Attachment "A"

South Florida Water Management District
Culvert 8 (S-268) Pump Attachment

Corrected Final (RTA) Design Report
Project I.D. No. 101009
June 15, 2017

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Engineer's Project No. 41091-002

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41091-001

Executive Summary

Culvert 8 is a US Army Corps of Engineers (USACE) Central & Southern Florida project culvert through the Herbert Hoover Dike (HHD) in Okeechobee County serving the S133 basin. It is located northeast of Lake Okeechobee (the Lake). The USACE identified Culvert 8 for replacement in the February 2011 Environmental Assessment Report for the Herbert Hoover Dike Culvert Replacement and Removal Project. As with all of the culvert replacement projects associated with the Lake, the USACE coordinated with South Florida Water Management District (the District) to ensure that flood control and water supply issues were adequately addressed, and that the culvert replacements serve the needs of both agencies. The USACE has completed the engineering design for the Culvert 8 replacement and will remove (as part of the construction) the District's existing sheetpile weir, which is located landside at the edge of the Federal right-of-way. This weir historically maintained water levels in the S133 basin at or below approximately 11.73 ft. NAVD88 (13 ft. NGVD). When the S133 pump station is unable to maintain water level within the regulation schedule, especially after a large storm event, the District installs portable pumps at Culvert 8 to pump over HHD to the Lake.

The USACE design for the Culvert 8 Replacement includes accommodations in the landside culvert headwall structure to allow the District to place a weir within what the USACE design terms the "emergency bulkhead slot" and continue maintaining the existing flood control function. In order to enhance the function of the weir for the new Culvert 8 design, the District desires to design, fabricate, and install modified weirs at Culvert 8 after the structure replacement is complete. The objective of this design is to enable the District to maintain water levels in the S133 basin at approximately 11.73 ft. NAVD by gravity when Lake water levels allow and via pumping when levels exceed 11.73 ft. NAVD. To accommodate a pumped flow condition, provisions are included for the District to (temporarily) add a bulkhead extension to the weir and install submersible hydraulic pumps to move stormwater to the Lake following large storm events when the Lake water levels are too high for gravity discharge.

The design presented herein describes three fabricated bulkheads which each include 42-inch MWI flanges to be compatible with the District's existing 42-inch MWI submersible hydraulic pumps (model HAC 342) and three fabricated bulkhead extensions to accommodate pumping when lake levels are above 11.73 ft. NAVD. The pumps, having a matching 42-inch MWI flange, can be bolted directly to the bulkheads and powered by diesel drive units on the access platform surrounding the headwall structure. Use of the submersible hydraulic pumps in this arrangement is facilitated by a MWI 90-degree intake for each pump. In addition, the design includes 42"x30" reducers to allow use of the District's 30-inch MWI submersible hydraulic pumps (model HAC 330) in the event the 42-inch pumps are not available and 42"x24" reducers to allow for use of 24-in MWI submersible hydraulic pumps (HAC 324) which are readily available in the rental market.

The District weir will have a finished height of 8.23 ft. above the culvert floor elevation of EL 3.5 ft. NAVD. This will provide a crest elevation of 11.73 ft. NAVD (13 ft. NGVD) allowing the bulkhead to act as a weir under gravity flow scenarios (Lake EL <11.73 ft. NAVD). During such times, blind flanges would be installed over the 42-inch landside flanged penetrations. Once the Lake level rises above EL 11.73 ft. NAVD and gravity flow is no longer possible, the blind flanges can be removed and the submersible hydraulic pumps installed on the bulkheads. This can be done underwater with divers or above grade via removal of the modified weirs. Once the pump attachment is complete, a bulkhead extension (stop log)

would be added to raise the bulkhead crest elevation to EL 19.96 ft. NAVD. It is noted that while this is below the culvert height of EL 20.0 ft. NAVD, design of the bulkhead extension with a height of 8.23 ft. to EL 19.96 ft. NAVD will allow the bulkhead to have dual use as a weir during times of gravity flow, if needed.

Section 1: Introduction

Culvert 8 is a US Army Corps of Engineers (USACE) Central & Southern Florida project culvert through the Herbert Hoover Dike (HHD) in Okeechobee County serving the S133 basin. It is located northeast of Lake Okeechobee (the Lake). The USACE identified Culvert 8 for replacement in the February 2011 Environmental Assessment Report for the Herbert Hoover Dike Culvert Replacement and Removal Project. As with all of the culvert replacement projects associated with the Lake, the USACE coordinated with South Florida Water Management District (the District) to ensure that flood control and water supply issues were adequately addressed, and that the culvert replacements serve the needs of both agencies. The USACE has completed the engineering design for the Culvert 8 replacement and will remove (as part of the construction) the District's existing sheetpile weir, which is located landside at the edge of the Federal right-of-way. This weir historically maintained water levels in the S133 basin at or below approximately 11.73 ft. NAVD (13 ft. NGVD). Refer to Appendix 1 for the Army of Corps of Engineers Corpscon v6.0.1 vertical datum conversion factor from NAVD88 to NGVD29. When the S133 pump station is unable to maintain water level within the regulation schedule, especially after a large storm event, the District installs portable pumps at Culvert 8 to pump over HHD to the Lake.

The design presented herein describes three fabricated bulkheads which each include 42-inch MWI flanges to be compatible with the District's existing 42-inch MWI submersible hydraulic pumps (model HAC 342P37) and three fabricated bulkhead extensions to protect against Lake levels above 11.73 ft. NAVD. The pumps, having a matching 42-inch MWI flange, can be bolted directly to the bulkheads and powered by the District's diesel drive units on the access platform surrounding the headwall structure. Use of the submersible hydraulic pumps in this arrangement is facilitated by a MWI 90-degree intake for each pump. In addition, the design includes 42"x30" reducers to allow use of the District's 30-inch MWI submersible hydraulic pumps (model HAC 330) in the event the 42-inch pumps are not available and 42"x24" reducers to allow for use of 24-in MWI submersible hydraulic pumps (HAC 324) which are readily available in the rental market.

Section 2: Operations

It is the District's desire to maintain water levels in the S133 basin at or below approximately 11.73 ft. NAVD (13 ft. NGVD). Operations to accomplish this differ according to two Lake water surface level scenarios and require the use of bulkheads. When Lake water levels are below 11.73 ft. NAVD, excess basin stormwaters can flow to the Lake by gravity over a bulkhead weir. However, when Lake levels exceed EL 11.73 ft. NAVD, an extension must be installed and excess basin waters must be discharged to the Lake via pumping. Both the bulkhead weir and the bulkhead extension are estimated to weigh up to approximately 10,000 lbs and will require the use of a crane for installation as the USACE culvert design does not include a hoist assembly. Likewise, installation of the pump assembly (approximately 6,000 lbs), when needed, will also require use of a crane. Both Lake water surface level scenarios are discussed below:

2.1 Gravity Flow to Lake Okeechobee (Lake EL <11.73 ft. NAVD)

The USACE design for Culvert 8 includes three steel-lined culvert pipes each 10-ft. in diameter and approximately 197 ft. in length with combination gates located at the Lakeside end of the culvert. Three 12.5 ft. wide openings are available on the Landside of the culvert for emergency bulkheads. The openings have a sill elevation of 3.5 ft. NAVD and a top elevation of 20.0 ft. NAVD with vertical rail slots on opposing sides to accommodate a roller-style bulkhead. A roller-style bulkhead weir providing a top elevation of 11.73 ft. NAVD is proposed to allow gravity flow of excess stormwater from the S133 basin when Lake levels are below EL 11.73 ft. NAVD and the combination gates located on the Lakeside of the culvert are open. When Lake levels rise above EL 11.73 ft. NAVD, combination gates on the Lakeside of the culvert must be closed to prevent flooding of the S133 basin or installation of a bulkhead extension must be added and pumps installed to discharge excess stormwaters to the Lake. The bulkhead extension proposed is 8.23 ft. in height and, once installed on top of the bulkhead weir, will raise the Landside bulkhead elevation to 19.96 ft. NAVD. It is noted that the highest recorded Lake elevation was 17.5 ft. NAVD (18.77 ft. NGVD) and occurred on November 2, 1947. While extension to EL 19.96 provides about 18-inches of freeboard from this level, design of the bulkhead extension with a height of 8.23 ft. will allow it to be used interchangeably as a bulkhead weir during times of gravity flow, if necessary.

2.2 Pumped Flow to Lake Okeechobee (Lake EL >11.73 ft. NAVD)

The USACE design for Culvert 8 includes three steel-lined culvert pipes each 10-ft. in diameter and approximately 197 ft. in length with combination gates located at the Lakeside end of the culvert. Three 12.5 ft. wide openings are available on the Landside of the culvert for emergency bulkheads. The openings have a sill elevation of 3.5 ft. NAVD and a top elevation of 20.0 ft. NAVD with vertical rail slots on opposing sides to accommodate a roller-style bulkhead. A roller-style bulkhead weir providing a top elevation of 11.73 ft. NAVD is proposed to allow gravity flow of excess stormwater from the S133 basin when Lake levels are below EL 11.73 ft. NAVD and the combination gates located on the Lakeside of the culvert are open. When Lake levels rise above EL 11.73 ft. NAVD, pumps must be installed to discharge excess stormwaters to the Lake to prevent flooding of the S133 basin.

Each of the modified bulkhead weirs has a 42-inch flanged penetration which incorporates a MWI bolt pattern on the Landside and a 42-in flap gate on the Lakeside. During gravity flow, a blind flange remains

in place on the Landside of the bulkhead. When pump installation is required on one or more of the bulkheads, the blind flange must be removed and the pump installed. A flap gate located on the Lakeside of the bulkhead penetration will prevent Lake water from flowing directly into the S133 basin through the penetration and allow installation of the pumps. Once the pumps are installed, a bulkhead extension must be added prior to operation to raise the bulkhead elevation and prevent short-circuiting of the pumped flow. A crane must be mobilized to install the bulkhead extension as the USACE culvert design does not include a hoist assembly.

Assuming an operation of gravity flow to the Lake via the bulkhead weirs, once it has become apparent that pumps are required, the following steps should be taken:

1. Mobilize a crane and divers.
2. Deploy divers and remove the 42-inch blind flange from one or more of the modified bulkhead weirs as needed.
3. Install submersible hydraulic pump assemblies at one or more of the three bulkhead weirs.
4. Install bulkhead extensions at each of the three bulkhead weirs (EL 11.73 ft. NAVD) to raise bulkhead elevation to EL 19.96 ft. NAVD.
5. Install submersible hydraulic pump drive units within fenced-in access area.
6. Make submersible hydraulic pump connections to each pump drive unit.
7. Ensure Lakeside combination gates are open.
8. Begin pump operations at lowest speed (to avoid damage to flap gate) until flow is initiated, then adjust to desired speed/flow rate.

Once pumps are no longer required, the following steps should be taken to restore gravity flow over the bulkhead weir:

1. Mobilize a crane and divers.
2. Slow pump operations to lowest speed (to avoid damage to flap gate), then shut down pumps.
3. Deploy divers and disconnect pumps from drive units.
4. Ensure all flap gates are closed and seated.
5. Remove pump assemblies from bulkhead weir.
6. Install blind flanges at each bulkhead as needed.
7. Remove pump drive units.
8. Remove bulkhead extension.
9. Ensure Lakeside combination gates are open.

It is noted that installation of the pump assemblies can be performed above grade without the use of divers. Once the pump assembly and hydraulic hoses are attached, lifting and installation of the bulkhead-pump assembly unit can then be made. Care must be taken to ensure hydraulic hoses are protected during installation of the bulkhead extension.

2.3 Hurricane Protocol

In the event of a hurricane, USACE protocol is to close and lock all culvert gates. If pumping equipment is in place at the Culvert 8 bulkheads and the District wishes it remain in place during a storm, the hydraulic hoses should be disconnected, capped and secured until the USACE unlocks HDD gates and returns the culvert to normal operations. No action is necessary if pumping equipment is not installed and is already stored in a protected location.

Section 3: Design Calculations

3.1 Pumped Flow Estimates

The USACE design for Culvert 8 includes three steel-lined culvert pipes each 10-ft. in diameter and approximately 197 ft. in length with combination gates installed on the Lakeside of the culvert. As the District expects to discharge up to 200 cfs when pumped flow is needed, approximately 67 cfs can be expected through each culvert pipe presenting velocities under 0.9 fps. Assuming a Hazen-Williams C-factor of 100, headloss through the culverts is expected to be negligible (<0.1 inches). Therefore, discharge can be determined directly from the available pumps and the head differential between the S133 basin and the Lake water surface levels. Because basin levels below EL 11.73 ft. NAVD do not require flood control measures, this is assumed to be the lowest upstream level. Pumped flow scenarios can then be assumed to begin when water levels in the S133 basin exceed EL 11.73 ft. NAVD and the S-133 Pump Station is at maximum capacity. It is known that the maximum Lake level recorded occurred in 1947 at EL 17.5 ft. NAVD (18.77 ft. NGVD). Therefore, static heads of up to approximately 6 ft. (worst case) would be expected under the pumped flow scenario.

Included as Appendix 2 are manufacturer pump curves for the District's existing MWI model HAC 342 and HAC 330 submersible hydraulic pumps. Additionally, pump curves are included for MWI HAC 324 pumps (24-inch pumps) which are readily available on the rental market and may necessarily be used if the District's existing pumps are not available. Pump flow rates vary depending on model, blade pitch, pump speed and head differential. As mentioned above, static head differential will vary depending on S133 basin and Lake water levels, however a maximum of approximately 6 ft. can be anticipated based on the highest recorded Lake level and a S133 basin level of 11.73 ft. NAVD. Dynamic headloss for this installation is a function of flow through the pump assembly and includes the 90-degree intake, flap gate and, in the case of the HAC 330 and HAC 324 pumps, 42"x30" and 42"x24" reducers, respectively. Dynamic losses were estimated for each pump model under the worst case static head and range from a maximum of about 3 feet for the HAC 324 to 5 feet for the HAC 342. Table 3.1 below presents the anticipated flow rate through each model of the District's hydraulic submersible pumps as well as those available on the rental market.

Table 3.1 Culvert 8 Pumped Flow Rates at Worst Case Water Surface Differential

Pump Model	Blade Pitch	Minimum Speed (rpm)	Maximum Speed (rpm)	Minimum Flow (cfs)	Maximum Flow (cfs)
HAC342	P37	200	440	40	156
HAC330	P0	294	588	18	58
HAC330	P12	294	588	21	65
HAC330	P25	294	588	23	71
HAC330	P37	294	588	27	78
HAC324	P0	352	750	11	25
HAC324	P12	352	750	11	42
HAC324	P25	352	750	13	47
HAC324	P37	352	750	14	51

As shown in Table 3.1, a total flow rate of 200 cfs can be achieved using the proposed available bulkhead penetrations, depending on the pump assembly installed, number of pumps, and existing water surface elevations.

3.2 Structural Calculations

The basis used for the bulkhead configuration is the District standard details for roller gates. The structural design of the lower roller gate (bulkhead weir) and upper roller gate (bulkhead extension) was performed considering two load cases. Case 1 assumes full head of water (16.46 ft) on one side of the gate assembly and no water on the opposite side. This case was considered as the worst case scenario but is unlikely to occur. Case 2 assumes full head of water on one side (16.46 ft) and 8.23 ft on the opposite side.

Calculations show that reactions are typically higher for Case 1 depending on the number of rollers assumed. Analysis of Case 1 indicates that the gate components identified on the District standard details are acceptable with a maximum load on the rollers of 11200 pounds when 5 rollers are used per side. An analysis was performed to determine the effect of reducing the number of rollers. The maximum reaction on the rollers when 4 rollers are used is 14100 pounds, and with 3 rollers the maximum reaction is 20200 pounds.

Analysis of Case 2 indicates that the gate components identified on the District standard details are acceptable. Case 2 was used as the basis for preparing the drawings. The maximum reaction on the rollers when 4 rollers and one pilot roller is used is 15600 pounds.

Appendix 3 contains the calculations described above.

Section 4: Technical Specifications

Because this project primarily includes the procurement of equipment necessary to provide for gravity flow from the S-133 basin to the Lake and the ability to use existing temporary pumps in the future when water levels in the S-133 basin exceed EL 11.73 ft. NAVD and the S-133 Pump Station is at maximum capacity, minimal construction services other than fabrication, initial installation and dry fit testing of the bulkheads, are envisioned. Subsequent mobilizations and demobilizations can be added depending upon District preferences. The list of technical specifications for the project are included in Appendix 4.

Section 5: Engineer's Opinion of Probable Cost

Based on quotes from manufacturers, an opinion of probable construction cost at this final stage of design for the project is presented in Table 5.1 below. Supporting cost documentation, including vendor quotes, is included in Appendix 5. It is noted that while either of the bulkheads can be used as a weir for gravity flow scenarios, only the bulkheads with the 42-inch penetrations accommodate the submersible hydraulic pumps and must be used in the bottom position when pumping is required.

Table 5.1 Culvert 8 Pump Attachment Opinion of Probable Cost South Florida Water Management District						
Description	**Quantity**	**Unit**	**Unit Cost**	**Material**	**Installation**	**Total**
ROLLER GATES AND APPURTENANCES						
Upper Roller Gate (Bulkhead Weir) with 42-inch Flap Gate	3	Each	$ 201,683	$ 605,050	$ -	$ 605,050
Lower Roller Gate (Bulkhead Extension)	3	Each	$ 152,267	$ 456,800	$ -	$ 456,800
42" Blind Flange (MWI Bolt Pattern)	3	Each	$ 20,455	$ 61,365	$ -	$ 61,365
42” x 24” MWI Flanged Reducer	2	Each	$ 1,695	$ 3,390	$ -	$ 3,390
42” x 30” MWI Flanged Reducer	2	Each	$ 3,250	$ 6,500	$ -	$ 6,500
Lift Bar for Roller Gate	1	Each	$ 4,000	$ 4,000	$ -	$ 4,000
Lift Bar for Roller Gate with Pump Assembly	1	Each	$ 8,000	$ 8,000	$ -	$ 8,000
CRANE						
Crane Rental	2	Week	$ 30,000	$ -	$ 60,000	$ 60,000
TESTING						
MWI Pump HAC324 (24-inch) with 90 Degree Intake [1]	1	Pump Assembly Rental, per Week	$ 1,500	$ -	$ 1,500	$ 1,500
MWI Pump HAC330 (30-inch) with 90 Degree Intake [1]	1	Pump Assembly Rental, per Week	$ 1,785	$ -	$ 1,785	$ 1,785
MWI Pump HAC342 (42-inch) with 90 Degree Intake [1]	1	Pump Assembly Rental, per Week	$ 2,730	$ -	$ 2,730	$ 2,730
Manufacturer Field Services	1	Week	$ 7,750	$ -	$ 7,750	$ 7,750
Contractor Services [2],[3]	1	LS	$ 122,000	$ -	$ -	$ 122,000
Total Direct Project Cost				$ 1,145,105	$ 73,765	**$ 1,340,870**
Sales Tax [3]	6.5%			$ 74,432	$ 4,795	$ 79,227
Field Office Overhead (FOOH)	0%					$ -
Home Office Overhead (HOOH)	0%					$ -
Subtotal Cost With Overhead						**$ 1,420,097**
Profit	12%					$ 170,412
Construction Cost						**$ 1,590,508**
Bonds	1.5%					$ 23,858
Total Project Construction Cost						**$ 1,614,400**
					Low Range -5%	**$ 1,533,680**
					High Range +5%	**$ 1,695,120**

Notes:

1. Pump drive unit omitted; it is not required for dry testing.
2. Includes mobilization, contractor services during construction, and demobilization. Labor is estimated at one part-time project manager with assistance for duration of the project, one 2-person crew during field verification (2 weeks duration), and one 3-person crew during testing/installation (2 weeks duration).
3. Sales tax not applied to Contractor's Services.

Section 6: Construction Schedule

Construction of the Culvert 8 Pump Attachment Project is estimated as follows:

Table 6.1 Culvert 8 Pump Attachment Construction Schedule

Item	Duration
Field verification of dimensions	2 weeks
Shop drawing development and approval	6 weeks
Fabrication and delivery	18 weeks
Installation and Testing	2 week
Total	**28 weeks**

Section 7: Permitting

Culvert 8 is a USACE Central & Southern Florida project culvert through the HHD in Okeechobee County serving the S133 basin. The USACE identified Culvert 8 for replacement in the February 2011 Environmental Assessment Report for the Herbert Hoover Dike Culvert Replacement and Removal Project. As with all of the culvert replacement projects associated with the Lake, the USACE coordinated with the District to ensure that flood control and water supply issues were adequately addressed, and that the culvert replacements serve the needs of both agencies. Because use and/or modification of the culvert must comply with USACE guidelines, the bulkhead designs and their intended uses must be submitted to USACE for approval. Per District policy, this will be performed by District personnel at the final design stage.

Section 8: Design Review Comments / Resolution

Appendix 6 summarizes both the Preliminary and Final Design submittal review comments and resolutions. The Final Design Phase Technical Review Briefing (TRB) Consensus Sheet is included.

Appendix 1: Conversion from NGVD29 to NAVD88, Corpscon v6.0.1 Program, U.S. Army Corps of Engineers

Attachment "A"

Office

Project

27 July 2016

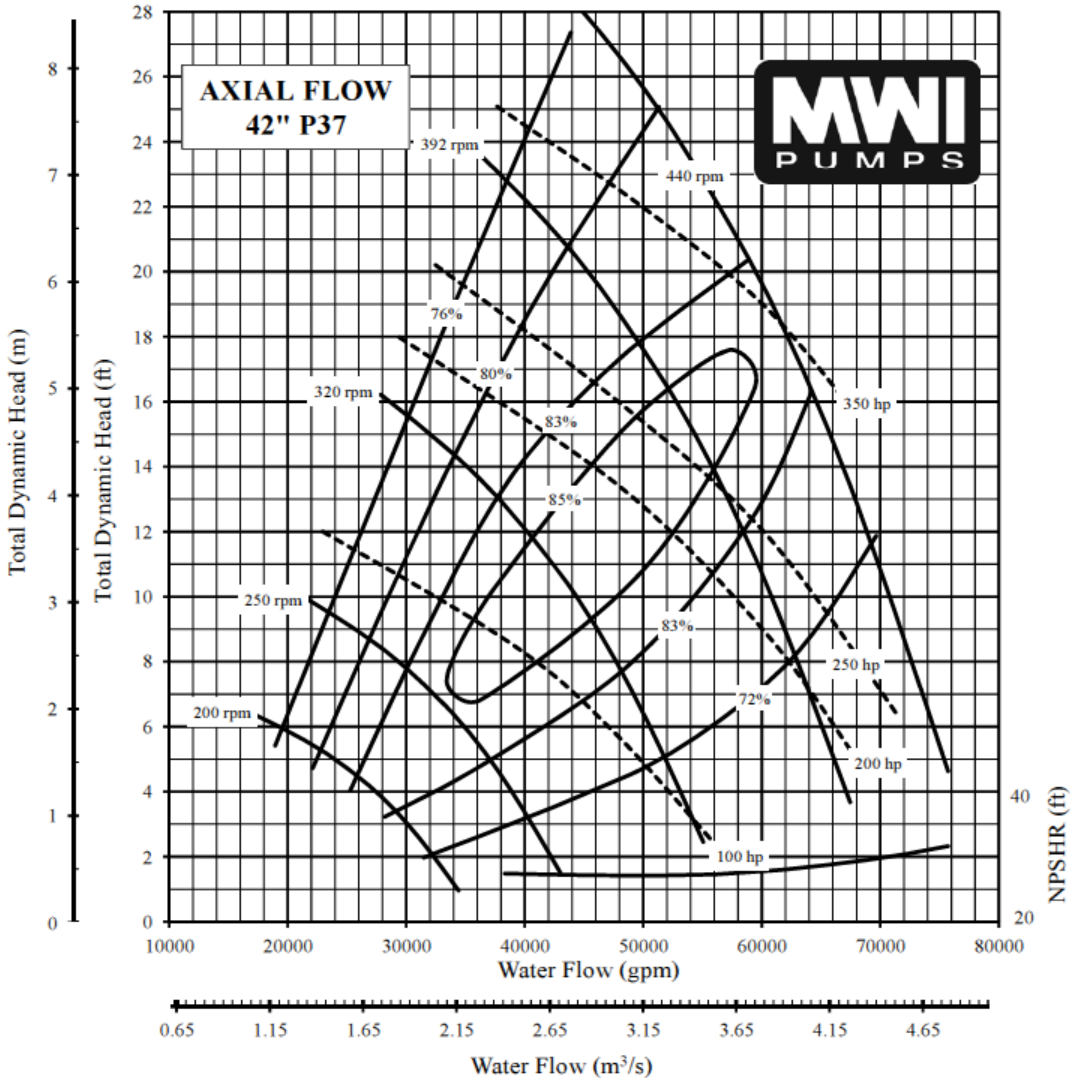
INPUT	OUTPUT
Geographic, flhpgn - Florida HPGN	State Plane, flhpgn - Florida HPGN
Vertical - NGVD29 (Custom), U.S. Feet	0901 - Florida East, U.S. Feet
	Vertical - NAVD88, U.S. Feet

Culvert 8

Latitude:	27 12 08.03
Longitude:	80 46 46.86
Elevation/Z:	0
Northing/Y:	1042747.576
Easting/X:	727777.418
Elevation/Z:	-1.270
Convergence:	0 06 02.57155
Scale Factor:	0.999947055
Combined Factor:	0.999951304

Remark:

Appendix 2: Submersible Hydraulic Pump Curves



PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 42"
MODEL NO: NC342P37	SPEED: As Noted
INTAKE DIA: 63"	DISCHARGE COLUMN DIA: 42"
CURVE NO.: VS342P37A	Ns: 11300 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PERFORMANCE CHARACTERISTICS OF THE MWI PUMP MODEL SHOWN AND WAS OBTAINED BY SCALE MODEL TEST AND CALCULATIONS IN ACORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE.

MWI CORPORATION
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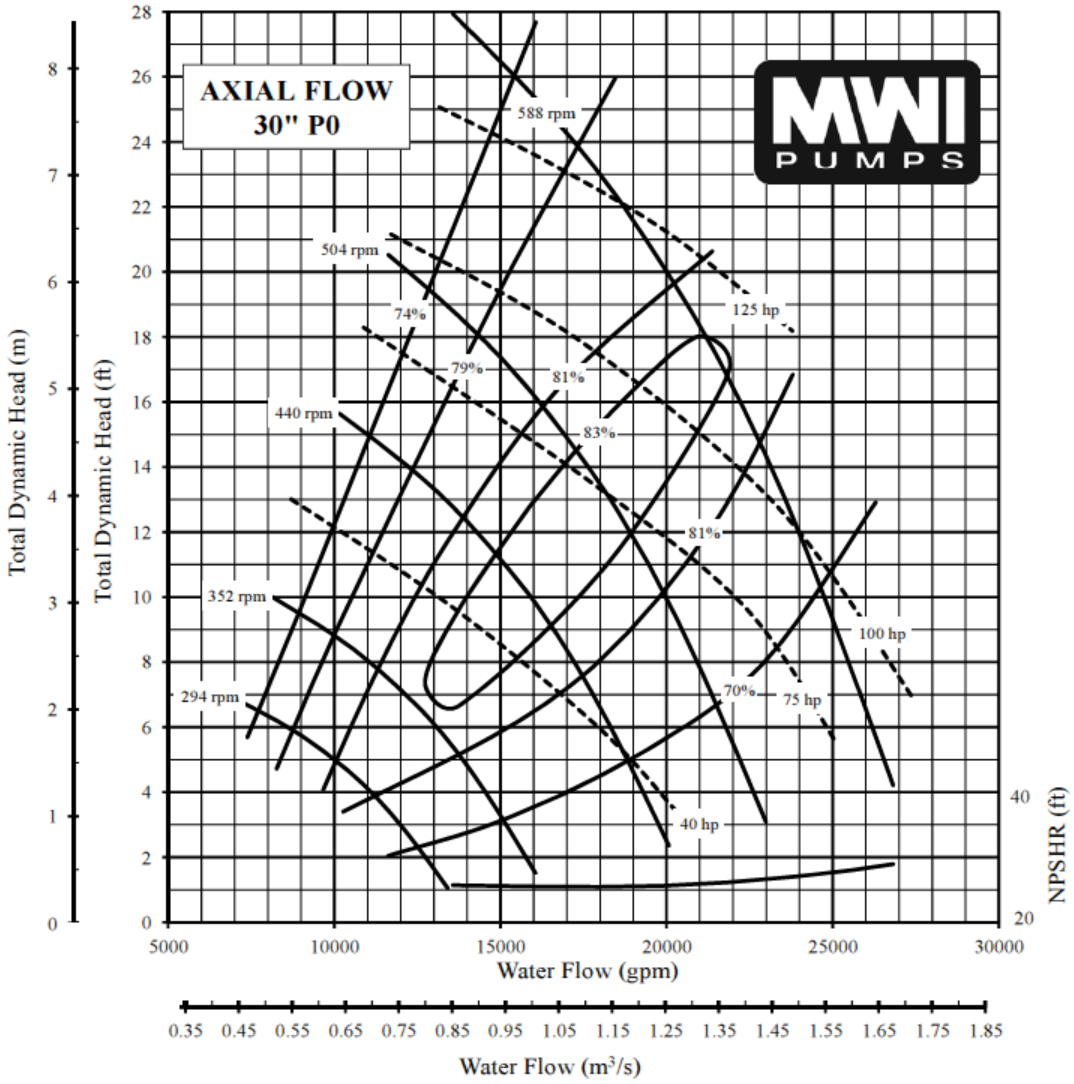
MWI CORPORATION
Deerfield Beach, Florida



PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 30"
MODEL NO: NC330P0	SPEED: As Noted
INTAKE DIA: 45"	DISCHARGE COLUMN DIA: 30"
CURVE NO.: VS330P0A	Ns: 9600 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

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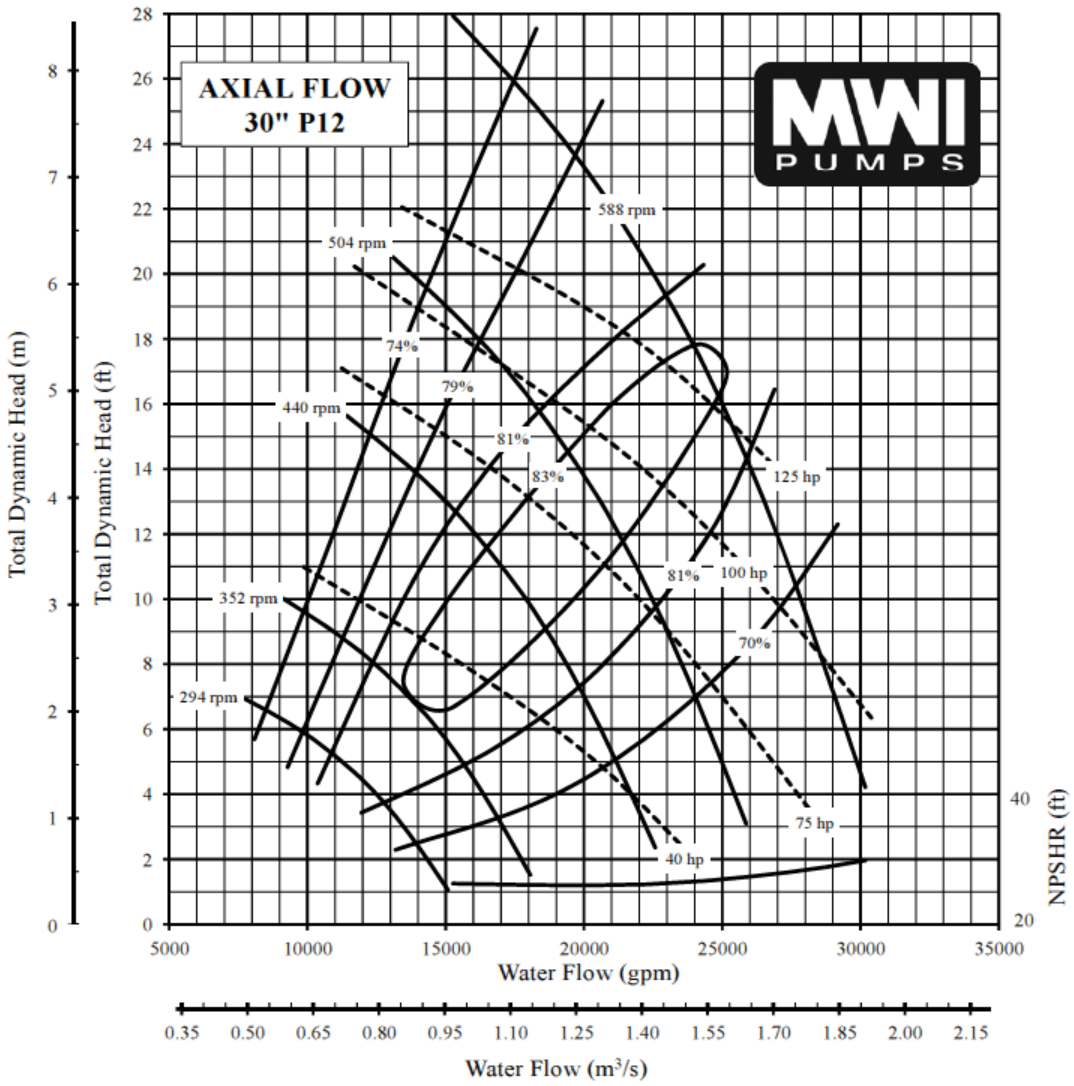

PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 30"
MODEL NO: NC330P12	SPEED: As Noted
INTAKE DIA: 45"	DISCHARGE COLUMN DIA: 30"
CURVE NO.: VS330P12A	Ns: 10200 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PERFORMANCE CHARACTERISTICS OF THE MWI PUMP MODEL SHOWN AND WAS OBTAINED BY SCALE MODEL TEST AND CALCULATIONS IN ACORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE.

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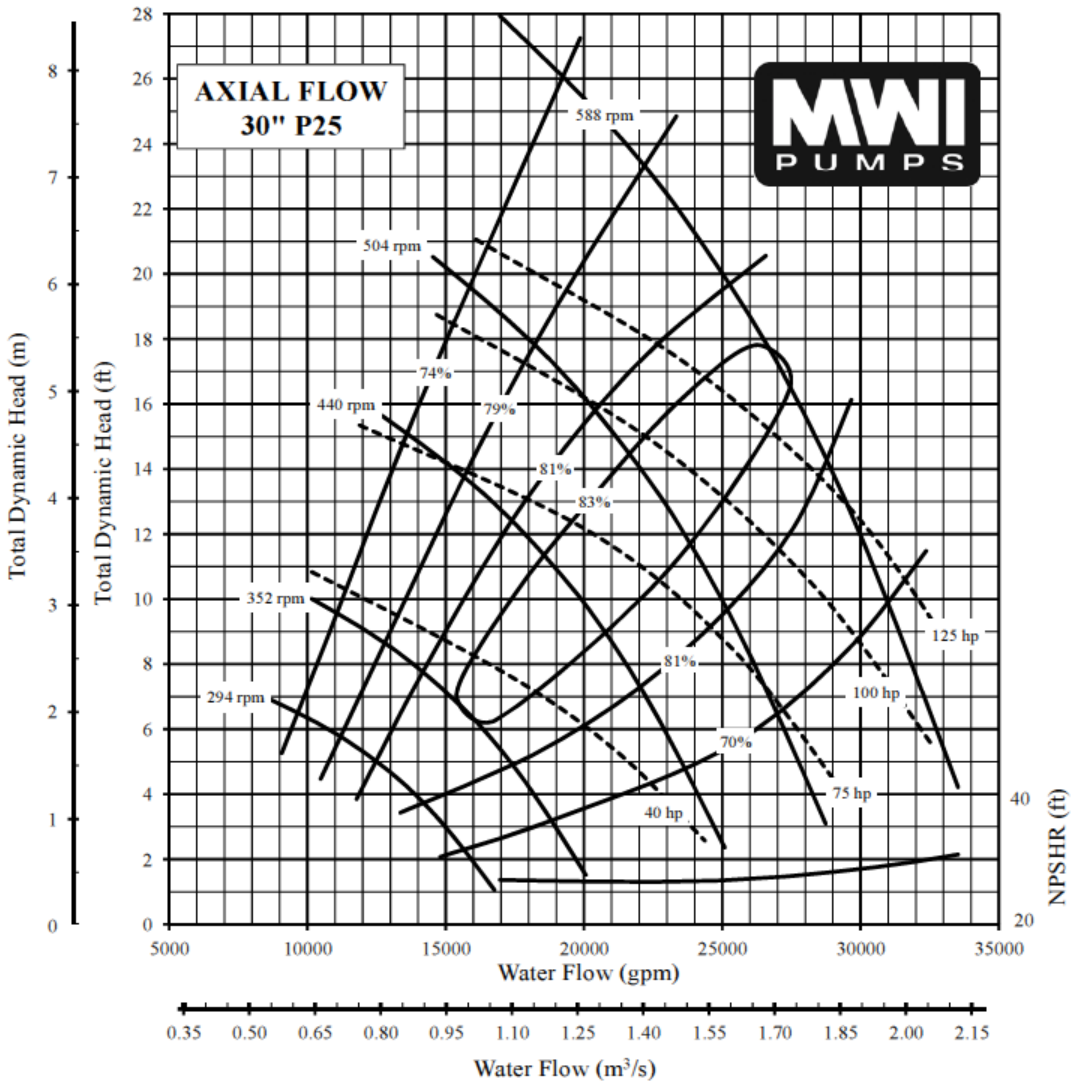

PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 30"
MODEL NO: NC330P25	SPEED: As Noted
INTAKE DIA: 45"	DISCHARGE COLUMN DIA: 30"
CURVE NO.: VS330P25A	Ns: 10900 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

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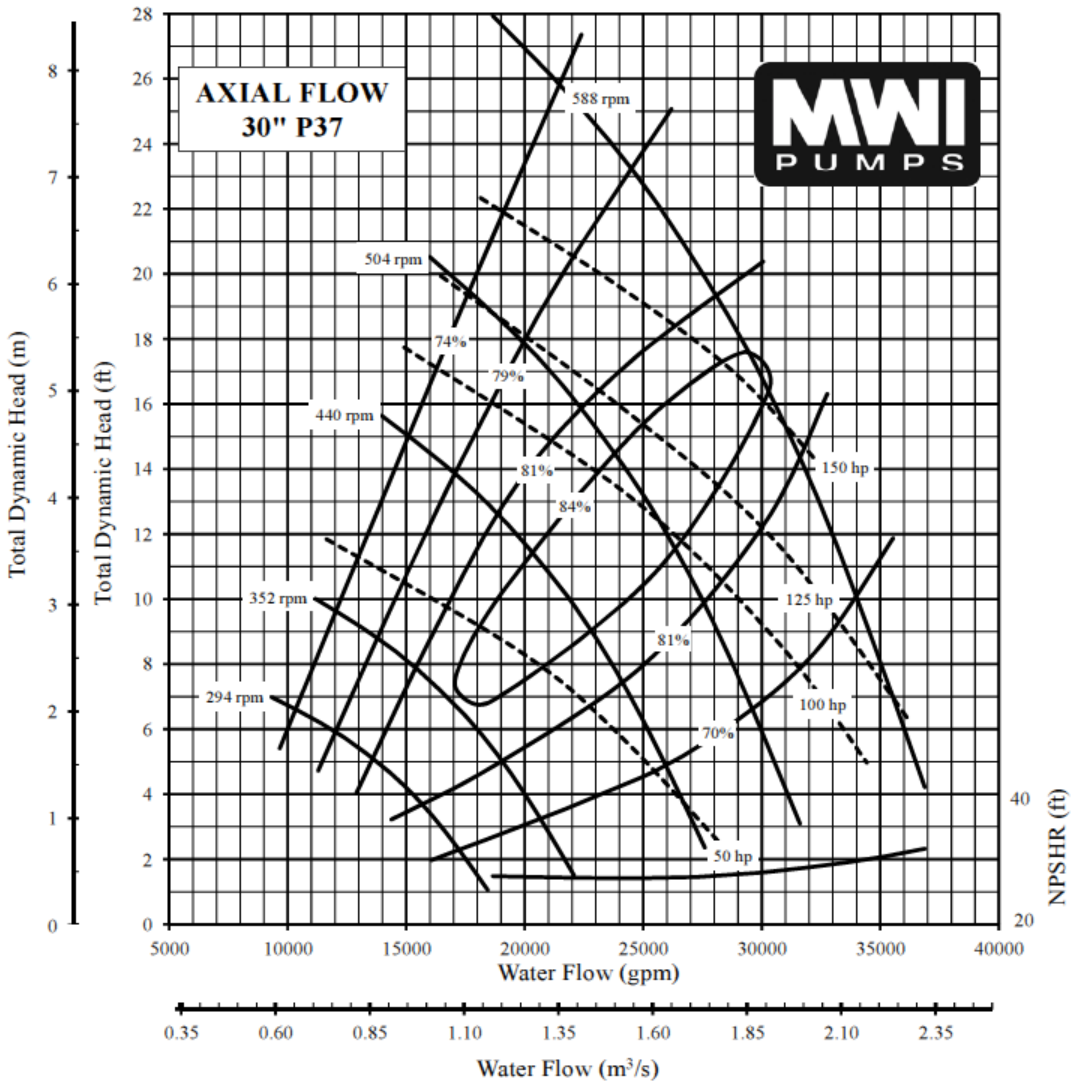

PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 30"
MODEL NO: NC330P37	SPEED: As Noted
INTAKE DIA: 45"	DISCHARGE COLUMN DIA: 30"
CURVE NO.: VS330P37A	Ns: 11300 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PERFORMANCE CHARACTERISTICS OF THE MWI PUMP MODEL SHOWN AND WAS OBTAINED BY SCALE MODEL TEST AND CALCULATIONS IN ACORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE.

MWI CORPORATION
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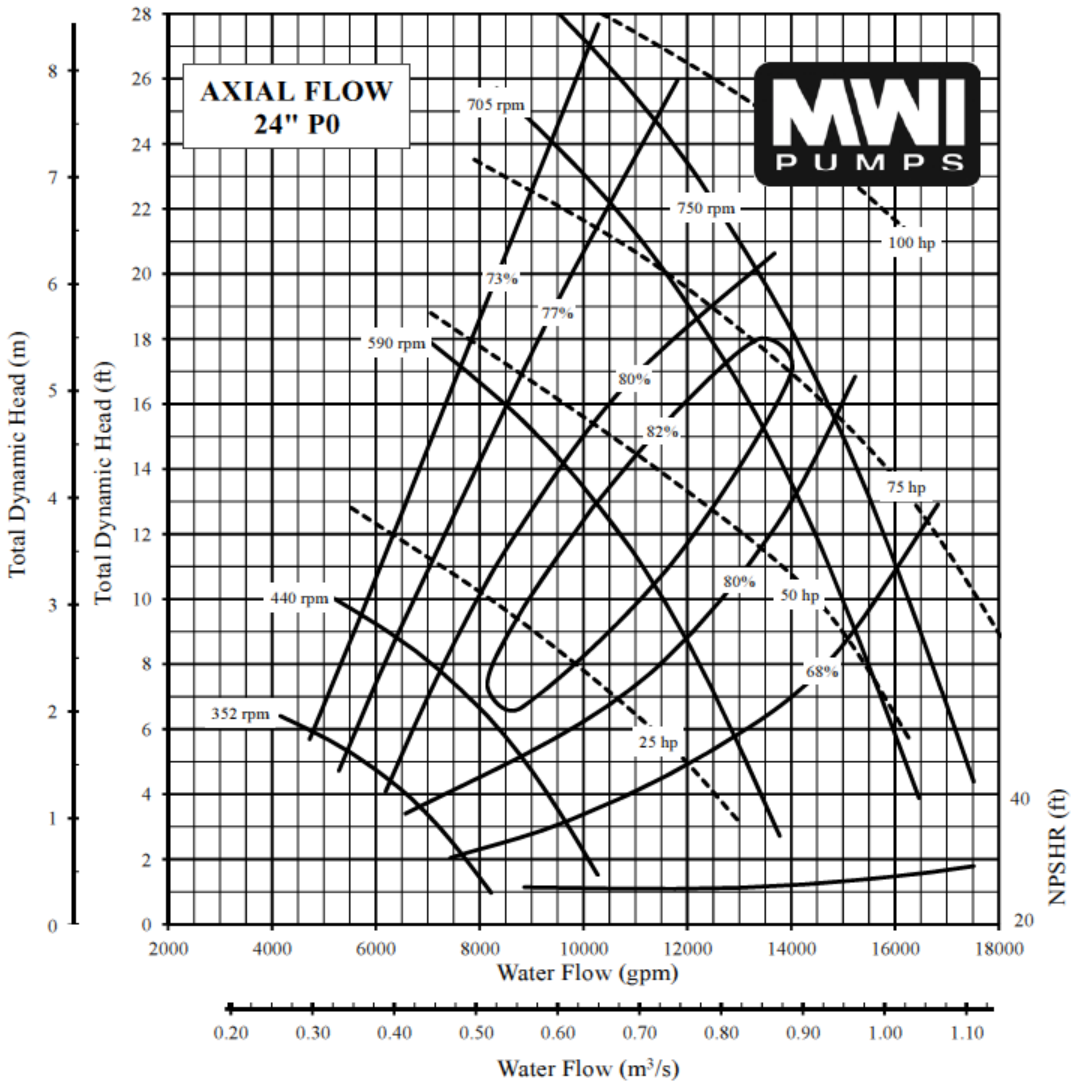
Deerfield Beach, Florida



PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 24"
MODEL NO: NC324P0	SPEED: As Noted
INTAKE DIA: 36"	DISCHARGE COLUMN DIA: 24"
CURVE NO.: VS324P0A	Ns: 9600 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

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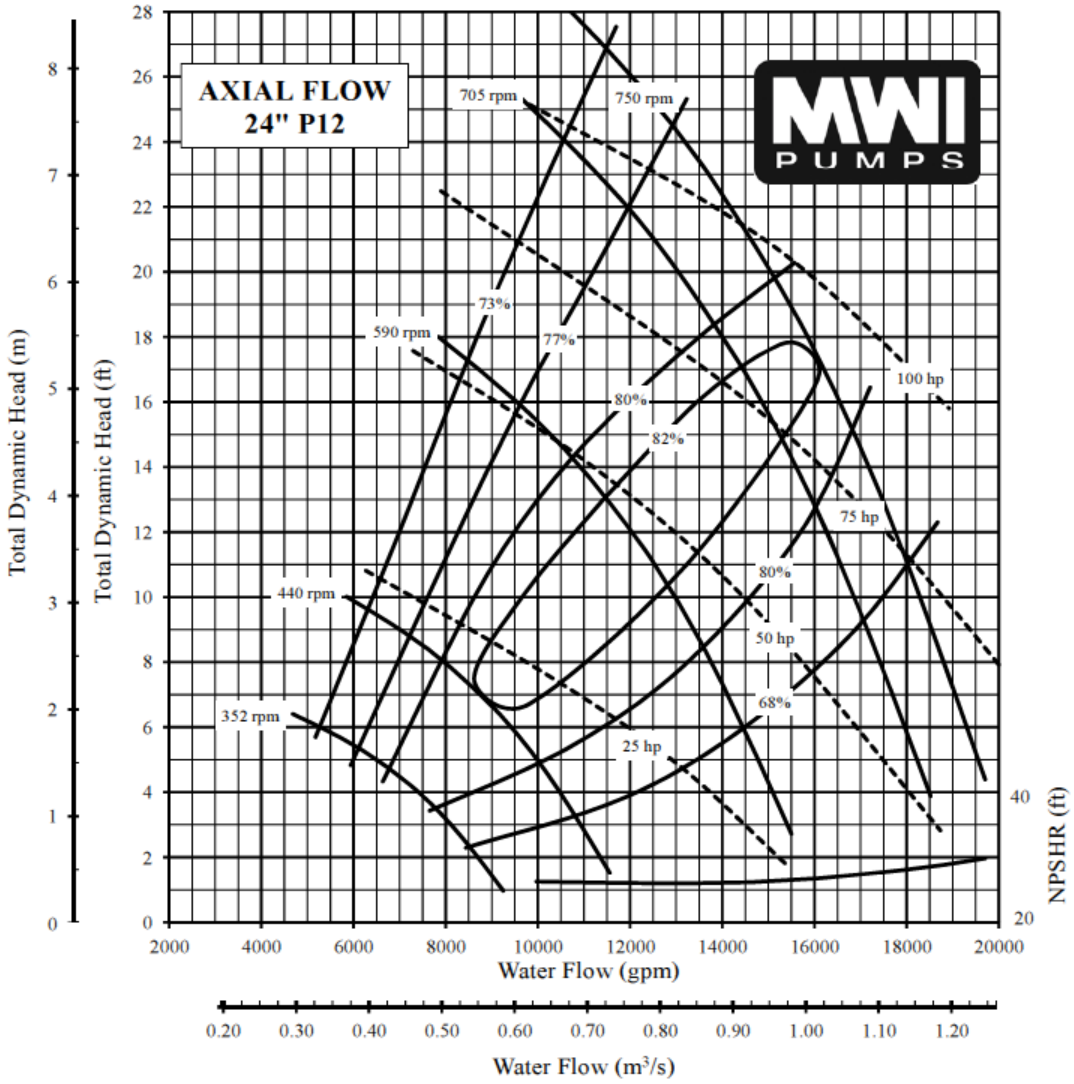

PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 24"
MODEL NO: NC324P12	SPEED: As Noted
INTAKE DIA: 36"	DISCHARGE COLUMN DIA: 24"
CURVE NO.: VS324P12A	Ns: 10200 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PERFORMANCE CHARACTERISTICS OF THE MWI PUMP MODEL SHOWN AND WAS OBTAINED BY SCALE MODEL TEST AND CALCULATIONS IN ACORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE.

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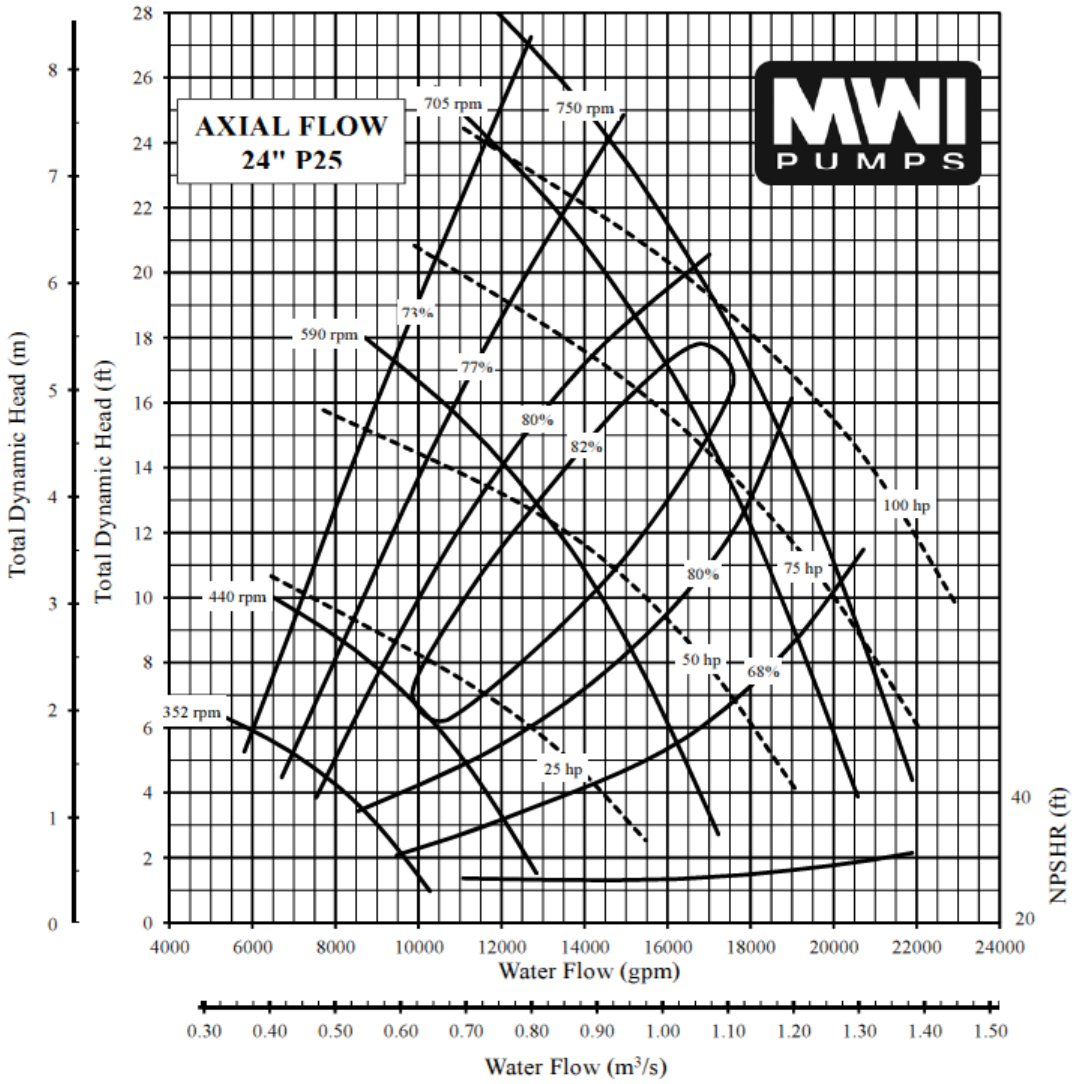

PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 24"
MODEL NO: NC324P25	SPEED: As Noted
INTAKE DIA: 36"	DISCHARGE COLUMN DIA: 24"
CURVE NO.: VS324P25A	Ns: 10900 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PERFORMANCE CHARACTERISTICS OF THE MWI PUMP MODEL SHOWN AND WAS OBTAINED BY SCALE MODEL TEST AND CALCULATIONS IN ACORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE.

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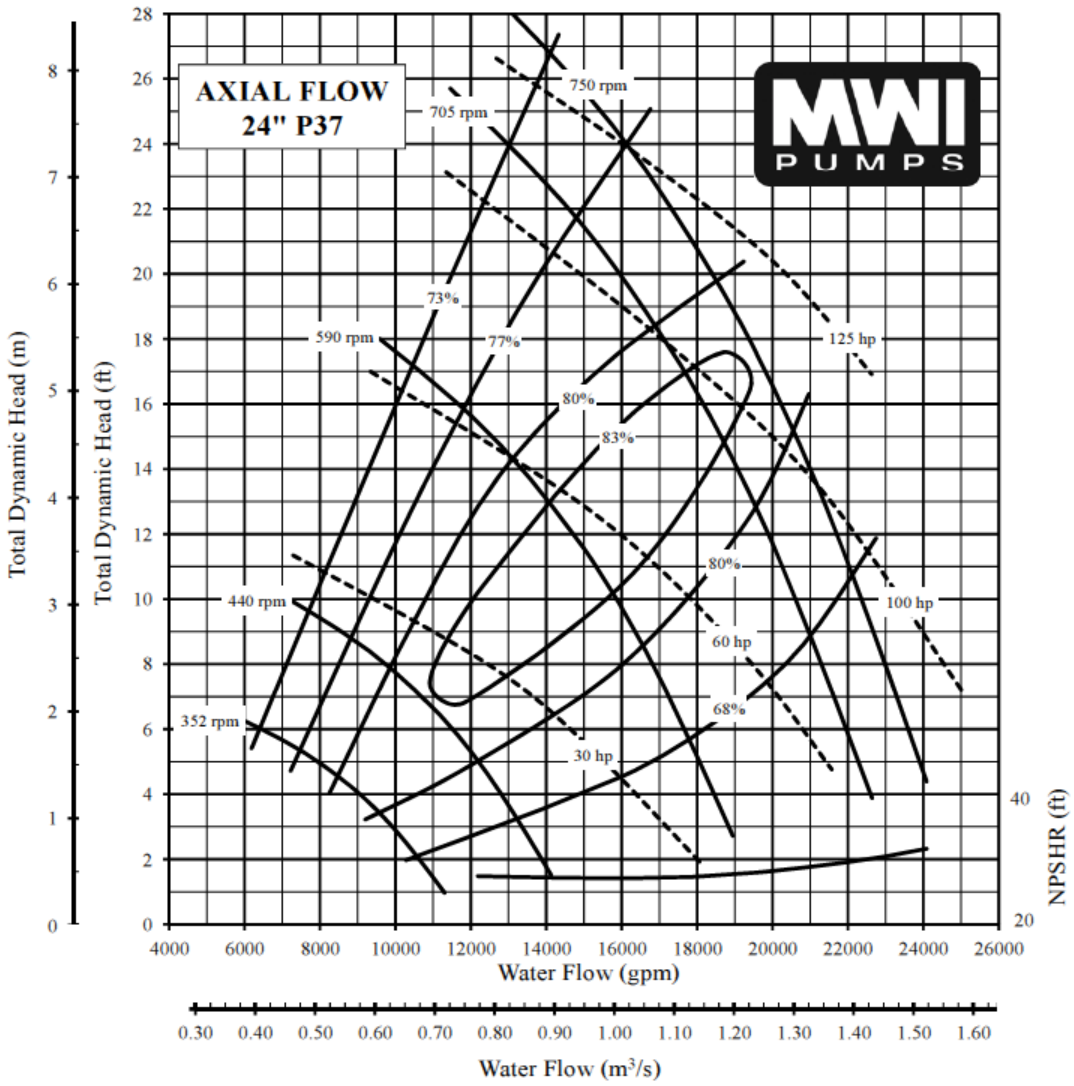

PUMP BOWL PERFORMANCE CURVE	
TYPE: AXIAL FLOW	PROPELLER DIA: 24"
MODEL NO: NC324P37	SPEED: As Noted
INTAKE DIA: 36"	DISCHARGE COLUMN DIA: 24"
CURVE NO.: VS324P37A	Ns: 11300 CODE: 0.50

SINGLE STAGE PERFORMANCE
FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 2.0 AND EFFICIENCY BY 1.0.
PERFORMANCE IS BASED ON PUMPING CLEAR, NON-AERATED WATER, WITH A SPECIFIC GRAVITY OF 1.0, TEMPERATURE 85 °F OR LESS AND AT SEA LEVEL. PUMP PERFORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITY, ALTITUDES AND SUMP CONDITIONS.

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Deerfield Beach, Florida

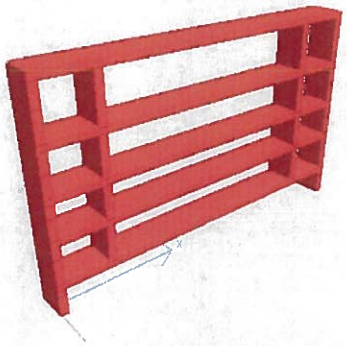
Appendix 3: Structural Calculations

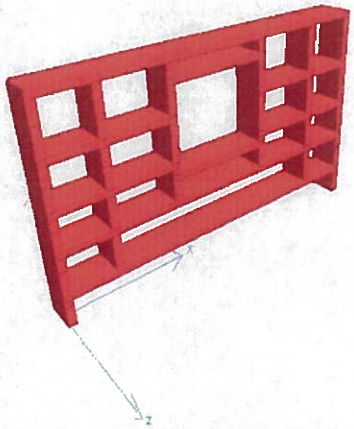
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

CULVERT 8 (S-268) PUMP ATTACHMENT

STRUCTURAL DESIGN CALCULATIONS

Building Code: Florida Building Code 2014





Designed: Jean Paul Silva

QC Check: Shajan Joykutty, P.E. 43323

JEAN PAUL SILVA LICENSE No.66522 STATE OF FLORIDA PROFESSIONAL ENGINEER

1/31/17

Jean Paul Silva, P.E. 66522

Hazen

2101 NW CORPORATE BLVD, SUITE 301
BOCA RATON, FL 33431

Attachment "A"

Hazen

JOB SFWMD - Culvert 8.

SHEET NO. 1 OF 61

CALCULATED BY Jean Paul Silva DATE 1/9/2017

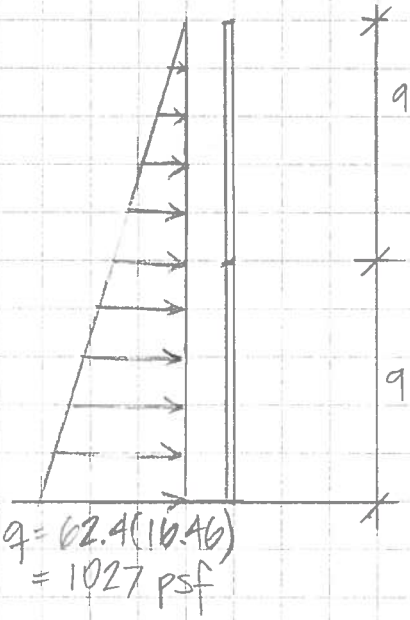
CHECKED BY DATE

SCALE

BULKHEAD.

Total height = 197.5" = 16.46 ft.
Bulkhead is in 2 pieces, but must check bottom piece with full height. Bulkhead pieces will be interchangeable so design of fully loaded will be used for both pieces.

CASE 1.



= 16.46 ft = 197.5"

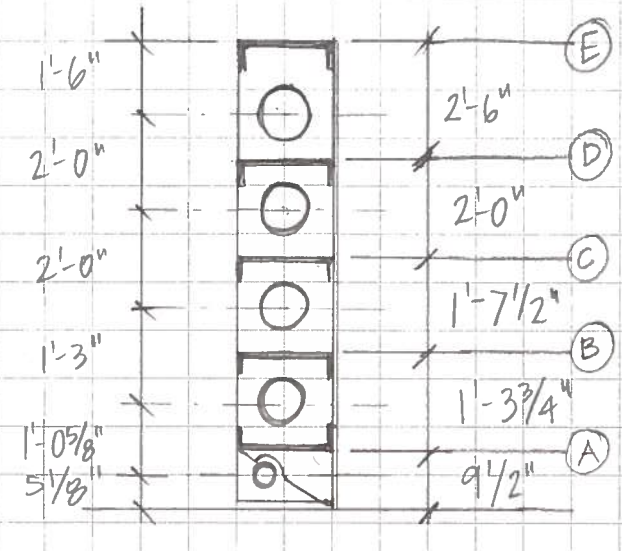
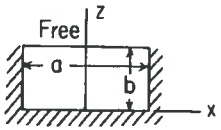


TABLE 11.4 Formulas for flat plates with straight boundaries and constant thickness (*Continued*)

10. Rectangular plate; three edges fixed, one edge (*a*) free



10a. Uniform over entire plate

$$(\text{At } x = 0, z = 0) \quad (\sigma_b)_{\max} = \frac{-\beta_1 q b^2}{t^2} \quad \text{and} \quad R = \gamma_1 q b$$

$$(\text{At } x = 0, z = b) \quad \sigma_a = \frac{\beta_2 q b^2}{t^2}$$

$$\left(\text{At } x = \pm\frac{a}{2}, z = b\right) \quad \sigma_a = \frac{-\beta_3 q b^2}{t^2} \quad \text{and} \quad R = \gamma_2 q b$$

a/b	0.25	0.50	0.75	1.0	1.5	2.0	3.0
β_1	0.020	0.081	0.173	0.321	0.727	1.226	2.105
β_2	0.016	0.066	0.148	0.259	0.484	0.605	0.519
β_3	0.031	0.126	0.286	0.511	1.073	1.568	1.982
γ_1	0.114	0.230	0.341	0.457	0.673	0.845	1.012
γ_2	0.125	0.248	0.371	0.510	0.859	1.212	1.627

(Ref. 49 for $\nu = 0.2$)

10aa. Uniform over $\frac{2}{3}$ of plate from fixed edge

$$(\text{At } x = 0, z = 0) \quad (\sigma_b)_{\max} = \frac{-\beta_1 q b^2}{t^2} \quad \text{and} \quad R = \gamma_1 q b$$

$$\left(\text{At } x = \pm\frac{a}{2}, z = 0.6b \text{ for } a > b \text{ or } z = 0.4b \text{ for } a \leq b\right) \quad \sigma_a = \frac{-\beta_2 q b^2}{t^2} \quad \text{and} \quad r = \gamma_2 q b$$

a/b	0.25	0.50	0.75	1.0	1.5	2.0	3.0
β_1	0.020	0.080	0.164	0.277	0.501	0.710	1.031
β_2	0.031	0.110	0.198	0.260	0.370	0.433	0.455
γ_1	0.115	0.230	0.334	0.424	0.544	0.615	0.674
γ_2	0.125	0.250	0.344	0.394	0.399	0.409	0.393

(Ref. 49 for $\nu = 0.2$)

10aaa. Uniform over $\frac{1}{3}$ of plate from fixed edge

$$(\text{At } x = 0, z = 0) \quad (\sigma_b)_{\max} = \frac{-\beta_1 q b^2}{t^2} \quad \text{and} \quad R = \gamma_1 q b$$

$$\left(\text{At } x = \pm\frac{a}{2}, z = 0.2b\right) \quad \sigma_a = \frac{-\beta_2 q b^2}{t^2} \quad \text{and} \quad R = \gamma_2 q b$$

a/b	0.25	0.50	0.75	1.0	1.5	2.0	3.0
β_1	0.020	0.068	0.110	0.148	0.202	0.240	0.290
β_2	0.026	0.063	0.084	0.079	0.068	0.057	0.040
γ_1	0.115	0.210	0.257	0.291	0.316	0.327	0.335
γ_2	0.111	0.170	0.194	0.185	0.174	0.170	0.180

(Ref. 49 for $\nu = 0.2$)

Attachment "A"

Hazen

JOB SFWMD - Culvert B

SHEET NO. 3 OF 61

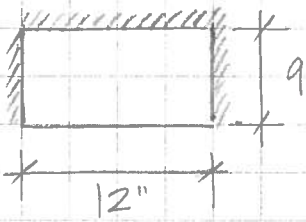
CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1.1. PLATE.

1.1.1) Bottom Area at Center.
3 sides supported, 1 side free.



$p = 1027 \text{ psf} = 7.13 \text{ psi}$

$a = 12"$

$b = 9.5"$

$\frac{a}{b} = \frac{12}{9.5} = 1.26 \rightarrow \beta_1 = \left(\frac{0.727 - 0.321}{1.5 - 1.0}\right)(1.26 - 1.0) + 0.321 = 0.532$

$\beta_2 = \left(\frac{0.484 - 0.259}{1.5 - 1.0}\right)(1.26 - 1.0) + 0.259 = 0.376$

$\beta_3 = \left(\frac{1.073 - 0.511}{1.5 - 1.0}\right)(1.26 - 1.0) + 0.511 = 0.803$

$\gamma_1 = \left(\frac{0.673 - 0.457}{1.5 - 1.0}\right)(1.26 - 1.0) + 0.457 = 0.569$

$\gamma_2 = \left(\frac{0.859 - 0.510}{1.5 - 1.0}\right)(1.26 - 1.0) + 0.510 = 0.692$

$F_{allowable} = 0.6F_y = 0.6(30000) = 18000 \text{ psi}$ ok

$f_{vert\ max} = \frac{\beta_1 q \cdot b^2}{t^2} = \frac{0.532(7.13)(9.5)^2}{(0.375)^2} = 2434 \text{ psi}$

$f_{horiz.\ center\ of\ free\ edge} = \frac{\beta_2 q \cdot b^2}{t^2} = \frac{0.376(7.13)(9.5)^2}{(0.375)^2} = 1721 \text{ psi}$

$f_{horiz\ max\ at\ free\ edge} = \frac{\beta_3 q \cdot b^2}{t^2} = \frac{0.803(7.13)(9.5)^2}{(0.375)^2} = 3674 \text{ psi}$

Attachment "A"

Hazen

JOB SFWMD- Culvert 8

SHEET NO. 4 OF 61

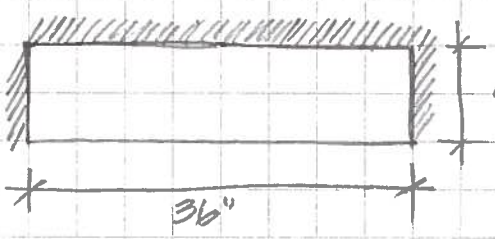
CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1.1.2) Bottom Area at Ends.

3 sides supported, 1 side free.



$P = 1027 psf = 7.13 psi$

$a = 36"$
$b = 9.5"$
$\frac{a}{b} = \frac{36}{9.5} = 3.79$ → too big. Reduce length by adding stiffener @ 18".

$a = 18"$
$b = 9.5"$
$\frac{a}{b} = \frac{18}{9.5} = 1.89$ →

$\beta_1 = \left(\frac{1.226 - 0.727}{2.0 - 1.5}\right)(1.89 - 1.5) + 0.727 = 1.116$

$\beta_2 = \left(\frac{0.605 - 0.484}{2.0 - 1.5}\right)(1.89 - 1.5) + 0.484 = 0.578$

$\beta_3 = \left(\frac{1.568 - 1.073}{2.0 - 1.5}\right)(1.89 - 1.5) + 1.073 = 1.459$

$\gamma_1 = \left(\frac{0.845 - 0.673}{2.0 - 1.5}\right)(1.89 - 1.5) + 0.673 = 0.807$

$\gamma_2 = \left(\frac{1.212 - 0.859}{2.0 - 1.5}\right)(1.89 - 1.5) + 0.859 = 1.134$

$$f_{max}^{vert} = \frac{1.116(7.13)(9.5)^2}{(0.375)^2} = 5107 \text{ psi}$$

$$f_{max}^{horiz} = \frac{1.459(7.13)(9.5)^2}{(0.375)^2} = 6676 \text{ psi}$$

1.1.3) Plate between (A) and (B)

span = 15.75"

$$p_1 = 62.4\left(\frac{197.5 - 9.5}{12}\right) = 977.6 \text{ psf}$$

$$p_2 = 62.4\left(\frac{197.5 - 9.5 - 15.75}{12}\right) = 895.7 \text{ psf}$$

$$p = \frac{977.6 + 895.7}{2} = 936.7 \text{ psf}$$

$$M = \frac{936.7\,(15.75/12)^2}{8} = 201.7 \frac{\text{lb-ft}}{\text{ft}}$$

$$S_{plate} = \frac{12(0.375)^2}{6} = 0.28 \text{ in}^3$$

$$f_b = \frac{M}{S} = \frac{201.7(12)}{0.28} = 8644 \text{ psi} < 18000 \text{ psi} \quad \text{ok}$$

1.1.4) Plate between (B) and (C)

span = 19.5"

$p_1 = 895.7$ psf

$$p_2 = 62.4\left(\frac{197.5 - 9.5 + 15.75 - 19.5}{12}\right) = 794.3 \text{ psf}$$

$$p = \frac{794.3 + 895.7}{2} = 845 \text{ psf}$$

$M = \frac{845\,(19.5/12)^2}{8} = 278.9$ lb-ft/ft

$f_b = \frac{278.9(12)}{0.28} = 11954$ psi < 18000 psi ok

1.1.5) Plate between Ⓒ and Ⓓ

Span = 24"

$p_1 = 794.3$ psf

$p_2 = 62.4\left(\frac{197.5 - 9.5 - 15.75 - 19.5 - 24}{12}\right) = 669.5$ psf

$p = \frac{794.3 + 669.5}{2} = 731.9$ psf

$M = \frac{731.9\,(2)^2}{8} = 365.95$ lb-ft/ft

$f_b = \frac{365.95(12)}{0.28} = 15684$ psi < 18000 psi ok

1.1.6) Plate between Ⓓ and Ⓔ

Span = 30"

$p_1 = 669.5$ psf.

$p_2 = 62.4\left(\frac{197.5 - 9.5 - 15.75 - 19.5 - 24 - 30}{12}\right) = 513.5$ psf.

$p = \frac{513.5 + 669.5}{2} = 591.5$ psf.

$M = \frac{591.5\,(2.5)^2}{8} = 462.1$ lb-ft/ft

Hazen

JOB

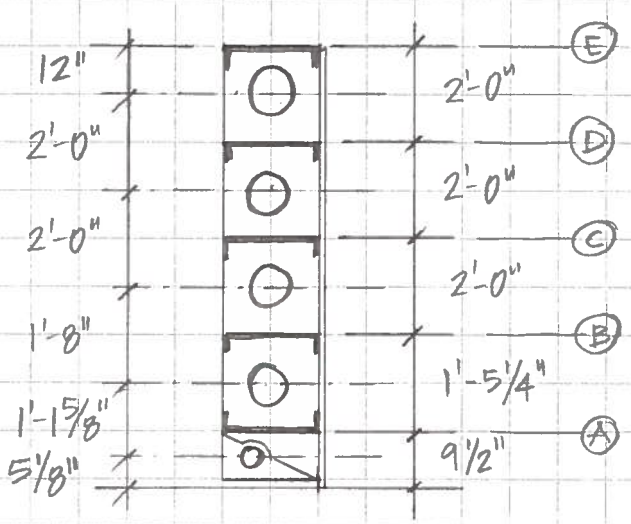
SHEET NO. 7 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

$f_b = \frac{462.1(12)}{0.28} = 19804 \text{ psi} > 18000 \text{ psi}$ N.G.



1.1.1a) Bottom Plate at Center: no change.

1.1.2a) Bottom Plate at ends: no change.

1.1.3a) Plate between (A) and (B):

span = 17.25"

$p_1 = 977.6$ psf

$p_2 = 62.4\left(\frac{197.5 - 9.5 - 17.25}{12}\right) = 887.9$ psf

$p = \frac{887.9 + 977.6}{2} = 932.8$ psf

$M = \frac{932.8(17.25/12)^2}{8} = 240.9$ lb-ft/ft

$f = \frac{240.9(12)}{0.28} = 10326 \text{ psi} < 18000 \text{ psi}$ OK

Attachment "A"

Hazen

JOB SFWMD - Culvert 8

SHEET NO. 8 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1.14a) Plate between (B) and (C)

span = 24"

p_1 = 887.9 psf

$p_2 = 887.9 - 62.4(2) = 763.1$ psf

$p = \frac{887.9 + 763.1}{2} = 825.5$ psf

$M = \frac{825.5(2)^2}{8} = 412.75$ lb-ft/ft

$f_b = \frac{412.75(12)}{0.28} = 17689$ psi < 18000 psi ok

1.15a) Plate between (C) and (D).

span = 24"

p_1 = 763.1 psf

$p_2 = 763.1 - 2(62.4) = 638.3$ psf.

$p = \frac{763.1 + 638.3}{2} = 700.7$ psf.

By observation, 3/8" thk ok

1.16a) Plate between (D) and (E).

span = 24"

p_1 = 638.3 psf

$p_2 = 638.3 - 2(62.4) = 513.5$ psf

By observation, 3/8" thk ok.

$p = \frac{513.5 + 638.3}{2} = 576$ psf

Hazen

JOB SFWMD - Culvert B.

SHEET NO. 9 OF 61

CALCULATED BY Jean Paul Silva DATE

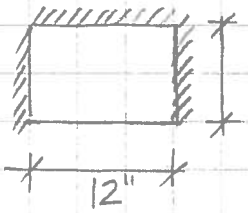
CHECKED BY DATE

SCALE

1.1b) PLATE

1.1.1b) Bottom

3 sides supported, 1 side free.



$p = 1027 \text{ psf} = 7.13 \text{ psi}$

$a = 12"$

$b = 14"$

$\frac{a}{b} = 0.857$ ⟶

$\beta_1 = \left(\frac{0.321 - 0.173}{1.0 - 0.75}\right)(0.857 - 0.75) + 0.173 = 0.236$

$\beta_2 = \left(\frac{0.259 - 0.148}{1.0 - 0.75}\right)(0.857 - 0.75) + 0.148 = 0.196$

$\beta_3 = \left(\frac{0.511 - 0.286}{1.0 - 0.75}\right)(0.857 - 0.75) + 0.286 = 0.382$

$\gamma_1 = \left(\frac{0.457 - 0.341}{1.0 - 0.75}\right)(0.857 - 0.75) + 0.341 = 0.391$

$\gamma_2 = \left(\frac{0.510 - 0.371}{1.0 - 0.75}\right)(0.857 - 0.75) + 0.371 = 0.431$

$f_{vert,max} = \frac{\beta_1 \cdot q \cdot b^2}{t^2} = \frac{0.236(7.13)(14)^2}{(0.375)^2} = 2345 \text{ psi}$ ok

$f_{horiz,max} = \frac{\beta_3 \cdot q \cdot b^2}{t^2} = \frac{0.382(7.13)(14)^2}{(0.375)^2} = 3796 \text{ psi}$ ok

Hazen

Attachment "A" SFWMD - Culvert B

JOB

SHEET NO. 10 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

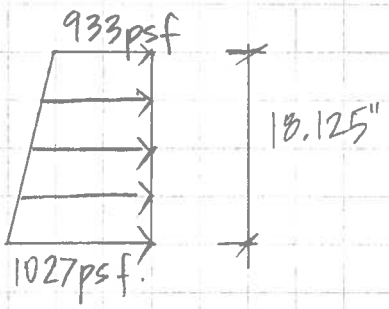
SCALE

1.2. HORIZONTAL MEMBER=

Span= 12.5 + 9" = 13.25 ft

1.2.1 Bottom member: (A)

Tributary width = $9.5" + \frac{17.25}{2} = 18.125"$



$$w = \frac{(933 + 1027)}{2}\left(\frac{18.125}{12}\right) = 1480 \ \frac{lb}{ft}$$

$$M = \frac{1480\,(13.25)^2}{8} = 32479 \ lb\cdot ft$$

$$V = \frac{1480\,(13.25)}{2} = 9805 \ lb$$

1.2.2 Member (B)

Tributary width = $\frac{17.25}{2} + 12 = 29.25$ in

$p_1 = 933$ psf

$p_2 = 933 - 62.4\left(\frac{29.25}{12}\right) = 781$ psf

$$w = \frac{(781 + 933)}{2}\left(\frac{29.25}{12}\right) = 2089 \ lb/ft$$

$$M = \frac{2089\,(13.25)^2}{8} = 45844 \ lb\cdot ft$$

$$V = \frac{2089\,(13.25)}{2} = 13840 \ lb$$

Hazen

JOB SFWMD - Culvert 8

SHEET NO. 11 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1.2.3 Member (C)

Tributary width = 24" = 2.0 ft

$p_1 = 781$ psf

$p_2 = 781 - 62.4(2) = 656$ psf

$w = \frac{656+781}{2}\left(2\right) = 1437$ lb/ft

$M = \frac{1437(13.25)^2}{8} = 31535$ lb·ft

$V = \frac{1437(13.25)}{2} = 9520$ lb

1.2.4 Member (D)

Tributary width = 24"

$p_1 = 656$ psf

$p_2 = 656 - 62.4(2) = 531$ psf

$w = \frac{656+531}{2}\left(\frac{24}{12}\right) = 1187$ lb/ft

$M = \frac{1187(13.25)^2}{8} = 26049$ lb·ft

$V = \frac{1187(13.25)}{2} = 7863$ lb

Hazen

JOB SFWMD - culvert 8

SHEET NO. 12 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1.2.5 Member (E)

Tributary width = $12 + \frac{9.5}{2} = 16.75"$

$p_1 = 531$ psf

$p_2 = 531 - 62.4\left(\frac{16.75}{12}\right) = 444$ psf

$w = \frac{531+444}{2}\left(\frac{16.75}{12}\right) = 680$ lb/ft

$M = \frac{680(13.25)^2}{8} = 14923$ lb·ft

$V = \frac{680(13.25)}{2} = 4505$ lb

} lateral.

Worst case is member (B): M = 45844 lb·ft
V = 13840 lb

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	13	OF 61
CALCULATED BY	JPS	DATE 1/10/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

INPUT

General Input							
Description	Bulkhead Horiz. Member		**Unbraced Length**	Lb	159	in. see notes
Section	C15x50			Cb	1.00	see notes
Fy	30	ksi	**Strong Axis**	kx major	1	see notes
Forces/Moments (Enter Positive Numbers)				Lx major	13.25	ft
M_{max} (strong)	45.84	k-ft		Cmx	1.00	see notes
M_{max} (weak)	0.00	k-ft	**Weak Axis**	ky minor	1	see notes
P_{max} (comp)	0	k		Ly minor	13.25	ft
P_{max} (tension)	0	k		Cmy	1.00	see notes
Shear V_{major} (k)	13.84	k	Does Combo include wind or earthquake?		no	(yes/no)

BEAM DATA

Shape	C	d/Af	6.210	Zx (in^3)	68.200
AISC Table No.	2	Min Fillet Design	0.500	Zy (in^3)	8.170
Nominal Depth (in)	15.000	Min Fillet Detail	0.240	J Torsional Constant	2.670
Nominal Weight (plf)	50.000	Tensile Group No.	2.000	Cw, Warping Constant	492.000
Area (in^2)	14.700	Ix (in^4)	404	X-Centroid	0.798
Actual Depth (in)	15.000	Sx (in^3)	54	eo dist (in)	0.583
Thickness of Web (in)	0.716	Rx (in)	5.240	xp	0.488
Width of Flange (in)	3.716	Iy (in^4)	11.000	ro Shear Center	5.490
Thickness of Flange (in)	0.650	Sy (in^3)	3.780	H flexural (LRFD)	0.937
K-Distance	1.438	Ry (in)	0.867		

AISC CH. B5 LOCAL BUCKLING / COMPACTNESS

B5.1

	Property	<= Compact Sec	<= Noncompact Sec	
bf/tf =	5.72	Not Applicable	17.34	**Flange is Noncompact**
h/tw =	19.13	Not Applicable	218.01	**Web is Noncompact**

AISC CH. F1 STRONG AXIS BENDING

Calculation of rT

Ir	2.85	in^4
Ar	4.13	in^2
r_T	0.83	in

F1.1 **Is Lb < Lc ?**

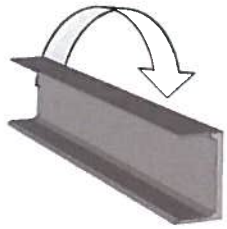
Lc' = 76*bf/SQRT(Fy) =	51.56	
Lc" = 20000/((d/Af)*Fy) =	107.35	**Use eqns of ASD F1.3**

F1.3 **Is Left Eqn <= L/r_T <= Right Eqn?**

Left Eqn	58.31	
L/rT	191.23	
Right Eqn	130.38	**No**

Is L/r_T > Right Eqn?

L/rT	191.23	
Right Eqn	130.38	**Yes, use Eq. F1-7**



Max: 0.6*Fy Fb =	18	ksi
Eq (F1-6) Fb =	-	ksi
Eq (F1-7) Fb =	4.65	ksi
Eq (F1-8) Fb =	12.15	ksi
ASD F1.3 Fb =	12.15	**ksi (major)**

Major Axis Bending

Fb =	12.15	ksi (from F1.1 or F1.3)
Sx (req'd) = M*12/Fb =	45.26	in^3
fb =	10.22	ksi (major)
Unity Check =	0.841	

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
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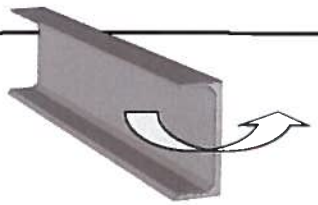
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

AISC CH. F2 WEAK AXIS BENDING



Section is Noncompact		
(F2-2) Fb =	18	**ksi (minor)**
Minor Axis Bending		
Fb =	18.00	ksi (from F2)
fb =	0.00	ksi (minor)
Unity Check =	**0.000**	

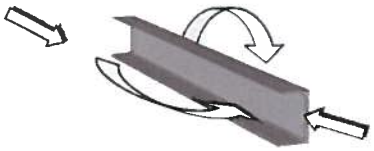
AISC CH. E2 FLEXURAL BUCKLING

$(kL/r)_x$ =	30.34	
$(kL/r)_y$ =	183.39	**Section is not Slender.**
C_c =	138.13	
Fa =	4.44	**ksi Eq(E2-2) Controls**
Flexural Buckling		
Fa =	4.44	ksi (from E2)
fa = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. D1 TENSION

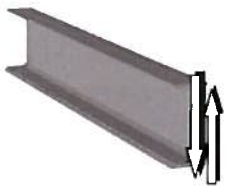
Ft =	18.00	**ksi**
Yeilding of Gross Area*		
Ft =	18.00	ksi (from E2)
ft = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. H COMBINED STRESSES



Fex	-	ksi see notes
Fey	-	ksi see notes
(H1-1)	-	
(H1-2)	-	
(H1-3)	0.84	
(H2-1)	0.84	
Unity Check	**0.841**	**ksi Design Conforms to AISC/ASD Specs**

AISC CH. F4 SHEAR



h/tw =	19.13	
380/SQRT Fy =	69.38	Eqn (F3-3) Controls
(F3-3) Fv =	12	**ksi**
Shear		
Fv =	12.00	ksi (from F2)
Av =	10.74	
fv =	1.29	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.11**	

Attachment "A"

Hazen

JOB SFWMD - Culvert 8

SHEET NO. 15 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1,2@ HORIZONTAL MEMBERS.

Span = 13.25 ft.

Worse case: w = 1995 $\frac{lb}{ft}$
(bottom member)

M = 43.7 kip·ft

V = 13.2 kip.

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	16	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

INPUT

General Input				Unbraced Length			
Description	Bulkhead Horiz. Member			Lb	159	in. see notes
Section	C15x50			Cb	1.00	see notes
Fy	30	ksi	Strong Axis	kx major	1	see notes
Forces/Moments (Enter Positive Numbers)				Lx major	13.25	ft
M_{max} (strong)	43.7	k-ft		Cmx	1.00	see notes
M_{max} (weak)	0.00	k-ft	Weak Axis	ky minor	1	see notes
P_{max} (comp)	0	k		Ly minor	13.25	ft
P_{max} (tension)	0	k		Cmy	1.00	see notes
Shear V_{major} (k)	13.20	k		Does Combo include wind or earthquake?		
					no	(yes/no)

BEAM DATA

Shape	C	d/Af	6.210	Zx (in^3)	68.200
AISC Table No.	2	Min Fillet Design	0.500	Zy (in^3)	8.170
Nominal Depth (in)	15.000	Min Fillet Detail	0.240	J Torsional Constant	2.670
Nominal Weight (plf)	50.000	Tensile Group No.	2.000	Cw, Warping Constant	492.000
Area (in^2)	14.700	Ix (in^4)	404	X-Centroid	0.798
Actual Depth (in)	15.000	Sx (in^3)	54	eo dist (in)	0.583
Thickness of Web (in)	0.716	Rx (in)	5.240	xp	0.488
Width of Flange (in)	3.716	Iy (in^4)	11.000	ro Shear Center	5.490
Thickness of Flange (in)	0.650	Sy (in^3)	3.780	H flexural (LRFD)	0.937
K-Distance	1.438	Ry (in)	0.867		

AISC CH. B5 LOCAL BUCKLING / COMPACTNESS

B5.1

	Property	<= Compact Sec	<= Noncompact Sec	
bf/tf =	5.72	Not Applicable	17.34	**Flange is Noncompact**
h/tw =	19.13	Not Applicable	218.01	**Web is Noncompact**

AISC CH. F1 STRONG AXIS BENDING

Calculation of rT

Ir	2.85	in^4
Ar	4.13	in^2
r_T	0.83	in

F1.1 **Is Lb < Lc ?**

Lc' = 76*bf/SQRT(Fy) =	51.56	
Lc" = 20000/((d/Af)*Fy) =	107.35	**Use eqns of ASD F1.3**

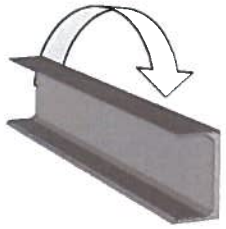
F1.3 **Is Left Eqn <= L/r_T <= Right Eqn?**

Left Eqn	58.31	
L/rT	191.23	
Right Eqn	130.38	**No**

Is L/r_T > Right Eqn?

L/rT	191.23	
Right Eqn	130.38	**Yes, use Eq. F1-7**

Max: 0.6*Fy Fb =	18	ksi
Eq (F1-6) Fb =	-	ksi
Eq (F1-7) Fb =	4.65	ksi
Eq (F1-8) Fb =	12.15	ksi
ASD F1.3 Fb =	**12.15**	**ksi (major)**



Major Axis Bending

Fb =	12.15	ksi (from F1.1 or F1.3)
Sx (req'd) = M*12/Fb =	43.15	in^3
fb =	9.75	ksi (major)
Unity Check =	**0.802**	

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	17	OF 61
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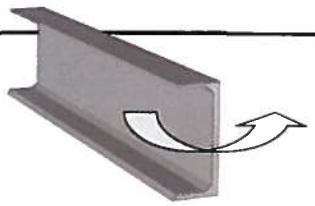
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

AISC CH. F2 WEAK AXIS BENDING



Section is Noncompact		
(F2-2) Fb =	18	**ksi (minor)**
Minor Axis Bending		
Fb =	18.00	ksi (from F2)
fb =	0.00	ksi (minor)
Unity Check =	**0.000**	

AISC CH. E2 FLEXURAL BUCKLING

$(kL/r)_x$ =	30.34	
$(kL/r)_y$ =	183.39	**Section is not Slender.**
C_c =	138.13	
Fa =	4.44	**ksi Eq(E2-2) Controls**
Flexural Buckling		
Fa =	4.44	ksi (from E2)
fa = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. D1 TENSION

Ft =	18.00	**ksi**
Yeilding of Gross Area*		
Ft =	18.00	ksi (from E2)
ft = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. H COMBINED STRESSES

Fex	-	ksi see notes
Fey	-	ksi see notes
(H1-1)	-	
(H1-2)	-	
(H1-3)	0.80	
(H2-1)	0.80	
Unity Check	**0.802**	**ksi Design Conforms to AISC/ASD Specs**

AISC CH. F4 SHEAR

h/tw =	19.13	
380/SQRT Fy =	69.38	Eqn (F3-3) Controls
(F3-3) Fv =	12	**ksi**
Shear		
Fv =	12.00	ksi (from F2)
Av =	10.74	
fv =	1.23	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.10**	

Hazen

JOB SJFWMD- Culvert 8.

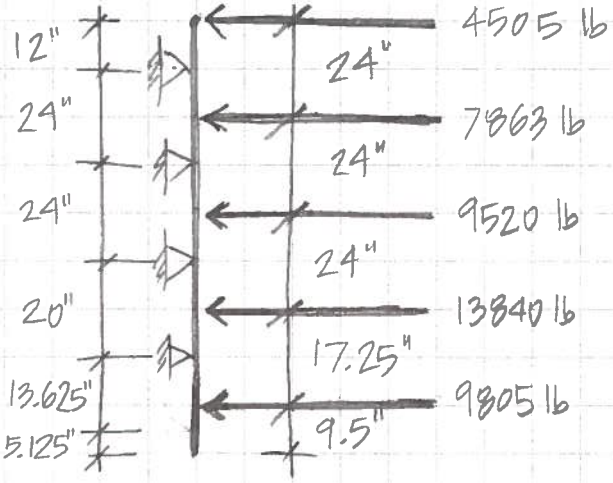
SHEET NO. 18 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1.3. VERTICAL MEMBER AT ENDS.



R= 9600 lb R= 12500 lb R= 16500 lb

R= 7200 lb

R= 7800 lb R= 13900 lb

R= 21000 lb R= 19200 lb R= 29000 lb

with 2 rollers (STAAD model "Bulkhead-1")

Mmax= 7.56 k-ft. → By observation, C15x50 ok

If one roller removed →
Mmax= 7.56 k-ft → C15x50 ok.

If two rollers removed →
Mmax = 15.9 k-ft → C15x50 ok

Attachment "A"

Hazen

JOB SFWMD - Culvert 8.

SHEET NO. 19 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1,3a) VERTICAL MEMBER AT ENDS.

from STAAD.. M_{max} = 5.53 k-ft
V_{max} = 8.24 kip

> by observation, C15X50 OK

Hazen

JOB SFWMD - Culvert B.

SHEET NO. 20 OF 61

CALCULATED BY Jean Paul Silva DATE 1/11/2017

CHECKED BY _____ DATE _____

SCALE _____

F.4. TOP HORIZONTAL MEMBER.

(Account for vertical load when lifting)

Weight of plate = $(13.25)(8.23)(0.375/12)(490) = 1670$ lb.

Horizontals = $13.25(50)(5) = 3313$ lb.

Verticals = $8.23(50)(4) = 1646$ lb

Rollers $\simeq 100(5)(2) = 1000$ lb.

Additional plates $\simeq \frac{(15)(14)(0.375)}{(12)^3}(14)(490) = 313$ lb.

TOTAL = 7942 lb ~ 8000 lb.

Assume supported at ends →

$$w = \frac{8000}{13.25} = 604 \frac{lb}{ft}$$

$$M = \frac{604(13.25)^2}{8} = 13255 \text{ lb-ft}$$

$$V = \frac{604(13.25)}{2} = 4002 \text{ lb}$$

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
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SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

INPUT

General Input						
Description	Bulkhead Top Horiz. Member		Unbraced Length	Lb	159	in. see notes
Section	C15x50			Cb	1.00	see notes
Fy	30	ksi	Strong Axis	kx major	1	see notes
Forces/Moments (Enter Positive Numbers)				Lx major	13.25	ft
M_{max} (strong)	18.3	k-ft		Cmx	1.00	see notes
M_{max} (weak)	13.26	k-ft	Weak Axis	ky minor	1	see notes
P_{max} (comp)	0	k		Ly minor	13.25	ft
P_{max} (tension)	0	k		Cmy	1.00	see notes
Shear V_{major} (k)	13.20	k	Does Combo include wind or earthquake?		no	(yes/no)

BEAM DATA

Shape	C	d/Af	6.210	Zx (in^3)	68.200
AISC Table No.	2	Min Fillet Design	0.500	Zy (in^3)	8.170
Nominal Depth (in)	15.000	Min Fillet Detail	0.240	J Torsional Constant	2.670
Nominal Weight (plf)	50.000	Tensile Group No.	2.000	Cw, Warping Constant	492.000
Area (in^2)	14.700	Ix (in^4)	404	X-Centroid	0.798
Actual Depth (in)	15.000	Sx (in^3)	54	eo dist (in)	0.583
Thickness of Web (in)	0.716	Rx (in)	5.240	xp	0.488
Width of Flange (in)	3.716	Iy (in^4)	11.000	ro Shear Center	5.490
Thickness of Flange (in)	0.650	Sy (in^3)	3.780	H flexural (LRFD)	0.937
K-Distance	1.438	Ry (in)	0.867		

AISC CH. B5 LOCAL BUCKLING / COMPACTNESS

B5.1

Property		<= Compact Sec	<= Noncompact Sec	
bf/tf =	5.72	Not Applicable	17.34	**Flange is Noncompact**
h/tw =	19.13	Not Applicable	218.01	**Web is Noncompact**

AISC CH. F1 STRONG AXIS BENDING

Calculation of rT

Ir	2.85	in^4
Ar	4.13	in^2
r_T	0.83	in

F1.1 **Is Lb < Lc ?**

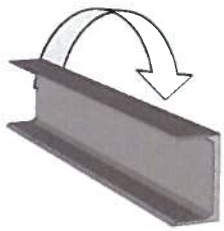
Lc' = 76*bf/SQRT(Fy) =	51.56	
Lc" = 20000/((d/Af)*Fy) =	107.35	**Use eqns of ASD F1.3**

F1.3 **Is Left Eqn <= L/r_T <= Right Eqn?**

Left Eqn	58.31	
L/rT	191.23	
Right Eqn	130.38	**No**

Is L/r_T > Right Eqn?

L/rT	191.23	
Right Eqn	130.38	**Yes, use Eq. F1-7**



Max: 0.6*Fy Fb =	18	ksi
Eq (F1-6) Fb =	-	ksi
Eq (F1-7) Fb =	4.65	ksi
Eq (F1-8) Fb =	12.15	ksi
ASD F1.3 Fb =	12.15	**ksi (major)**

Major Axis Bending

Fb =	12.15	ksi (from F1.1 or F1.3)
Sx (req'd) = M*12/Fb =	18.07	in^3
fb =	4.08	ksi (major)
Unity Check =	0.336	

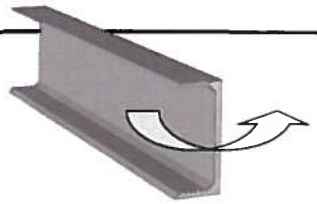
HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	22	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

AISC CH. F2 WEAK AXIS BENDING



Section is Noncompact		
(F2-2) Fb =	**18**	**ksi (minor)**
Minor Axis Bending		
Fb =	18.00	ksi (from F2)
fb =	42.10	ksi (minor)
Unity Check =	**2.339**	

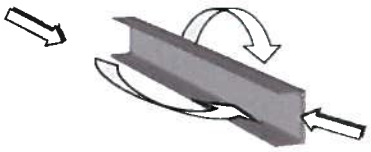
AISC CH. E2 FLEXURAL BUCKLING

$(kL/r)_x$ =	30.34	
$(kL/r)_y$ =	183.39	**Section is not Slender.**
C_c =	138.13	
Fa =	**4.44**	**ksi Eq(E2-2) Controls**
Flexural Buckling		
Fa =	4.44	ksi (from E2)
fa = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. D1 TENSION

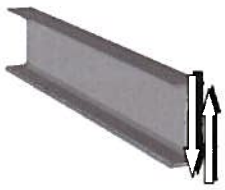
Ft =	**18.00**	**ksi**
Yeilding of Gross Area*		
Ft =	18.00	ksi (from E2)
ft = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. H COMBINED STRESSES



Fex	-	ksi see notes
Fey	-	ksi see notes
(H1-1)	-	
(H1-2)	-	
(H1-3)	2.67	
(H2-1)	2.67	
Unity Check	**2.674**	**ksi NO GOOD, Increase Size**

AISC CH. F4 SHEAR



h/tw =	19.13	
380/SQRT Fy =	69.38	Eqn (F3-3) Controls
(F3-3) Fv =	12	**ksi**
Shear		
Fv =	12.00	ksi (from F2)
Av =	10.74	
fv =	1.23	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.10**	

Attachment "A"

Hazen

JOB SFWMP - Culvert 8

SHEET NO. 23 OF 61

CALCULATED BY Jean Paul Silva DATE 1/11/2017

CHECKED BY DATE

SCALE

1.5. LIFTING TAB.

T= 4000 lb.

weld size= 3/8".

Allowable load = $0.3(70)(0.707)(3/8) = 5.57$ kip/in

length needed = $\frac{4000}{5570} = 0.7$"

length provided = 62". OK

Hazen

JOB SFWMD - Culvert 8

SHEET NO. 24 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

1.6 ROLLERS.

With 2 rollers on each side, load on roller is 29000 lb. Seems excessive. Increase number of active rollers to 3 by making pilot roller be of same diameter as other rollers.

Software licensed to	Job No 41091-002	Sheet No 25/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-1.std	Date/Time 10-Jan-2017 14:37	

Reactions

Hazen

JOB SFWMD - Culvert B.

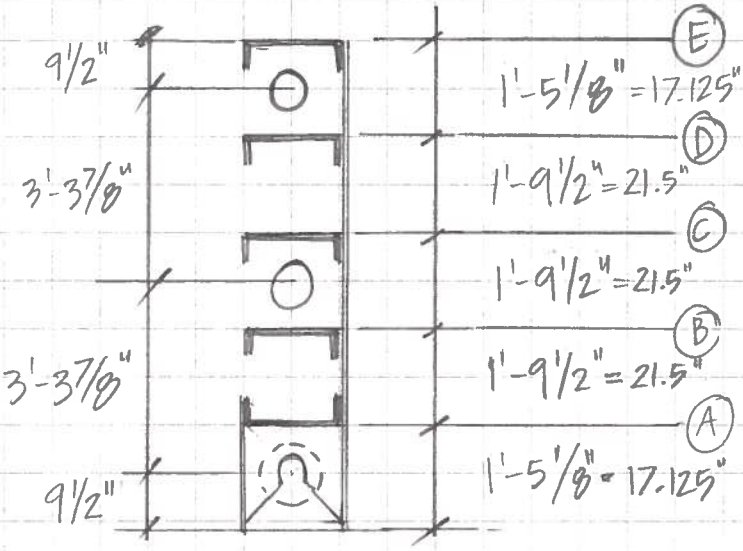
SHEET NO. 26 OF 61

CALCULATED BY Jean Paul Silva DATE 1/10/17

CHECKED BY DATE

SCALE

Load on horizontal members w/ 3 rollers :



E	513.6 psf	468.98 psf
D	602.55 psf	558.03 psf
C	714.35 psf	658.45 psf
B	826.15 psf	770.25 psf
A	937.95 psf	882.1 psf
	1027 psf	982.48 psf

$$W_A = \left(\frac{1027 + 882.1}{2}\right)\left(17.125 + \frac{21.5}{2}\right)\left(\frac{1}{12}\right) = 2217 \frac{lb}{ft}$$

$$W_B = \left(\frac{882.1 + 770.25}{2}\right)\left(\frac{21.5}{12}\right) = 1480 \frac{lb}{ft}$$

$$W_C = \left(\frac{770.25 + 658.45}{2}\right)\left(\frac{21.5}{12}\right) = 1280 \frac{lb}{ft}$$

$$W_D = \left(\frac{658.45 + 558.03}{2}\right)\left(\frac{21.5 + 17.125}{2}\right)\left(\frac{1}{12}\right) = 979 \frac{lb}{ft}$$

$$W_E = \left(\frac{558.03 + 468.98}{2}\right)\left(\frac{17.125}{12}\right) = 733 \frac{lb}{ft}$$

Max reaction = 20.2 kip (see STAAD model "Bulkhead-2")

ROLLER REACTIONS TOO HIGH. INCREASE # OF ROLLERS TO 4.

With 4 rollers, max reaction on rollers = 14.1 kip (see STAAD model "Bulkhead-3")

INCREASE TO 5 ROLLERS.

Attachment "A"

27/61

Load on horizontal members w/ 4 rollers.

Total Gate Height 197.5 in

Element	H over floor (in)	Pressure (psf)	Member Load (lb/ft)
gate 2 first horiz	112.75	440.7	
mid point	105.75	477.1	
Member E	98.75	513.5	834
mid point	86.75	575.9	
Member D	74.75	638.3	1277
mid point	62.75	700.7	
Member C	50.75	763.1	1526
mid point	38.75	825.5	
Member B	26.75	887.9	1337
mid point	20.375	921.05	
Member A	14	954.2	1654
Bottom	0	1027	

Attachment "A"

Load on horizontal members w/ 5 rollers.

28/61

Total Gate Height 197.5 in

Element	H over floor (in)	Pressure (psf)	Member Load (lb/ft)
gate 2 first horiz	112.75	440.7	
mid point	105.75	477.1	
Member E	98.75	513.5	834
mid point	86.75	575.9	
Member D	74.75	638.3	1190
mid point	64.25	692.9	
Member C	53.75	747.5	1208
mid point	44.75	794.3	
Member B	35.75	841.1	1401
mid point	24.875	897.65	
Member A	14	954.2	1995
Bottom	0	1027	

Max reaction = 11.2 kip

Software licensed to	Job No 41091-002	Sheet No 29/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-2.std	Date/Time 10-Jan-2017 17:45	

Reactions

Software licensed to	Job No 41091-002	Sheet No 30/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-3.std	Date/Time 11-Jan-2017 14:14	

Reactions

Attachment "A"

Hazen

JOB SFWMD. - Culvert 8.

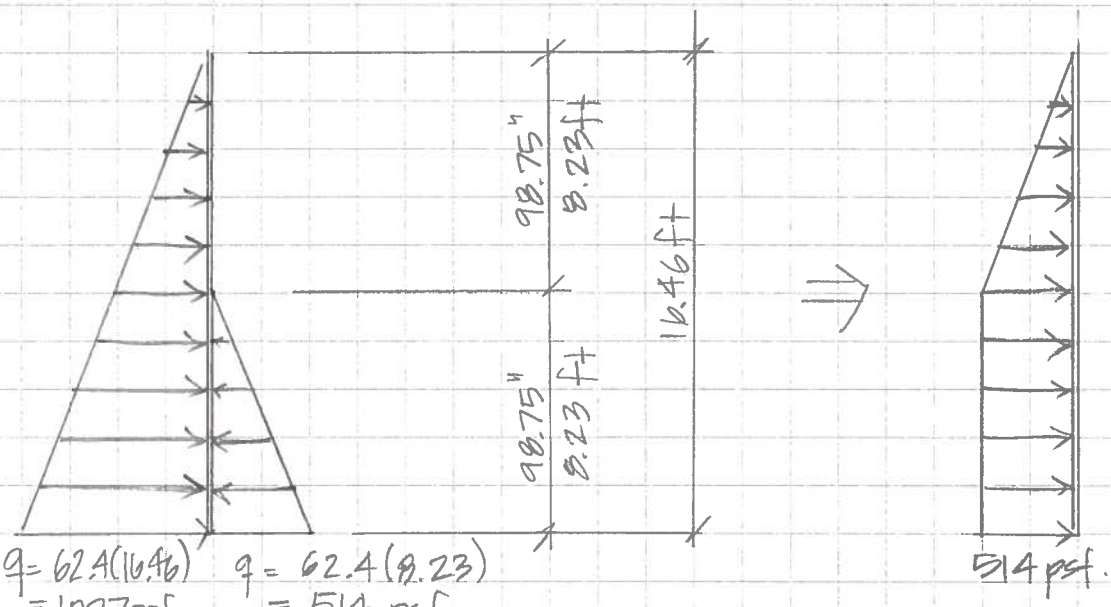
SHEET NO. 31 OF 61

CALCULATED BY Jean Paul Silva DATE 1/20/2017.

CHECKED BY DATE

SCALE

CASE 2.



$q = 62.4(16.46) = 1027 psf.$

$q = 62.4(8.23) = 514 psf.$

Attachment "A"

Hazen

JOB SFWMD - Culvert B

SHEET NO. 32 OF 61

CALCULATED BY Jean Paul Silva DATE 1/20/2017

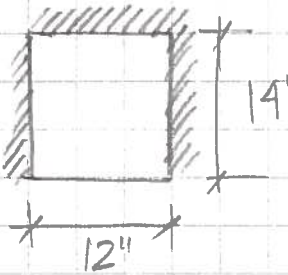
CHECKED BY DATE

SCALE

2.1 PLATE.

2.1.1 Bottom Plate.

3 sides supported, 1 side free.



$p = 514 psf = 3.6 psi$

$a = 12"$

$b = 14"$

$\frac{a}{b} = 0.857 \rightarrow$ $\beta_1 = 0.236$, $\beta_2 = 0.196$, $\beta_3 = 0.382$, $\gamma_1 = 0.391$, $\gamma_2 = 0.431$

$$f_{vert.\,max} = \frac{\beta_1 \cdot q \cdot b^2}{t^2} = \frac{0.236(3.6)(14)^2}{(0.375)^2} = 1184 psi \quad \underline{ok}.$$

$$f_{horiz\,max} = \frac{\beta_3 \cdot q \cdot b^2}{t^2} = \frac{0.382(3.6)(14)^2}{(0.375)^2} = 1917 psi \quad \underline{ok}$$

Hazen

JOB SFWMD - Culvert 8

SHEET NO. 33 OF 61

CALCULATED BY Jean Paul Silva DATE 1/23/2017

CHECKED BY DATE

SCALE

2.1.2 Plate between horizontal members:
largest span = 24".
$p = 514$ psf.

$$M = \frac{514(2)^2}{8} = 257 \frac{lb\cdot ft}{ft}$$

$$S_{plate} = \frac{12(0.375)^2}{6} = 0.28 in^3$$

$$f_b = \frac{257(12)}{0.28} = 11014 psi < 18000 psi \quad OK$$

2.2 HORIZONTAL MEMBERS.

Span = 13.25 ft.
tributary width worse case = 24.5 in (bottom member)
$p = 514$ psf.

$$w = 514\left(\frac{24.5}{12}\right) = 1050 lb/ft$$

$$M = \frac{1050(13.25)^2}{8} = 23043 lb\cdot ft.$$

$$V = \frac{1050(13.25)}{2} = 6956 lb$$

(comparable to results from STAAD model)

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	34	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

INPUT

General Input							
Description	Bulkhead Top Horiz. Member		Unbraced Length	Lb	159	in. see notes
Section	C15x50			Cb	1.00	see notes
Fy	30	ksi	Strong Axis	kx major	1	see notes
Forces/Moments (Enter Positive Numbers)				Lx major	13.25	ft
M_{max} (strong)	23.04	k-ft		Cmx	1.00	see notes
M_{max} (weak)	0.00	k-ft	Weak Axis	ky minor	1	see notes
P_{max} (comp)	0	k		Ly minor	13.25	ft
P_{max} (tension)	0	k		Cmy	1.00	see notes
Shear V_{major} (k)	7.00	k	Does Combo include wind or earthquake?			
					no	(yes/no)

BEAM DATA

Shape	C	d/Af	6.210	Zx (in^3)	68.200
AISC Table No.	2	Min Fillet Design	0.500	Zy (in^3)	8.170
Nominal Depth (in)	15.000	Min Fillet Detail	0.240	J Torsional Constant	2.670
Nominal Weight (plf)	50.000	Tensile Group No.	2.000	Cw, Warping Constant	492.000
Area (in^2)	14.700	Ix (in^4)	404	X-Centroid	0.798
Actual Depth (in)	15.000	Sx (in^3)	54	eo dist (in)	0.583
Thickness of Web (in)	0.716	Rx (in)	5.240	xp	0.488
Width of Flange (in)	3.716	Iy (in^4)	11.000	ro Shear Center	5.490
Thickness of Flange (in)	0.650	Sy (in^3)	3.780	H flexural (LRFD)	0.937
K-Distance	1.438	Ry (in)	0.867		

AISC CH. B5 LOCAL BUCKLING / COMPACTNESS

B5.1	Property	<= Compact Sec	<= Noncompact Sec	
bf/tf =	5.72	Not Applicable	17.34	**Flange is Noncompact**
h/tw =	19.13	Not Applicable	218.01	**Web is Noncompact**

AISC CH. F1 STRONG AXIS BENDING

Calculation of rT

Ir	2.85	in^4
Ar	4.13	in^2
r_T	0.83	in

F1.1 **Is Lb < Lc ?**

Lc' = 76*bf/SQRT(Fy) =	51.56	
Lc" = 20000/((d/Af)*Fy) =	107.35	**Use eqns of ASD F1.3**

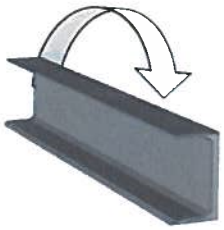
F1.3 **Is Left Eqn <= L/r_T <= Right Eqn?**

Left Eqn	58.31	
L/rT	191.23	
Right Eqn	130.38	**No**

Is L/r_T > Right Eqn?

L/rT	191.23	
Right Eqn	130.38	**Yes, use Eq. F1-7**

Max: 0.6*Fy Fb =	18	ksi
Eq (F1-6) Fb =	-	ksi
Eq (F1-7) Fb =	4.65	ksi
Eq (F1-8) Fb =	12.15	ksi
ASD F1.3 Fb =	12.15	**ksi (major)**



Major Axis Bending

Fb =	12.15	ksi (from F1.1 or F1.3)
Sx (req'd) = M*12/Fb =	22.75	in^3
fb =	5.14	ksi (major)
Unity Check =	0.423	

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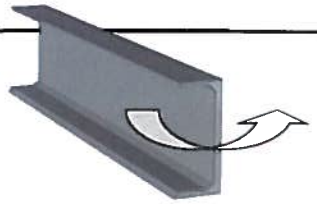
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	35	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

AISC CH. F2 WEAK AXIS BENDING



Section is Noncompact		
(F2-2) Fb =	18	**ksi (minor)**
Minor Axis Bending		
Fb =	18.00	ksi (from F2)
fb =	0.00	ksi (minor)
Unity Check =	**0.000**	

AISC CH. E2 FLEXURAL BUCKLING

$(kL/r)_x$ =	30.34	
$(kL/r)_y$ =	183.39	**Section is not Slender.**
C_c =	138.13	
Fa =	4.44	**ksi Eq(E2-2) Controls**
Flexural Buckling		
Fa =	4.44	ksi (from E2)
fa = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. D1 TENSION

Ft =	18.00	**ksi**
Yeilding of Gross Area*		
Ft =	18.00	ksi (from E2)
ft = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. H COMBINED STRESSES

Fex	-	ksi see notes
Fey	-	ksi see notes
(H1-1)	-	
(H1-2)	-	
(H1-3)	0.42	
(H2-1)	0.42	
Unity Check	**0.423**	**ksi Design Conforms to AISC/ASD Specs**

AISC CH. F4 SHEAR

h/tw =	19.13	
380/SQRT Fy =	69.38	Eqn (F3-3) Controls
(F3-3) Fv =	12	**ksi**
Shear		
Fv =	12.00	ksi (from F2)
Av =	10.74	
fv =	0.65	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.05**	

Attachment "A"

36/61

Horizontal member loading.

Total Gate Height 197.5 in

Element	H over floor (in)	Pressure (psf)	Member Load (lb/ft)
gate 2 first horiz	114.5	514	
mid point	106.625	514	
Member E	98.75	514	851
mid point	86.75	514	
Member D	74.75	514	964
mid point	64.25	514	
Member C	53.75	514	835
mid point	44.75	514	
Member B	35.75	514	814
mid point	25.75	514	
Member A	15.75	514	1103
Bottom	0	514	

Hazen

JOB SFWMD - Culvert 8

SHEET NO. 37 OF 61.

CALCULATED BY Jean Paul Silva DATE 1/23/2017.

CHECKED BY DATE

SCALE

2.3 VERTICAL MEMBER AT ENDS.

Mmax = 6 k·ft. (with 4 rollers).
By observation, C15x50 ok.

2.4 TOP HORIZONTAL MEMBER.

Weight of plate = 1670 lb
Weight of horizontals = 3313 + 50(13.25)(2) = 4638 lb
Weight of verticals = 1696 lb.
Weight of rollers ≈ 1000 lb
Weight of additional plates ≈ 313 lb

TOTAL = 9267 lb ~ 9500 lb.

Mvert = 2.5 k·ft
Mhoriz = 18.4 k·ft
} from STAAD model.

2.5 LIFTING TAB.

T = 4500 lb.
weld size = 3/8".

Allowable load = 0.3(70)(0.707)(3/8) = 5.57 k/in
length needed = $\frac{4.5}{5.57}$ = 0.81 in
length provided = 62" ok

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	39	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

INPUT

General Input							
Description	Bulkhead Top Horiz. Member		Unbraced Length	Lb	159	in.	see notes
Section	C15x50			Cb	1.00		see notes
Fy	30	ksi	Strong Axis	kx major	1		see notes
Forces/Moments (Enter Positive Numbers)				Lx major	13.25	ft	
M_{max} (strong)	18.4	k-ft		Cmx	1.00		see notes
M_{max} (weak)	2.50	k-ft	Weak Axis	ky minor	1		see notes
P_{max} (comp)	0	k		Ly minor	13.25	ft	
P_{max} (tension)	0	k		Cmy	1.00		see notes
Shear V_{major} (k)	5.60	k	Does Combo include wind or earthquake?		no		(yes/no)

BEAM DATA

Shape	C	d/Af	6.210	Zx (in^3)	68.200
AISC Table No.	2	Min Fillet Design	0.500	Zy (in^3)	8.170
Nominal Depth (in)	15.000	Min Fillet Detail	0.240	J Torsional Constant	2.670
Nominal Weight (plf)	50.000	Tensile Group No.	2.000	Cw, Warping Constant	492.000
Area (in^2)	14.700	Ix (in^4)	404	X-Centroid	0.798
Actual Depth (in)	15.000	Sx (in^3)	54	eo dist (in)	0.583
Thickness of Web (in)	0.716	Rx (in)	5.240	xp	0.488
Width of Flange (in)	3.716	Iy (in^4)	11.000	ro Shear Center	5.490
Thickness of Flange (in)	0.650	Sy (in^3)	3.780	H flexural (LRFD)	0.937
K-Distance	1.438	Ry (in)	0.867		

AISC CH. B5 LOCAL BUCKLING / COMPACTNESS

B5.1	Property	<= Compact Sec	<= Noncompact Sec	
bf/tf =	5.72	Not Applicable	17.34	**Flange is Noncompact**
h/tw =	19.13	Not Applicable	218.01	**Web is Noncompact**

AISC CH. F1 STRONG AXIS BENDING

Calculation of rT

Ir	2.85	in^4
Ar	4.13	in^2
r_T	0.83	in

F1.1 **Is Lb < Lc ?**

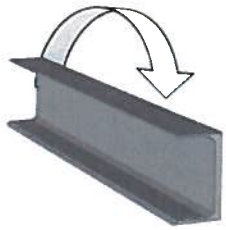
Lc' = 76*bf/SQRT(Fy) =	51.56	
Lc" = 20000/((d/Af)*Fy) =	107.35	**Use eqns of ASD F1.3**

F1.3 **Is Left Eqn <= L/r_T <= Right Eqn?**

Left Eqn	58.31	
L/rT	191.23	
Right Eqn	130.38	**No**

Is L/r_T > Right Eqn?

L/rT	191.23	
Right Eqn	130.38	**Yes, use Eq. F1-7**



Max: 0.6*Fy Fb =	18	ksi
Eq (F1-6) Fb =	-	ksi
Eq (F1-7) Fb =	4.65	ksi
Eq (F1-8) Fb =	12.15	ksi
ASD F1.3 Fb =	**12.15**	**ksi (major)**

Major Axis Bending

Fb =	12.15	ksi (from F1.1 or F1.3)
Sx (req'd) = M*12/Fb =	18.17	in^3
fb =	4.10	ksi (major)
Unity Check =	**0.338**	

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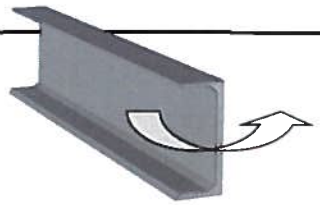
JOB	SFWMD-Culvert 8	
SHEET NO.	30	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

AISC CH. F2 WEAK AXIS BENDING



Section is Noncompact		
(F2-2) Fb =	18	**ksi (minor)**
Minor Axis Bending		
Fb =	18.00	ksi (from F2)
fb =	7.94	ksi (minor)
Unity Check =	**0.441**	

AISC CH. E2 FLEXURAL BUCKLING

$(kL/r)_x$ =	30.34	
$(kL/r)_y$ =	183.39	**Section is not Slender.**
C_c =	138.13	
Fa =	4.44	**ksi Eq(E2-2) Controls**
Flexural Buckling		
Fa =	4.44	ksi (from E2)
fa = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. D1 TENSION

Ft =	18.00	**ksi**
Yeilding of Gross Area*		
Ft =	18.00	ksi (from E2)
ft = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. H COMBINED STRESSES

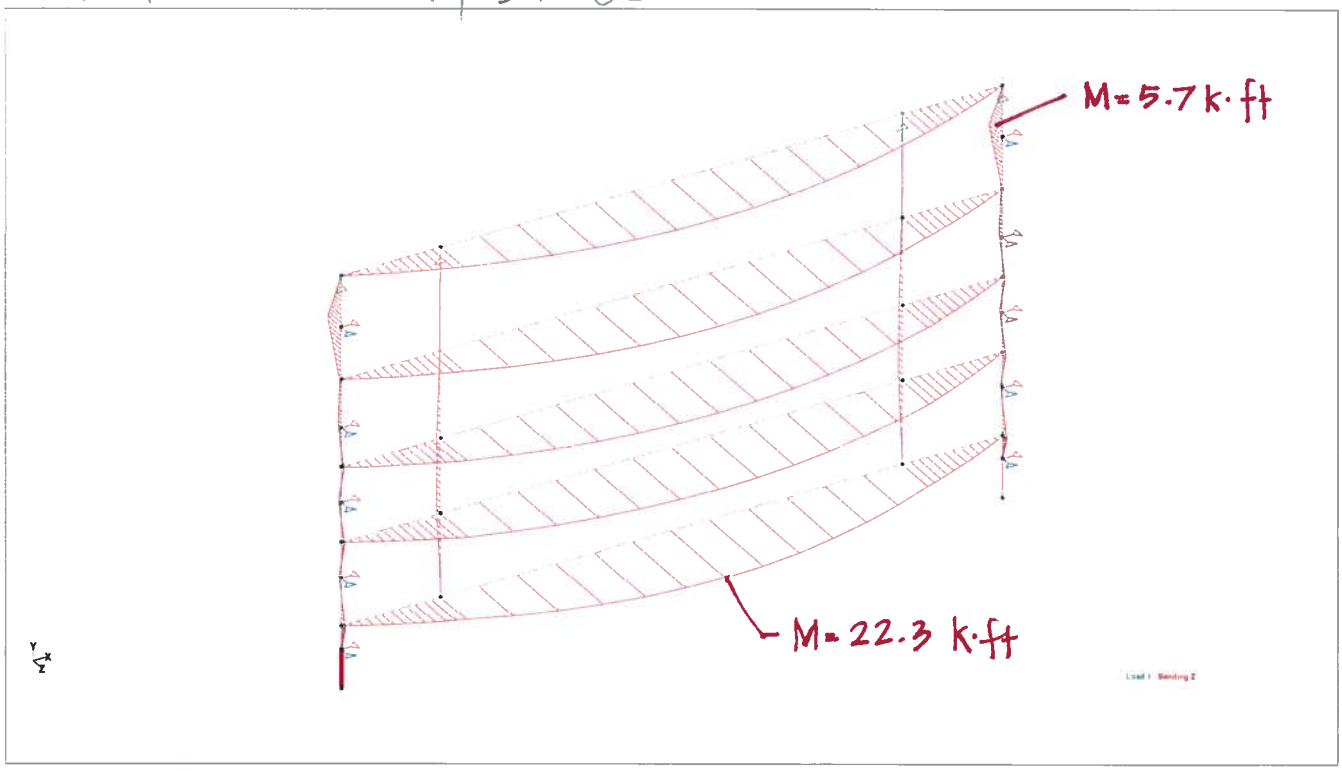
Fex	-	ksi see notes
Fey	-	ksi see notes
(H1-1)	-	
(H1-2)	-	
(H1-3)	0.78	
(H2-1)	0.78	
Unity Check	**0.779**	**ksi Design Conforms to AISC/ASD Specs**

AISC CH. F4 SHEAR

h/tw =	19.13	
380/SQRT Fy =	69.38	Eqn (F3-3) Controls
(F3-3) Fv =	12	**ksi**
Shear		
Fv =	12.00	ksi (from F2)
Av =	10.74	
fv =	0.52	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.04**	

Software licensed to	Job No 41091-002	Sheet No 40/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-1.1.std	Date/Time 23-Jan-2017 15:18	

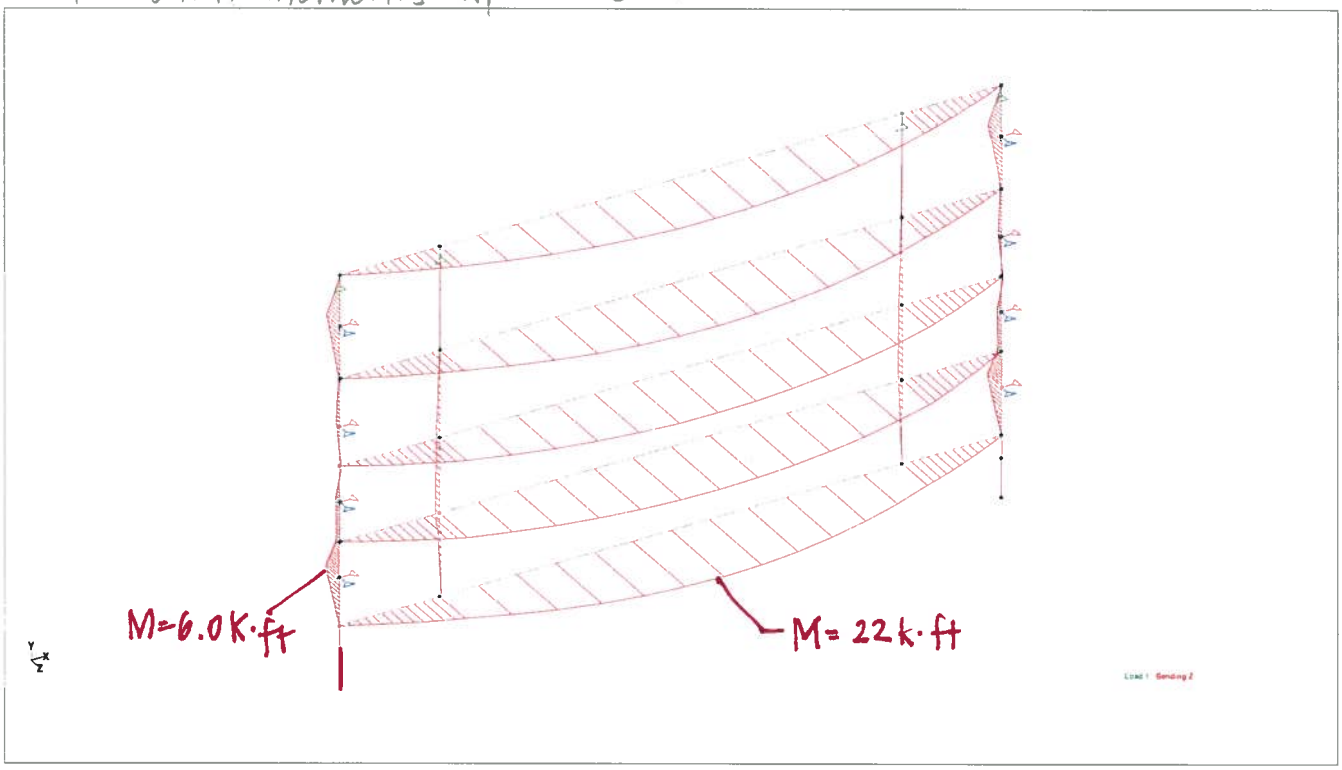
Horizontal moments w/ 5 rollers.



Whole Structure Mz 1kip-ft:1in 1 LOAD CASE 1

Software licensed to	Job No 41091-002	Sheet No 41/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-2.1.std	Date/Time 23-Jan-2017 15:35	

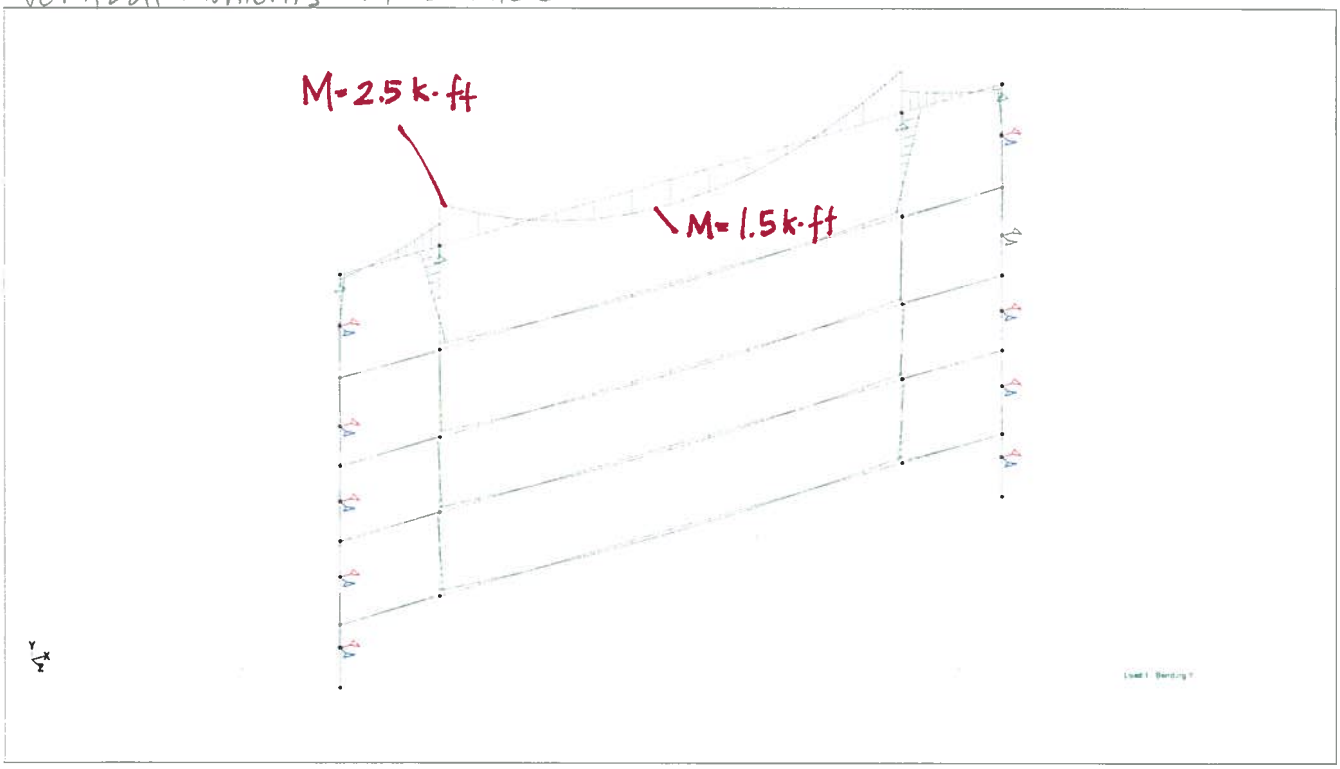
Horizontal moments w/ 4 rollers



Whole Structure Mz 1kip-ft:1in 1 LOAD CASE 1

Software licensed to	Job No 41091-002	Sheet No 42/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-1.1.std	Date/Time 23-Jan-2017 15:18	

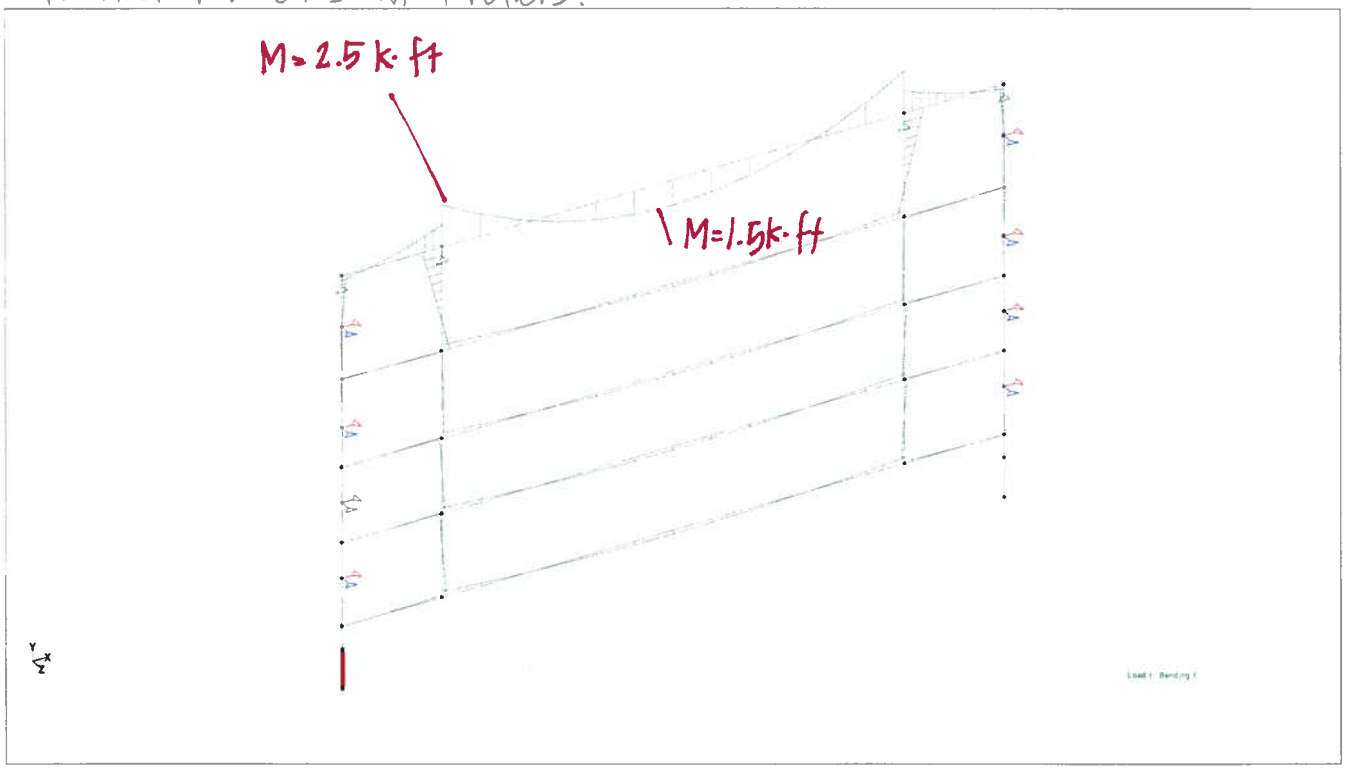
Vertical moments w/ 5 rollers



Whole Structure My 0.25kip-ft:1in 1 LOAD CASE 1

Software licensed to	Job No 41091-002	Sheet No 43/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-2.1.std	Date/Time 23-Jan-2017 15:35	

Vertical moments w/ 4 rollers.



Whole Structure My 0.25kip-ft:1in 1 LOAD CASE 1

Hazen

JOB SFWMD - culvert 8

SHEET NO. 44 OF 61

CALCULATED BY Jean Paul Silva DATE

CHECKED BY DATE

SCALE

2.6 ROLLERS.

Max load on rollers w/ 5 rollers = 10500 lb.

Max load on rollers w/ 4 rollers = 12500 lb

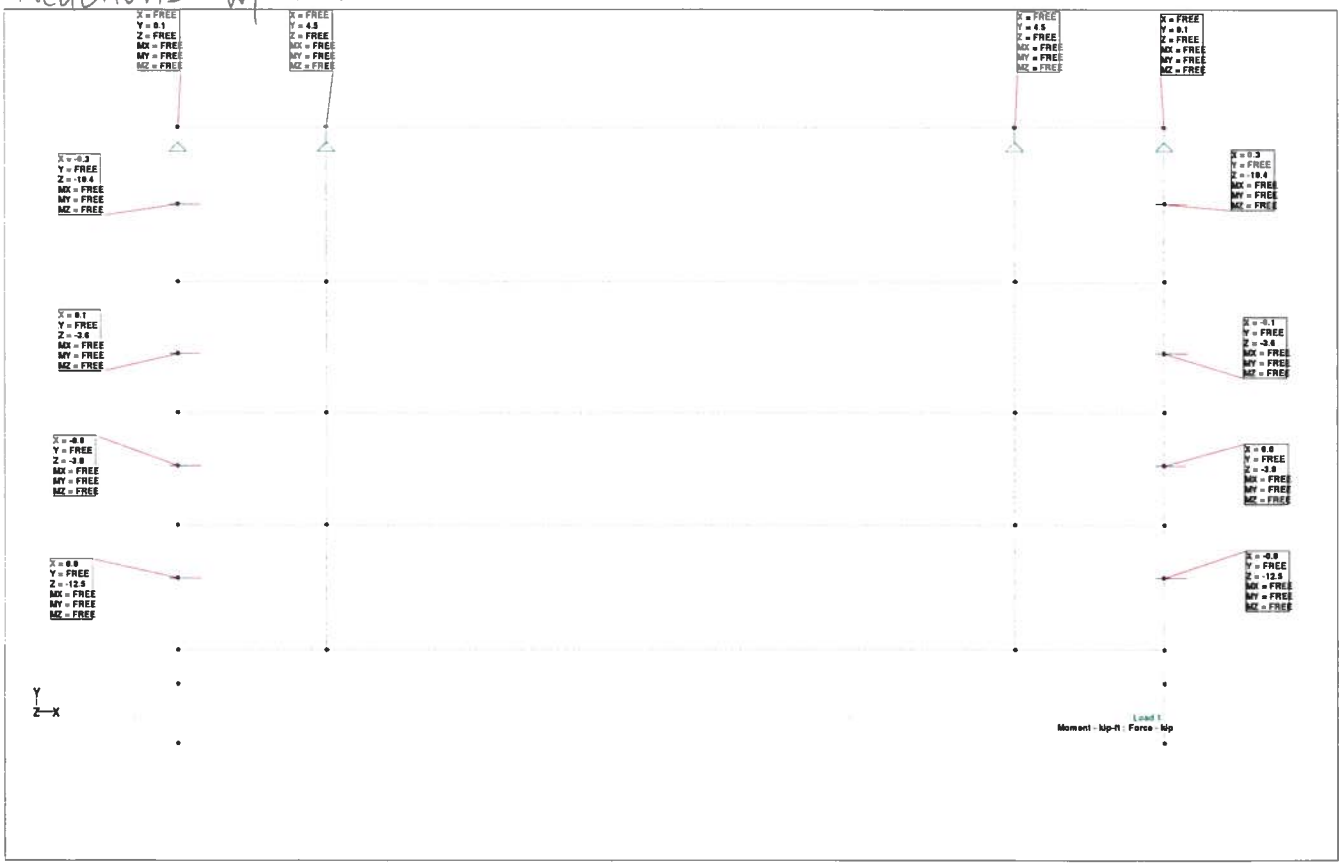
Software licensed to	Job No 41091-002	Sheet No 45/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-1.1.std	Date/Time 23-Jan-2017 15:18	

Reactions w/ 5 rollers

Reactions

Software licensed to	Job No 41091-002	Sheet No 40/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-2.1.std	Date/Time 23-Jan-2017 15:35	

Reactions w/ 4 rollers.



Reactions

Attachment "A"

Hazen

JOB SFWMD - Culvert 8

SHEET NO. 47 OF 61

CALCULATED BY Jean Paul Silva DATE 1/24/2017.

CHECKED BY DATE

SCALE

3 CHECK BULKHEAD WITH PIPE OPENING.

3.1 HORIZONTAL MEMBER

M= 36.7 k·ft → C15X50 ok

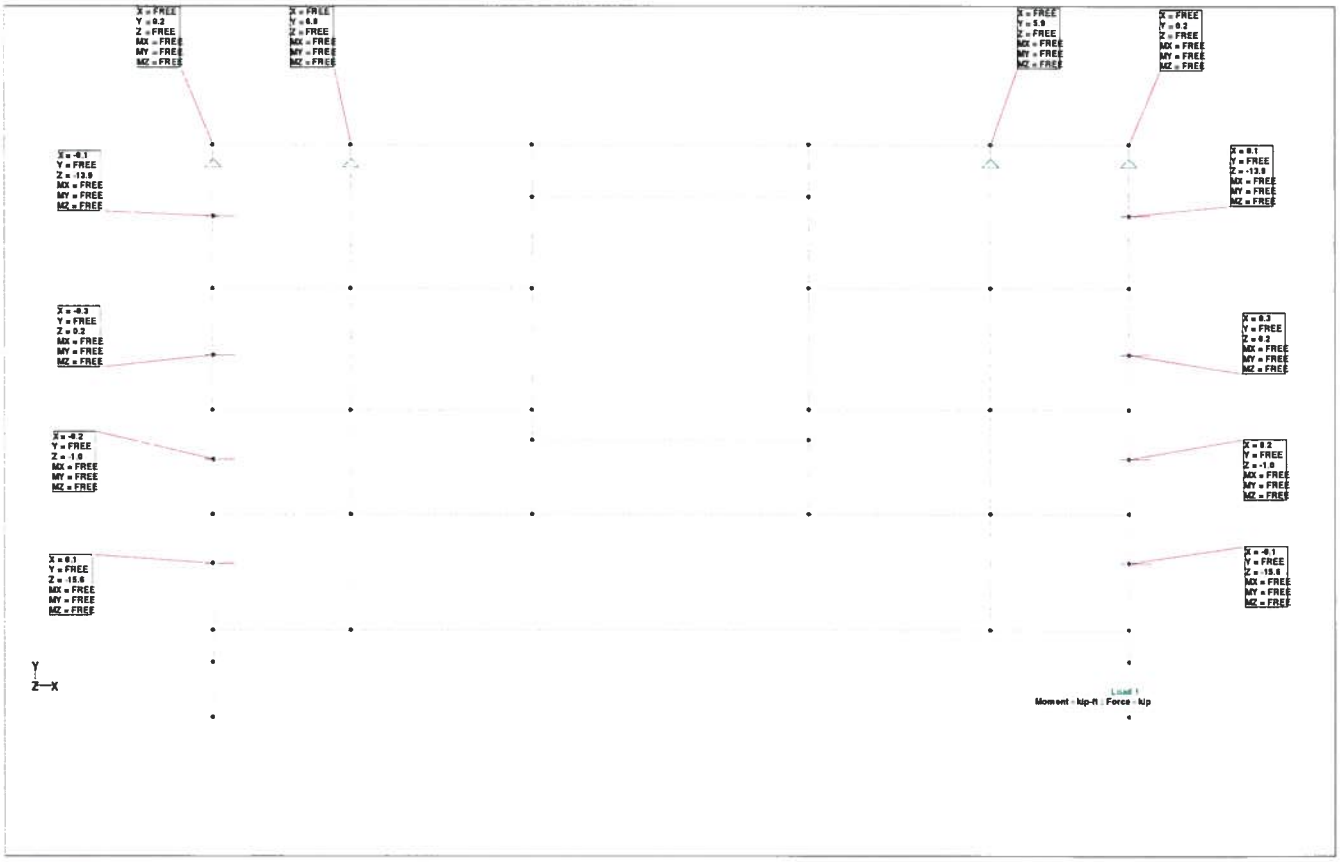
3.2 HORIZONTAL TOP MEMBER:

Mx= 36.7 k·ft
My= 1.27 k·ft → C15X50 ok

3.3 LIFTING TAB.

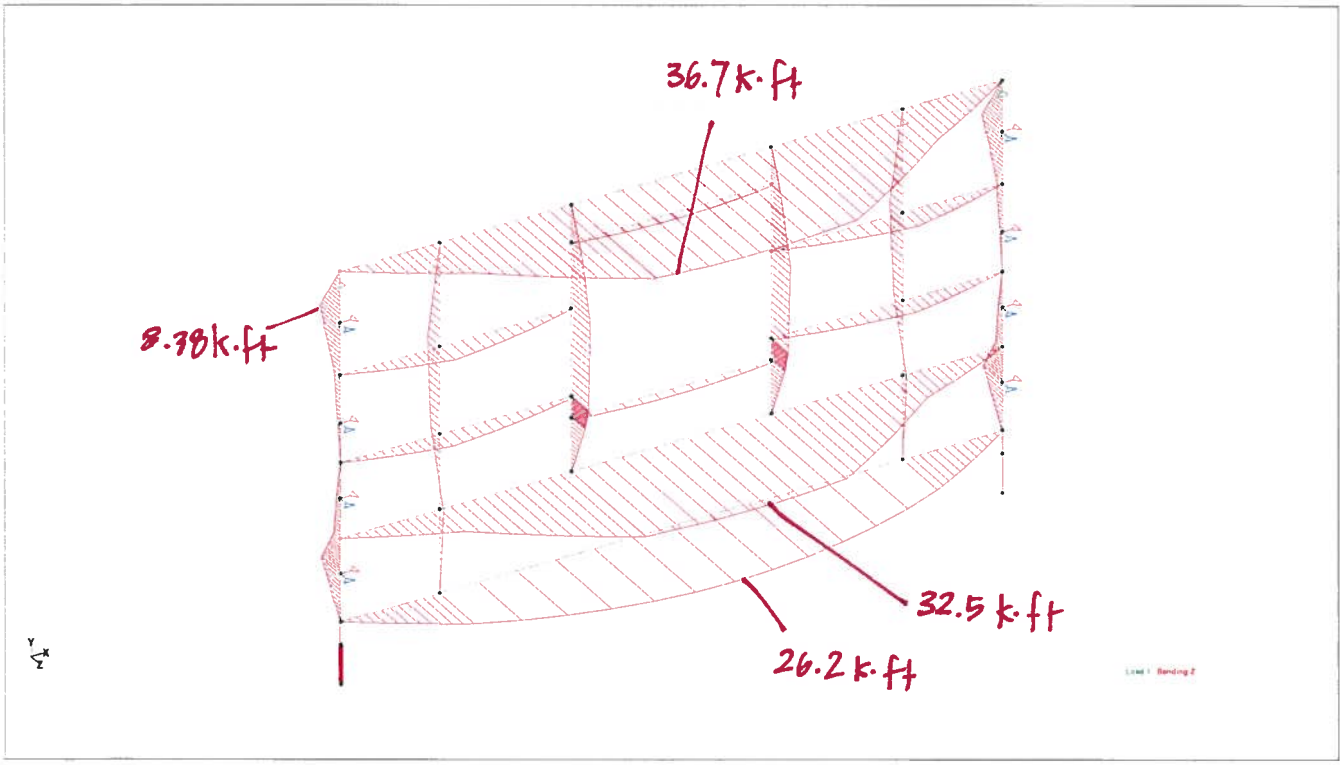
R= 6.0 kip. ok.

Software licensed to	Job No 41091-002	Sheet No 48/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-2.2.std	Date/Time 23-Jan-2017 17:51	



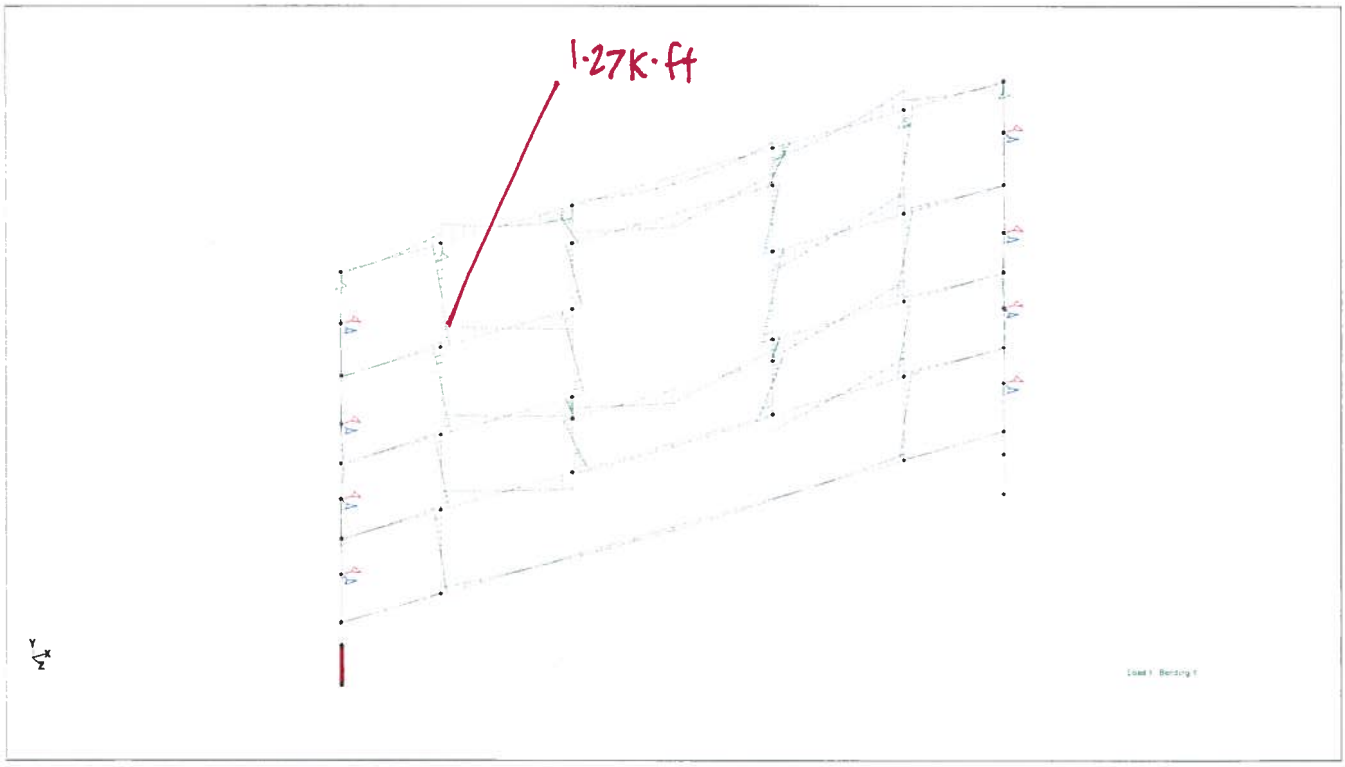
Reactions

Software licensed to	Job No 41091-002	Sheet No 49/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-2.2.std	Date/Time 23-Jan-2017 17:51	



Whole Structure Mz 1kip-ft:1in 1 LOAD CASE 1

Software licensed to	Job No 41091-002	Sheet No 50/61	Rev
	Part Bulkhead Vertical Member		
Job Title Culvert 8	Ref		
	By	Date 10-Jan-17	Chd
Client SFWMD	File Bulkhead-half-2.2.std	Date/Time 23-Jan-2017 17:51	



Whole Structure My 0.25kip-ft:1in 1 LOAD CASE 1

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	51	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

INPUT

General Input							
Description	Bulkhead Horiz. Member		**Unbraced Length**	Lb	159	in. see notes
Section	C15x50			Cb	1.00	see notes
Fy	30	ksi	**Strong Axis**	kx major	1	see notes
Forces/Moments (Enter Positive Numbers)				Lx major	13.25	ft
M_{max} (strong)	36.7	k-ft		Cmx	1.00	see notes
M_{max} (weak)	0.00	k-ft	**Weak Axis**	ky minor	1	see notes
P_{max} (comp)	0	k		Ly minor	13.25	ft
P_{max} (tension)	0	k		Cmy	1.00	see notes
Shear V_{major} (k)	9.00	k	Does Combo include wind or earthquake?		no	(yes/no)

BEAM DATA

Shape	C	d/Af	6.210	Zx (in^3)	68.200
AISC Table No.	2	Min Fillet Design	0.500	Zy (in^3)	8.170
Nominal Depth (in)	15.000	Min Fillet Detail	0.240	J Torsional Constant	2.670
Nominal Weight (plf)	50.000	Tensile Group No.	2.000	Cw, Warping Constant	492.000
Area (in^2)	14.700	Ix (in^4)	404	X-Centroid	0.798
Actual Depth (in)	15.000	Sx (in^3)	54	eo dist (in)	0.583
Thickness of Web (in)	0.716	Rx (in)	5.240	xp	0.488
Width of Flange (in)	3.716	Iy (in^4)	11.000	ro Shear Center	5.490
Thickness of Flange (in)	0.650	Sy (in^3)	3.780	H flexural (I-Rf^2/I)	0.937
K-Distance	1.438	Ry (in)	0.867		

AISC CH. B5 LOCAL BUCKLING / COMPACTNESS

B5.1	Property	<= Compact Sec	<= Noncompact Sec	
bf/tf =	5.72	Not Applicable	17.34	**Flange is Noncompact**
h/tw =	19.13	Not Applicable	218.01	**Web is Noncompact**

AISC CH. F1 STRONG AXIS BENDING

Calculation of rT

Ir	2.85	in^4
Ar	4.13	in^2
r_T	0.83	in

F1.1 **Is Lb < Lc ?**

Lc' = 76*bf/SQRT(Fy) =	51.56	
Lc" = 20000/((d/Af)*Fy) =	107.35	**Use eqns of ASD F1.3**

F1.3 **Is Left Eqn <= L/r_T <= Right Eqn?**

Left Eqn	58.31	
L/rT	191.23	
Right Eqn	130.38	**No**

Is L/r_T > Right Eqn?

L/rT	191.23	
Right Eqn	130.38	**Yes, use Eq. F1-7**

Max: 0.6*Fy Fb =	18	ksi
Eq (F1-6) Fb =	-	ksi
Eq (F1-7) Fb =	4.65	ksi
Eq (F1-8) Fb =	12.15	ksi
ASD F1.3 Fb =	12.15	**ksi (major)**

Major Axis Bending

Fb =	12.15	ksi (from F1.1 or F1.3)
Sx (req'd) = M*12/Fb =	36.24	in^3
fb =	8.19	ksi (major)
Unity Check =	0.674	

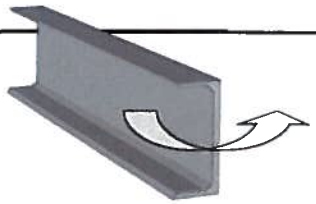
HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	52	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

AISC CH. F2 WEAK AXIS BENDING



Section is Noncompact		
(F2-2) Fb =	18	**ksi (minor)**
Minor Axis Bending		
Fb =	18.00	ksi (from F2)
fb =	0.00	ksi (minor)
Unity Check =	**0.000**	

AISC CH. E2 FLEXURAL BUCKLING

$(kL/r)_x$ =	30.34	
$(kL/r)_y$ =	183.39	**Section is not Slender.**
C_c =	138.13	
Fa =	4.44	**ksi Eq(E2-2) Controls**
Flexural Buckling		
Fa =	4.44	ksi (from E2)
fa = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. D1 TENSION

Ft =	18.00	**ksi**
Yeilding of Gross Area*		
Ft =	18.00	ksi (from E2)
ft = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. H COMBINED STRESSES

Fex	-	ksi see notes
Fey	-	ksi see notes
(H1-1)	-	
(H1-2)	-	
(H1-3)	0.67	
(H2-1)	0.67	
Unity Check	**0.674**	**ksi Design Conforms to AISC/ASD Specs**

AISC CH. F4 SHEAR

h/tw =	19.13	
380/SQRT Fy =	69.38	Eqn (F3-3) Controls
(F3-3) Fv =	12	**ksi**
Shear		
Fv =	12.00	ksi (from F2)
Av =	10.74	
fv =	0.84	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.07**	

HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	53	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

INPUT

General Input							
Description	Bulkhead Top Horiz. Member		Unbraced Length	Lb	159	in. see notes
Section	C15x50			Cb	1.00	see notes
Fy	30	ksi	Strong Axis	kx major	1	see notes
Forces/Moments (Enter Positive Numbers)				Lx major	13.25	ft
M_{max} (strong)	36.7	k-ft		Cmx	1.00	see notes
M_{max} (weak)	1.27	k-ft	Weak Axis	ky minor	1	see notes
P_{max} (comp)	0	k		Ly minor	13.25	ft
P_{max} (tension)	0	k		Cmy	1.00	see notes
Shear V_{major} (k)	9.00	k	Does Combo include wind or earthquake?		no	(yes/no)

BEAM DATA

Shape	C	d/Af	6.210	Zx (in^3)	68.200
AISC Table No.	2	Min Fillet Design	0.500	Zy (in^3)	8.170
Nominal Depth (in)	15.000	Min Fillet Detail	0.240	J Torsional Constant	2.670
Nominal Weight (plf)	50.000	Tensile Group No.	2.000	Cw, Warping Constant	492.000
Area (in^2)	14.700	Ix (in^4)	404	X-Centroid	0.798
Actual Depth (in)	15.000	Sx (in^3)	54	eo dist (in)	0.583
Thickness of Web (in)	0.716	Rx (in)	5.240	xp	0.488
Width of Flange (in)	3.716	Iy (in^4)	11.000	ro Shear Center	5.490
Thickness of Flange (in)	0.650	Sy (in^3)	3.780	H flexural (LRFD)	0.937
K-Distance	1.438	Ry (in)	0.867		

AISC CH. B5 LOCAL BUCKLING / COMPACTNESS

B5.1	Property	<= Compact Sec	<= Noncompact Sec	
bf/tf =	5.72	Not Applicable	17.34	**Flange is Noncompact**
h/tw =	19.13	Not Applicable	218.01	**Web is Noncompact**

AISC CH. F1 STRONG AXIS BENDING

Calculation of rT

Ir	2.85	in^4
Ar	4.13	in^2
r_T	0.83	in

F1.1 **Is Lb < Lc ?**

Lc' = 76*bf/SQRT(Fy) =	51.56	
Lc" = 20000/((d/Af)*Fy) =	107.35	**Use eqns of ASD F1.3**

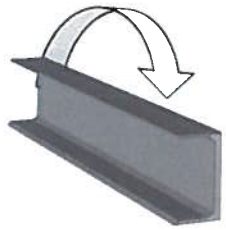
F1.3 **Is Left Eqn <= L/r_T <= Right Eqn?**

Left Eqn	58.31	
L/rT	191.23	
Right Eqn	130.38	**No**

Is L/r_T > Right Eqn?

L/rT	191.23	
Right Eqn	130.38	**Yes, use Eq. F1-7**

Max: 0.6*Fy Fb =	18	ksi
Eq (F1-6) Fb =	-	ksi
Eq (F1-7) Fb =	4.65	ksi
Eq (F1-8) Fb =	12.15	ksi
ASD F1.3 Fb =	**12.15**	**ksi (major)**



Major Axis Bending

Fb =	12.15	ksi (from F1.1 or F1.3)
Sx (req'd) = M*12/Fb =	36.24	in^3
fb =	8.19	ksi (major)
Unity Check =	**0.674**	

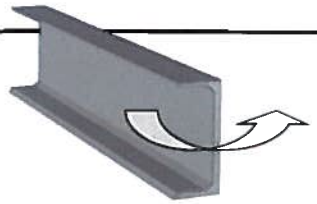
HAZEN AND SAWYER
Environmental Engineers & Scientists

JOB	SFWMD-Culvert 8	
SHEET NO.	54	OF 61
CALCULATED BY	JPS	DATE 1/11/17
CHECKED BY		DATE
SCALE		

AISC/ASD STEEL SECTION DESIGN

Program written by Jean Paul Silva

AISC CH. F2 WEAK AXIS BENDING



Section is Noncompact		
(F2-2) Fb =	18	**ksi (minor)**
Minor Axis Bending		
Fb =	18.00	ksi (from F2)
fb =	4.03	ksi (minor)
Unity Check =	**0.224**	

AISC CH. E2 FLEXURAL BUCKLING

$(kL/r)_x$ =	30.34	
$(kL/r)_y$ =	183.39	**Section is not Slender.**
C_c =	138.13	
Fa =	4.44	**ksi Eq(E2-2) Controls**
Flexural Buckling		
Fa =	4.44	ksi (from E2)
fa = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. D1 TENSION

Ft =	18.00	**ksi**
Yeilding of Gross Area*		
Ft =	18.00	ksi (from E2)
ft = P/A =	0.00	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.000**	

AISC CH. H COMBINED STRESSES

Fex	-	ksi see notes
Fey	-	ksi see notes
(H1-1)	-	
(H1-2)	-	
(H1-3)	0.90	
(H2-1)	0.90	
Unity Check	**0.898**	**ksi Design Conforms to AISC/ASD Specs**

AISC CH. F4 SHEAR

h/tw =	19.13	
380/SQRT Fy =	69.38	Eqn (F3-3) Controls
(F3-3) Fv =	12	**ksi**
Shear		
Fv =	12.00	ksi (from F2)
Av =	10.74	
fv =	0.84	**ksi Design Conforms to AISC/ASD Specs**
Unity Check =	**0.07**	

Attachment "A"

Hazen

JOB SFWMD - Culvert B

SHEET NO. 55 OF 61

CALCULATED BY Jean Paul Silva DATE 1/24/2017.

CHECKED BY DATE

SCALE

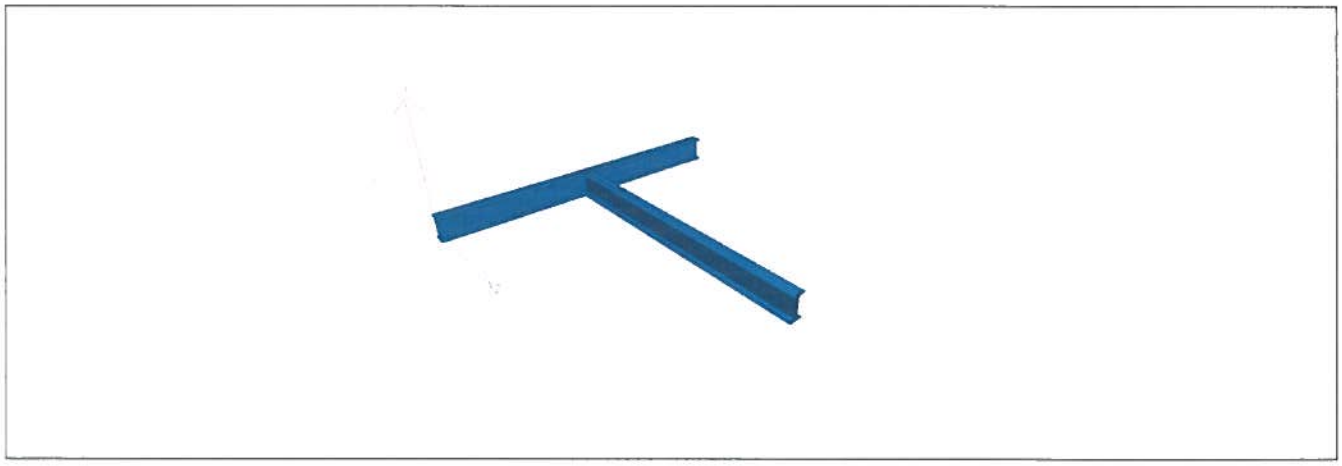
PICKING BAR.

Loads from bulkhead = 6.2 kip.

Loads from pump = $\frac{5500}{2}$ = 2750 lb

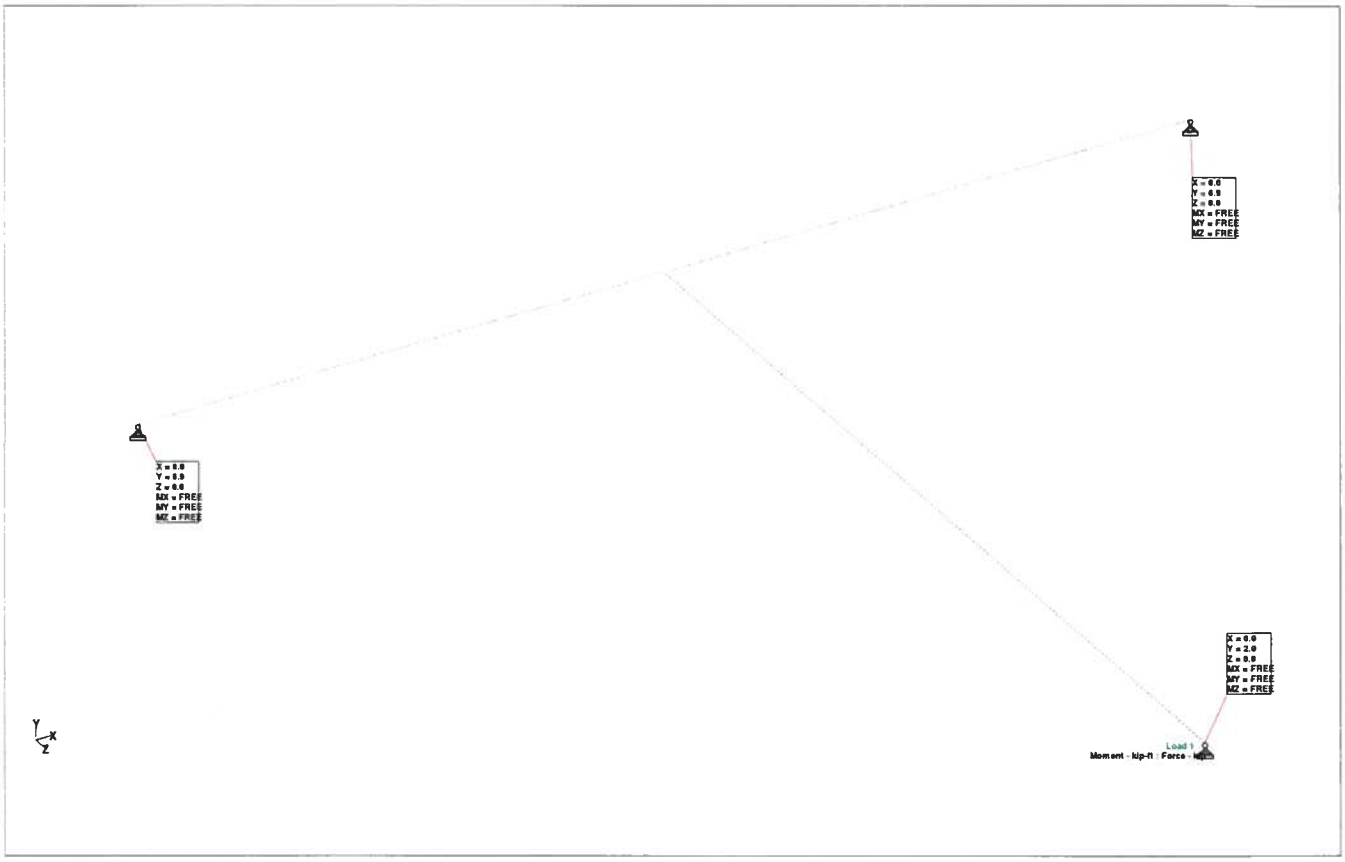
W 10X22 ok

Software licensed to	Job No	Sheet No 56/61	Rev
	Part		
Job Title Culvert 8	Ref		
	By JPS	Date 24-Jan-17	Chd
Client SFWMD	File PickUpBeam1.std	Date/Time 24-Jan-2017 09:43	



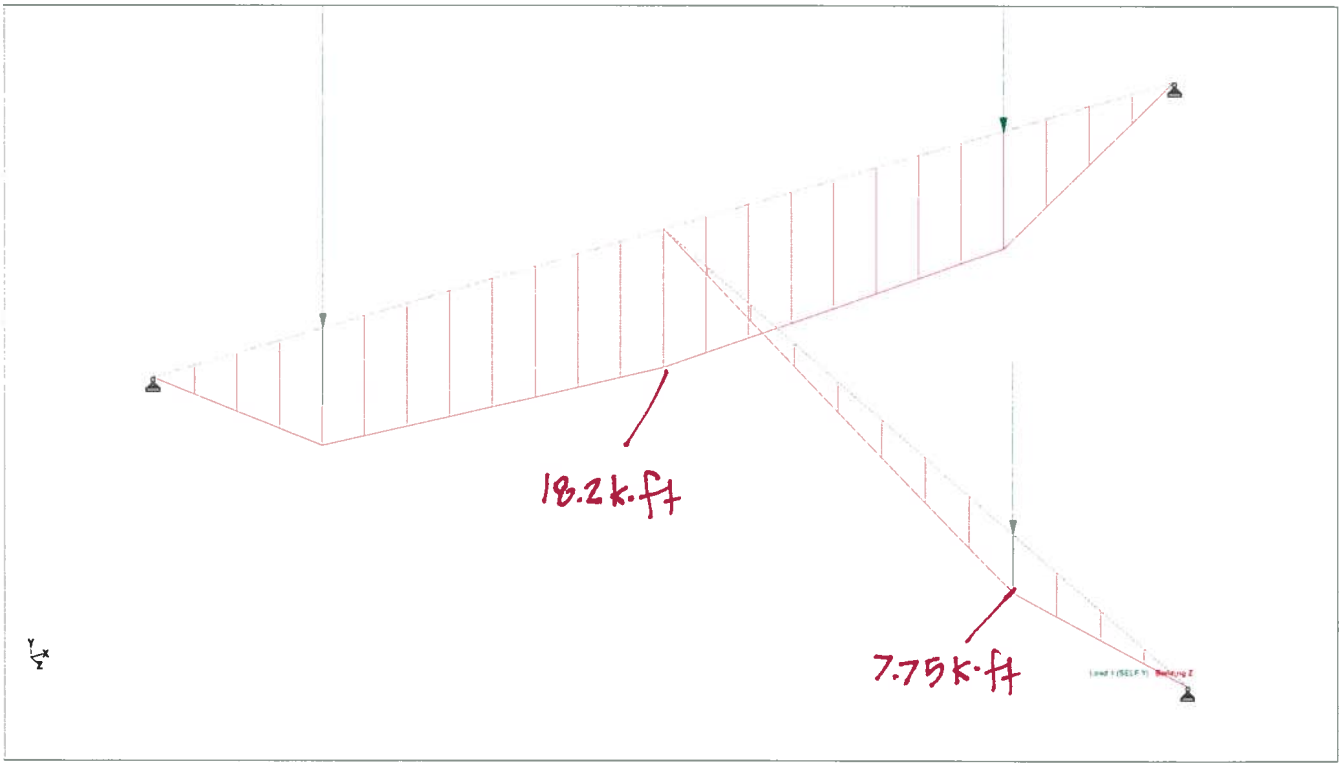
3D Rendered View

Software licensed to	Job No	Sheet No 57/61	Rev
	Part		
Job Title Culvert 8	Ref		
	By JPS	Date 24-Jan-17	Chd
Client SFWMD	File PickUpBeam1.std	Date/Time 24-Jan-2017 09:43	



Reactions

Software licensed to	Job No	Sheet No 58 / 61	Rev
	Part		
Job Title Culvert 8	Ref		
	By JPS	Date 24-Jan-17	Chd
Client SFWMD	File PickUpBeam1.std	Date/Time 24-Jan-2017 09:43	



Whole Structure Loads 1.2kip:1ft Mz 10kip-ft:1ft 1 LOAD CASE 1

Hazen

JOB	SDWRP		
SHEET NO.	59	OF	61
CALCULATED BY	JPS	DATE	
CHECKED BY		DATE	
SCALE			

AISC/ASD STEEL SECTION DESIGN

Program written by Erik Nelson (1/27/00)

INPUT

General Input						
Description	Pick Up Beam		**Unbraced Length**	Lb	144	in.*
Section	w10x22			Cb	1.00	*
Fy	30	ksi	**Strong Axis**	kx major	1	
Forces/Moments (Enter Positive Numbers)				Lx major	12	ft
M_{max} (strong)	18.2	k-ft		Cmx	1.00	*
M_{max} (weak)	0.00	k-ft	**Weak Axis**	ky minor	1	
P_{max} (comp)	0	k		Ly minor	12	ft
P_{max} (tension)	0	k		Cmy	1.00	*
Shear V_w (k)	6.90	k	Does Combo include wind or earthquake?		no	(yes/no)*

BEAM DATA

Shape	W	h/tw	36.900	Rx (in)	4.270
AISC Table No.	1	d/tw	42.400	Iy (in^4)	11.400
Nominal Depth (in)	10.000	Fy''' (ASD)	47.000	Sy (in^3)	3.970
Nominal Weight (plf)	22.000	Fy''' (LRFD)	36.800	Ry (in)	1.330
Jumbo Shape?	NO	X1 (LRFD)	2150.000	Zx (in^3)	26.000
Area (in^2)	6.490	X2 (LRFD)	0.007	Zy (in^3)	6.100
Actual Depth (in)	10.170	RT	1.520	J Torsional Constant	0.240
Thickness of Web (in)	0.240	d/Af	4.910	Cw, Warping Constant	275.000
Width of Flange (in)	5.750	Min Fillet Design	0.300	Wno Warping F(n)	14.100
Thickness of Flange (in)	0.360	Min Fillet Detail	0.320	Sw Warping Moment	7.300
K-Distance	0.750	Tensile Group No.	1.000	Qf (in^3)	4.950
bf/2tf	8.000	Ix (in^4)	118	Qw (in^3)	13.000
Fy'	0.000	Sx (in^3)	23		

AISC CH. B5 LOCAL BUCKLING / COMPACTNESS

B5.1	Property	<= Compact Sec	<= Noncompact Sec	
bf/2tf* =	8.00	11.87	17.34	Flange is Compact
h/tw =	36.90	-	184.48	Criteria is Satisfied
d/tw =	42.40	116.85	-	Web is Compact

AISC CH. F1 STRONG AXIS BENDING

F1.1 Is Lb < Lc ?

Lc' = 76*bf/SQRT(Fy) =	79.78	
Lc" = 20000/((d/Af)*Fy) =	135.78	**Use eqns of ASD F1.3**

F1.3 Is Left Eqn <= L/r_T <= Right Eqn?

Left Eqn	58.31	
L/rT	94.74	
Right Eqn	130.38	**Yes, use Eq. F1-6**

Is L/r_T > Right Eqn?

L/rT	94.74	
Right Eqn	130.38	**No**

Max: 0.6*Fy Fb =	18	ksi
Eq (F1-6) Fb =	14.72	ksi
Eq (F1-7) Fb =	-	ksi
Eq (F1-8) Fb =	16.97	ksi
ASD F1.3 Fb =	**16.97**	**ksi (major)**

Major Axis Bending

Fb =	16.97	ksi (from F1.1 or F1.3)
Sx (req'd) = M*12/Fb =	12.87	in^3
fb =	9.41	ksi (major)
Unity Check =	**0.555**	

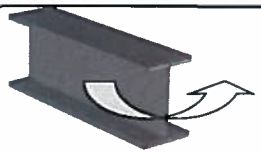
Hazen

JOB	SDWRP		
SHEET NO.	60	OF	61
CALCULATED BY	JPS	DATE	
CHECKED BY		DATE	
SCALE			

AISC/ASD STEEL SECTION DESIGN

Program written by Erik Nelson (1/27/00)

AISC CH. F2 WEAK AXIS BENDING



Section is Compact		
(F2-1) Fb =	22.5	ksi (minor)
Minor Axis Bending		
Fb =	22.50	ksi (from F2)
fb =	0.00	ksi (minor)
Unity Check =	0.000	

AISC CH. E2 FLEXURAL BUCKLING

$(kL/r)_x$ =	33.72	
$(kL/r)_y$ =	108.27	Section is not Slender.
C_c =	138.13	
Fa =	10.94	ksi Eq (E2-1) Controls
Flexural Buckling		
Fa =	10.94	ksi (from E2)
fa = P/A =	0.00	ksi Design Conforms to AISC/ASD Specs
Unity Check =	0.000	

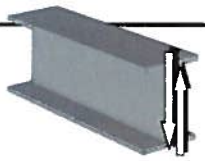
AISC CH. D1 TENSION

Ft =	18.00	ksi
Yeilding of Gross Area*		
Ft =	18.00	ksi (from E2)
ft = P/A =	0.00	ksi Design Conforms to AISC/ASD Specs
Unity Check =	0.000	

AISC CH. H COMBINED STRESSES

Fex	-	ksi see notes
Fey	-	ksi see notes
(H1-1)	-	
(H1-2)	-	
(H1-3)	0.55	
(H2-1)	0.55	
Unity Check	0.555	ksi Design Conforms to AISC/ASD Specs

AISC CH. F4 SHEAR



380/SQRT Fy =	69.38	Eqn (F3-3) Controls
(F3-3) Fv =	12	ksi
Shear		
Fv =	12.00	ksi (from F2)
Av =	2.44	
fv =	2.83	ksi Design Conforms to AISC/ASD Specs
Unity Check =	0.24	

Hazen

JOB	SDWRP		
SHEET NO.	61	OF	61
CALCULATED BY	JPS	DATE	
CHECKED BY		DATE	
SCALE			

AISC/ASD STEEL SECTION DESIGN

Program written by Erik Nelson (1/27/00)

AISC CH. K BEAMS WITH CONCENTRATED LOADS

K1.2 LOCAL FLANGE BENDING

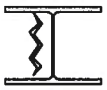
Maximum Computed force delivered to the flange P = Fyw*tf^2/(0.16*factor) =	14.58	kips

K1.3 LOCAL WEB YEILDING

Length of Bearing or Length of Concentrated Load = N =	8.0	in.
0.66*Fyw*tw*(N+2.5k) =	46.93	kips
Maximum Interior Load P = 0.66*Fyw*tw*(N+5.0k) =	55.84	kips

K1.4 WEB CRIPPLING

Length of Bearing or Length of Concentrated Load = N =	8.0	in.
Maximum Concentrated Load at dist<d/2 P = 34tw^2(1+3(N/d)(tw/tf)^1.5)*sqrt(Fy*tf/tw) =	30.30	kips
Maximum Concentrated Interior Load P = 67.5tw^2(1+3(N/d)(tw/tf)^1.5)*sqrt(Fy*tf/tw) =	60.15	kips



K1.5 SIDESWAY WEB BUCKLING

Is the Loaded Flange restrained against rotation?	no	(yes/no)
c = (dc/tw)/(Lb/bf) =	1.44	
Maximum Concentrated Compressive Force P = 6800*tw^3/h*(0.4*c^3)	11.94	kips

K1.6 COMPRESSION BUCKLING OF WEB

Maximum Computed force delivered to the flange P = 4100*sqrt(Fy)*tw^3/(dc*factor) =	21.48	kips

1 Lb = unbraced length of compression flange (in)
2 Noncompact section criteria for welded I-Shapes may include a factor, kc. This is not included in current program.
3 When the bending moment at any point within an unbraced length is larger than that at both ends of this length then Cb = 1.
4 For frames braced against joint translation and for cantilevers, Cb = 1.
5 Cb = 1.75 + 1.05 * (M1/M2) + 0.3 * $(M1/M2)^2$ < 2.3 where M1 is the smaller and
6 Does not check Flexural-Torsional Buckling
7 This progam does not check 0.5Fu for tension members. Effective net area checks must be considered independently.
8 A factor of 4/3 is applied to allowables if the combination includes wind or earthquake loads (AISC/ASD H1, A5.2)
9 k factors can be found on K - Values Worksheet

Appendix 4: Technical Specifications

Attachment "A"

ENGINEERING DESIGN STANDARDS FOR WATER RESOURCE FACILITIES

RFB 6000000818

CULVERT 8 (S-268) PUMP ATTACHMENT

OKEECHOBEE COUNTY, FLORIDA
PROJECT ID#: 101009

CORRECTED FINAL (RTA)
TECHNICAL SPECIFICATIONS

JUNE 2017

TABLE OF CONTENTS

J. Philip Cooke, P.E.
FL Engineering Certificate No.: 47137

Jean Paul Silva, P.E.
FL Engineering Certificate No.: 66522

END OF DIRECTORY

Appendix 5: Opinion of Probable Cost Supporting Documentation

*******Appendix 5 section - blank*******

Appendix 6: Design Submittals – Summary of Review Comments / Resolution

Hazen

Version No.: 1
Last Updated: 1/26/2017

Review Comment Tracking Log

Facility Name: South Florida Water Management District
Project Name: Culvert 8 (S-268) Pump Attachment
Hazen Project No.: 41092-002; District Project No.: 101009
Review Submittal: Preliminary Design Submittal Review Comments
Date Comments Received 6-Sep-16

Project Director: Rob Taylor
Project Manager: J.P. Cooke

Preliminary Design Reviewer					Design Team		Reviewer
ID	Reviewer Name	Reference Dwg, Spec, Page	SFWMD Review Comments / Questions	Project Scope Change?	Response Type	Hazen and Sawyer Resolution/ Response Comment	Back-Checked
1	Jack Ismalon	Cost Estimate	"A review was performed and it is noted that the estimate reflects the work performed. However, there are a number of observations that I would like to point out: a. The provided cost estimate of $10,000 for bulkhead installation seems too low. B. It is imperative that field measurement of bulkhead slots will be done before fabrication. c. SFWMD DCM-7 markup system should be used for our Capital Project."	No	Concur	a. Addressed b. Addressed on Drawings and Specifications c. Cost Estimate provided in Design Report according to Cost Estimating Procedure for Capital Projects	T. VanEyk
2	Matthew Alexander	Civil, Plans & Specs	I do not have any comments	No	Concur	No Change	T. VanEyk
3	Jill Skaggs	Drawings - General	Drawings - General. a. Add north arrows to plan views of all drawings. b. Revise standard text size to 0.1" (min) when drawings are plotted full size (24" x 36") – refer to District CAD Standards for additional text requirements. c. Show flow arrows in plan and section views. d. Please refer to District drawing template for standard flow arrow, section/detail titles, north arrow blocks, etc. e. Refer to District CAD Standards for linework used to distinguish between existing and proposed features.	No	Concur	Addressed	T. VanEyk
4	Jill Skaggs	Drawings - General	a. Note 2. Should this note read "....along the embankment crest to the S-268 (C-8) work area."? b. S-268 (C-8) Site Access - Plan. Should the callout at "S-268 Primary Access Point (West)" instead be labeled "S-268 Primary Access Point (East)"?	No	Concur	Addressed	T. VanEyk
5	Howard Ehmke	Civil - Site Plans	Sheet 3 of 7 Surveyor's Notes: Number 3 add…First line correct "THE" to THE". At the end of note 3 add this statement "This conversion is based on Corpscon 6.0.1 - A U.S. Army Corps of Engineers Engineering Research and Development Center Topographic Engineering Center Alexandria, Virginia Windows-based program to convert coordinates and elevations between datum's using vertcon05.txt and vertcon05.05 files supplied by the U.S. Army Corps of Engineers South Atlantic Division, Jacksonville Fl." The survey drawing shall be added under the "Reference drawings." Please make a copy of the survey available for District review.	No	Concur	Addressed to degree possible; included USACE reference drawings	T. VanEyk
6	Howard Ehmke	Civil Plans	Additional Data provided - Conversion from NAVD88 to NGVD29, U.S. Army Corps of Engineers Corpscon v6.0.1	No	Concur	Incorporated in Report	T. VanEyk

Preliminary Design Reviewer					Design Team		Reviewer
ID	**Reviewer Name**	**Reference Dwg, Spec, Page**	**SFWMD Review Comments / Questions**	**Project Scope Change?**	**Response Type**	**Hazen and Sawyer Resolution/ Response Comment**	**Back-Checked**
7	Teri Swartz	PDR	"The design report mentions that some coordination has already occurred with USACE as part of the Culvert 8 design process. Can you please provide the name of the USACE PM or other contact person? I will follow up on the Section 408 requirements for this work."	No	Yes	USACE Contact: Ingrid Bon	T. VanEyk
8	Teri Swartz	Drawing S001	Will details be provided for the reducers listed on sheet S001?	No	Yes	Addressed per design drawings	T. VanEyk
9	Teri Swartz	Plans and Specs	What testing will the contractor be required to perform? Will they need to test with both District pumps (42" and 30")and rental pumps (24")?	No	No	Contract documents include provisions for Contractor -supplied pumps	T. VanEyk
10	Jose Guardiario	Drawing C001	"Provide USACE Design Site Plan for entire C8 Culvert and indicate at what level is the design (Final or BCOE)."	No	Concur	Addressed	T. VanEyk
11	Jose Guardiario	Drawing C001	Add Section B on Proposed Pump Unit Arrangement	No		Addressed	T. VanEyk
12	Jose Guardiario	Drawing C001	"Show enlargement of pump arrangement on the Site Plan, to show how relates to entire Culvert"	No	Concur	Addressed	T. VanEyk
13	Jose Guardiario	Drawings S001	Use Type 304 Stainless Steel	No	Concur	Addressed	T. VanEyk
14	Jose Guardiario	Drawing REF 01	"Eliminate cut line; provide entire site layout, and highlight area where work will be done. Show design access road, HHD centerline,…"	No	Concur	Site Layout added to G004 and C001	T. VanEyk
15	Jose Guardiario	Drawing REF 01	"Show outline of HHD embankment"	No	Concur	Top of HHD Embankment added to USACE Reference Drawing	T. VanEyk
16	Jose Guardiario	Drawing REF 01	"Indicate Source of Drawing"	No	Concur	Addressed; Note added which references USACE Culvert 8 Reconstruction Plans	T. VanEyk
17	Jose Guardiario	Drawing REF 02	"Are SST channels readily available. If not, indicate bent or welded fabrication"	No	Yes	Addressed	T. VanEyk
18	Jose Guardiario	Drawing REF 02	"Revise to indicate SST rails. Refer to other USACE and SFWMD design drawings."	No	Withdrawn	Addressed by USACE, per TRB Meeting	T. VanEyk
19	Jian Cai	Drawing G001	Change Title of John Mitnik	No	Concur	Addressed	T. VanEyk
20	Jian Cai	Drawing G002	Refer to District's standard Abbreviations and Symbols	No	Concur	Addressed	T. VanEyk
21	Jian Cai	Drawing G002	Revise Section and Detail identification according to District's Section Cut and Detail Symbology	No	Concur	Addressed	T. VanEyk
22	Jian Cai	Drawing G003	Fix notes text. Suggest to provide brief scope. Suggest to add General Notes.	No	Concur	Addressed	T. VanEyk
23	Jian Cai	Drawing S001	Add note similar to: "The Contractor shall field verify the bulkhead dimensions"."REF drawings are for reference only."	No	Concur	Addressed	T. VanEyk
24	Jian Cai	Drawing REF 01	Fix Section Reference	No	Concur	Addressed	T. VanEyk
25	Michael Millares	Drawing S001	"Number of rollers employed on each bulkhead seems excessive. Typically, a District overhead lift gate of this size would have 3 rollers on each side."	No	Needs Discussion	Refer to Design Load Calculations	T. VanEyk
26	William Genz	Drawing S001	"Why are bulkheads shown these drawings using a roller/ rail system? This adds considerable cost to the project and doesn't seem justified unless they will be used frequently."	No	USACE Structure	Addressed during TRB Meeting	T. VanEyk
27	Vincent Loehrlein	Structural - Hydraulic/Structures; Drawing S001	"The gate appears to have far more rollers than necessary. It may be desirable to have a small set of guide rollers at the bottom to use as starter rollers for setting in the slots with a crane."	No	Needs Discussion	Refer to Design Load Calculations	T. VanEyk
28	Vincent Loehrlein	Drawing S001	"If the lower portion of the gate will be permanently left in place to act as a weir, it should be stainless steel instead of carbon steel. We have been converting carbon steel gates to stainless throughout the system as they come up for cycle maintenance as it has a lower life cycle cost. Carbon steel left in the water will need to be blasted and re-coated in 15 years."	No	Concur	Addressed	T. VanEyk
29	Vincent Loehrlein	Drawing S001	"The gate rails are carbon steel while the liner plate is stainless. This will set up dissimilar metal corrosion."	No	Concur	Addressed	T. VanEyk

Preliminary Design Reviewer					Design Team		Reviewer
ID	**Reviewer Name**	**Reference Dwg, Spec, Page**	**SFWMD Review Comments / Questions**	**Project Scope Change?**	**Response Type**	**Hazen and Sawyer Resolution/ Response Comment**	**Back-Checked**
30	Vincent Loehrlein	Structural - Hydraulic/Structures	“Unclear if the gate slots are existing or if this design is to be incorporated into a Corps' design. Please clarify if these details must be worked with another set of design drawings. If so, it would be helpful to have the other relevant drawings attached for reference.”	No	Concur	Addressed; Reference Drawing for Bulkhead and Rail Details included from USACE Reconstruction Construction Plans	T. VanEyk
31	Vincent Loehrlein	Drawing S001	“DWG. S-001, Section E, shows I-beams for gate stiffeners. Typically, turned down channels are used. One reason for this is that when lifting the gate, water is trapped in the upper flanges and adds significantly to the lift weight. Those above the water line will hold rainwater. Drain holes could be provided, but these can clog and there is a time lag between start of lift and draining. The result may be a larger crane required to make the lift.”	No	Concur	Addressed	T. VanEyk
32	Vincent Loehrlein	Drawing S001	“Side seal arrangements are not standard and will need to be modified. Typically provided on one side and mounted to extend from gate so they are sealed by water pressure, not compression.”	No	Needs Discussion	Double side seal used to improve water tightness	T. VanEyk
33	Vincent Loehrlein	Drawing S001	“It is unclear that the horizontal seal between the two gate pieces and at the base of the bulkhead will seal adequately with a vibrating pump attached. Suggest adding a flap of neoprene to the bottom of the upper piece. Typically gate halves are bolted together, which is undesirable in this case. At the bottom of the bulkhead, suggest considering a small step down at the concrete that a flap could seat against to provide a more positive closure. Possibly, a flap of low durometer neoprene against the exist. slab would be adequate to assure closure.”	No	Concur	See bottom seal arrangement on drawings. USACE concrete structure not changed.	T. VanEyk
34	Anthony Wegner	Architectural	“Plans call for “ship’s ladder” to be used to access a maintenance service platform. Request specification call for standard tread and prohibit use of alternating tread style of “ship’s ladder””.	No	Not Applicable	USACE Structure	T. VanEyk
35	Anthony Wegner	Architectural	“Wall mounted davit arm sleeve should be called for. If located at the stem operating level between the vertical ladder and the rungs it can provide fall protection for both sets of ladders.”	No	Not Applicable	USACE Structure	T. VanEyk
36	Anthony Wegner	Architectural	“How is access to staff gauge anticipated for maintenance purposes? Can it be reached from the service platform? If not can a section of the service platform at that point be extended to enable maintenance?”	No	Not Applicable	USACE Structure	T. VanEyk
37	Anthony Wegner	Architectural	“Will manways and manhole covers be provided at any points along the 185 feet of culvert to allow for access to inspect/maintain/repair culvert or will access be only through either end?”	No	Not Applicable	USACE Structure	T. VanEyk
38	Jill Skaggs	Structural Plans	a. Show in plan, section and elevation views dimensions for bulkhead weir, extension, flap gate and ladder rungs. b. Please explain the intent of installing rungs on the bulkhead weir (landside); show rungs in sections and plans for weir and extension, as applicable. c. In the next submittal, provide details for the following: i. Side seals for bulkhead weir and bulkhead extension ii. Bottom seal for weir and extension iii. Roller assembly iv. Typical welds for member-to-member and member-to-skin plate v. Flap gate-to-weir connection vi. Attachment of ladder rungs to bulkhead skin plate vii. Lift bar d. Add notes for the contractor to field verify existing "as-built" conditions at Section F/S001 Bulkhead Recess Detail, Section BW/REF01 Bottom Seal Detail, etc., including dimensions, locations, and details prior to fabrication of the bulkheads.	No	Concur	a. Addressed b. Rungs were added to facilitate diver access per preliminary comment from SFWMD Gatekeeper c. Addressed d. Addressed	T. VanEyk

Preliminary Design Reviewer					Design Team		Reviewer
ID	**Reviewer Name**	**Reference Dwg, Spec, Page**	**SFWMD Review Comments / Questions**	**Project Scope Change?**	**Response Type**	**Hazen and Sawyer Resolution/ Response Comment**	**Back-Checked**
39	Vincent Loehrlein	Preliminary Design Report	Include protocol in the event of hurricane; “Presumably the Corps would close the C-8 gates at such times to preclude flooding due to wind pushing lake water higher than normal, potentially overtopping the weir. Pumping would have to be suspended at such times.”	No	Concur	Addressed - based on discussion with USACE	T. VanEyk
40	Vincent Loehrlein	Preliminary Design Report	"The PDR indicates the design is meant to allow removal of the weir portion (bottom) of the gate to attach the pump on dry land. In this case, the picker system shown in the drawings will no longer be over the center of gravity (c.g.) of the combined gate and pump weight, causing the gate to lean. A modified lift scheme will need to be devised that centers the pick over the expected combined c.g. Note that if different size pumps are used (as indicated may occur in the PDR), then schemes would be needed for each combination, including reducers, that are part of the pick.”	No	Concur	Addressed	T. VanEyk
41	Vincent Loehrlein	Preliminary Design Report	“What is to be done with the existing weir once the bulkhead/weirs are in place? Will it be removed as part of this project? Did not see info on the intended disposition in the PDR.”	No	Concur	Addressed within Report; Existing bulkhead weir to be demolished by USACE during C-8 Reconstruction	T. VanEyk
42	Jian Cai	PDR; Page ES-1	Is it called emergency bulkhead slot?	No	Yes	USACE Structure	T. VanEyk
43	Jian Cai	PDR; Section 2, Page 4	"Not clear", in response to Report phrase, "While extension to EL 19.96 provides about 19-inches of freeboard from this level, it also allows for the extension to double as a weir should a bulkhead becom damaged.	No	Concur	Sentence revised for clarity	T. VanEyk
44	Jian Cai	PDR; Section 2, Page 5	"Not accurate statement. S-133 PS operation range is 13.25 - 14.00 NGVD. It means flood control mode for S-133 basin doesn’t depend on the Lake stage. The temporary pumps at Culvert 8 operates …"	No	Concur	Sentence revised to reflect, "when pumps are required."	T. VanEyk
45	Jian Cai	PDR; Section 2, Page 5	"Is there anything to do with the Lake water level for the pump"	No	Concur	Sentence revised to reflect, "when pumps are no longer required."	T. VanEyk
46	Jian Cai	PDR; Section 2, Page 6	"The combination gate can only open to lakeside"	No	Concur	Sentence deleted	T. VanEyk

Public/SBU/FOUO

Comment Report: All Comments
Project: Culvert 8 Pump Attachment
Review: Final Plans and Specifications Review
Displaying 42 comments for the criteria specified in this report.

Id	Discipline	DocType	Spec	Sheet	Detail
143507	Cost Estimating	Cost Estimate	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

A Review was performed, and it is noted that the cost estimate reflects the work to be performed. However, there are a number of observations that I would like to point out:

a. Please submit the Bulkheads quote from manufacturer, and attached to the report.
b. The provided cost estimate assumed that cofferdam and dewatering will not be required.
c. Cost estimate assumed that the project will apply with USACE regulation when working on culvert through the Herbert Hoover Dike.

Submitted By: Jack Ismalon (561-682-6187). Submitted On: Feb 06 2017

1-0 Evaluation **Concurred**

a. Acknowledged. Bulkhead manufacturer quotes are attached and will be included in the report.
b. Correct; Culvert 8 project is currently under construction by USACE.
c. Correct; Culvert 8 project is currently under construction by USACE.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 20 2017 (Attachment: 2017-01_SFWMD_Culvert_8_Blkhd_Mfg_Quotes.pdf)

1-1 Backcheck Recommendation **Close Comment**

Closed without comment.

Submitted By: Jack Ismalon (561-682-6187) Submitted On: Mar 22 2017

Current Comment Status: **Comment Closed**

143662	Cost Estimating	Cost Estimate	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

Please provide backup to cost estimate.

Submitted By: Matthew Alexander (561-682-2580). Submitted On: Feb 13 2017

1-0 Evaluation **Concurred**
Backup cost estimate information is attached and will be provided in the final report.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 20 2017 (Attachment: 2017-01_SFWMD_Culvert_8_Cost_Quotes.pdf)

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Matthew Alexander (561-682-2580) Submitted On: Mar 21 2017
Current Comment Status: **Comment Closed**

143663 Civil Plans and Specs n/a n/a n/a

Comment Classification: **For Official Use Only (FOUO)**

Please add RFB number to plans and specifications.

Submitted By: Matthew Alexander (561-682-2580). Submitted On: Feb 13 2017

1-0 Evaluation **Concurred**
Will add RFB 6000000818 to plans and specifications.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Matthew Alexander (561-682-2580) Submitted On: Mar 21 2017
Current Comment Status: **Comment Closed**

143664 Civil Plans and Specs 01020 n/a n/a

Comment Classification: **For Official Use Only (FOUO)**

Please delete bid items B, C, and D.

It is my understanding that the SFWMD only needs Item A, the fabrication of bulkheads, installation, and provision of equipment.

Submitted By: Matthew Alexander (561-682-2580). Submitted On: Feb 13 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Matthew Alexander (561-682-2580) Submitted On: Mar 21 2017

Current Comment Status: **Comment Closed**

143690	General	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

No comments. Final design package will be submitted to USACE for Section 408 approval.

Submitted By: Teri Swartz (561-682-2505). Submitted On: Feb 15 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Debbie Gale (561-682-2424) Submitted On: Mar 21 2017

Current Comment Status: **Comment Closed**

143755	General	Plans	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

I have no comments.

Submitted By: Roy Sapp (863-462-5280). Submitted On: Feb 22 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Debbie Gale (561-682-2424) Submitted On: Mar 21 2017

Current Comment Status: **Comment Closed**

143756	Civil	Design Memorandum or Report	n/a	3.2 Structural Calculations, page 8	n/a

Comment Classification: **For Official Use Only (FOUO)**
(Document Reference: Hazen and Sawyer, Culvert 8 (S-268) Pump Attachment, Final Design Report Hazen No. 41091-002, January 27, 2017) [**Critical/Flagged.**]
Coordinating Discipline(s): Civil

Case 1 has a higher seating/unseating head compared to Case 2, but the Case 2 reactions are higher. Verify calculations.

Submitted By: Jose Guardiario ((561) 682-2594). Submitted On: Feb 22 2017

1-0 Evaluation **Concurred**
Calculations show reactions typically higher for Case 1 depending on the number of rollers

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Open Comment**
Include this verbiage in the report

Submitted By: Jose Guardiario ((561) 682-2594) Submitted On: Mar 22 2017

2-0 Evaluation **Concurred**
This verbiage will be included in the report.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 06 2017

2-1 Backcheck Recommendation **Close Comment**
Flagged for follow-up

Submitted By: Jose Guardiario ((561) 682-2594) Submitted On: Apr 13 2017
Current Comment Status: **Comment Closed**

143757 Civil Plans n/a S001 and S002 n/a

Comment Classification: **For Official Use Only (FOUO)**
[**Critical/Flagged.**]
Coordinating Discipline(s): Civil

Provide reference details on how lifting bracket will dovetail into the bottom of the bulkhead extension. You may need to offset the lifting bracket to eliminate conflicts with the extension structural members

(Attachment: SFWMD_Culvert_8_Drawings_jg20170222.pdf)

Submitted By: Jose Guardiario ((561) 682-2594). Submitted On: Feb 22 2017

1-0 Evaluation **Concurred**
The bottom of each gate is not flat and has sufficient space to sit on bottom bulkhead without interference from lifting brackets. A detail will be provided to indicate how the bulkhead extension sits on the bulkhead.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Flagged for follow-up

Submitted By: Jose Guardiario ((561) 682-2594) Submitted On: Mar 22 2017
Current Comment Status: **Comment Closed**

143765 General Plans and Specs n/a G001 n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Please update signature to Alan Shirkey (see attached)

(Attachment: SFWMD-Engineering_Cover-external.dwg)

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Open Comment**
Please remove Executive Director's name from coversheet. Please see revised coverpage in District Standard's folder in documentum.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017

2-0 Evaluation **Concurred**
The Executive Director's name will be removed from the coversheet. A revised coverpage was retrieved from the District's Standards folder in documentum.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 06 2017

2-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 11 2017
Current Comment Status: **Comment Closed**

143766 Structural Plans n/a 10 of 16 Note 4

Comment Classification: **For Official Use Only (FOUO)**
(Document Reference: S005)

Note 4 requires chains used for lifting to be "hot dipped galvanized" but there is not mention of the requirement that lifting chains also be Alloy Steel Grade 80 or 100. Request adding requirement that chains be Alloy Steel Grade 80 or 100.

Submitted By: Anthony Wegner (561 753-2400 x 4703). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Drawing will be revised to require lifting straps to be Allow Steel Grade 80 or 100.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
No Further Comment

Submitted By: Anthony Wegner (561 753-2400 x 4703) Submitted On: Mar 27 2017

Current Comment Status: **Comment Closed**

143767	General	Plans and Specs	n/a	All drawings	n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Please remove revision descriptions from all boarders. They are intended to be used to track changes after RTA set.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Will revise border descriptions accordingly.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017

Current Comment Status: **Comment Closed**

143768	Structural	Plans	n/a	10 of 16	J/S005

Comment Classification: **For Official Use Only (FOUO)**
(Document Reference: S005)

Detail shows multiple lifting chain shackles rigged from one lifting bar attachment point using an undetermined unidentifiable object between each shackle and the lifting point. Also chain slings are at an angle which reduces lifting capacity and stability. Recommend clarifying lifting shackle attachment point drawing and designing it so that chain slings are vertical with each individual attachment point to the lifting bar.

Submitted By: Anthony Wegner (561 753-2400 x 4703). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Chain items will be identified. Lifting bar is provided with multiple lifting points such that chains can be attached to a point that results in a vertical condition.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
No Further Comment

Submitted By: Anthony Wegner (561 753-2400 x 4703) Submitted On: Mar 27 2017

Current Comment Status: **Comment Closed**

143769	General	Plans and Specs	n/a	01010	n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Update section 1.09B per revised standards.

Current
The following reference materials are available for inspection at the offices of the DISTRICT.

Replace with:
The following reference materials are included as part of this solicitation.

Remove list of drawings from 1.09 A and match with District Standards.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Will update 01010(1.09B) per revised standards and remove list of drawings from 1.09A.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143770 Structural Plans n/a 10 of 16 J/S005

Comment Classification: **For Official Use Only (FOUO)**
(Document Reference: S005)

Below the hook lifting bar missing label required by ANSI/ASME Standard B30.20, "Below-the-Hook Lifting Devices". Unsure if proposed design meets the design requirements of that standard. Specifications for the lifting bar should include that the lifting bar shall be designed and fabricated in accordance with ANSI/ASME Standard B30.20, "Below-the-Hook Lifting Devices".

Submitted By: Anthony Wegner (561 753-2400 x 4703). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Specifications for the lifting bar and straps will require design, fabrication and labeling in accordance with ANSI/ASME Standard B30.20, "Below-the-Hook Lifting Devices".

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
No Further Comment.

Submitted By: Anthony Wegner (561 753-2400 x 4703) Submitted On: Mar 27 2017

Current Comment Status: **Comment Closed**

143771	General	Plans and Specs	n/a	01010	n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

3rd paragraph on page 2 needs to be numbered. Also at the final design, all information should be complete. Please add location where bulkhead will be stored.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
3rd paragraph on page 2 will be numbered and location of bulkhead storage at Field Station's laydown year off of HWY 710 will be added.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017

Current Comment Status: **Comment Closed**

143772	Mechanical - Pump Stations	Plans	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

Ref. Dwg. C001: Pumps do not appear to have proper submergence. For example, per MWI, a 42" pump of this design requires 84" of submergence (water surface to intake bell).

Submitted By: Michael Millares (561-682-6345). Submitted On: Feb 23 2017

1-0 Evaluation **Non-concurred**
HAC 342 is worst case. Documents provided by MWI (attached) identify the HAC 342 submersible hydraulic pump as requiring 73-in of submergence above the floor. Using the sill at EL 4.5', this would put the minimum water surface to start pumping at EL 10.58'. Because the District's intent is to use the pumps when the water level exceeds EL 11.73', an additional 13.8-in of submergence will be provided under standard operating conditions.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 20 2017 (Attachment: Hydraflo_Horizontal_Dimension_Sheet.pdf)

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Michael Millares (561-682-6345) Submitted On: Apr 03 2017

2-0 Evaluation **Concurred**
Concur

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 18 2017

2-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Jian Cai (561-242-5520) Submitted On: Apr 18 2017
Current Comment Status: **Comment Closed**

143773 Structural Plans n/a n/a n/a

Comment Classification: **For Official Use Only (FOUO)**

Could find no evidence of fall protection (davit arm sleeves, ladder tie of anchor points, etc.) in the drawings. Request District standards be followed regarding installation of fall protection equipment. Drawing shows installed individual ladder rungs on one gate section? Unclear as to the installation specifications of the individual ladder rungs or why they are on only one section.

Submitted By: Anthony Wegner (561 753-2400 x 4703). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Noted. As this is a USACE facility currently under construction, will have District PM provide suggestion to USACE. Regarding ladder rungs on bottom gate section, this is to facilitate divers in the event of pump assembly/disassembly in place underwater.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
No Further Comment

Submitted By: Anthony Wegner (561 753-2400 x 4703) Submitted On: Mar 27 2017
Current Comment Status: **Comment Closed**

143774 General Plans and Specs n/a Drawings n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Many drawing have J P Cooke's title block and boarder has J P Silva as an engineer. Please update and QA/QC submittals prior to the next submittal.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Will revise title blocks accordingly.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143775 General Plans and Specs n/a S-DWGS n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Culvert opening, center wall dimension, etc. are provided in ref drawings towards the end. Please include dimensions pertinent to proposed design in plan and elevation views for easy reference and verification.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

Revised Feb 23 2017.

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143776 General Plans and Specs n/a S001 n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Note " Alternative framing member shapes may be.....". Submittals requirements for gates are covered in spec 11285. Recommend removing it from plans to avoid conflict. What is the thought process behind allowing for alternative framing member shapes?

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Note will be deleted.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Open Comment**
Is it being deleted from the entire package or only drawings?

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017

2-0 Evaluation **Concurred**
It will be deleted from the drawings.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 07 2017

2-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 11 2017

Current Comment Status: **Comment Closed**

143777 General Plans and Specs n/a 01300 and 01310 n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Please use most up to date specs from documentum.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017

Current Comment Status: **Comment Closed**

143778 General Plans and Specs n/a 01510 n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

References specs 01590 and 02402 which are not applicable to the project. Please QA/QC documents prior to submittal at the next phase.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Open Comment**
To help me verify this comment at check-set - you are concurring that these two specs are not applicable and references will be removed?

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017

2-0 Evaluation **Concurred**
Correct. Specification 01590 (Field Offices and Sheds) and specification 02402 (Bypass) do not apply to this project. References to these two specifications will be removed.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 06 2017

2-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 11 2017
Current Comment Status: **Comment Closed**

143779 General Plans and Specs n/a 01700 n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Section 01700 references section 01050 which is not included. Survey/as-built requirements don't apply to this project?

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Open Comment**
Does spec 01050 apply? Are you removing reference or adding this spec? Response is hard for me to verify at the Check-set.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017

2-0 Evaluation **Concurred**
Section 01050 does not apply to this project. There are notes on the drawings that the contractor shall field verify elevations and dimensions of the existing structure prior to bulkhead weir and bulkhead extension fabrication.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 06 2017

2-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 11 2017
Current Comment Status: **Comment Closed**

143780 General Plans and Specs n/a 02215 n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Please assure information is not missing from 1.04 4.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143781 General Plans and Specs n/a Warramty n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

Please remove one year Manufacturer's warranty from specs starting at 05120 (remove 1.06 A). One year contractor warranty should be kept. Update other specs as necessary.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Acknowledged

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143782 General Plans and Specs n/a 15001 n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): General

What is the intent of Section 15001. Doesn't have scope or parts or execution.

Please provide redline track change version of entire spec book as a part of evaluation.

Submitted By: Neha Pandya (561-682-2623). Submitted On: Feb 23 2017

1-0 Evaluation **Concurred**
Correct. There are no mechanical parts or equipment being provided. Section 15001 will be removed from the specifications. Printed redline versions of specifications will be submitted.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Neha Pandya (561-682-2623) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143788	Civil	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

Design Report pg. 6, sec. 2.3 Hurricane Protocol says in the event of a hurricane pumping equipment should be removed. Why would the equipment not be left in place? What parts are vulnerable in a storm? Can it be more easily protected in place than by removal? This would appear to potentially require a major effort and staff is limited pre-hurricane. Also crane operations may be restricted at such a time due to wind gusts that can arise days prior to onslaught.

Submitted By: Vincent Loehrlein (561-682-6174). Submitted On: Feb 27 2017

1-0 Evaluation **Concurred**
Inclusion of a Hurricane Protocol was requested at the Preliminary Design stage. During the use of pumping equipment, pump drive units, hoses, andfuel tank(s) remain above grade and exposed where they may be impacted by the storm or debris.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Open Comment**
I don't see removing the drive units and fuel tanks for every hurricane threat. They should be relatively well-armored for hurricane effects. The hoses would need to be secured. This issue needs more discussion to clarify exactly what will have to be protected or removed. Otherwise it either won't happen or unnecessary actions will occur.

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 03 2017

2-0 Evaluation **Concurred**
We will recommend that all equipment be left in place with the hydraulic hoses disconnected and capped. The emergency procedure outlined in the Design Report will be revised accordingly.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 06 2017

2-1 Backcheck Recommendation **Close Comment**
OK

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 13 2017

Current Comment Status: **Comment Closed**

143789	Mechanical - Gates and Valves	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

Dwg. S001: Number of rollers continues to appear excessive. Is this many rollers necessary?

Submitted By: Vincent Loehrlein (561-682-6174). Submitted On: Feb 27 2017

1-0 Evaluation **Concurred**
Number of rollers were determined following spacing recommendations from District standard details. Reduction in the number of rollers was evaluated but not implemented because of the possibility of overstress of the roller assembly.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Noted.

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 03 2017

Current Comment Status: **Comment Closed**

143790	Structural	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**
[**Critical/Flagged.**]

Dwg. S001, The lower gate section is shown with lifting lugs that appear to be in the way of seating the upper section. These lugs do not show up in the section views so it is not possible to determine their position.

Submitted By: Vincent Loehrlein (561-682-6174). Submitted On: Feb 27 2017

1-0 Evaluation **Concurred**
A section will be added to show the 2 gates together. The bottom of the gates are not flat to avoid interference with lifting lugs

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Noted. Need to see final detail.

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 03 2017

Current Comment Status: **Comment Closed**

143791	Mechanical - Gates and Valves	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**
[**Critical/Flagged.**]

Dwg. S001, Typically gates that are in two parts are bolted together with a seal between them. These gates will not be bolted together in order to facilitate use separately. However, it would still be beneficial to have some sort of seal, possibly a flap. This comment was made in the preliminary review and the response was that it would be addressed.

Submitted By: Vincent Loehrlein (561-682-6174). Submitted On: Feb 27 2017

1-0 Evaluation **Concurred**
Bottoms of gates are provided with seals that allow them to be used as bulkhead or extension. A detail showing the connection between gates will be added.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Noted. Need to see final detail.

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143792	Mechanical - Gates and Valves	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): Structural

Dwg. S002, previous comment noted dissimilar metal issue between rails and rollers. This was to be discussed with USACE. What was the outcome? Nothing appears to have been revised.

Submitted By: Vincent Loehrlein (561-682-6174). Submitted On: Feb 27 2017

1-0 Evaluation **Concurred**
A conference call was held with USACE, District and Engineer on 10/19/16. USACE acknowldedged the design issue and stated that they have since revised their design however the revision was made subsequent to releasing C-8 for construction. They also stated that they will attempt to address the revision during the shop drawing submittal stage if possible, however if this is not possible, maintenance of the C-8 structure will be the responsibility of USACE.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 20 2017

1-1 Backcheck Recommendation **Close Comment**
Noted.

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143793	Mechanical - Gates and Valves	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): Structural

Dwg. S002, Sec. E shows bars attached to the lakeside face of the gate. The note says see detail but does not indicate where the detail is. Sht. S004 shows a detail 5 that appears to apply to the upper bar but doesn't depict how the others are connected. It is unclear what the purpose of these bars is or what their length is.

Submitted By: Vincent Loehrlein (561-682-6174). Submitted On: Feb 27 2017

1-0 Evaluation **Concurred**
Detail callout will be clarified. Callout will refer to detail 5 on drawing S004.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 20 2017

1-1 Backcheck Recommendation **Open Comment**
What is the purpose of the bars?

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 03 2017

2-0 Evaluation **Concurred**
The purpose of the bars is to provide additional reinforcement of the horizontal members of the gate. The bars are per the District standard details.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 07 2017

2-1 Backcheck Recommendation **Open Comment**
The District standards are being revised and this item may be removed. It appears to be a specialized design that applied in one location that may not apply in most cases. The bars add over 1,000# to each gate which is undesirable if not structurally needed. The designer should determine if the stresses in the channel stiffeners are high enough that the added cover plate is needed.

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 13 2017

3-0 Evaluation **Concurred**
Based on the design stress, the channel stiffeners are not necessary and will be deleted.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Apr 18 2017

3-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Jian Cai (561-242-5520) Submitted On: Apr 18 2017
Current Comment Status: **Comment Closed**

143794	Mechanical - Gates and Valves	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**
[**Critical/Flagged.**]
Coordinating Discipline(s): Structural

Dwg. S003, need a detail of how the J-seals on the sides interface with the flat seals on the bottom. They are not in the same plane so water can flow between them. We have had this be an issue at other gates (e.g. S-46).

Submitted By: Vincent Loehrlein (561-682-6174). Submitted On: Feb 27 2017

1-0 Evaluation **Concurred**
J-seal detail will be revised to extend 0.25-in below clamp bar to correspond with bottom seal.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Noted. Need to see final detail.

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143795	Mechanical - Gates and Valves	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**
[**Critical/Flagged.**]
Coordinating Discipline(s): Structural

Dwg. S004, Detail 6 does not look like our typical seal detail for a gate bottom. The clamp bar should not extend for the full length of the seal material since this will not allow the neoprene to create a closure with bottom surface. The ¾" also seems excessive. I believe this is typically more like 1/8" but cannot confirm at this time.

Submitted By: Vincent Loehrlein (561-682-6174). Submitted On: Feb 27 2017

1-0 Evaluation **Concurred**
The detail for the seal of a gate bottom is similar to the District typical detail but had to be modified to accommodate the project conditions. The clamp bar will be revised. The 3/4" dimension is per the District Standard detail.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Noted. Need to see final detail.

Submitted By: Vincent Loehrlein (561-682-6174) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143858	Mechanical - Miscellaneous	Plans	n/a	S005	Section H

Comment Classification: **Public (Public)**
Coordinating Discipline(s): Mechanical - Miscellaneous

Section H is questionable. It shows a lifting point that's located directly on the 42" flap gate/piping assembly which mates to the pump

Submitted By: Northon Jocelyn ((561) 682-2593). Submitted On: Feb 28 2017

1-0 Evaluation **Concurred**
Section H depicts lifting straps on the roller gate lift eyes (4), 1 strap directly above the mounted hydraulic pump, 1 strap directly above the 90-degree intake and 2 angled straps on the 90-deg intake to provide lateral support. Section will be revised for clarification.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Northon Jocelyn ((561) 682-2593) Submitted On: Apr 05 2017
Current Comment Status: **Comment Closed**

143859	Mechanical - Miscellaneous	Plans	n/a	S001	list of pump assemblies

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): Mechanical - Miscellaneous

what's driving the need for three of the
42"x 24" and three of the 42"x30". should this be one each considering the maximum design flow of 200cfs and the pump sizes

Submitted By: Northon Jocelyn ((561) 682-2593). Submitted On: Feb 28 2017

1-0 Evaluation **Concurred**
Because the District does not currently possess available pumping units for the C-8 Pump Attachment design, it is the District's intent to rent pumps if necessary. Due to the uncertainty of the pump rental market availability in the future, the full set of reducers was envisioned to provide maximum flexibility. Based on comments from other reviewers, the number of 42"x24" and 42"x30" reducers will be revised from three to two each.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Northon Jocelyn ((561) 682-2593) Submitted On: Apr 05 2017
Current Comment Status: **Comment Closed**

143860	Mechanical - Miscellaneous	Plans	n/a	S001	list of pump assemblies

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): Mechanical - Miscellaneous

what's driving the need to have the different pump sizes. wouldn't be easier to simply stage the intake and pump for a period of time to lower the intake using a 42" pump

Submitted By: Northon Jocelyn ((561) 682-2593). Submitted On: Feb 28 2017

1-0 Evaluation **Concurred**
Use of a 42" pump provides the most efficient solution. However, because the District does not currently possess available pumping units for the C-8 Pump Attachment design, it is the District's intent to rent pumps if necessary. Due to the uncertainty of the pump rental market availability in the future, the accomodation of various size pumping units was envisioned to provide maximum flexibility.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Northon Jocelyn ((561) 682-2593) Submitted On: Apr 05 2017
Current Comment Status: **Comment Closed**

143861	Other	Other	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**
Coordinating Discipline(s): Other

Is the labor cost to install the MWI pumps listed under testing included in the dollar amount

Submitted By: Northon Jocelyn ((561) 682-2593). Submitted On: Feb 28 2017

1-0 Evaluation **Concurred**
Labor cost is represented in the crane rental costs, manufacturer field services costs, general contractor mobilization and demobilization costs; Testing equipment costs will be revised based on dry fit testing only.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 20 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Northon Jocelyn ((561) 682-2593) Submitted On: Apr 05 2017
Current Comment Status: **Comment Closed**

143862	Other	Plans and Specs	01010 1.03 B	n/a	n/a

Comment Classification: **Public (Public)**
Coordinating Discipline(s): General

testing/operation of the pumps to be rented should be a separate task clearly defined in the contract as the water conditions at the time may not be conducive to operation of the pumps at design heads. That said, check fit of the complete assembly (bulkhead with pump adapter, reducing flanges and pump assembly) is much more likely possible and can be done at significantly less dollars since it doesn't involve running the pumps

Submitted By: Northon Jocelyn ((561) 682-2593). Submitted On: Feb 28 2017

1-0 Evaluation **Concurred**
Testing will be revised to dry fit test of the pump assemblies.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Northon Jocelyn ((561) 682-2593) Submitted On: Apr 05 2017
Current Comment Status: **Comment Closed**

143864	Civil	Design Memorandum or Report	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

See the attached

(Attachment: 41091-002_Culvert_8_Pump_Attachment_Report_(01-27-17)_JC.pdf)

Submitted By: Jian Cai (561-242-5520). Submitted On: Mar 01 2017

1-0 Evaluation **Concurred**
Revisions made to report and discussed with reviewer 3/10/17. Testing costs include pump equipment rental and bulkhead manufacturer field services. Labor cost is represented in the crane rental costs, manufacturer field services costs, general contractor mobilization and demobilization costs; Testing equipment costs will be revised based on dry fit testing only. Backup information for costs are attached.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 20 2017 (Attachment: 2017-01_SFWMD_Culvert_8_Cost_Quotes1.pdf)

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Jian Cai (561-242-5520) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143865	Civil	Plans and Specs	n/a	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

See the attached

(Attachment: SFWMD_Culvert_8_Technical_Specifications_(01-27-17)JC.pdf)

Submitted By: Jian Cai (561-242-5520). Submitted On: Mar 01 2017

1-0 Evaluation **Concurred**
Revisions will be made to the specifications accordingly.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Jian Cai (561-242-5520) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

143866 Civil Plans n/a n/a n/a

Comment Classification: **For Official Use Only (FOUO)**

See the attached

(Attachment: SFWMD_Culvert_8_Drawings_(JC02-22-17).pdf)

Submitted By: Jian Cai (561-242-5520). Submitted On: Mar 01 2017

1-0 Evaluation **Concurred**
Revisions will be made to the drawings accordingly.

Submitted By: Phil Cooke (954-987-0066) Submitted On: Mar 17 2017

1-1 Backcheck Recommendation **Close Comment**
Closed without comment.

Submitted By: Jian Cai (561-242-5520) Submitted On: Apr 03 2017
Current Comment Status: **Comment Closed**

Attachment "A"

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Technical Review Briefing (TRB)

Consensus Sheet

Engineering and Construction Bureau

(To be completed at the TRB)

Briefing Date: April 27, 2017
Project Name/ Phase: Culvert 8 Pump Attachment
Project Manager: Jian Cai
Project SAP Number: 101009
Summary of Comments, Direction, and Issues to Carry Forward to Next Phase:

1. Pump arrangement : Is it possible to have more flexibility when attach the pums to bulkhead ?
   Response : It will need additional pieces, we'll not do it.
2. Screen in the intake : This will impact the pump performance. There is no need to add screen.

Consensus for Proceeding to Next Project Phase:

Current Phase: Final Design

Next Phase: Corrected Final/RTA

Engineering and Construction Bureau (Print Name & Sign) ALAN SHIRLEY	Date: 4-27-17
Field Operations Bureau (Print Name & Sign) Chris Edelstein	Date: 4/28/17
Other Signatory – i.e. Operations, USACE Representative (modify as needed) (Print Name & Sign)	Date:

Revision 6-15-16

Attachment "A"

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Culvert 8 Pump Attachment

Final Design Technical Briefing: April 27, 2017

Sign In Sheet

MEETING LOCATION: B-1, Richard Rogers Conference Rm

Attendees	Company	Phone / Ext.	E-mail	Initial
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Roy Sapp	Via phone			
~~Chris~~ Bruce Chesser	Via phone			
Jian Cai	SFWMD			