STRUCTURE B-2-D
INSPECTION DATE: 1/19/2022

Single Barrel, 54” Diameter x 97’ Long

Location:	Lake Apopka MFW
	B-2-D
Latitude:	28.6731 N
Longitude:	81.6918 W
Type:	Gated Culvert
No. Barrels:	One
Inspection	
Start Date:	1/19/2022
End Date:	1/19/2022

TEAM MEMBERS	
Lead Engineer	Jeffrey O’Connor, P.E.
Dive Supervisor	Patrick Savadge
Diver	Miguel King
Diver – Standby	Aaron Willard
Dive Tender	Charles Peach
Dive Tender	
Animal Control	TJ McDonagh
SJRWMD Agent	Willie Hughley

Respectfully Submitted,
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Vice President
Project Manager

JEFFREY H. O'CONNOR LICENSE No. 50914 STATE OF FLORIDA PROFESSIONAL ENGINEER

Digitally signed by Jeffrey H O'Connor
Date: 2022.03.17 10:15:04 -04'00'

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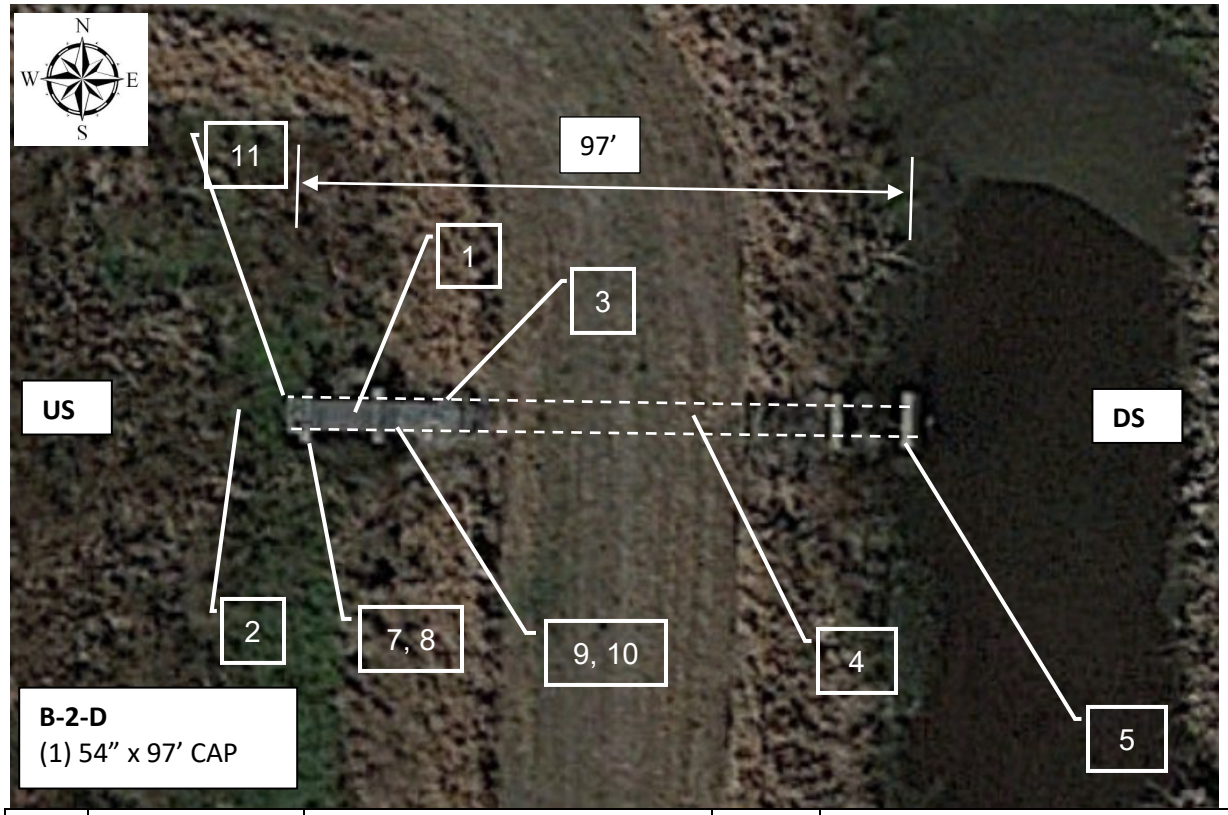
Aerial View of Structure



No.	Item No.	Inspection Item	Rating	Deficiency
1	DS115	Culverts	C-3	Constr. joint at 89’ has corroded bolts
2	US57	Fouling Marine Growth	C-3	Thick vegetation adjacent to gate
3	US1001	Topside: Walkway	C-3	Support angle doesn’t extend to ground, angle cut by mower; stair stringers corrosion
4	DS56	Shoaling / Scour	C-2	18” depth of sediment in barrel
5	DS109, DS1000	Piers, Topside: Piers	C-2	Minor concrete scaling on piers and unfilled block-outs with vegetation on tops of piers.
6	DS115	Culverts	C-2	Four minor leaks at the gate ring
7	US109	Piers	C-2	Minor concrete scaling on piers.
8	US1000	Topside: Piers	C-2	Minor mechanical spalls and unfilled block-outs with vegetation on tops of piers.
9	US1001	Topside: Walkway	C-2	Coating loss and minor corrosion on grating
10	US1002	Topside: Railing	C-2	Coating loss on railing
11	US1003	Topside: Gates	C-2	Minor corrosion on anchors for gate frame braces.

Structure Description and Method of Underwater Inspection

Structure B-2-D is a gated culvert comprised of one barrel, extending west (gated end) to east. The barrel is a corrugated aluminum pipe (CAP), 54 inches diameter by 97 feet long. The west end has an access pier comprised of a concrete pier and a galvanized and coated superstructure. There is a manual lift gate at the upstream end.

The underwater inspection was performed by a 5-person dive team on January 19, 2022. The dive team worked from a dive trailer, using surface-supplied air, and accessed the structure areas from the bank.

The scope of services included the underwater inspection of the submerged structure components and topside elements.

The air temperature was 60 degrees F. and the weather was mostly clear. The underwater visibility ranged from 0.5 to 2 feet.

Rating System

C-1: No action needed

C-2: Monitor condition at next dive inspection (5 years)

C-3: Schedule repair/replacement (for routine items)

C-4: Schedule repair/replacement (for safety or operational items)

C-5: Repair/replace immediately (for structural items)

C-6: Critical - Repair/replace immediately (for operational items)

Summary of Observations

Items Rated C-5 and Above

There were no items rated C-5 and above.

Items Rated C-4

There were no items rated C-5 and above.

Items Rated C-3

- Item DS115: The culvert has a push clamp at the construction joint at 89' in from the downstream end. The clamp is tight, but all six bolts have minor to moderate corrosion.
    - Recommended Action: Replace all of the bolts for the push clamp at 89' with stainless steel and use washers. Divers are needed for this repair.
- Item US57: The upstream waterway has thick vegetation in front of the gate.
    - Recommended Action: Remove the vegetation in front of the gate to allow for full drainage capacity.
- Item US1001: The walkway angle support at the SE corner (stairs) does not extend into the ground and has moderate corrosion with minor section loss. The support at the NE corner has been cut by a mower through one leg of the angle. (2) The stair stringers have 100% coating loss and moderate corrosion.

- Recommended Action: Drive in a new angle next to the existing leg at the SE corner and secure with bolts. Bolt in a splice plate over the damaged leg on the NE corner. (2) Apply a new protective coating to the stair stringers.

Items Rated C-2

- Item DS56: Sediment is up to 18" deep in the barrel, mostly from the downstream end up to 70' of penetration.
  - Recommended Action: Monitor the sediment level and clean it out if it natural velocities cannot remove it and it blocks more than 30% of the flow capacity.
- Item DS109: The piers have minor scaling of 1/16" to 1/8" and exposed aggregate from just above the waterline to the channel bottom.
  - Recommended Action: Monitor the concrete for advanced scaling and aggregate loss.
- Item DS1000: The piers have two block-outs in the top that are partially filled, but have vegetation growing in them.
  - Recommended Action: Monitor the tops of the piers for cracking. Apply herbicide as necessary to keep vegetation down.
- Item DS115: The culvert has four minor leaks at the joint between the barrel and the ring at the gate. The leaks are from the 10:00 position to the 2:00 position.
  - Recommended Action: Monitor the construction joint at the gate ring for higher flow leaks.
- Item US109: The piers have minor scaling of 1/16" to 1/8" and exposed aggregate from just above the waterline to the channel bottom.
  - Recommended Action: Monitor the concrete for advanced scaling and aggregate loss.
- Item US1000: The piers have minor mechanical spalls at the top up to 1" of penetration. The piers have two block-outs in the top that are partially filled, but have vegetation growing in them.
  - Recommended Action: Monitor the spalls at the tops of the piers for cracking or staining. Monitor the tops of the piers for cracking. Apply herbicide as necessary to keep vegetation down.
- Item US1001: The grating has loss of coating with no corrosion over 100% of its area.
  - Recommended Action: Monitor the grating for advanced corrosion and section loss. Consider applying new protective coating.
- Item US1002: The railings have loss of coating with no corrosion over 30% of the area.
  - Recommended Action: Monitor the railing for advanced corrosion and section loss. Consider applying new protective coating.
- Item US1003: The anchors for the horizontal braces for the gate guides have loss of coating and minor corrosion with minimal section loss.
  - Recommended Action: Monitor the gate guide brace anchor bolts for advanced corrosion and section loss.

PHOTOGRAPHS

Item No.: DS115 Culverts	Rating: C-3	Photo Description: Corroded push clamp bolt
Deficiency: The culvert has a push clamp at the construction joint at 89' in from the downstream end. The clamp is tight, but all six bolts have minor to moderate corrosion.		
Probable Cause: The clamp bolts have experienced galvanic corrosion due to contact of dissimilar metals (mild steel and aluminum).		
Recommendation: Replace all of the bolts for the push clamp at 89' with stainless steel and use washers. Divers are needed for this repair.		

Item No.: US57 Fouling / Marine Growth	Rating: C-3	Photo Description: Vegetation adjacent to gate.
Deficiency: The upstream waterway has thick vegetation in front of the gate.		
Probable Cause: Grasses and weeds and natural. Need to keep up with maintenance clearing.		
Recommendation: Remove the vegetation in front of the gate to allow for full drainage capacity.		

Item No.: US1001 Topside Walkway	Rating: C-3	Photo Description: Support angle doesn't extend to ground; Damaged support angle

Deficiency: (1) The walkway angle support at the SE corner (stairs) does not extend into the ground and has moderate corrosion with minor section loss. The support at the NE corner has been cut by a mower through one leg of the angle. (3) The stair stringers have 100% coating loss and moderate corrosion.

Probable Cause: The ground may have washed away or the support was not made long enough for proper embedment. The damaged support on the NE corner was hit by a mower. The protective coating has reached the end of its service life, allowing corrosion to occur.

Recommendation: (1) Drive in a new angle next to the existing leg at the SE corner and secure with bolts. Bolt in a splice plate over the damaged leg on the NE corner. (2) Apply a new protective coating to the stair stringers.

Mechanical damage

APPENDIX

CHECKLISTS

UNDERWATER FIELD RECORD

Structure Name/No.: B-2-D

Structure Location: MFW Lake Apopka
Latitude: N 28.6731
Longitude: W 81.6918

Structure Type/No. Barrels: Gated Culvert/ One Barrel
Culvert Material: CAP

Inspection Details		Day 1	Day 2	Day 3
Date (MM/DD/YYYY)		1/19/2022		
On Site Time (24 Hr)		7:15		
Left Site Time (24 Hr)		10:30		
U/S Elevation [NGVD29]		NA		
D/S Elevation [NGVD29]		NA		
Distance U/S inspected (ft)		NA		
Distance D/S inspected (ft)		NA		
Debris removed		None		
Maintenance Performed		None		

Project Team Members

Lead Engineer		Jeffrey O'Connor, P.E.
Senior Engineer		
Admin / Technician		
Dive Supervisor		Patrick Savadge
Dive Tender		Charles Peach
Diver		Miguel King
Backup Diver		Aaron Willard
Backup Diver		
Animal Control		TJ McDonaugh
SJRWMD Agent on site		Willie Hughley

Overall Structure Rating: C-2

Underwater Deficiencies Summary

Underwater Recommendations Summary

Rating Scale for Individual Components

C-1: No action needed
C-2: Monitor Condition at next dive inspection (5 years)
C-3: Schedule repair/replacement (for routine items)
C-4: Schedule repair/replacement (for safety or operational items)
C-5: Repair/replace immediately (for structural items)
C-6: Critical - Repair/replace immediately (for operational items)

Structure Name/No.: B-2-D

UPSTREAM EROSION CONTROL

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
US1	Slope/Banks of Channel	1	No deficiencies noted		
US2	Rip Rap	NA	None present		
US3	Exposed erosion-Control Fabric	NA	None present		
US4	Evidence of stone displacement (bedding stone)	NA	None present		
US5	Channel Stabilization and erosion control	1	No deficiencies noted		

UPSTREAM GENERAL

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
US50	Structural - General Concrete Condition	2	Minor concrete scaling on piers - refer to US109		
US51	Structural - General Metal Condition	3	Coating loss, moderate corrosion and supports not anchored into the ground. Refer to US1001, US1002, US1003, US1004		
US52	Structural - General Timber Condition	NA	Item not present		
US53	Construction Joints (Bolts, Welds)	NA	Item not present		
US54	Channels for Stoplogs or Flashboards	NA	Item not present		
US55	Settlement	NA	Item not present		
US56	Shoaling/Scour	NA	Item not present		
US57	Fouling/Marine Growth	3	The upstream waterway has thick vegetation in front of the gate.	Remove the vegetation in front of the gate to allow for full drainage capacity.	Grasses and weeds and natural. Need to keep up with maintenance clearing.
US58	Debris	NA	Item not present		
US59	Stilling Wells	NA	Item not present		
US60	Underwater Controls/Instruments	NA	Item not present		
US61	Fenders	NA	Item not present		

UPSTREAM STRUCTURE

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
US100	Wingwalls	NA	Item not present		
US101	Buttresses (support arms for wall)	NA	Item not present		
US102	Abutments	NA	Item not present		
US103	Retention Walls	NA	Item not present		
US104	Headwall	NA	Item not present		
US105	Expansion/Construction Joints	NA	Item not present		
US106	Sheetpiles and Bulkheads	NA	Item not present		
US107	Wales/Tiebacks	NA	Item not present		
US108	Intake Bays	NA	Item not present		
US109	Piers	2	The piers have minor scaling of 1/16" to 1/8" and exposed aggregate from just above the waterline to the channel bottom.	Monitor the concrete for advanced scaling and aggregate loss.	The concrete scaling is caused by chemical attack from the water.
US110	Foundation	NA	Item not present		
US111	Weir/Weir crest	NA	Item not present		
US112	Baffles	NA	Item not present		
US113	Underwater Apron Slabs	NA	Item not present		
US114	Structural Support, Bracing or Frames	NA	Item not present		
US115	Culverts	1	Exterior section of culvert no deficiencies noted.		
US116	Risers	NA	Item not present		

Structure Name/No.: B-2-D

UPSTREAM GATES

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
US151	Structure Gate(s)	1	No deficiencies noted		
US152	Gate Guides and Gate Control	1	No deficiencies noted		
US153	Gate Seals & Mating Surface	1	No deficiencies noted		
US154	Cathodic Protection (entire structure)	NA	Item not present		
US155	Operator/Actuator Components	1	No deficiencies noted		
US156	Emergency Closure Gates	NA	Item not present		
US306	Navigation Lock Miter Gates	NA	Item not present		

UPSTREAM TOPSIDE

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
US1000	Topside: Piers	2	(1) The piers have minor mechanical spalls at the top up to 1" of penetration. (2) The piers have two block-outs in the top that are partially filled, but have vegetation growing in them.	(1) Monitor the spalls at the tops of the piers for cracking or staining. (2) Monitor the tops of the piers for cracking. Apply herbicide as necessary to keep vegetation down.	(1) The mechanical spalls are due to impact from equipment. (2) The block-outs are from construction. It is not known why the voids were not completely filled with grout.
US1001	Topside: Walkway	3	(1) C-3: The walkway angle support at the SE corner (stairs) does not extend into the ground and has moderate corrosion with minor section loss. The support at the NE corner has been cut by a mower through one leg of the angle. (2) C-3: The stair stringers have 100% coating loss and moderate corrosion. (3) C-2: The grating has loss of coating with no corrosion over 100% of its area.	(1) Drive in a new angle next to the existing leg at the SE corner and secure with bolts. Bolt in a splice plate over the damaged leg on the NE corner. (2) Apply a new protective coating to the stair stringers. (3) Monitor the grating for advanced corrosion and section loss. Consider applying new protective coating.	(1) The ground may have washed away or the support was not made long enough for proper embedment. The damaged support on the NE corner was hit by a mower. The protective coating has reached the end of its service life, allowing corrosion to occur. (3) Protective coating may be near the end of its service life.
US1002	Topside: Railing	2	The railings have loss of coating with no corrosion over 30% of the area.	Monitor the railing for advanced corrosion and section loss. Consider applying new protective coating.	Protective coating may be near the end of its service life.
US1003	Topside: Gates	2	The anchors for the horizontal braces for the gate guides have loss of coating and minor corrosion with minimal section loss.	Monitor the gate guide brace anchor bolts for advanced corrosion and section loss.	The corrosion is galvanic corrosion due to contact of the mild steel anchor bolts and the aluminum brackets.
US1004	Topside: Additional Items and Comments	NA	None		

Structure Name/No.: B-2-D

DOWNSTREAM EROSION CONTROL

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
DS1	Slope/Banks of Channel	1	No deficiencies noted		
DS2	Rip Rap	NA	Item not present		
DS3	Exposed erosion-Control Fabric	NA	Item not present		
DS4	Evidence of stone displacement (bedding stone)	NA	Item not present		
DS5	Channel Stabilization and erosion control	1	No deficiencies noted		

DOWNSTREAM GENERAL

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
DS50	Structural - General Concrete Condition	2	Minor scaling. Refer to DS109		
DS51	Structural - General Metal Condition	NA	Item not present		
DS52	Structural - General Timber Condition	NA	Item not present		
DS53	Construction Joints (Bolts, Welds)	NA	Item not present		
DS54	Channels for Stoplogs or Flashboards	NA	Item not present		
DS55	Settlement	NA	Item not present		
DS56	Shoaling/Scour	2	Sediment is up to 18" deep in the barrel, mostly from the downstream end up to 70' of penetration.	Monitor the sediment level and clean it out if it natural velocities cannot remove it and it blocks more than 30% of the flow capacity.	It is natural for the sediment to enter the barrel through the gate. Velocities have not been high enough to evacuate the deposits.
DS57	Fouling/Marine Growth	1	No deficiencies noted		
DS58	Debris	NA	Item not present		
DS59	Stilling Wells	NA	Item not present		
DS60	Underwater Controls/Instruments	NA	Item not present		
DS61	Fenders	NA	Item not present		

DOWNSTREAM STRUCTURE

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
DS100	Wingwalls	NA	Item not present		
DS101	Buttresses (support arms for wall)	NA	Item not present		
DS102	Abutments	NA	Item not present		
DS103	Retention Walls	NA	Item not present		
DS104	Headwall	NA	Item not present		
DS105	Expansion/Construction Joints	NA	Item not present		
DS106	Sheetpiles and Bulkheads	NA	Item not present		
DS107	Wales/Tiebacks	NA	Item not present		
DS108	Intake Bays	NA	Item not present		
DS109	Piers	2	The piers have minor scaling of 1/16" to 1/8" and exposed aggregate from just above the waterline to the channel bottom.	Monitor the concrete for advanced scaling and aggregate loss.	The concrete scaling is caused by chemical attack from the water.
DS110	Foundation	NA	Item not present		
DS111	Weir/Weir crest	NA	Item not present		
DS112	Baffles	NA	Item not present		
DS113	Underwater Apron Slabs	NA	Item not present		
DS114	Structural Support, Bracing or Frames	NA	Item not present		

Structure Name/No.: B-2-D

DS115	Culverts	3	(1) C-3: The culvert has a push clamp at the construction joint at 89' in from the downstream end. The clamp is tight, but all six bolts have minor to moderate corrosion. (2) C-2: The culvert has four minor leaks at the joint between the barrel and the ring at the gate. The leaks are from the 10:00 position to the 2:00 position.	(1) Replace all of the bolts for the push clamp at 89' with stainless steel and use washers. Divers are needed for this repair. (2) Monitor the construction joint at the gate ring for higher flow leaks.	(1) The clamp bolts have experienced galvanic corrosion due to contact of dissimilar metals (mild steel and aluminum). (2) The minor leaks at 89' are most likely due to construction.

DOWNSTREAM GATES

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
DS151	Structure Gate(s)	1	No deficiencies noted		
DS152	Gate Guides and Gate Control	NA	Item not present		
DS153	Gate Seals & Mating Surface	1	No deficiencies noted		
DS154	Cathodic Protection (entire structure)	NA	Item not present		
DS155	Operator/Actuator Components	NA	Item not present		
DS156	Emergency Closure Gates	NA	Item not present		
DS157	Navigation Lock Miter Gates	NA	Item not present		

DOWNSTREAM TOPSIDE

Finding #	Inspection Item	Rating	Comments	Recommended action	Probable cause
DS1000	Topside: Piers	2	The piers have two block-outs in the top that are partially filled, but have vegetation growing in them.	Monitor the tops of the piers for cracking. Apply herbicide as necessary to keep vegetation down.	The block-outs are from construction. It is not known why the voids were not completely filled with grout.
US1004	Topside: Additional Items and Comments	NA	None		