

**STRUCTURE B-2-A**  
**INSPECTION DATE: 1/19/2022**



Single Barrel, 54" Diameter x 97' Long

Location:	Lake Apopka MFW
	B-2-A
Latitude:	28.6695 N
Longitude:	81.6918 W
Type:	Gated Culvert
No. Barrels:	One
Inspection	
Start Date:	1/19/2022
End Date:	1/19/2022

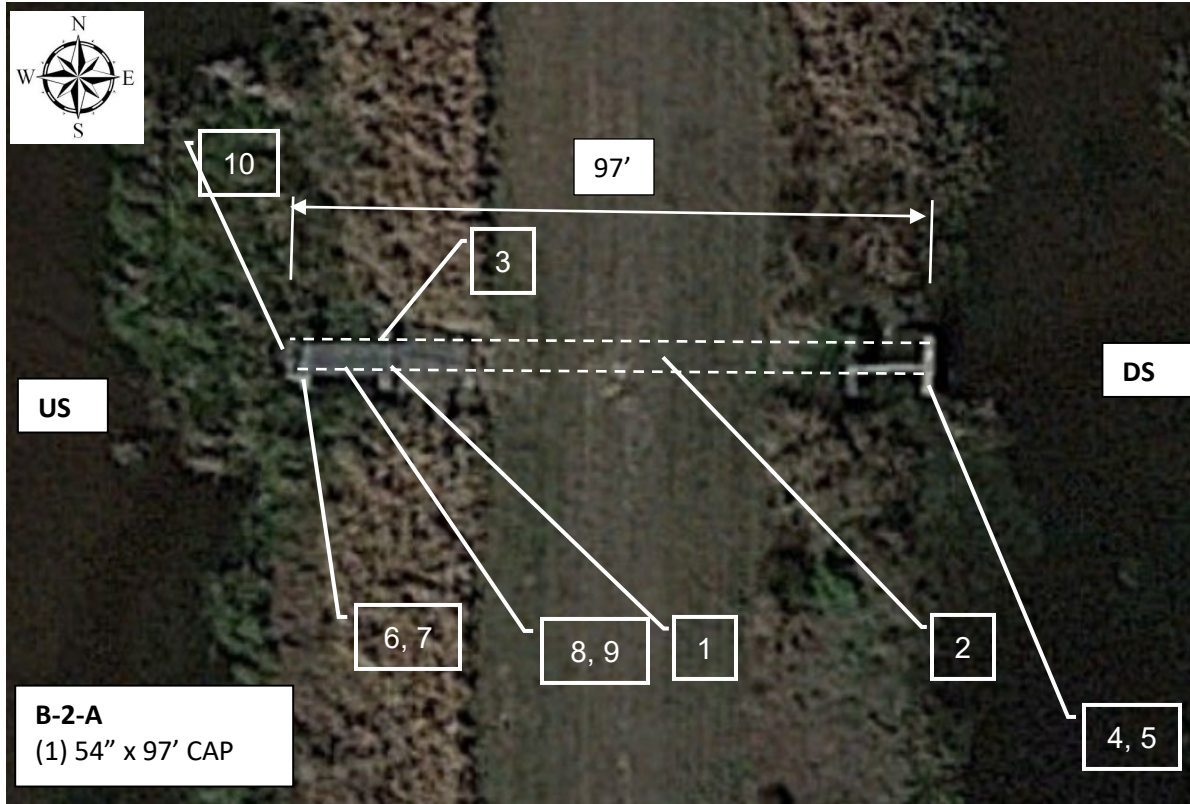
TEAM MEMBERS	
Lead Engineer	Jeffrey O'Connor, P.E.
Dive Supervisor	Patrick Savadge
Diver	Miguel King
Diver – Standby	Aaron Willard
Dive Tender	Charles Peach
Dive Tender	
Animal Control	TJ McDonagh
SJRWMD Agent	Willie Hughley

Respectfully Submitted,  
**UNDERWATER ENGINEERING SERVICES, INC.**  
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Vice President  
Project Manager



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**Aerial View of Structure**



No.	Item No.	Inspection Item	Rating	Deficiency
1	DS115	Culverts	C-4	Constr. joint at 80' has rubber gasket pulled out more than half circumference w/ leak
2	DS115	Culverts	C-3	Constr. Joints at 20', 45' and 64' from DS end have loose clamps and corroded bolts
3	US1001	Topside: Walkway	C-3	Broken anchor for one walkway support angle.
4	DS109	Piers	C-2	Minor concrete scaling on piers.
5	DS1000	Topside: Piers	C-2	West pier has patched spall, mechanical spall and unfilled block-outs with veg. on tops
6	US109	Piers	C-2	Minor concrete scaling on piers.
7	US1000	Topside: Piers	C-2	Unfilled block-outs with vegetation on tops of piers.
8	US1001	Topside: Walkway	C-2	Coating loss and minor corrosion.
9	US1002	Topside: Railing	C-2	Coating loss on railing
10	US1003	Topside: Gates	C-2	Minor corrosion on anchors for gate frame braces.

### Structure Description and Method of Underwater Inspection

Structure B-2-A 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

- Item DS115: (1) The construction joint at 80' in from the downstream end had exposed rubber gasket exposed all around and completely pulled out over more than 50% of the circumference. The diver did not penetrate beyond this point for safety reasons (entanglement) and potential damage of pulling out more gasket and causing a major leak. There were moderate leaks at 12:00 and 2:00.
  - Recommended Action: Install a new push clamp at the 80' construction joint. Use aluminum clamp and stainless steel bolts. This may require trimming the existing gasket and installing a new gasket under the new clamp. Divers are needed for this repair.

#### Items Rated C-3

- Item DS115: (1) The culvert has a push clamp at the construction joint at 20' in from the downstream end. The clamp is loose. The clamp has two sets of bolts at 3:00 and 9:00 with three bolts each. Two of the 3 bolts at 3:00 are out of the clamp and have minor to moderate corrosion. The three bolts at 9:00 have minor to

moderate corrosion. (2) The culvert has a similar push clamp at the construction joint at 45' in from the downstream end. The clamp is loose and all six bolts have minor to moderate corrosion. (3) The culvert has a similar push clamp at the construction joint at 64' 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 clamps with stainless steel and use washers. Realign and tighten each clamp. Divers are needed for this repair.
- Item US1001: The anchor for the walkway angle support at the west pier has broken due to corrosion.
  - Recommended Action: Install a new anchor for the walkway support anchor at the west pier.

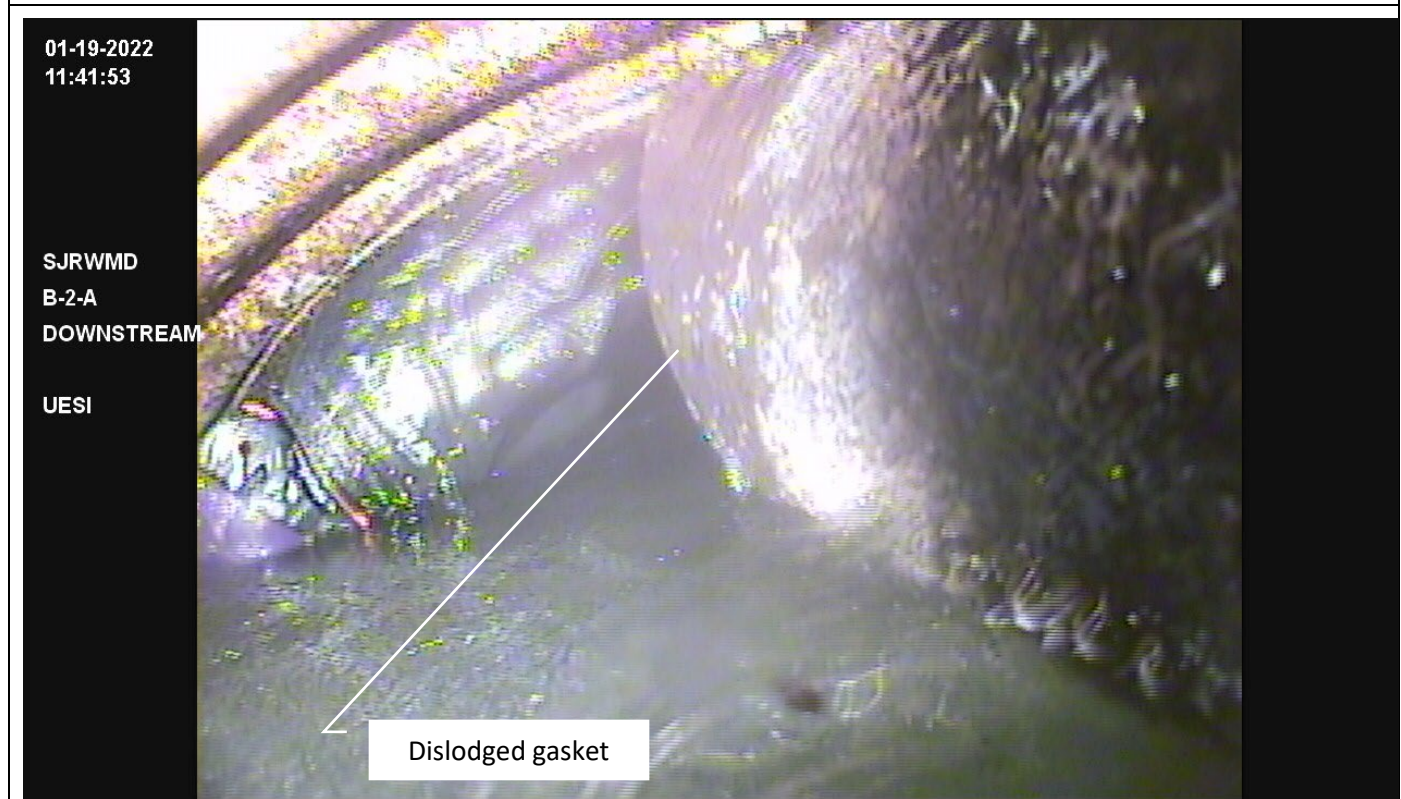
#### Items Rated C-2

- 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: (1) The west pier has a patched spall on the west face at the top adjacent to the block-out, approximately 18" x 12" x 1/2", with no exposed rebar or staining. The top east corner of the same pier has an 8" x 4" x 1" deep mechanical spall with no staining. (2) The piers have two block-outs in the top that are partially filled, but have vegetation growing in them.
  - Recommended Action: Monitor the spall and patched spall and the tops of the west pier for cracking. Apply herbicide as necessary to keep vegetation down.
- 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 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 US1001: The walkway angle supports into ground have loss of coating and minor corrosion over 100% of the members. The grating has loss of coating with no corrosion over 100% of its area.
  - Recommended Action: Monitor the grating and supports 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-4	Photo Description: Dislodged gasket at 80' penetration
<p>Deficiency: The construction joint at 80' in from the downstream end had exposed rubber gasket exposed all around and completely pulled out over more than 50% of the circumference. The diver did not penetrate beyond this point for safety reasons (entanglement) and potential damage of pulling out more gasket and causing a major leak. There were moderate leaks at 12:00 and 2:00.</p>		
<p>Probable Cause: The dislodged gasket and leak at the 80' construction joint may have occurred during construction or a repair.</p>		
<p>Recommendation: Install a new push clamp at the 80' construction joint. Use aluminum clamp and stainless steel bolts. This may require trimming the existing gasket and installing a new gasket under the new clamp.</p>		



Item No.: DS115 Culverts	Rating: C-3	Photo Description: Push clamp at 45' penetration showing corroded bolt
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Deficiency: (1) The culvert has a push clamp at the construction joint at 20' in from the downstream end. The clamp is loose. The clamp has two sets of bolts at 3:00 and 9:00 with three bolts each. Two of the 3 bolts at 3:00 are out of the clamp and have minor to moderate corrosion. The three bolts at 9:00 have minor to moderate corrosion. (2) The culvert has a similar push clamp at the construction joint at 45' in from the downstream end. The clamp is loose and all six bolts have minor to moderate corrosion. (3) The culvert has a similar push clamp at the construction joint at 64' 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). Some of the washers may have failed due to corrosion - or were not installed, allowing the bolts to detach from the clamp and the clamp to become loose.

Recommendation: Replace all of the bolts for the push clamps with stainless steel and use washers. Realign and tighten each clamp.



Item No.: US1001 Topside Walkway	Rating: C-3	Photo Description: Broken anchor for support angle
Deficiency: The anchor for the walkway angle support at the west pier has broken due to corrosion.		
Probable Cause: The anchor failed due to corrosion.		
Recommendation: Install a new anchor for the walkway support anchor at the west pier.		



# APPENDIX

# CHECKLISTS



# UNDERWATER FIELD RECORD

## Structure Name/No.: **B-2-A**

**Structure Location:** MFW Lake Apopka  
 Latitude: N 28.6695  
 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)	10:40		
Left Site Time (24 Hr)	12:15		
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 McDonough
SJRWMD Agent on site	Willie Hughley

**Overall Structure Rating:** C-2

Underwater Deficiencies

Summary

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Underwater Recommendations

Summary

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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-A**

**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	2	Coating loss and minor corrosion. 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	1	No deficiencies noted		
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-A**

**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	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.
US1001	Topside: Walkway	3	(1) C-3: The anchor for the walkway angle support at the west pier has broken due to corrosion. (2) C-2: The walkway angle supports into ground have loss of coating and minor corrosion over 100% of the members. The grating has loss of coating with no corrosion over 100% of its area.	(1) Install a new anchor for the walkway support anchor at the west pier. (2) Monitor the grating and supports for advanced corrosion and section loss. Consider applying new protective coating.	(1) The anchor failed due to corrosion. (2) 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-A**

**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	1	Minimal sediment in barrel		
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-A**

DS115	Culverts	4	(1) C-4: The construction joint at 80' in from the downstream end had exposed rubber gasket exposed all around and completely pulled out over more than 50% of the circumference. The diver did not penetrate beyond this point for safety reasons (entanglement) and potential damage of pulling out more gasket and causing a major leak. There were moderate leaks at 12:00 and 2:00. (2) C-3: The culvert has a push clamp at the construction joint at 20' in from the downstream end. The clamp is loose. The clamp has two sets of bolts at 3:00 and 9:00 with three bolts each. Two of the 3 bolts at 3:00 are out of the clamp and have minor to moderate corrosion. The three bolts at 9:00 have minor to moderate corrosion. (3) C-3: The culvert has a similar push clamp at the construction joint at 45' in from the downstream end. The clamp is loose and all six bolts have minor to moderate corrosion. (4) C-3: The culvert has a similar push clamp at the construction joint at 64' in from the downstream end. The clamp is tight, but all six bolts have minor to moderate corrosion.	(1) Install a new push clamp at the 80' construction joint. Use aluminum clamp and stainless steel bolts. This may require trimming the existing gasket and installing a new gasket under the new clamp. Divers are needed for this repair. (2, 3, 4) Replace all of the bolts for the push clamps with stainless steel and use washers. Realign and tighten each clamp. Divers are needed for this repair.	(1) The dislodged gasket and leak at the 80' construction joint may have occurred during construction or a repair. (2, 3, 4) The clamp bolts have experienced galvanic corrosion due to contact of dissimilar metals (mild steel and aluminum). Some of the washers may have failed due to corrosion - or were not installed, allowing the bolts to detach from the clamp and the clamp to become loose.
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**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	(1) The west pier has a patched spall on the west face at the top adjacent to the block-out, approximately 18" x 12" x 1/2", with no exposed rebar or staining. The top east corner of the same pier has an 8" x 4" x 1" deep mechanical spall with no staining. (2) The piers have two block-outs in the top that are partially filled, but have vegetation growing in them.	(1, 2) Monitor the spall and patched spall and the tops of the west pier for cracking. Apply herbicide as necessary to keep vegetation down.	The spall was due to the block-out. The block-outs are from construction. It is not known why the voids were not completely filled with grout.

**Structure Name/No.: B-2-A**

US1004	Topside: Additional Items and Comments	NA	None		
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