceeds required flexural strength

Transverse reinforcement - (for shrinkage and temperature)

Transverse reinforcement provided	**No. 6 @ 6 in o.c.**
Area of reinforcement provided	$A_{t_prov} =$ **0.884** in^2/ft
Min ratio of transverse reinforcement – cl. 7.6.1.1	$\rho_t =$**0.0018**
Minimum area of transverse reinforcement required	$A_{t_req} = \rho_t \times h =$ **0.518** in^2/ft
	PASS - Area of transverse steel provided OK
Maximum allowable spacing of bars	$s_{max_t} = min(5 \times h, 18\ in) =$ **18.000** in
Actual transverse bar spacing provided	$s_t =$ **6.000** in
	PASS - Spacing of transverse bars is less than allowable
	Library item: Transverse steel calcs

Check for shear

Required shear strength	$V_u =$ **39.200** kips/ft
Size effect factor – cl. 22.5.5.1.3	$\lambda_s = min(\sqrt{(2 / (1 + (d / 1\ in) / 10))}, 1.0) =$ **0.80**
Ratio of longitudinal reinforcement	$\rho_w = A_{s_prov} / d =$ **0.006**

Shear strength provided by concrete	$V_c = \min(8 \times \lambda_s \times \lambda \times (\rho_w)^{1/3}, 5 \times \lambda) \times \sqrt{(f'_c \times 1\ psi)} \times d =$ **21.235** kips/ft
Shear strength provided by shear steel (assumed)	$V_s = 0$ kips/ft
Shear capacity of section	$V = V_c + V_s =$ **21.235** kips/ft
Design shear capacity of section	$\phi V = 0.75 \times V =$ **15.926** kips/ft

FAIL - One-way shear capacity, revise the section properties

Check of clear cover – cl. 20.5.1.1

Permissible min nominal cover to all reinforcement	$c_{min} = 0.75$ in
Clear cover to tension reinforcement (+ve mnt)	$c_c = h - d - D/2 =$ **2.000** in

PASS - Cover to steel resisting positive moment exceeds allowable minimum cover

Deflection

Support condition	**Simply supported**
Basic span-to-thickness ratio - Table 7.3.1.1	$ratio_{basic} =$ **20**
Type of concrete	**Normal weight**
Concrete density factor - Table 7.3.1.1	$f_{density} =$ **1.00**
Allowable span-to-thickness ratio	$ratio_{allow} = ratio_{basic} / (f_{density} \times (0.4 + f_y / 100000\ psi)) =$ **20.000**
Actual span-to-thickness ratio	$ratio_{actual} = l_n / h =$ **4.500**

PASS - The slab thickness is adequate to control deflection

Design summary

Slab is 24.0 in thick in 5000 psi concrete

Tension steel provided - positive moment, No. 8 @ 6 in o.c. in 60000 psi steel

Transverse steel provided , No. 6 @ 6 in o.c. in 60000 psi steel

24" Thick Concrete Wall – Shear Tie design:

Table 9.7.6.2.2—Maximum spacing of legs of shear reinforcement

Required V_s		Maximum s, in.			
		Nonprestressed beam		Prestressed beam	
		Along length	Across width	Along length	Across width
$\le 4\sqrt{f'_c}b_w d$	Lesser of:	$d/2$	d	$3h/4$	$3h/2$
		24 in.			
$> 4\sqrt{f'_c}b_w d$	Lesser of:	$d/4$	$d/2$	$3h/8$	$3h/4$
		12 in.			

Vu = 39.2kip < 4 * (5000psi)^0.5 * 12" * 21.5" = 72.97k

d/2 = (depth - c.c.) / 2 = (24" - 2.5") / 2 = 10.75"

9.6.3.4 If shear reinforcement is required and torsional effects can be neglected according to 9.5.4.1, $A_{v,min}$ shall be in accordance with Table 9.6.3.4.

Table 9.6.3.4—Required $A_{v,min}$

Beam type	$A_{v,min}$		
Nonprestressed and prestressed with $A_{ps}f_{pu} < 0.4(A_{ps}f_{pu} + A_s f_y)$	Greater of:	$0.75\sqrt{f'_c}\frac{b_w}{f_{yt}}$	(a)
		$50\frac{b_w}{f_{yt}}$	(b)
Prestressed with $A_{ps}f_{pu} \ge 0.4(A_{ps}f_{pu} + A_s f_y)$	Lesser of:	Greater of: $0.75\sqrt{f'_c}\frac{b_w}{f_{yt}}$	(c)
		Greater of: $50\frac{b_w}{f_{yt}}$	(d)
		$\frac{A_{ps}f_{pu}}{80 f_{yt} d}\sqrt{\frac{d}{b_w}}$	(e)

bw = width = 12"

fyt = rebar yield strength of transverse rebar = 60ksi

f'c = 5000psi

(a) Av,min / s = 0.75 * (5000psi)^0.5 * 12 / 60000psi = 0.0106" <- controls

(b) Av,min / s = 50 * 12 / 60000 = 0.01"

--> s <= Av / 0.01" = 0.22in^2 / 0.0106" = 20.75" max spacing required.

Av = area of stirrups. 1-#4 stirrups = 0.2in^2

s= 20.75" max or d/2 = 10.75" --> So 10.75" spacing controls!

-->use 10" spacing

Check for ϕVn for s = 10":

$V_s = A_v f_{yt}\left(\frac{d}{s}\right)$ = 0.2in^2 * 60ksi * (24"-2.5")/10" = 25.8k

ϕVn = ϕVc + ϕVs) = 15.926k + 0.75*25.8k = 35.3k < Vu=39.2k.

$V_u \le \phi(V_c + V_s) \rightarrow V_s \ge \frac{V_u}{\phi} - V_c$

Vs = 39.2k / 0.75 - 15.926k = 36.3k

$V_s = A_v f_{yt}\left(\frac{d}{s}\right) \rightarrow s \le \frac{A_v f_{yt} d}{V_s}$

s <= (0.2in^2 * 60ksi * 21.5") / 36.3k = 7.1k --> Use 6" horizontal spacing (12" vertical spacing)

Check for ϕVn for s = 6":

ϕVs = 0.75 * 0.2in^2 * 60ksi * (24"-2.5")/6" = 32.25k

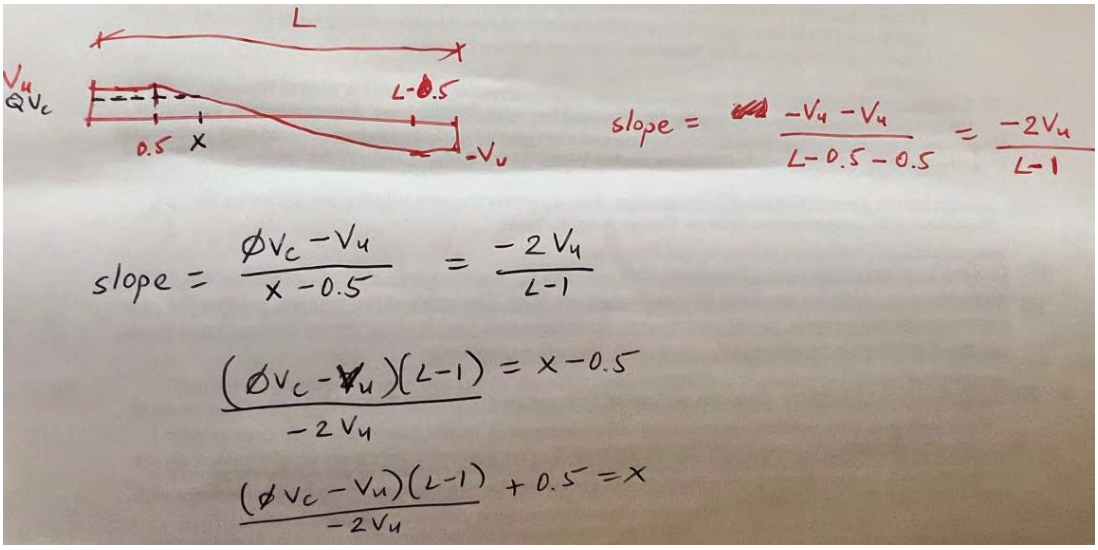
ϕVn = ϕVc + ϕVs = 15.926 + 32.25k = 48.176k > Vu,max = 39.2k

--> #4 ties @6"o.c. provide enough shear capacity for the maximum shear force.

Based on the demand at each inlet/manhole, the appropriate wall thickness and related design is assigned to each location.

	BOX DESIGN						TIES
	Design Clear	Effective depth at 1-way span	Mu	Vu	Wall Thickness	Wall Reinf	End of Ties from support
	ft	ft	kip-ft	kip	in		ft
MH-1-1	7	9	17.7	6.6	12	#6 @ 6"	
MH-1-2	7	7	13.7	5.2	12	#6 @ 6"	
MH-1-3	7	15	29.4	11.0	15	#7 @ 6"	
MH-2-1	7.5	4	13.0	4.7	12	#6 @ 6"	
MH-2-2	7.5	4	13.0	4.7	12	#6 @ 6"	
MH-3-1	10.91667	10	41.8	11.9	15	#7 @ 6"	
MH-3-2	8.5	7	19.4	6.4	12	#6 @ 6"	
MH-3-3	8.5	9	24.9	8.3	12	#6 @ 6"	
MH-3-4	7.5	3	21.6	7.8	12	#6 @ 6"	
MH-3-5	8	9	22.3	7.7	12	#6 @ 6"	
MH-3-13	7.5	3	21.6	7.8	12	#6 @ 6"	
MH-4-1	13.33333	17	107.0	25.7	24	#8 @ 6"	3.00
MH-4-2	8	9	22.3	7.7	12	#6 @ 6"	
MH-4-3	9.5	38	116.5	37.3	24	#8 @ 6"	3.00
MH-4-4	9.5	13	39.9	12.8	18	#7 @ 6"	
MH-5-2	8.166667	12	29.8	10.3	12	#7 @ 6"	
MH-5-3	10	20	74.2	22.1	24	#8 @ 6"	2.00
MH-5-4	10	11	40.8	12.1	18	#7 @ 6"	
MH-6-1	10.5	31	115.0	34.2	24	#8 @ 6"	4.00
MH-6-2	9.333333	35	107.3	34.3	24	#8 @ 6"	3.00
MH-6-3	9.333333	25	76.6	24.5	24	#8 @ 6"	2.00
MH-6-4	4.5	7	6.5	3.0	12	#6 @ 6"	

End of ties calculated using the following formula for 'x':



	CHIMNEY DESIGN						TIES
	Design Clear	Effective depth at 1-way span	Mu	Vu	Wall Thickness	Wall Reinf	End of Ties from support
	ft	ft	kip-ft	kip	in		ft
MH-1-1	7	7	13.7	5.2	12	#6 @ 6"	
MH-1-2	-	-	-	-	-	-	
MH-1-3	-	-	-	-	-	-	
MH-2-1	-	-	-	-	-	-	
MH-2-2	-	-	-	-	-	-	
MH-3-1	10.91667	8	33.4	9.5	12	#7 @ 6"	
MH-3-2	-	-	-	-	-	-	
MH-3-3	-	-	-	-	-	-	
MH-3-4	-	-	-	-	-	-	
MH-3-5	-	-	-	-	-	-	
MH-3-13	-	-	-	-	-	-	
MH-4-1	-	-	-	-	-	-	
MH-4-2	-	-	-	-	-	-	
MH-4-3	6.5	34	58.6	22.9	24	#8 @ 6"	2.00
MH-4-4	-	-	-	-	-	-	
MH-5-2	8.166667	10	24.8	8.6	12	#6 @ 6"	
MH-5-3	-	-	-	-	-	-	
MH-5-4	-	-	-	-	-	-	
MH-6-1	-	-	-	-	-	-	
MH-6-2	-	-	-	-	-	-	
MH-6-3	9.333333	22	67.4	21.6	24	#8 @ 6"	2.00
MH-6-4	-	-	-	-	-	-	

	BOX DESIGN							TIES
	Design Clear ft	Effective depth at 1 way span ft	Mu kip-ft	Vu kip	Wall Thickness in	Wall Reinf	Wall Reinf Inside Face	End of Ties from support ft
IN-1-1	8	6	14.9	5.2	12	#6 @6"	#6 @ 12"	
IN-1-2	8	40	99.3	34.3	24	#8 @ 6"	#6 @ 6"	3.00
IN-2-3	8	2	47.8	16.5	24	#8 @ 6"	#6 @ 6"	1.00
IN-2-4	8	7	17.4	6.0	12	#6 @6"	#6 @ 12"	
IN-2-5	8	3	24.2	8.4	12	#6 @6"	#6 @ 12"	
IN-3-4	8	3	24.2	8.4	12	#6 @6"	#6 @ 12"	
IN-3-5	8	2	47.8	16.5	24	#8 @ 6"	#6 @ 6"	1.00
IN-3-6	8	4	14.6	5.1	12	#6 @6"	#6 @ 12"	
IN-3-7	9	4	18.1	5.8	12	#6 @6"	#6 @ 12"	
IN-3-8	8	4	14.6	5.1	12	#6 @6"	#6 @ 12"	
IN-3-9	8	6	14.9	5.2	12	#6 @6"	#6 @ 12"	
IN-3-10	8	4	14.6	5.1	12	#6 @6"	#6 @ 12"	
IN-3-11	8	6	14.9	5.2	12	#6 @6"	#6 @ 12"	
IN-3-12	8	3	24.2	8.4	12	#6 @6"	#6 @ 12"	
IN-3-13	6	3	14.6	6.0	12	#6 @6"	#6 @ 12"	
IN-3-14	8	2	47.8	16.5	24	#8 @ 6"	#6 @ 6"	1.00
IN-3-15	8	2	47.8	16.5	24	#8 @ 6"	#6 @ 6"	1.00
IN-3-16	8	7	17.4	6.0	12	#6 @6"	#6 @ 12"	
IN-3-17	4.5	6	5.6	2.6	12	#6 @6"	#6 @ 12"	
IN-3-18	8	5	12.4	4.3	12	#6 @6"	#6 @ 12"	
IN-4-12	9	40	122.6	39.2	24	#8 @ 6"	#6 @ 6"	3.00
IN-4-13	8	9	22.3	7.7	12	#6 @6"	#6 @ 12"	
IN-4-14	11.25	4	21.8	6.5	12	#6 @6"	#6 @ 12"	
IN-4-15	8.17	7	17.4	6.0	12	#6 @6"	#6 @ 12"	
IN-4-16	10.6667	23	85.3	25.4	24	#8 @ 6"	#6 @ 6"	3.00
IN-4-17	6.5	4	10.2	4.0	12	#6 @6"	#6 @ 12"	
IN-4-18	8.00	9	22.3	7.7	12	#6 @6"	#6 @ 12"	
IN-5-16	8.17	9	22.3	7.7	12	#6 @6"	#6 @ 12"	
IN-5-17	8	5	12.4	4.3	12	#6 @6"	#6 @ 12"	
IN-5-18	8.16667	22	54.6	18.9	24	#8 @ 6"	#6 @ 6"	2.00
IN-5-19	8	7	17.4	6.0	12	#6 @6"	#6 @ 12"	
IN-5-20	8	4	14.6	5.1	12	#6 @6"	#6 @ 12"	
IN-5-21	3.75	3	3.0	1.4	12	#6 @6"	#6 @ 12"	
IN-5-22	4.5	7	6.5	3.0	12	#6 @6"	#6 @ 12"	
IN-5-23	4.5	5	4.6	2.1	12	#6 @6"	#6 @ 12"	
IN-5-24	8	4	14.6	5.1	12	#6 @6"	#6 @ 12"	
IN-5-25	4.5	4	5.5	2.5	12	#6 @6"	#6 @ 12"	

CHIMNEY DESIGN						TIES
Design Clear ft	Effective depth at 1 way span ft	Mu kip-ft	Vu kip	Wall Thickness in	Wall Reinf	End of Ties from support ft
-	-	-	-	-	-	
8	38	94.4	32.6	24	#8 @ 6"	3.00
-	-	-	-	-	-	
8	5	12.4	4.3	12	#6 @6"	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
2.66667	1	11.9	5.5	12	#6 @6"	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
8	4	14.6	5.1	12	#6 @6"	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
8	5	12.4	4.3	12	#6 @6"	
-	-	-	-	-	-	
-	-	-	-	-	-	
9	29	88.9	28.4	24	#8 @ 6"	3.00
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
8	22	54.6	18.9	24	#8 @ 6"	2.00
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
8.17	19	47.2	16.3	24	#8 @ 6"	1.00
8	5	12.4	4.3	12	#6 @6"	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	
-	-	-	-	-	-	

4 Pond Outlet Design

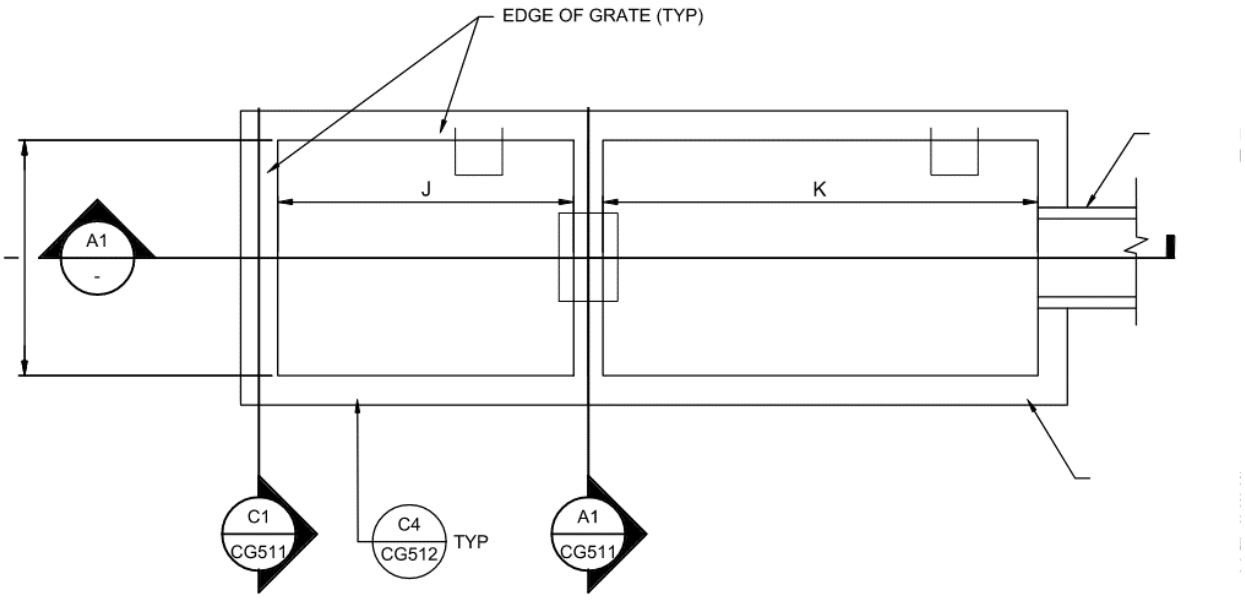
4.1 Design Summary

The following calculations are for the reinforced concrete Pond Outlets at Yap Island Airport. There are (5) different sizes of Pond Outlets planned for this project.

Pond Outlet Dimensions:

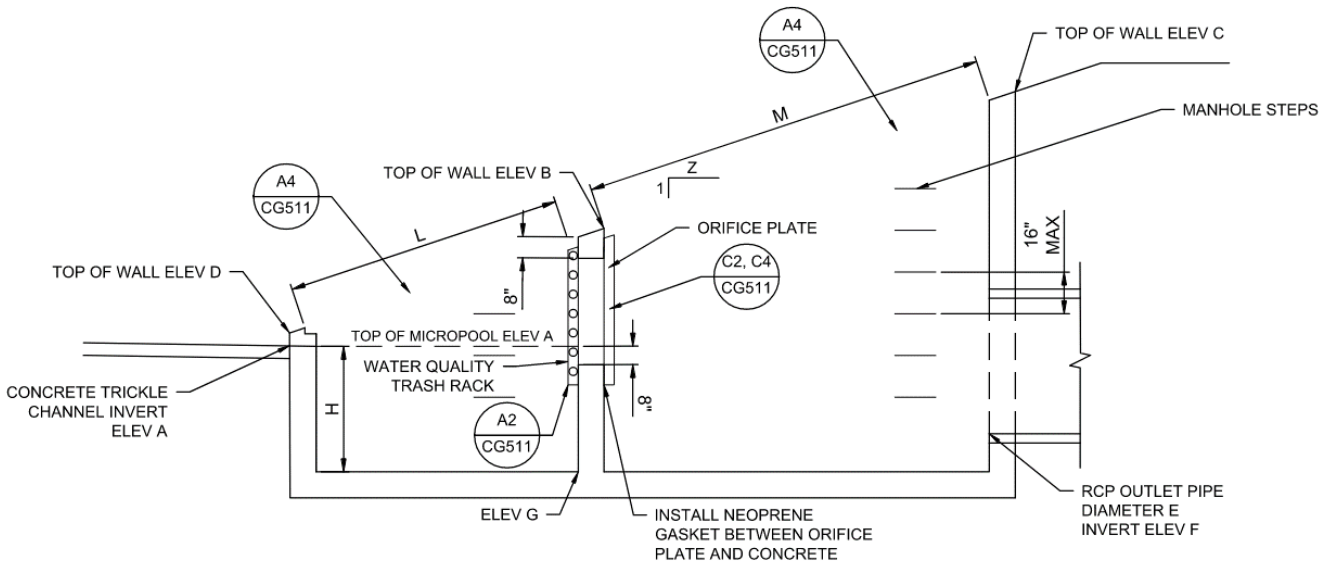
POND OUTLET STRUCTURE DETAIL DIMENSION											
POND	A	B	C	D	E	F	G	H	I	J	K
OUTFALL 3	26.17	29.92	34.20	26.85	66"	21.28	20.67	5.50'	20.00'	7.54'	12.00'
OUTFALL 4	14.63	17.63	21.91	15.31	72"	14.49	13.13	1.50'	20.00'	5.29'	12.00'
OUTFALL 5	46.97	50.47	54.75	47.61	66"	43.24	42.47	4.50'	16.00'	6.91'	12.00'
OUTFALL 6	67.23	69.73	71.94	67.88	42"	64.73	64.23	3.00'	10.00'	5.73'	8.00'
OUTFALL 6A	49.00	52.25	52.25	N/A	36"	47.00	46.50	2.50'	7.00'	N/A	7.00'

Pond Outlet Plan View:



C1 OUTLET STRUCTURE PLAN
SCALE: NTS

Pond Outlet Elevation View:



A1 OUTLET STRUCTURE PROFILE
SCALE: NTS

4.2 Design Assumptions

- The tallest wall of each Pond Outlet is conservatively designed as a cantilever retaining wall. See the following Enercalc output at various wall heights for analysis and design information.
- Wall designs assumed retained soil is full height of wall with a backfill slope of 1:1 above the top of wall.
- The middle walls are designed as cantilever concrete walls with a wall pressure equivalent to the water pressure if the drain becomes blocked.
- Base slab is designed using the Enercalc retaining wall module. The tall retaining wall creates the most moment in the slab and thus creates the most conservative slab design for the other 2 walls.
- Sliding is resisted by the shorter wall as well as the base slab. The shorter wall will be designed per the tall wall retaining wall calculation in Enercalc assuming the shorter wall acts as a key.

4.3 Wall Analysis and Design

4.3.1 14' Tall Wall

Cantilevered Retaining Wall Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 14' Tall Wall - Sliding Check

Code Reference:

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	14.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 14' Tall Wall - Sliding Check

Design Summary

Wall Stability Ratios

Overturning	=	3.63	OK
Sliding	=	1.31	Ratio < 1.5!
Global Stability	=	6.79	

Total Bearing Load	=	11,641 lbs	
...resultant ecc.	=	19.16 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	561 psf	OK
Soil Pressure @ Heel	=	211 psf	OK
Allowable	=	3,400 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	785 psf	
ACI Factored @ Heel	=	296 psf	
Footing Shear @ Toe	=	32.2 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	5,405.6 lbs	
less 100% Passive Force	-	4,238.5 lbs	
less 100% Friction Force	-	2,861.3 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	1,008.7 lbs	NG

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	14.00		
Rebar Size	=	# 8		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	0.839		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	7,056.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	32,928.0		
Moment.....Allowable	=	39,225.5		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	51.1		
Shear.....Allowable	psi =	73.2		
Anet (Masonry)	in2 =			
Wall Weight	psf =	175.0		
Rebar Depth 'd'	in =	11.50		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 14' Tall Wall - Sliding Check

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.6533 in2/ft	
0.0018bh : 0.0018(12)(14) :	0.3024 in2/ft	Horizontal Reinforcing Options :
	==========	One layer of : Two layers of :
Required Area :	0.6533 in2/ft	#4@ 7.94 in #4@ 15.87 in
Provided Area :	0.79 in2/ft	#5@ 12.30 in #5@ 24.60 in
Maximum Area :	2.9325 in2/ft	#6@ 17.46 in #6@ 34.92 in

Footing Data

Toe Width	=	20.00 ft
Heel Width	=	1.17
Total Footing Width	=	21.17
Footing Thickness	=	18.00 in
Key Width	=	14.00 in
Key Depth	=	66.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	785	296 psf
Mu' : Upward	=	126,257	0 ft-#
Mu' : Downward	=	54,000	0 ft-#
Mu: Design	=	72,257 NG	0 ft-# OK
phiMn	=	49,895	OK - Flush
Actual 1-Way Shear	=	32.20	0.00 psi
Allow 1-Way Shear	=	70.25	62.60 psi

Toe Reinforcing = # 8 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 8 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 2.12 in, #5@ 3.28 in, #6@ 4.66 in, #7@ 6.36 in, #8@ 8.38 in, #9@ 10.61 in, #10@ 13.47 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 3.77 in, #5@ 5.84 in, #6@ 8.29 in, #7@ 11

Min footing T&S reinf Area 8.23 in2
Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 14' Tall Wall - Sliding Check

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	5,405.6	5.17	27,929.1			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)						
Soil Over HL (bel. water tbl)						
Water Table						
Sloped Soil Over Heel =					21.17	
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =						
Surcharge Over Toe =						
Stem Weight(s) =				2,450.0	20.58	50,429.2
Earth @ Stem Transitions =						
Footing Weight =				4,762.5	10.58	50,403.1
Key Weight =				962.5	0.58	561.5
Vert. Component =						
Total =	5,405.6	**O.T.M.** =	27,929.1	**Total =** 8,175.0 lbs	**R.M.=**	101,393.8

Resisting/Overturning Ratio = **3.63**

Vertical Loads used for Soil Pressure = 11,640.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.010	in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 14' Tall Wall - Sliding Check

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

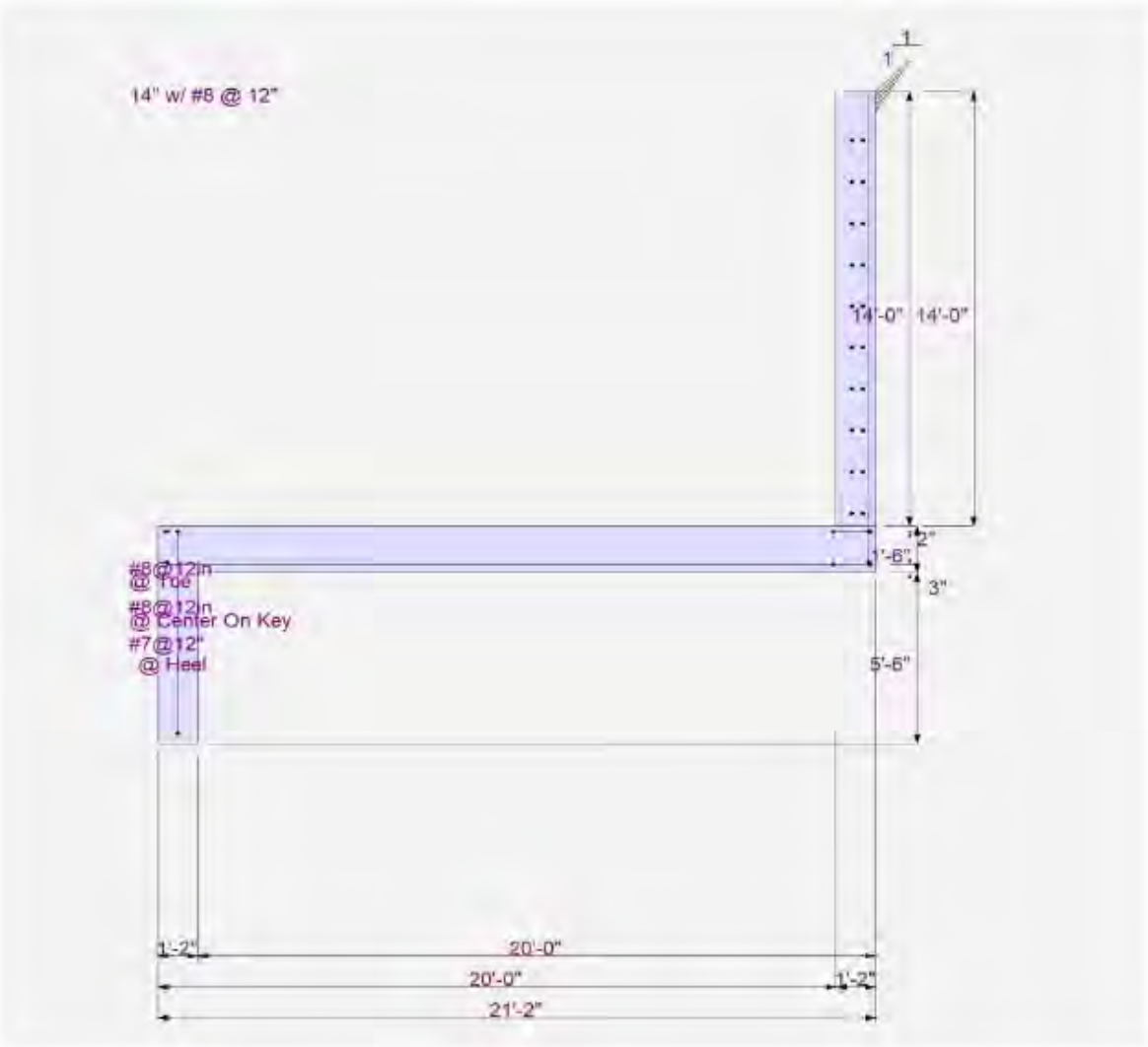
Lap Splice length for #8 bar specified in this stem design segment (25.4.2.4a) =	33.09 in
Development length for #8 bar specified in this stem design segment =	25.46 in
Hooked embedment length into footing for #8 bar specified in this stem design segment =	14.40 in
As Provided =	0.7900 in2/ft
As Required =	0.6533 in2/ft

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 14' Tall Wall - Sliding Check



4.3.2 12.5' Tall Wall

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 12.5' Tall Wall - Sliding Check

Code Reference

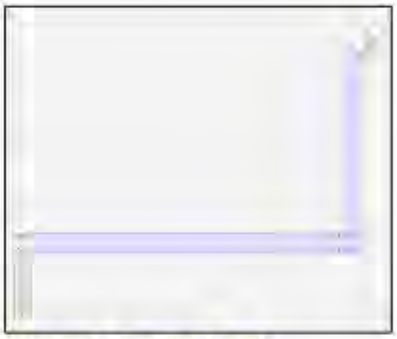
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	12.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 12.5' Tall Wall - Sliding Check

Design Summary

Wall Stability Ratios

Overturning	=	3.87	OK
Sliding	=	1.20	Ratio < 1.5!
Global Stability	=	5.72	

Total Bearing Load	=	8,059	lbs
...resultant ecc.	=	15.49	in

Eccentricity within middle third

Soil Pressure @ Toe	=	454 psf	OK
Soil Pressure @ Heel	=	201 psf	OK
Allowable	=	3,400 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	636 psf	
ACI Factored @ Heel	=	281 psf	
Footing Shear @ Toe	=	28.3 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	4,305.6	lbs
less 100% Passive Force	-	2,856.9	lbs
less 100% Friction Force	-	2,292.5	lbs
Added Force Req'd	=	0.0	lbs OK
....for 1.5 Stability	=	1,309.0	lbs NG

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	12.00		
Rebar Size	=	# 7		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.942**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	5,625.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	23,437.5		
Moment.....Allowable	=	24,863.0		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	49.0		
Shear.....Allowable	psi =	73.6		
Anet (Masonry)	in2 =			
Wall Weight	psf =	150.0		
Rebar Depth 'd'	in =	9.56		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 12.5' Tall Wall - Sliding Check

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.5623 in2/ft		
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.5623 in2/ft	#4@ 9.26 in	#4@ 18.52 in
Provided Area :	0.6 in2/ft	#5@ 14.35 in	#5@ 28.70 in
Maximum Area :	2.4384 in2/ft	#6@ 20.37 in	#6@ 40.74 in

Footing Data

Toe Width	=	19.00 ft
Heel Width	=	1.00
Total Footing Width	=	20.00
Footing Thickness	=	16.00 in
Key Width	=	12.00 in
Key Depth	=	54.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	636	281 psf
Mu' : Upward	=	94,509	0 ft-#
Mu' : Downward	=	43,320	0 ft-#
Mu: Design	=	51,189 NG	0 ft-# OK
phiMn	=	32,966	OK - Flush
Actual 1-Way Shear	=	28.33	0.00 psi
Allow 1-Way Shear	=	67.24	65.54 psi

Toe Reinforcing = # 7 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 6 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 2.57 in, #5@ 3.98 in, #6@ 5.66 in, #7@ 7.72 in, #8@ 10.16 in, #9@ 12.87 in, #10@ 16.34 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 5.66 in, #5@ 8.77 in, #6@ 12.46 in, #7@ 1

Min footing T&S reinf Area 6.91 in2
Min footing T&S reinf Area per foot 0.35 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.94 in	#4@ 13.89 in
#5@ 10.76 in	#5@ 21.53 in
#6@ 15.28 in	#6@ 30.56 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 12.5' Tall Wall - Sliding Check

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		4,305.6	4.61	19,853.7	Soil Over HL (ab. water tbl)			
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)			
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=	20.00	
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	1,875.0	19.50	36,562.5
					Earth @ Stem Transitions	=			
					Footing Weight	=	4,000.0	10.00	40,000.0
					Key Weight	=	675.0	0.50	337.5
					Vert. Component	=			
Total	=	4,305.6	**O.T.M.** =	19,853.7	**Total =**		6,550.0 lbs	**R.M.=**	76,900.0

Resisting/Overturning Ratio = **3.87**

Vertical Loads used for Soil Pressure = 8,058.8 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.008	in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 12.5' Tall Wall - Sliding Check

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

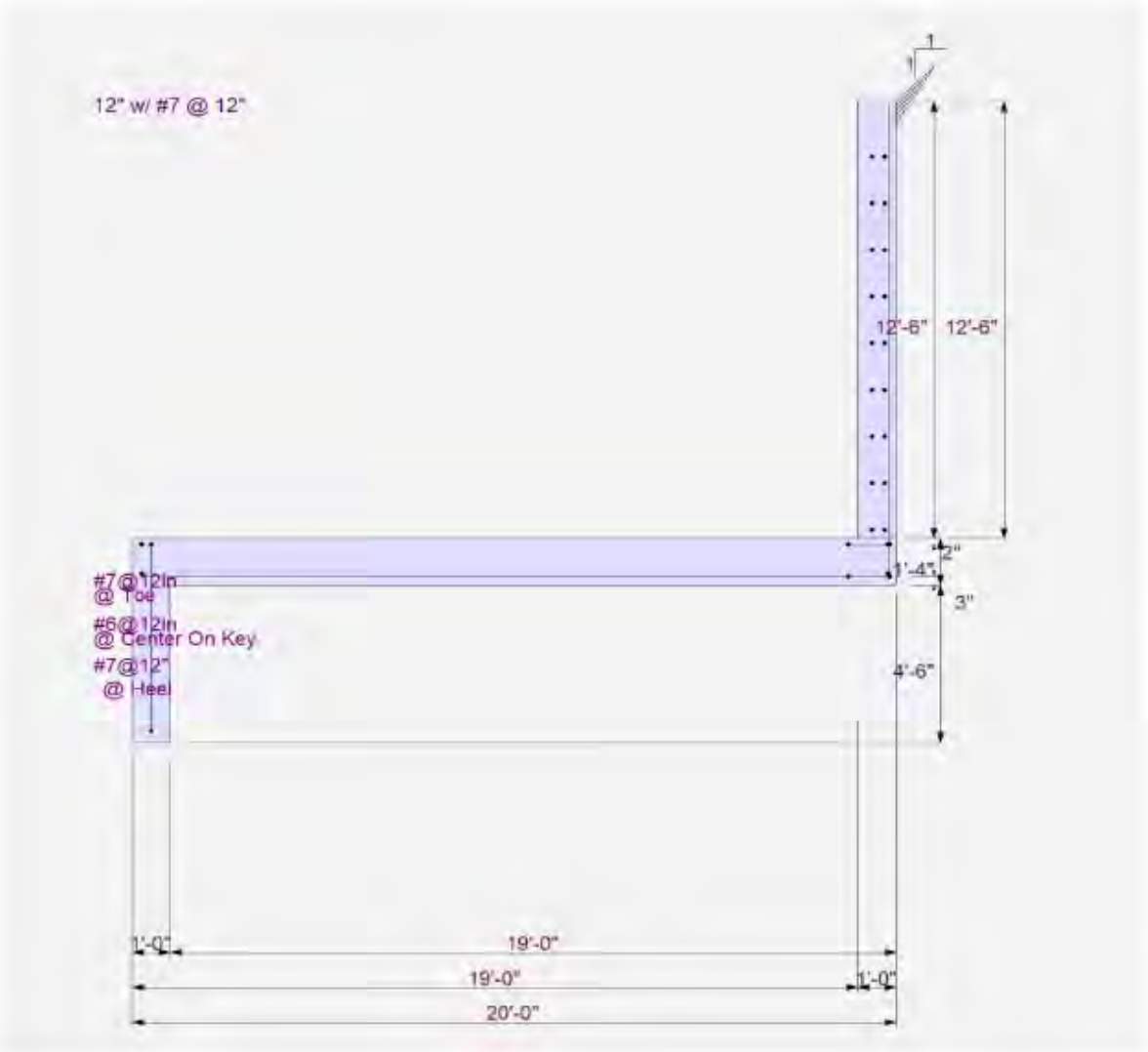
Lap Splice length for #7 bar specified in this stem design segment (25.4.2.4a) =	28.96 in
Development length for #7 bar specified in this stem design segment =	22.27 in
Hooked embedment length into footing for #7 bar specified in this stem design segment =	11.79 in
As Provided =	0.6000 in2/ft
As Required =	0.5623 in2/ft

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 12.5' Tall Wall - Sliding Check



4.3.3 9' Tall Wall

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 9' Tall Wall - Sliding Check

Code Reference

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 9' Tall Wall - Sliding Check

Design Summary

Wall Stability Ratios

Overturning	=	5.52	OK
Sliding	=	1.37	Ratio < 1.5!
Global Stability	=	11.64	

Total Bearing Load	=	4,857	lbs
...resultant ecc.	=	6.61	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	272	psf OK
Soil Pressure @ Heel	=	187	psf OK
Allowable	=	3,400	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	381	psf
ACI Factored @ Heel	=	261	psf
Footing Shear @ Toe	=	23.3	psi OK
Footing Shear @ Heel	=	0.0	psi OK
Allowable	=	106.1	psi

Sliding Calcs

Lateral Sliding Force	=	2,250.0	lbs
less 100% Passive Force	-	1,665.1	lbs
less 100% Friction Force	-	1,424.1	lbs
Added Force Req'd	=	0.0	lbs OK
....for 1.5 Stability	=	285.8	lbs NG

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	9.00		
Rebar Size	=	# 5		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.895**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	2,916.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	8,748.0		
Moment.....Allowable	=	9,771.4		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	33.8		
Shear.....Allowable	psi =	65.0		
Anet (Masonry)	in2 =			
Wall Weight	psf =	112.5		
Rebar Depth 'd'	in =	7.19		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 9' Tall Wall - Sliding Check

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2823 in2/ft		
0.0018bh : 0.0018(12)(9) :	0.1944 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2823 in2/ft	#4@ 12.35 in	#4@ 24.69 in
Provided Area :	0.31 in2/ft	#5@ 19.14 in	#5@ 38.27 in
Maximum Area :	1.8328 in2/ft	#6@ 27.16 in	#6@ 54.32 in

Footing Data

Toe Width	=	17.00 ft
Heel Width	=	0.75
Total Footing Width	=	17.75
Footing Thickness	=	12.00 in
Key Width	=	9.00 in
Key Depth	=	42.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	381	261	psf
Mu' : Upward	=	49,493	0	ft-#
Mu' : Downward	=	26,010	0	ft-#
Mu: Design	=	23,483 NG	0	ft-# OK
phiMn	=	16,565	OK - Flush	
Actual 1-Way Shear	=	23.29	0.00	psi
Allow 1-Way Shear	=	68.73	73.64	psi

Toe Reinforcing = # 6 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 5 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 3.77 in, #5@ 5.84 in, #6@ 8.29 in, #7@ 11.31 in, #8@ 14.89 in, #9@ 18.85 in, #10@ 23.94 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 9.07 in, #5@ 14.06 in, #6@ 18 in, #7@ 18

Min footing T&S reinf Area 4.60 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 9' Tall Wall - Sliding Check

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,250.0	3.33	7,500.0	Soil Over HL (ab. water tbl)			
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)			
Hydrostatic Force				Water Table			
Buoyant Force =				Sloped Soil Over Heel =		17.75	
Surcharge over Heel =				Surcharge Over Heel =			
Surcharge Over Toe =				Adjacent Footing Load =			
Adjacent Footing Load =				Axial Dead Load on Stem =			
Added Lateral Load =				* Axial Live Load on Stem =			
Load @ Stem Above Soil =				Soil Over Toe =			
=				Surcharge Over Toe =			
				Stem Weight(s) =	1,012.5	17.38	17,592.2
				Earth @ Stem Transitions =			
Total =	2,250.0	**O.T.M.** =	7,500.0	Footing Weight =	2,662.5	8.88	23,629.7
				Key Weight =	393.8	0.38	147.7
				Vert. Component =			
				Total =	4,068.8 lbs	**R.M.=**	41,369.5

Resisting/Overturning Ratio = **5.52**

Vertical Loads used for Soil Pressure = 4,857.2 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.004	in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 9' Tall Wall - Sliding Check

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

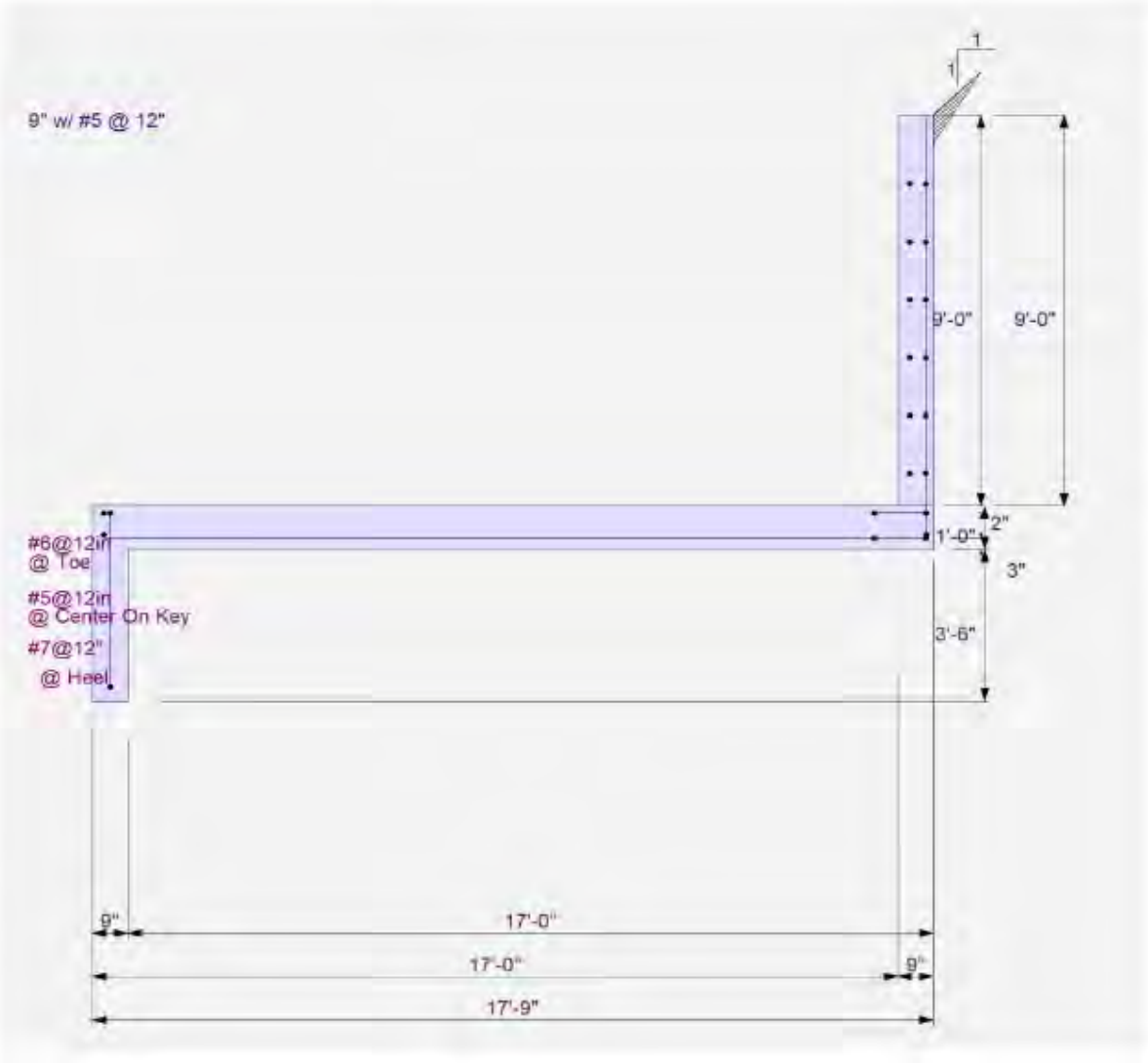
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	16.55 in
Development length for #5 bar specified in this stem design segment =	12.73 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	7.11 in
As Provided =	0.3100 in2/ft
As Required =	0.3049 in2/ft

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 9' Tall Wall - Sliding Check



4.3.4 8' Tall Wall

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 8' Tall Wall - Sliding Check

Code Reference

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 8' Tall Wall - Sliding Check

Design Summary

Wall Stability Ratios

Overturning	=	5.08	OK
Sliding	=	1.34	Ratio < 1.5!
Global Stability	=	42.54	

Total Bearing Load	=	3,901	lbs
...resultant ecc.	=	3.46	in

Eccentricity within middle third

Soil Pressure @ Toe	=	257	psf	OK
Soil Pressure @ Heel	=	201	psf	OK
Allowable	=	3,400	psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	359	psf	
ACI Factored @ Heel	=	282	psf	
Footing Shear @ Toe	=	18.1	psi	OK
Footing Shear @ Heel	=	0.0	psi	OK
Allowable	=	106.1	psi	

Sliding Calcs

Lateral Sliding Force	=	1,822.5	lbs	
less 100% Passive Force	-	1,297.5	lbs	
less 100% Friction Force	-	1,141.9	lbs	
Added Force Req'd	=	0.0	lbs	OK
....for 1.5 Stability	=	294.4	lbs	NG

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	9.00		
Rebar Size	=	# 5		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.628**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	2,304.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	6,144.0		
Moment.....Allowable	=	9,771.4		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	26.7		
Shear.....Allowable	psi =	65.0		
Anet (Masonry)	in2 =			
Wall Weight	psf =	112.5		
Rebar Depth 'd'	in =	7.19		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 8' Tall Wall - Sliding Check

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1982 in2/ft		
0.0018bh : 0.0018(12)(9) :	0.1944 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1982 in2/ft	#4@ 12.35 in	#4@ 24.69 in
Provided Area :	0.31 in2/ft	#5@ 19.14 in	#5@ 38.27 in
Maximum Area :	1.8328 in2/ft	#6@ 27.16 in	#6@ 54.32 in

Footing Data

Toe Width	=	13.50 ft
Heel Width	=	0.75
Total Footing Width	=	14.25
Footing Thickness	=	12.00 in
Key Width	=	6.00 in
Key Depth	=	36.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	359	282 psf
Mu' : Upward	=	30,513	0 ft-#
Mu' : Downward	=	16,403	0 ft-#
Mu: Design	=	14,110 NG	0 ft-# OK
phiMn	=	11,865	OK - Flush
Actual 1-Way Shear	=	18.12	0.00 psi
Allow 1-Way Shear	=	61.01	73.64 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 5 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 6.27 in, #5@ 9.72 in, #6@ 13.80 in, #7@ 18.82 in, #8@ 24.79 in, #9@ 31.38 in, #10@ 39.85 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 8.81 in, #5@ 13.67 in, #6@ 18 in, #7@ 18

Min footing T&S reinf Area 3.69 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 8' Tall Wall - Sliding Check

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,822.5	3.00	5,467.5	Soil Over HL (ab. water tbl)			
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)			
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=	14.25	
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	900.0	13.88	12,487.5
					Earth @ Stem Transitions	=			
					Footing Weight	=	2,137.5	7.13	15,229.7
					Key Weight	=	225.0	0.25	56.3
					Vert. Component	=			
Total	=	1,822.5	**O.T.M.** =	5,467.5	**Total =**		3,262.5 lbs	**R.M.=**	27,773.4

Resisting/Overturning Ratio = **5.08**

Vertical Loads used for Soil Pressure = 3,901.2 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.004	in

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

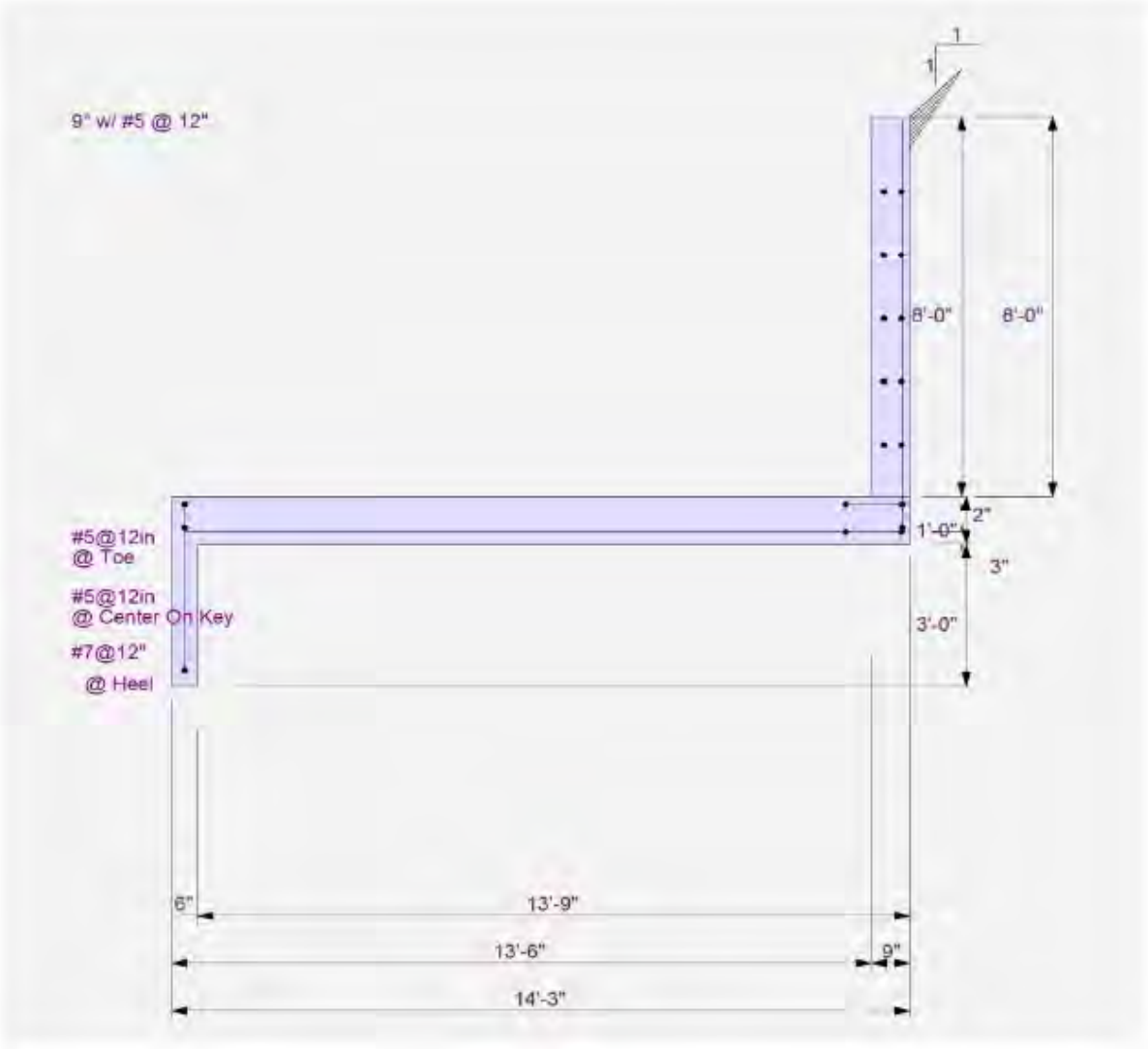
Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	16.55 in
Development length for #5 bar specified in this stem design segment =	12.73 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	7.11 in
As Provided =	0.3100 in2/ft
As Required =	0.2643 in2/ft

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build.20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 8' Tall Wall - Sliding Check



4.3.5 5.75' Tall Wall

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 5.75' Tall Wall - Sliding Check

Code Reference:

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	5.75 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	173.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 5.75' Tall Wall - Sliding Check

Design Summary

Wall Stability Ratios

Overturning	=	3.15	OK
Sliding	=	1.48	Ratio < 1.5!
Global Stability	=	1.42	

Total Bearing Load	=	1,983	lbs
...resultant ecc.	=	12.87	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	409	psf OK
Soil Pressure @ Heel	=	31	psf OK
Allowable	=	3,400	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	572	psf
ACI Factored @ Heel	=	44	psf
Footing Shear @ Toe	=	20.5	psi OK
Footing Shear @ Heel	=	0.0	psi OK
Allowable	=	106.1	psi

Sliding Calcs

Lateral Sliding Force	=	950.6	lbs
less 100% Passive Force	-	827.2	lbs
less 100% Friction Force	-	577.5	lbs
Added Force Req'd	=	0.0	lbs OK
....for 1.5 Stability	=	21.3	lbs NG

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	6.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.613**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	1,190.3		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	2,281.3		
Moment.....Allowable	=	3,718.8		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	23.3		
Shear.....Allowable	psi =	66.9		
Anet (Masonry)	in2 =			
Wall Weight	psf =	75.0		
Rebar Depth 'd'	in =	4.25		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 5.75' Tall Wall - Sliding Check

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1283 in2/ft		
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 18.52 in	#4@ 37.04 in
Provided Area :	0.2 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	1.0838 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Footing Data

Toe Width	=	7.00 ft
Heel Width	=	0.50
Total Footing Width	=	7.50
Footing Thickness	=	9.00 in
Key Width	=	12.00 in
Key Depth	=	30.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	572	44 psf
Mu' : Upward	=	9,991	0 ft-#
Mu' : Downward	=	3,308	0 ft-#
Mu: Design	=	6,684 OK	0 ft-# OK
phiMn	=	7,680	OK - Flush
Actual 1-Way Shear	=	20.49	0.00 psi
Allow 1-Way Shear	=	70.26	83.48 psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 5 @ 14.35 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 8.40 in, #5@ 13.02 in, #6@ 18.48 in, #7@ 25.20 in, #8@ 33.19 in, #9@ 42.01 in, #10@ 53.35 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18

Min footing T&S reinf Area 1.46 in2
Min footing T&S reinf Area per foot 0.19 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 12.35 in	#4@ 24.69 in
#5@ 19.14 in	#5@ 38.27 in
#6@ 27.16 in	#6@ 54.32 in

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 5.75' Tall Wall - Sliding Check

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	950.6	2.17	2,059.7			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)						
Soil Over HL (bel. water tbl)						
Water Table						
Sloped Soil Over Hee =					7.50	
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =						
Surcharge Over Toe =						
Stem Weight(s) =				431.3	7.25	3,126.6
Earth @ Stem Transitions =						
Footing Weight =				843.8	3.75	3,164.1
Key Weight =				375.0	0.50	187.5
Vert. Component =						
Total =	950.6	**O.T.M.** =	2,059.7	**Total =** 1,650.0 lbs	**R.M.=**	6,478.1

Resisting/Overturning Ratio = **3.15**

Vertical Loads used for Soil Pressure = 1,983.1 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.009	in

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

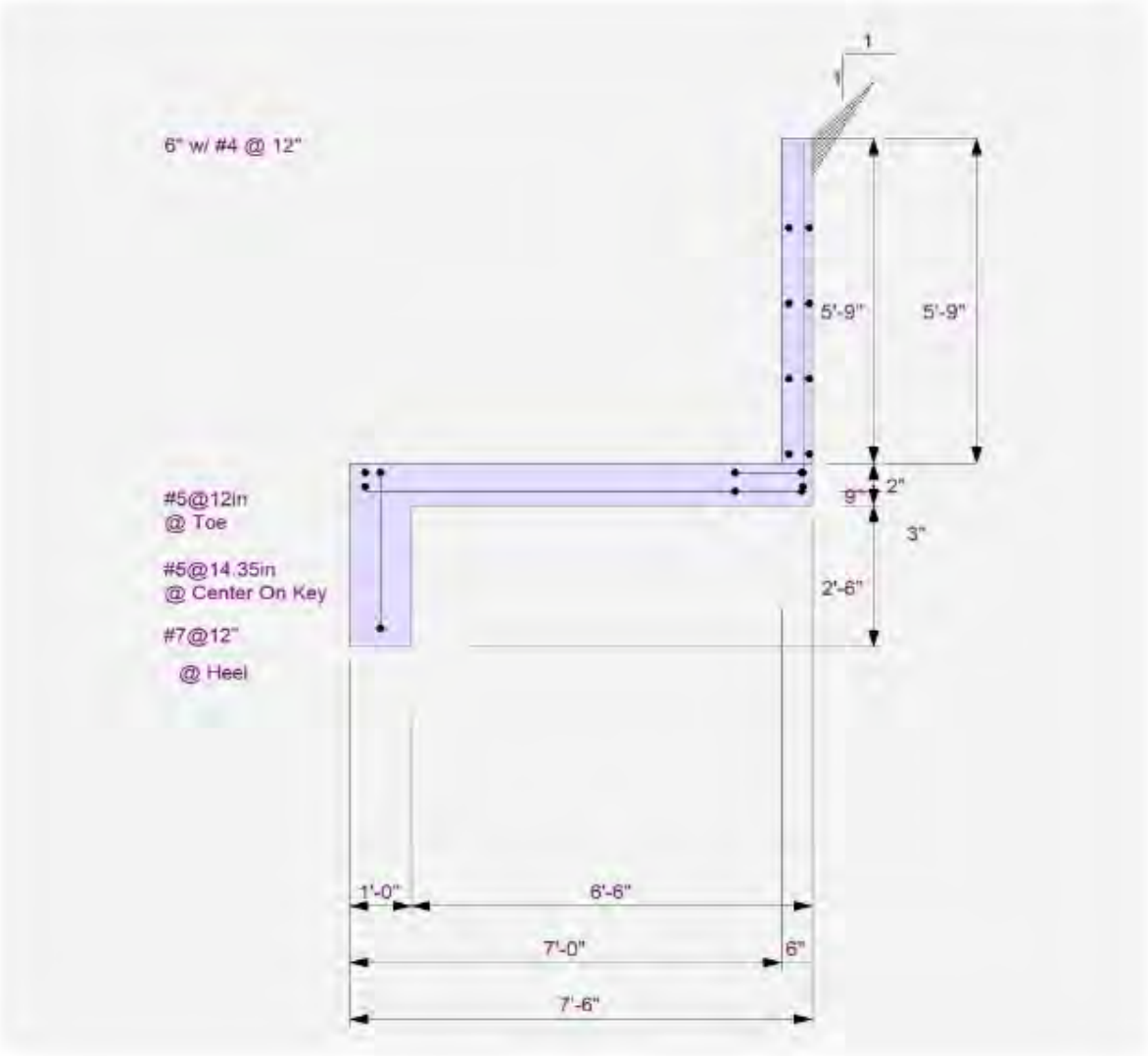
Lap Splice length for #4 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	5.09 in
As Provided =	0.2000 in2/ft
As Required =	0.1711 in2/ft

Cantilevered Retaining Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: 5.75' Tall Wall - Sliding Check



4.3.6 9.25' Tall Middle Wall

Concrete Slender Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: "Wall 2" - 9.25' Tall - Design as Cantilever Wall

Code References

Calculations per ACI 318-19 Sec 11.8, IBC 2021, ASCE 7-16

Load Combinations Used : ASCE 7-16

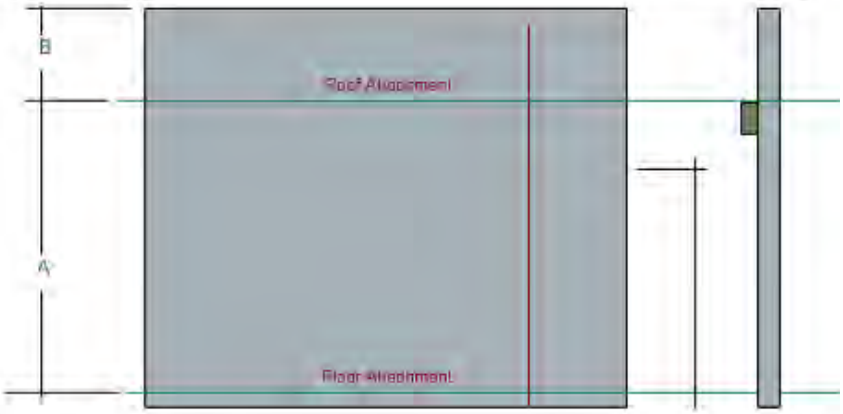
General Information

f'c : Concrete 28 day streng	=	5.0 ksi	Wall Thickness		9.0 in	Temp Diff across thickness	= deg F
Fy : Rebar Yield	=	60.0 ksi	Rebar at wall center			Min Allow Out-of-Plane Defl Ratio	= 0.0 /2 for Cantilever
Ec : Concrete Elastic Modul	=	4,030.51 ksi	Rebar "d" distance		4.50 in		
λ : Lt Wt Conc Factr	=	1.0	Lower Level Rebar . . .			Min allow As/bd	= 0.0020
Fr : Rupture Modulus	=	353.553 psi	Bar Size	#	8	Using Stiff. Reduction Factor per ACI 318-14	
Max Allow As/bd	=	0.02125	Bar Spacing		12.0 in		Section 11.8.3
Max Pu/Ag = f'c *	=	0.060					
Concrete Density	=	150.0 pcf					
Width of Design Strip	=	12.0 in					

One-Story Wall Dimensions

A Clear Height	=	9.250	ft
B Parapet height	=		ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :

Full area WIND load psf

Seismic Loads :

Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight

Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W		Endpoints from Base top	bottom
Distributed Lateral Load			0.4620			k/ft	6.0	ft

Concrete Slender Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: "Wall 2" - 9.25' Tall - Design as Cantilever Wall

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.20D+1.60L	Maximum Bending Stress Rat	0.9375		
		Max Mu	-13.353 k-ft	Phi * Mn	14.242 k-ft
PASS	Service Deflection Check L Only	Actual Defl. Ratio L/	439	Allowable Defl. Ratio	150.0
		Max. Deflection	0.5052 in	/2 for Cantilever	
PASS	Axial Load Check +1.20D+1.60L	Max Pu / Ag	0.8993 psi	Max. Allow. Defl.	1.480 in
		Location	0.1542 ft	0.06 * f'c	300.0 psi
PASS	Reinforcing Limit Check OK per ACI 318 Section 22.2	Actual As/bd	0.01463	Max Allow As/bd	0.02125

Maximum Reactions *for Load Combination...*

Top Horizontal		0.0 k
Base Horizontal	+D+L	2.772 k
Vertical Reaction	D Only	1.041 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.06*f'c*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+1.60L at 0.00 to 0.31	0.000	32.400	4.77	13.35	0.90	14.24	0.790	0.0146	0.0213	4.50
+1.20D+L at 0.00 to 0.31	0.000	32.400	4.77	8.34	0.90	14.24	0.790	0.0146	0.0213	4.50
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+L+E at 0.00 to 0.31	0.000	32.400	4.77	8.34	0.90	14.24	0.790	0.0146	0.0213	4.50
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+L at 8.94 to 9.25	0.000	4.77	0.00	729.00	70.39	546.750	0.504	440.7
+D+0.750L at 8.94 to 9.25	0.000	4.77	0.00	729.00	70.39	546.750	0.225	984.9
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.750L+0.5250E at 8.94 to 9.25	0.000	4.77	0.00	729.00	70.39	546.750	0.225	984.9
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
L Only at 8.94 to 9.25	0.000	4.77	0.00	729.00	70.39	546.750	0.505	439.4
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	1.041 k
+D+L	2.8 k	0.00 k	1.041 k
+D+0.750L	2.1 k	0.00 k	1.041 k
+0.60D	0.0 k	0.00 k	0.624 k
+D+0.70E	0.0 k	0.00 k	1.041 k
+D+0.750L+0.5250E	2.1 k	0.00 k	1.041 k
+0.60D+0.70E	0.0 k	0.00 k	0.624 k
L Only	2.8 k	0.00 k	0.000 k

4.3.7 8' Tall Middle Wall

Concrete Slender Wall Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: "Wall 2" - 8' Tall - Design as Cantilever Wall

Code References

Calculations per ACI 318-19 Sec 11.8, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

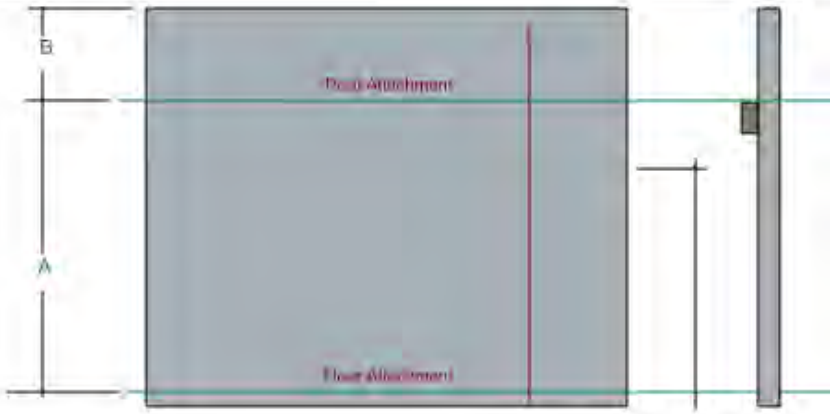
General Information

f'c : Concrete 28 day streng	=	5.0 ksi	Wall Thickness		9.0 in	Temp Diff across thickness	=	deg F
Fy : Rebar Yield	=	60.0 ksi	Rebar at wall center			Min Allow Out-of-Plane Defl Ratio	=	0.0
Ec : Concrete Elastic Modu	=	4,030.51 ksi	Rebar "d" distance		4.50 in			/2 for Cantilever
λ : Lt Wt Conc Facto	=	1.0	Lower Level Rebar			Min allow As/bd	=	0.0020
Fr : Rupture Modulus	=	353.553 psi	Bar Size	#	7	Using Stiff. Reduction Factor per ACI 318-14		
Max Allow As/bd	=	0.02125	Bar Spacing		12.0 in			Section 11.8.3
Max Pu/Ag = f'c *	=	0.060						
Concrete Density	=	150.0 pcf						
Width of Design Strip	=	12.0 in						

One-Story Wall Dimensions

A Clear Height = 8.0 ft
B Parapet height = ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :
Full area WIND load psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load			0.3750		k/ft	5.330	ft

Concrete Slender Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: "Wall 2" - 8' Tall - Design as Cantilever Wall

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	0.7669		
	+1.20D+1.60L	Max Mu	-8.541 k-ft	Phi * Mn	11.138 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	1,758	Allowable Defl. Ratio	150.0
	+D+L	Max. Deflection	0.1092 in		/2 for Cantilever
PASS	Axial Load Check	Max Pu / Ag	0.7778 psi	Max. Allow. Defl.	1.280 in
	+1.20D+1.60L	Location	0.1333 ft	0.06 * f'c	300.0 psi
PASS	Reinforcing Limit Check				
	OK per ACI 318 Section 22.2	Actual As/bd	0.01111	Max Allow As/bd	0.02125

Maximum Reactions *for Load Combination...*

Top Horizontal		0.0 k
Base Horizontal	L Only	1.999 k
Vertical Reaction	+D+0.750L	0.90 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.06*f'c*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+1.60L at 0.00 to 0.27	0.000	32.400	4.77	8.54	0.90	11.14	0.600	0.0111	0.0213	4.50
+1.20D+L at 0.00 to 0.27	0.000	32.400	4.77	5.33	0.90	11.14	0.600	0.0111	0.0213	4.50
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+L+E at 0.00 to 0.27	0.000	32.400	4.77	5.33	0.90	11.14	0.600	0.0111	0.0213	4.50
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+L at 7.73 to 8.00	0.000	4.77	0.00	729.00	57.16	546.750	0.109	1,757.9
+D+0.750L at 7.73 to 8.00	0.000	4.77	0.00	729.00	57.16	546.750	0.036	5,279.7
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.750L+0.5250E at 7.73 to 8.00	0.000	4.77	0.00	729.00	57.16	546.750	0.036	5,279.7
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
L Only at 7.73 to 8.00	0.000	4.77	0.00	729.00	57.16	546.750	0.109	1,761.6
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	0.900 k
+D+L	2.0 k	0.00 k	0.900 k
+D+0.750L	1.5 k	0.00 k	0.900 k
+0.60D	0.0 k	0.00 k	0.540 k
+D+0.70E	0.0 k	0.00 k	0.900 k
+D+0.750L+0.5250E	1.5 k	0.00 k	0.900 k
+0.60D+0.70E	0.0 k	0.00 k	0.540 k
L Only	2.0 k	0.00 k	0.000 k

4.3.8 6' Tall Middle Wall

Concrete Slender Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: "Wall 2" - 6' Tall - Design as Cantilever Wall

Code References

Calculations per ACI 318-19 Sec 11.8, IBC 2021, ASCE 7-16

Load Combinations Used : ASCE 7-16

General Information

f'c : Concrete 28 day streng	=	5.0 ksi	Wall Thickness		6.0 in	Temp Diff across thickness	=	deg F
Fy : Rebar Yield	=	60.0 ksi	Rebar at wall center			Min Allow Out-of-Plane Defl Ratio	=	0.0
Ec : Concrete Elastic Modul	=	4,030.51 ksi	Rebar "d" distance		3.0 in			/2 for Cantilever
λ : Lt Wt Conc Fact	=	1.0	Lower Level Rebar . .			Min allow As/bd	=	0.0020
Fr : Rupture Modulus	=	353.553 psi	Bar Size	#	5	Using Stiff. Reduction Factor per ACI 318-14		
Max Allow As/bd	=	0.02125	Bar Spacing		12.0 in			Section 11.8.3
Max Pu/Ag = f'c *	=	0.060						
Concrete Density	=	150.0 pcf						
Width of Design Strip	=	12.0 in						

One-Story Wall Dimensions

A Clear Height = 6 ft

B Parapet height = ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :

Full area WIND load psf

Seismic Loads :

Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight

Seismic Wall Lateral Load psf

Fp 1.0 = 0.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom	
Distributed Lateral Load			0.280		k/ft	4.0		ft

Concrete Slender Wall

Project File: Pond Outlet Wall Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: "Wall 2" - 6' Tall - Design as Cantilever Wall

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	0.9177		
	+1.20D+1.60L	Max Mu	-3.592 k-ft	Phi * Mn	3.915 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	1,697	Allowable Defl. Ratio	150.0
	+D+L	Max. Deflection	0.08485 in		/2 for Cantilever
PASS	Axial Load Check	Max Pu / Ag	0.5833 psi	Max. Allow. Defl.	0.960 in
	+1.20D+1.60L	Location	0.10 ft	0.06 * f'c	300.0 psi
PASS	Reinforcing Limit Check				
	OK per ACI 318 Section 22.2	Actual As/bd	0.008611	Max Allow As/bd	0.02125

Maximum Reactions *for Load Combination...*

Top Horizontal		0.0 k
Base Horizontal	L Only	1.120 k
Vertical Reaction	+D+L	0.450 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Axial Load 0.06*f'c*b*t k	Moment Values Mcr k-ft	Moment Values Mu k-ft	Moment Values Phi	Moment Values Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+1.60L at 0.00 to 0.20	0.000	21.600	2.12	3.59	0.90	3.91	0.310	0.0086	0.0213	3.00
+1.20D+L at 0.00 to 0.20	0.000	21.600	2.12	2.24	0.90	3.91	0.310	0.0086	0.0213	3.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+L+E at 0.00 to 0.20	0.000	21.600	2.12	2.24	0.90	3.91	0.310	0.0086	0.0213	3.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Moment Values Mactual k-ft	Stiffness I gross in^4	Stiffness I cracked in^4	Stiffness I effective in^4	Deflections Deflection in	Deflections Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+L at 5.80 to 6.00	0.000	2.12	0.00	216.00	13.86	162.000	0.085	1,697.1
+D+0.750L at 5.80 to 6.00	0.000	2.12	0.00	216.00	13.86	162.000	0.029	4,957.6
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.750L+0.5250E at 5.80 to 6.00	0.000	2.12	0.00	216.00	13.86	162.000	0.029	4,957.6
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
L Only at 5.80 to 6.00	0.000	2.12	0.00	216.00	13.86	162.000	0.085	1,702.9
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	0.450 k
+D+L	1.1 k	0.00 k	0.450 k
+D+0.750L	0.8 k	0.00 k	0.450 k
+0.60D	0.0 k	0.00 k	0.270 k
+D+0.70E	0.0 k	0.00 k	0.450 k
+D+0.750L+0.5250E	0.8 k	0.00 k	0.450 k
+0.60D+0.70E	0.0 k	0.00 k	0.270 k
L Only	1.1 k	0.00 k	0.000 k

5 Stilling Basin Design

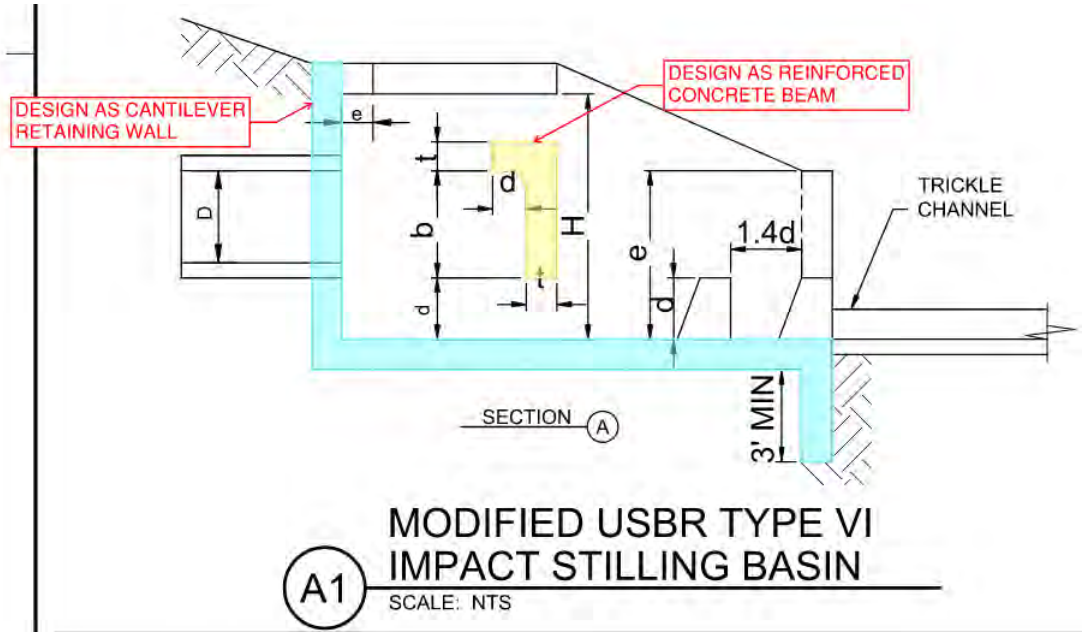
5.1 Design Summary

The following calculations are for the reinforced concrete stilling basins, Basin 3 and Basin 5, at Yap Island Airport. As Basin 3 is slightly larger than Basin 5, Basin 3 will be designed, and the requirements will be applied to both basins.

See below for Stilling Basin Dimensions:

STILLING BASIN DIMENSIONS		
	Basin 3	Basin 5
W =	10.97 ft	9.82 ft
H =	8.23 ft	7.36 ft
L =	14.63 ft	13.09 ft
a =	5.49 ft	4.91 ft
b =	4.12 ft	3.68 ft
c =	5.49 ft	4.91 ft
d =	1.83 ft	1.64 ft
e =	0.91 ft	0.82 ft
f =	1.37 ft	1.23 ft
t =	0.91 ft	0.82 ft

See below for the Stilling Basin Layout:



5.2 Design Assumptions

- The headwall and wingwalls are conservatively designed assuming walls are cantilevered only. See the following Enercalc output for analysis and design information.
- Wall designs assumed retained soil is full height of wall with a backfill slope of 1:1 above the top of the headwall.
- The base slab is designed per the Enercalc retaining wall module.
- Sliding is resisted by key at edge of base slab.
- The force on the beam used to slow the flow from the pipe is calculated using $\gamma_{water} * A_{pipe} * V_{water}$ over a time of 1 second, giving a point load.
    - $\gamma_{water} = 62.4$ pcf
    - $A_{pipe} = 2.63$ ft^2
    - $V_{water} = 22.75$ ft/sec
        - 62.4 * 2.63 * 22.75 = 3735 lbs → Use 4 kips to be conservative

5.3 Wall Analysis, Design, and Sliding Check

Cantilevered Retaining Wall Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build 20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Typical Wall Design

Code Reference

Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	1.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	3,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Strength Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Cantilevered Retaining Wall

Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Typical Wall Design

Design Summary

Wall Stability Ratios

Overturning	=	4.02	OK
Sliding	=	1.60	OK
Global Stability	=	10.97	
Total Bearing Load	=	5,313 lbs	
...resultant ecc.	=	11.60 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	459 psf	OK
Soil Pressure @ Heel	=	187 psf	OK
Allowable	=	3,400 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	643 psf	
ACI Factored @ Heel	=	262 psf	
Footing Shear @ Toe	=	14.2 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	106.1 psi	

Sliding Calcs

Lateral Sliding Force	=	2,480.6 lbs	
less 100% Passive Force	-	2,406.3 lbs	
less 100% Friction Force	-	1,555.3 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	9.00		
Rebar Size	=	# 7		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Center		
Design Data				
fb/FB + fa/Fa	=	**0.781**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	2,916.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	8,748.0		
Moment.....Allowable	=	11,194.2		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	54.0		
Shear.....Allowable	psi =	94.7		
Anet (Masonry)	in2 =			
Wall Weight	psf =	112.5		
Rebar Depth 'd'	in =	4.50		

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	5,000.0
Fy	psi =	60,000.0

Cantilevered Retaining Wall

Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Typical Wall Design

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.4629 in2/ft		
0.0018bh : 0.0018(12)(9) :	0.1944 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.4629 in2/ft	#4@ 12.35 in	#4@ 24.69 in
Provided Area :	0.6 in2/ft	#5@ 19.14 in	#5@ 38.27 in
Maximum Area :	1.1475 in2/ft	#6@ 27.16 in	#6@ 54.32 in

Footing Data

Toe Width	=	13.00 ft
Heel Width	=	0.75
Total Footing Width	=	13.75
Footing Thickness	=	18.00 in
Key Width	=	9.00 in
Key Depth	=	36.00 in
Key Distance from Toe	=	0.00 ft

f'c = 5,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	643	262 psf
Mu' : Upward	=	44,193	0 ft-#
Mu' : Downward	=	22,815	0 ft-#
Mu: Design	=	21,378 OK	0 ft-# OK
phiMn	=	38,366	OK - Flush
Actual 1-Way Shear	=	14.21	0.00 psi
Allow 1-Way Shear	=	64.01	62.60 psi

Toe Reinforcing = # 7 @ 12.00 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = # 5 @ 12.00 in
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 5.38 in, #5@ 8.33 in, #6@ 11.83 in, #7@ 16.14 in, #8@ 21.25 in, #9@ 26.90 in, #10@ 34.16 in

Heel: Flush heel condition. No reinforcing required.

Key: #4@ 7.81 in, #5@ 12.1 in, #6@ 17.18 in, #7@ 1

Min footing T&S reinf Area 5.35 in2
Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

Cantilevered Retaining Wall

Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Typical Wall Design

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,480.6	3.50	8,682.2			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)						
Soil Over HL (bel. water tbl)						
Water Table						
Sloped Soil Over Heel =					13.75	
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =						
Surcharge Over Toe =						
Stem Weight(s) =				1,012.5	13.38	13,542.2
Earth @ Stem Transitions =						
Footing Weight =				3,093.8	6.88	21,269.5
Key Weight =				337.5	0.38	126.6
Vert. Component =						
Total =	2,480.6	**O.T.M.** =	8,682.2	**Total =** 4,443.8 lbs	**R.M.=**	34,938.3

Resisting/Overturning Ratio = **4.02**

Vertical Loads used for Soil Pressure = 5,313.1 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	15.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.139	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Typical Wall Design

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

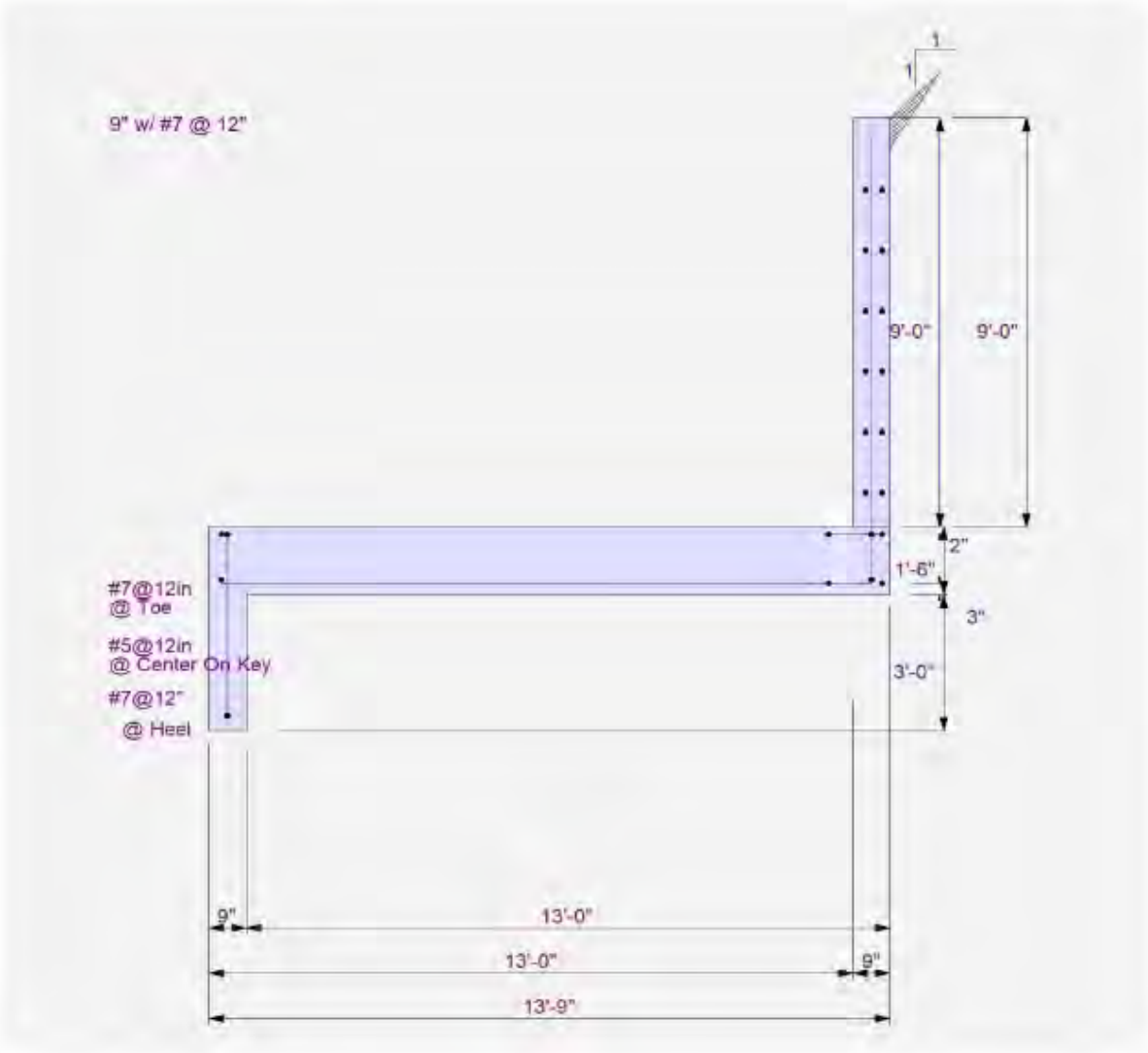
Lap Splice length for #7 bar specified in this stem design segment (25.4.2.4a) =	28.96 in
Development length for #7 bar specified in this stem design segment =	22.27 in
Hooked embedment length into footing for #7 bar specified in this stem design segment =	11.79 in
As Provided =	0.6000 in2/ft
As Required =	0.4629 in2/ft

Cantilevered Retaining Wall

Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Typical Wall Design



5.4 Beam Design

Concrete Beam Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Stilling Basin Beam Design

CODE REFERENCES

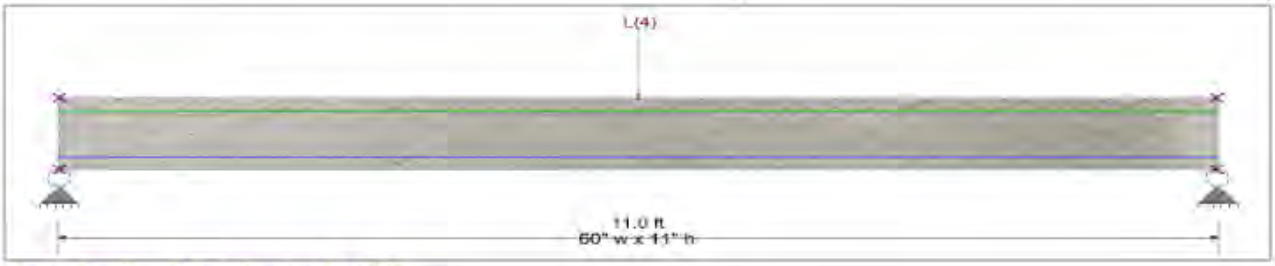
Calculations per ACI 318-19, IBC 2021, ASCE 7-16
Load Combination Set : ASCE 7-16

General Information

f'c	5.0 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c^1/2 * 7.50	530.33 psi		Shear :	0.750
ψ Density	145.0 pcf	β1		0.80
λ LtWt Factor	1.0			
Elastic Modulus	4,030.51 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	60.0 ksi	E - Stirrups		29,000.0 ksi
E - Main Rebar	29,000.0 ksi	Stirrup Bar Size #		3
		Number of Resisting Legs Per Stirrup		1.0

Seismic Design Category = A





Cross Section & Reinforcing Details

Rectangular Section, Width = 60.0 in, Height = 11.0 in
Span #1 Reinforcing....
6-#5 at 2.0 in from Bottom, from 0.0 to 11.0 ft in this span
6-#5 at 2.0 in from Top, from 0.0 to 11.0 ft in this span

Point Load : L = 4.0 k @ 5.50 ft ⟶ 62.4 lbs/ft³ * 2.63 ft² * 22.75 ft/sec = 3735 lbs --> Use 4 kips to be conservative

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.207** : 1	
Section used for this span	**Typical Section**	
Mu : Applied	17.568	k-ft
Mn * Phi : Allowable	84.744	k-ft
Location of maximum on span	5.510	ft
Span # where maximum occurs	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0 <360.0	
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	
Max Downward Total Deflection	0.007 in	Ratio =	18480 >=240.0	Span: 1 : L Only
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0	Span: 1 : L Only

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.000	2.000
Max Upward from Load Combinations	1.500	1.500
Max Upward from Load Cases	2.000	2.000
L Only	2.000	2.000
+0.750L	1.500	1.500

Shear Stirrup Requirements

Entire Beam Span Length : Vu <= Phi*lambda*sqrt(f'c)*bw*d, Req'd Vs = Not Reqd per 9.3.6.1, Stirrups are not required.

Concrete Beam

Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Stilling Basin Beam Design

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu Actual	(k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd
+1.60L	1	0.00	9.00	3.20	3.20	0.00	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	0.12	9.00	3.20	3.20	0.38	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	0.24	9.00	3.20	3.20	0.77	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	0.36	9.00	3.20	3.20	1.15	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	0.48	9.00	3.20	3.20	1.54	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	0.60	9.00	3.20	3.20	1.92	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	0.72	9.00	3.20	3.20	2.31	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	0.84	9.00	3.20	3.20	2.69	0.89	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	0.96	9.00	3.20	3.20	3.08	0.78	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	1.08	9.00	3.20	3.20	3.46	0.69	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	1.20	9.00	3.20	3.20	3.85	0.62	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	1.32	9.00	3.20	3.20	4.23	0.57	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	1.44	9.00	3.20	3.20	4.62	0.52	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	1.56	9.00	3.20	3.20	5.00	0.48	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	1.68	9.00	3.20	3.20	5.39	0.45	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	1.80	9.00	3.20	3.20	5.77	0.42	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	1.92	9.00	3.20	3.20	6.16	0.39	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	2.04	9.00	3.20	3.20	6.54	0.37	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	2.16	9.00	3.20	3.20	6.92	0.35	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	2.28	9.00	3.20	3.20	7.31	0.33	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	2.40	9.00	3.20	3.20	7.69	0.31	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	2.52	9.00	3.20	3.20	8.08	0.30	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	2.64	9.00	3.20	3.20	8.46	0.28	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	2.77	9.00	3.20	3.20	8.85	0.27	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	2.89	9.00	3.20	3.20	9.23	0.26	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.01	9.00	3.20	3.20	9.62	0.25	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.13	9.00	3.20	3.20	10.00	0.24	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.25	9.00	3.20	3.20	10.39	0.23	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.37	9.00	3.20	3.20	10.77	0.22	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.49	9.00	3.20	3.20	11.16	0.22	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.61	9.00	3.20	3.20	11.54	0.21	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.73	9.00	3.20	3.20	11.93	0.20	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.85	9.00	3.20	3.20	12.31	0.19	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	3.97	9.00	3.20	3.20	12.70	0.19	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	4.09	9.00	3.20	3.20	13.08	0.18	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	4.21	9.00	3.20	3.20	13.46	0.18	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	4.33	9.00	3.20	3.20	13.85	0.17	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	4.45	9.00	3.20	3.20	14.23	0.17	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	4.57	9.00	3.20	3.20	14.62	0.16	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	4.69	9.00	3.20	3.20	15.00	0.16	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	4.81	9.00	3.20	3.20	15.39	0.16	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	4.93	9.00	3.20	3.20	15.77	0.15	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	5.05	9.00	3.20	3.20	16.16	0.15	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	5.17	9.00	3.20	3.20	16.54	0.15	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	5.29	9.00	3.20	3.20	16.93	0.14	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	5.41	9.00	3.20	3.20	17.31	0.14	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	5.53	9.00	-3.20	3.20	17.50	0.14	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	5.65	9.00	-3.20	3.20	17.12	0.14	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	5.77	9.00	-3.20	3.20	16.73	0.14	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	5.89	9.00	-3.20	3.20	16.35	0.15	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	6.01	9.00	-3.20	3.20	15.97	0.15	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	6.13	9.00	-3.20	3.20	15.58	0.15	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	6.25	9.00	-3.20	3.20	15.20	0.16	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	6.37	9.00	-3.20	3.20	14.81	0.16	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	6.49	9.00	-3.20	3.20	14.43	0.17	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	6.61	9.00	-3.20	3.20	14.04	0.17	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	6.73	9.00	-3.20	3.20	13.66	0.18	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0

Concrete Beam

Project File: Stilling Basin Design.ec6

LIC# : KW-06015079, Build:20.24.02.03 JACOBS ENGINEERING (c) ENERCALC INC 1983-2023

DESCRIPTION: Stilling Basin Beam Design

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu Actual	(k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd
+1.60L	1	6.85	9.00	-3.20	3.20	13.27	0.18	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	6.97	9.00	-3.20	3.20	12.89	0.19	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	7.09	9.00	-3.20	3.20	12.50	0.19	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	7.21	9.00	-3.20	3.20	12.12	0.20	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	7.33	9.00	-3.20	3.20	11.73	0.20	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	7.45	9.00	-3.20	3.20	11.35	0.21	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	7.57	9.00	-3.20	3.20	10.96	0.22	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	7.69	9.00	-3.20	3.20	10.58	0.23	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	7.81	9.00	-3.20	3.20	10.19	0.24	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	7.93	9.00	-3.20	3.20	9.81	0.24	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	8.05	9.00	-3.20	3.20	9.43	0.25	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	8.17	9.00	-3.20	3.20	9.04	0.27	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	8.30	9.00	-3.20	3.20	8.66	0.28	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	8.42	9.00	-3.20	3.20	8.27	0.29	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	8.54	9.00	-3.20	3.20	7.89	0.30	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	8.66	9.00	-3.20	3.20	7.50	0.32	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	8.78	9.00	-3.20	3.20	7.12	0.34	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	8.90	9.00	-3.20	3.20	6.73	0.36	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.02	9.00	-3.20	3.20	6.35	0.38	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.14	9.00	-3.20	3.20	5.96	0.40	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.26	9.00	-3.20	3.20	5.58	0.43	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.38	9.00	-3.20	3.20	5.19	0.46	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.50	9.00	-3.20	3.20	4.81	0.50	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.62	9.00	-3.20	3.20	4.42	0.54	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.74	9.00	-3.20	3.20	4.04	0.59	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.86	9.00	-3.20	3.20	3.65	0.66	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	9.98	9.00	-3.20	3.20	3.27	0.73	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	10.10	9.00	-3.20	3.20	2.89	0.83	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	10.22	9.00	-3.20	3.20	2.50	0.96	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	10.34	9.00	-3.20	3.20	2.12	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	10.46	9.00	-3.20	3.20	1.73	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	10.58	9.00	-3.20	3.20	1.35	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	10.70	9.00	-3.20	3.20	0.96	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	10.82	9.00	-3.20	3.20	0.58	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0
+1.60L	1	10.94	9.00	-3.20	3.20	0.19	1.00	34.60	Vu <= Phi*lambd	t Reqd pe	34.6	0.0

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	11.000	17.57	84.74	0.21
Span # 1	1	11.000	17.57	84.74	0.21
+1.60L					
Span # 1	1	11.000	17.57	84.74	0.21
L Only					
Span # 1	1	11.000	10.98	84.74	0.13

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	.ocation in Span (ft	Load Combination	Max. "+" Defl (in)	ocation in Span (ft
L Only	1	0.0071	5.500		0.0000	0.000