

## Paducah Railroad Culvert Evaluation

There were a total of 13 railroad culvert locations walked down outside the Limited Area (LA) fence and 9 inside the LA fence. One culvert on Warren Road was also included because of its potential impact to the railroads and access to public warning sirens.

### Summary

Culvert Location ID	Global Positioning System (GPS) Location	Railroad Culvert Condition
1	37.08443° N, 88.84167° W	Track #1: one 36" metal culvert (steel pipe (SP)) 100 feet west of Mile Marker 10: 90% silted.
2	37.08823° N, 88.84338° W	Track #1: two 30" reinforced concrete pipe (RCP) culverts 75 yards south of Woodville Road: south culvert is silted two-thirds and the north culvert is 100% silted. The old road bed parallel to the tracks has two culverts partially silted. Two concrete support pedestals may be a hazard.
3	37.09137° N, 88.84135° W	Track #1: two 60" RCP culverts 285 yards north of Woodville Road: the outer segments on the west side of each culvert are dislodged with the next segment inside the south culvert beginning to dislodge as well, grout has fallen out of segment joints, outer segments of both culverts are beginning to slump slightly on the east side, and there is slight washing between the two culverts. No immediate danger in terms of sinkholes or subsidence.
4	37.09294° N, 88.84021° W	Track #1, two RCP culverts (48" and 36") 130 yards south of the 1-1Ws switch: both culverts are 50% silted, woody growth around culvert ends and a 6" diameter tree grows atop the south culvert. The interior walls of the culvert are acceptable.
5	37.09935° N, 88.83578° W	Track #1, Culvert was replaced to correct deficiency.
6	37.09983° N, 88.83549° W	Track #1, one 36" RCP culvert with a metal pipe extension, 100 yards north of the sinkhole culvert: the metal pipe extension is dented inside and the pipe is egg shaped and may be pulled away from the concrete culvert. The concrete culvert is bowed downward approximately 40 feet inside the culvert and heavy vegetation is above the culvert on the east side.

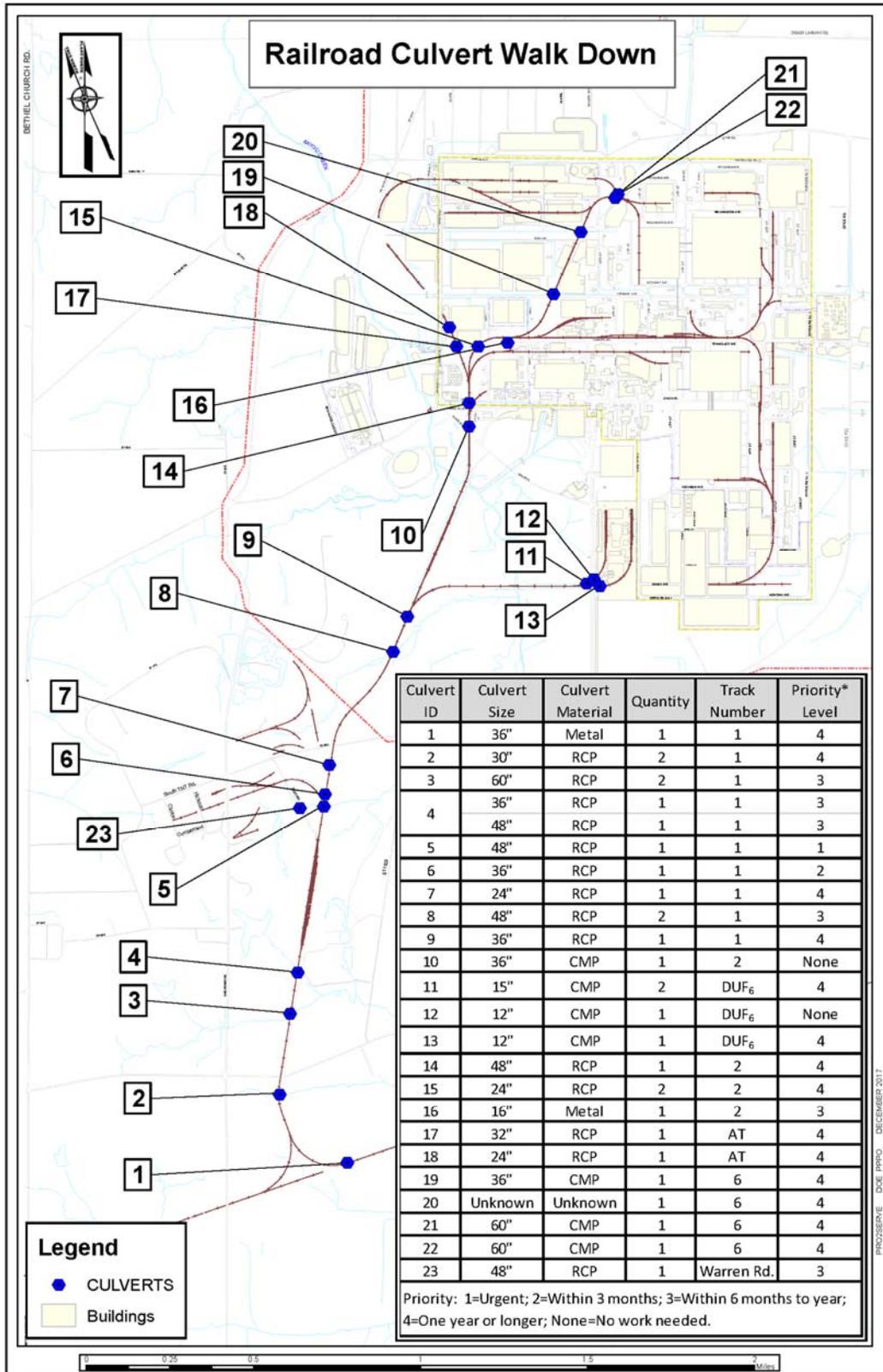
## Railroad Culvert Walk Down

Culvert Location ID	Global Positioning System (GPS) Location	Railroad Culvert Condition
7	37.10095° N, 88.83466° W	Track #1, one 24" RCP culvert, approximately 50 yards north of culvert #6, and 150 yards south of South Acid Rd crossing. First segment on inlet (west) side has dislodged. Culvert is partially filled with silt, rocks, and debris. Top of outlet segment has been damaged over the years, but this segment appears to be connected to the adjoining segments. (This culvert was missed by Pro2Serve personnel during the initial walk down due to extensive vegetation surrounding both the inlet and outlet.)
8	37.10466° N, 88.82938° W	Track #1, two 48" RCP culverts north of South Acid Road, 200 yards south of the 2-DUF <sub>6</sub> switch: both culverts are one-third silted, have slight erosion between the culverts on both the east and west ends, and have heavy vegetation above and around the culverts.
9	37.105348°N 88.828556°W	Track #1, one 36" RCP culvert located under the high voltage sign on north side of the 161 kV lines. The inlet segment has dislodged and has allowed rocks, debris, and vegetation to fall and grow in the crevice area between the segments. The remaining culvert is remarkably clear, only about 10% silted in. The top of the outlet segment has been damaged and the concrete reinforcing wire is partially blocking the outlet. (This culvert was missed by Pro2Serve personnel during the initial walkdown due to extensive vegetation surrounding both the inlet and outlet.)
10	37.112768° N, 88.821301° W	Track #2, one 36" corrugated metal pipe (CMP) culvert, approximately 60 feet north of the Curlee Road crossing: the culvert is clear, and there are no erosion or vegetation issues. A small deformation (approximately 4 inch indentation) exists on the culvert roof, approximately 25' inside the pipe from the west end. Not considered an issue at this time.
11	37.104566° N, 88.818231° W	DUF <sub>6</sub> , two 15" CMP culverts, approximately 60 feet west of Hobbs Road on the DUF <sub>6</sub> -B spur; north culvert is 75% silted and the south culvert is 50% silted. The metal appears to be in good condition.
12	37.104627° N, 88.817798° W	DUF <sub>6</sub> , one 12" CMP culvert, between Hobbs Road and the Old Haul Road on the DUF <sub>6</sub> -B spur. No sediment or erosion issues and the metal appears to be in good condition.
13	37.104263° N, 88.817624° W	DUF <sub>6</sub> , one 12" CMP culvert, approximately 50 feet east of the Old Haul Road, on the DUF <sub>6</sub> -A track near the south end of the DUF <sub>6</sub> trailers: the culvert is in good condition and not silted, however, this culvert is too small for the area being drained and when heavy rains occur, water backs up beneath Trailer #06 (personnel waded water to enter the trailer).
14	37.113718° N, 88.820853° W	Track #2, one 48" RCP culvert inside the LA north of Gate 37: good condition and no erosion, some silting of the ditch on the west end (backing water into the culvert) and some vegetation on the east end.

## Railroad Culvert Walk Down

Culvert Location ID	Global Positioning System (GPS) Location	Railroad Culvert Condition
15	37.11591° N, 88.81935° W	Track #2, two 24" RCP culverts inside the LA, approximately 175 feet west of 4 <sup>th</sup> Street: minor erosion between the culverts on the west side of the track and sediment in the north culvert.
16	37.115625° N, 88.817754° W	Track #2, one 16" metal culvert, inside the LA, 75 feet west of the 6 <sup>th</sup> Street railroad crossing: the culvert is 95% silted.
17	37.11623° N, 88.82044° W	Track #AT, one 32" RCP culvert, inside the LA, 150 feet north of monitoring well 188: there is some erosion on top of the culvert on the outlet (west) side and around the inlet culvert on the east side. The culvert is clear of sediment.
18	37.11712° N, 88.82047° W	Track #AT, one 24" RCP culvert, inside the LA, approximately 100 yards south of the rail stops near Patrol Road #1: erosion exists on the east end near the radiological zone at C-745-A1, the culvert is 50% silted, and one segment is slightly dislodged on the east end.
19	37.116920° N, 88.814529° W	Track #6, one 36" CMP culvert, inside the LA, 25 feet north of Virginia Avenue: the west end is covered by rip rap and could not be viewed, the east end is approximately 50% silted. There is no erosion on either end.
20	37.119069° N, 88.811962° W	Track #6, unknown type and size culvert(s), inside the LA, 130 feet north of Texas Avenue: both ends of the culvert are extremely overgrown with vegetation and are inside a radiological (RAD) zone. Due to the heavy vegetation and RAD zones, the inspectors could not inspect the culverts, but water appears to be flowing properly toward Outfall 001.
21	37.119971° N, 88.809576° W	Track #6, one 60" CMP, inside the LA, 260 feet east of 10 <sup>th</sup> Street: the culvert is in good condition with no erosion. However, it has a plastic bag partially blocking the north end. A moderate amount of ballast material is inside the culvert.
22	37.120086° N, 88.809377° W	Track #6, one 60" CMP, inside the LA approximately 300 feet east of 10 <sup>th</sup> Street: the culvert is in acceptable condition but partially plugged by heavy vegetation.
23	37.099643° N, 88.837032° W	This is one non-railroad 48" RCP culvert, located under Warren Road, approximately 350 feet west of the sinkhole culvert (#5) provides direct drainage toward the railroad and provides access to Public Warning Sirens (PWS) 1A and 1B: it has one segment displaced on the west end and the bottom is eroded.

# Railroad Culvert Walk Down



Supporting Information:

## Railroad Culvert Walk Down

### Location 1

**Track #1, one 36" steel pipe culvert approximately 100 feet west of Mile Marker 10**, at approximate GPS coordinates 37.08443° N, 88.84167° W. This culvert extends diagonally beneath the railroad and is approximately 90% silted. There is no washing or significant signs of deterioration but the silted material should be removed. See photographs 2419 and 2425 below:



*2419 Metal Pipe Culvert (36") Outlet, West End, Looking East*



*2425 Metal Pipe Culvert (36"), West End Inlet Interior of Culvert, 90% Silted*

### Location 2

**Track #1, two 30" RCP culverts, approximately 75 yards south of Woodville Road**, at approximate GPS coordinates 37.08823° N, 88.84338° W. On the west side, both culverts were covered with debris (see photographs 7424 and 7437) and it was only through significant excavation that one opening was found. Due to silting, it was not possible to determine the full condition of the concrete. However, the roof of the concrete appeared to be in acceptable condition. The south culvert is two thirds plugged on the east end and covered in debris on the west end. The north culvert is nearly completely plugged on the east end (see photo 7454) and covered with debris on the west end. Very little water flows through the north culvert. The embankments are not eroded and there is no sign of sinkholes.

## Railroad Culvert Walk Down



7424 Two RCP Culverts (30") Covered in Debris West End (Inlet)



7437 RCP Culverts (30") After Partially Uncovering Debris,



7454 Two RCP Culverts, (30"), East End, 90% Silted

An old road bed extends for a significant distance east of and parallel to the railroad embankment. As such, a depression exists between the road bed and the railroad embankment and the two culverts (mentioned above) drain into this depression. This depression is approximately 20 to 25 feet deep and approximately 60 to 80 feet east of the railroad. The drain pipe(s) exiting this depression beneath the old road bed could not be seen (due to plugging and vegetation) on the west side of the road bed. The east side had stagnant water standing and the culvert(s) were under water 4 to 6 inches. The entire area needs to have vegetation control performed and culverts cleaned.

In addition, two large concrete tank pedestals (over seven feet tall) and associated piping are strewn haphazardly on the west side of the railroad. See photographs 7427 and 7432 below.

## Railroad Culvert Walk Down



7427 Concrete Tank Supports, West of Tracks



7432 Concrete Tank Support, 7' Tall

These present a hazard if railcars should derail at this location. The concrete structures and/or metal pipe could easily puncture a loaded tank car.

### Location 3

**Track #1, two 60" RCP culverts, approximately 285 yards north of Woodville Road at approximate GPS coordinates 37.09137° N, 88.84135° W.** On the west end, two five foot segments (one on each culvert) have dislodged downward (approximately one foot). In addition, the second concrete segment, inside the south culvert (west end), has signs of separation from the third segment (slumping down slightly) and may need attention. See photographs 7541 and 7517 below:



7541 West Side of 60" RCP Culverts



7517 South RCP Culvert, West End

The westernmost segments of both culverts should be temporarily removed, the ground stabilized and the segments placed back into position. Debris has piled against the inlet of both culverts on the west end. However, further inside the culverts, the concrete does not appear to be deteriorated and other than the segments mentioned above, the interior segments are not separated and the bottom of the pipe is intact. Flow is completely open through both culverts. Slight erosion has occurred around the

## Railroad Culvert Walk Down

dislodged outer segments and on top of the culverts (west end). At this point, the embankment (on the west side) does not have sink holes or major depressions and it is not in danger of subsiding.

On the east side of the track, both culverts have begun to slump on the outer segments, see photo 7560. The north culvert, outer segment, has slumped approximately 6 inches and separated from the main culvert, see photo 7583. The outer segment of the south culvert has slumped approximately 3 inches, see photo 7575, but has not separated completely from the main culvert.



7560 Two RCP Culverts (60"), East Side, Outlet



7583 North RCP Culvert (60"), Separated Segment



7575 South RCP Culvert (60"), Separated Segment

Water appears to be clearing the ditch well and the high-water marks (indicating stream stage) are very slight. However, the earth is beginning to give way on both sides, and above, the east end of the culverts. Slight washing has occurred between the two culverts. A small amount of concrete spalling was observed on the sides of the north culvert. Spalling is approximately 1/4" deep. Both culverts have grouted segment joints but, in many cases, the grouting has fallen out. It is recommended that both the inlet and outlet sides of these culverts be stabilized, erosion control be performed, and new grouting

## Railroad Culvert Walk Down

installed. There appears to be no immediate danger (in terms of sinkholes or subsidence) but repairs and cleanup work should be completed within the next year.

### Location 4

**Track #1, two RCP culverts, the north culvert is 48” and the south culvert is 36”, approximately 130 yards south of the 1-1Ws switch, at approximate GPS coordinates 37.09294° N, 88.84021° W.** Both culverts are approximately half silted in, see photo 7673. No segments appear to be substantially dislodged and there is no sign of subsidence or washing. However, there is significant woody growth around both culverts. Near the west end (culvert inlet) a 6” tree is growing atop the south culvert and the outer concrete segment is beginning to displace (possibly due to the tree growth), see photograph 7669.



7673 RCP Culverts (48” on North and 36” on South), West End



7669 South RCP Culvert, West End, with 6” Tree on Top

The bottoms of the culverts could not be seen but the sides appear to be in good and acceptable condition with the segments intact under the rail bed. See photographs 7684 and 7697.



7684 North RCP Culvert (48”) Interior, Looking East



7697 South RCP Culvert (36”) Interior, Looking East

## Railroad Culvert Walk Down

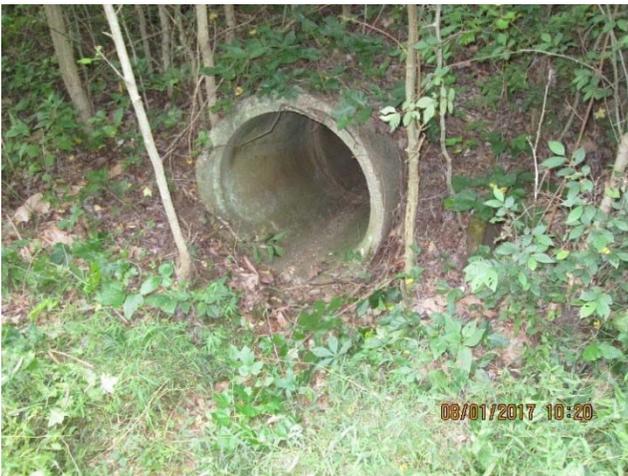
The leading edges of both culverts (west end) have their lip broken but this is of little concern. It is recommended that vegetation control be performed, the tree (atop the south culvert) be removed, and the silt, rocks, and debris inside the culvert be removed.

### Location 5

**Sinkhole culvert. This culvert is a 48" RCP culvert, located approximately 175 yards north of the 1-1Wn switch and was identified in June, 2017 as having extreme deterioration.** The culvert is at approximate GPS coordinates 37.09935° N, 88.83578° W. This culvert was replaced.

### Location 6

**Track #1, a 36" (primarily) RCP culvert located approximately 100 yards north of the sinkhole culvert,** at approximate GPS coordinates 37.09983° N, 88.83549° W. This culvert is unusual in that the primary culvert (beneath the tracks) is concrete, however, the east end of the culvert has an approximate 14 foot metal pipe extension. The culvert is clear and has no sign of erosion or subsidence on the west side. Water appears to be clearing the ditch well and there are no high-water marks on the surrounding vegetation. The grout has begun to fall away from the concrete segments and the bottom has a slight deterioration. See photographs 7797 and 7810.



*7797 RCP Culvert (36") West Side*



*7810 RCP Culvert (36") Interior, Looking East from West Side*

On the east side of the railroad, above the 36" culvert, the embankment is severely overgrown and the culvert cannot be seen from the track level. Access to this location is best attained by taking the east trail to the sinkhole culvert and veering northward along the marked path.

The 36" culvert on the east side of the track is a section of metal pipe that appears to have been placed into position to provide a culvert beneath an old road bed that, at one time, ran parallel to the east side of the railroad embankment. The metal pipe (approximately 14 to 16 feet in length) is butted against, and appears to be attached to, the concrete culvert (discussed above). However, at this joint the metal pipe has separated from the concrete culvert, become egg shaped, skewed to the side, and deflected

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downward at least 6 inches. This creates a significant disturbance in water flow through the culvert and into the pipe. In addition, the concrete culvert appears to have a significant hump, and downward slope, approximately 20 feet further inside the culvert. This places the hump location approximately beneath the east rail and it may indicate erosion below the culvert or below the connection to the metal pipe. The metal pipe was observed to have a bent roof (possibly due to heavy loads having traversed the roadway at some time in the past). See photographs 7874, 7835, 7848, and 7867.



7874 Culvert (36") North of Sinkhole Repair Location, East End



7835 Culvert (36") Metal Pipe, Extension on East Side of Concrete Culvert



7848 Culvert (36"), East End, Metal Pipe Showing Dented in Top



7867 Culvert (36"), East End, Metal Pipe Showing Egg Shape, Skewed From the Connecting Point to the Concrete Culvert and the Hump in the Concrete Culvert

Though it does not appear to be an immediate hazard, it is recommended further inspections be performed of this culvert and a determination as to the need for repairs (if any) or replacement. Consideration should be given to making repairs to this location in conjunction with the repair to the sinkhole culvert issue identified in May, 2017. Without some level of repair, within the next several years, this culvert may become a major issue.

## Railroad Culvert Walk Down

### Location 7

Track #1, One 36" RCP culvert, approximately 50 yards north of culvert #6, and 150 yards south of South Acid Rd crossing, at approximate GPS coordinates 37.10095° N, 88.83466° W. First segment on inlet (west) side has dislodged. Culvert is partially filled with silt, rocks, and debris (see photo 8313 below). Top of outlet segment has been damaged over the years, and this segment appears to be dislodged from the adjoining segments (see photos 8333 and 8328 below). Water does not flow through this culvert on a continuous basis, only during a substantial rain event.



*8313, Inlet (west side) segment dislodged and filling with rocks, soil, debris, and vegetation. Outlet visible in background.*



*8333, Outlet (east side) of culvert about half filled with rocks, soil, debris, and vegetation.*



*8328, Outlet (west) side segment with damaged top and some vegetation debris still covering the culvert outlet.*

The inlet segment needs to be reset and the silt, rocks, and debris cleaned out. The vegetation debris needs to be removed from both ends of the culvert, and controlled going forward. (This culvert was

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missed by Pro2Serve personnel during the initial walkdown due to extensive vegetation surrounding both the inlet and outlet.)

### Location 8

**Track #1, two 48" RCP culverts, north of South Acid Road, approximately 200 yards south of the 2-DUF<sub>6</sub> switch and 90 feet south of the Danger High Voltage Sign,** at approximate GPS coordinates 37.10466° N, 88.82938° W. These two culverts extend at a sharp (south to north) angle beneath the railroad tracks and serve to drain an active stream on the west side of the tracks. On the west side, approximately one third of the inlet (on both culverts) is silted and there is minor erosion (between the culverts) for a distance of 5 to 6 feet eastward toward the railroad embankment (see photographs 7711, 7722, and 7730).



*7711 RCP Culverts (48") South of 2-DUF<sub>6</sub> Switch*



*7722 RCP Culvert (48") South of 2-DUF<sub>6</sub> Switch, North Culvert Interior*



*7730 RCP Culvert (48") South of 2-DUF<sub>6</sub> Switch, South Culvert Interior*

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On the east side of the railroad embankment, rip rap is located above the two 48 inch culverts for a distance of approximately 40 feet. This rip rap has become heavily overgrown with low growing vegetation and access to the stream bed must be made on the east side of the track, approximately 30 feet north of the Danger High Voltage Sign. No subsidence or potholes were observed above or to the sides of the culverts. There is slight erosion between the culverts. Water is standing in the stream bed at the culvert outlet. This stream appears to be effectively draining, however, vegetation is heavily overgrown downstream of the culvert outlets. See photographs 7783, 7786, and 7793. It is recommended to remove the sediment, repair the erosion, and perform vegetation control to facilitate inspection access.



*7783 RCP Culverts, Two (48"), South of 2-DUF<sub>6</sub> Switch, East Outlet Heavily Overgrown (Water Standing Near Culverts)*



*7786 RCP Culverts, Two (48"), South of 2-DUF<sub>6</sub> Switch, East Side Outlet*



*7793 RCP Culverts, Two (48"), South of 2-DUF<sub>6</sub> Switch, Access to East Side is 20' North of Danger High Voltage Sign*

## Railroad Culvert Walk Down

### Location 9

**Track #1, one 36" RCP culvert directly under the "Danger High Voltage" sign on the north side of the 161kV lines**, at approximate GPS coordinates 37.10539° N, 88.82854° W. The first inlet (west side) segment has separated from the adjacent segment and rolled about 1 foot south. Rock, soil, debris, and vegetation are getting inside the culvert at the break, (see photos, 5403 and 5410 below). The culvert itself is surprisingly clear of debris, and only about 10% filled with mud. Water does not flow through this culvert on a continuous basis, only during significant rain events. The top part of the outlet (east side) segment has been damaged and the remaining reinforcing wire is hanging down in the path of the water exiting the culvert and could catch and hold any large debris such as limbs or large grass. See photos 8369 and 8364 below.



5403, Inlet (west side) segment dislodged and crevice filling with rocks, soil, debris, and vegetation.



5410, Inlet (west side) segment dislodged and filling with rocks, soil, debris, and vegetation. Outlet visible in background.



8369, Main culvert under Track 1 is 90% unobstructed. .



8364, Outlet (east side) segment, Top damaged, wire reinforcing partially blocking culvert exit.

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Recommend resetting the inlet segment, remove the sediment, rocks and vegetation along with the reinforcing wire on the outlet segment. (This culvert was missed by Pro2Serve personnel during the initial walkdown due to extensive vegetation surrounding both the inlet and outlet.)

### Location 10

**Track #2, one 36" CMP culvert approximately 60 feet north of Curlee Road crossing, at approximate GPS coordinates 37.112768° N, 88.821301° W.** This culvert is clear, and there are no erosion or vegetation issues. However, there is a dented in deformation (approximately 4 inches deep) on the north side of the culvert top, approximately 25 feet inside the culvert from the west end. The dent is not considered an issue at this time and it does not affect drainage. No work is needed at this culvert location. See photographs 8141, 8161, and 8158.



8141 CMP Culvert (36"), 60' North of Curlee Road, West End



8161 CMP Culvert (36"), 60' North of Curlee Road, West End, Interior Looking East



8158 CMP Culvert (36"), 60' North of Curlee Road, East End

### Location 11

## Railroad Culvert Walk Down

**DUF<sub>6</sub>, two 15" CMP culverts, approximately 60 feet west of Hobbs Road on the DUF<sub>6</sub>-B spur, at approximate GPS coordinates 37.104566° N, 88.818231° W. The north culvert is approximately 75% silted and the south culvert is approximately 50% silted. The culvert metal appears to be in good condition and there are no erosion or vegetation control issues. Recommend removing the sediment. See photographs 8090, 8104, 8105, and 8114.**



*8090 CMP Culvert (15"), DUF<sub>6</sub>-B, 60' West Of Hobbs Road, East End*



*8104 CMP Culvert (15"), DUF<sub>6</sub>-B, 60' West Of Hobbs Road, West End*



*8105 CMP Culvert (15"), DUF<sub>6</sub>-B, 60' West Of Hobbs Road, South Culvert Looking East*



*8114 CMP Culvert (15"), DUF<sub>6</sub>-B, 60' West Of Hobbs Road, North Culvert Looking East*

### **Location 12**

**DUF<sub>6</sub>, one 12" CMP culvert, between Hobbs Road and the Old Haul Road on the DUF<sub>6</sub>-B spur, at approximate GPS coordinates 37.104627° N, 88.817798° W. No sediment, erosion or vegetation**

## Railroad Culvert Walk Down

issues and the metal appears to be in good condition. Recommend no work at this location. See photographs 8120 and 8122.



8120 CMP Culvert (12"), DUF<sub>6</sub>-B, Between Hobbs and Old Haul Road, South End Looking North



8122 CMP Culvert (12"), DUF<sub>6</sub>-B, Between Hobbs and Old Haul Road, South End Looking North, Interior

### Location 13

**DUF<sub>6</sub>, one 12" CMP culvert, approximately 50 feet east of the Old Haul Road on the DUF<sub>6</sub>-A track, at approximate GPS coordinates 37.104263° N, 88.817624° W.** This culvert has no sediment, erosion or vegetation issues and the metal appears to be in good condition. However, the culvert size appears to be inadequate for the area being drained. In discussions with residents of the trailer complex (immediately north of the culvert), it was noted that during heavy rain, water backs up under Trailer-06. This is a training trailer and is occupied an average of three times per week. While no work is needed at this location it is recommended that a drainage study be performed to determine if a second culvert is needed. See photographs 8073, 8080, and 8086.



8073 CMP Culvert (12"), DUF<sub>6</sub>-A, South of Trailers, North End



8080 CMP Culvert (12"), DUF<sub>6</sub>-A, South of Trailers, North End, Looking South, Interior

## Railroad Culvert Walk Down



*8086 CMP Culvert (12"), DUF<sub>6</sub>-A, South of Trailers, Looking Eastward toward Culvert and Its Relationship to Trailers*

### **Location 14**

**Track #2, one 48" RCP culvert inside the LA fence, north of Gate 37 and south of Service Road A**, at approximate GPS coordinates 37.113718° N, 88.820853° W. This culvert appears to be approximately 50% silted. There is a radiological zone on the east side (of the culvert) and due to vegetation inside the ropes, the culvert inlet could not be seen. The west side could be accessed and the culvert appears to be in good condition, with no erosion or deterioration. See photographs 6927, 6934, and 6942.



*6927 Concrete Culvert (48"), Near Gate 37, East Side, Inlet*



*6934 Concrete Culvert (48"), Near Gate 37, West Side, Outlet*

## Railroad Culvert Walk Down



6942 Concrete Culvert (48"), Near Gate 37, Interior as Viewed From the West End

### Location 15

**Track #2, two 24" RCP culverts approximately 175 feet west of 4<sup>th</sup> Street**, at approximate GPS coordinates 37.11591° N, 88.81935° W. Both culverts have approximately 50% sediment build-up and the east end of both culverts have chipped edges, but they are still serviceable. On the west side of the tracks, the separation between the two culverts has experienced minor erosion (2 to 3 feet deep) approximately 9 feet away from the track. Recommend removing the sediment and filling the eroded area. See photographs 7039, 7034, and 7059.



7039 Concrete Culverts (24"), West of 4<sup>th</sup> Street, West Side Looking East



7034 North Concrete Culvert (24"), West of 4<sup>th</sup> Street, West Side (Outlet), Looking East

## Railroad Culvert Walk Down



*7059 South Concrete Culvert (24"), West of 4<sup>th</sup> Street, East Side, (Inlet), Looking West*

### **Location 16**

**Track #2, one 16" metal culvert, inside the LA fence, approximately 75 feet west of the 6<sup>th</sup> Street crossing, at approximate GPS coordinates 37.115625° N, 88.817754° W. This culvert crosses beneath Track #6 and is approximately 95% blocked. See photographs 6951 and 6955. Recommend cleaning the silt and rock from this culvert.**



*6951 Metal Culvert (16"), East of Switch 2-6, Looking Southwest*



*6955 Metal Culvert (16"), East of Switch 2-6, Close up of Outlet*

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### Location 17

**Track #AT, one 32" RCP culvert, inside the LA fence, approximately 150 feet north of monitoring well 188**, at approximate GPS coordinates 37.11623° N, 88.82044° W. This culvert has a slight amount of erosion on top of the culvert on the west side of the track and erosion on the south side of the culvert on the east side of the track. See photographs 7022, 7002, and 7021. The culvert appears to be clear with no indications of interior degradation. Recommend filling the eroded areas.



*7022 Concrete Culvert (32"), Track-AT.  
East Side*



*7002 Concrete Culvert (32"), Track-AT.  
West Side*



*7021 Concrete Culvert (32"), Track #AT,  
Interior View from East Side Looking West*

### Location 18

**Track #AT, one 24" RCP culvert, inside the LA fence, approximately 100 yards south of the rail stops near Patrol Road #1**, at approximate GPS coordinates 37.11712° N, 88.82047° W. Washing has occurred on the east side of the track near the radiological zone at the corner of C-745-A1. The culvert is approximately 50% silted and, with the exception of one three foot segment dislodged (on the east side), the concrete segments are uniform and in acceptable condition. Recommend repairing the erosion on the east side, removing the sediment, and repositioning/reconnecting the displaced section to the existing culvert. See photographs 6984, 6989, and 6999.

## Railroad Culvert Walk Down



6984 Concrete Culvert (24"), Track #AT, West Side



6989 Concrete Culvert (24"), Track #AT, Interior View, West Side Looking to the East



6999 Concrete Culvert (24"), Track #AT, East End, Outer Section Displaced

### Location 19

**Track #6, one 36" CMP culvert, inside the LA fence, approximately 25 feet north of Virginia Avenue,** at approximate GPS coordinates 37.116920° N, 88.814529° W. The west (outlet) end of this culvert is covered by rip rap and cannot be seen. The east (inlet) end appears to be 50% silted. No erosion either side of the track centerline, 20 feet each side. Recommend repositioning the rip rap at the culvert outlet (to facilitate inspection), remove sediment and trim the vegetation. See photographs 7903, 7938, and 7955.

## Railroad Culvert Walk Down



7903 CMP Culvert (36"), Track #6, East End Covered in Rip Rap



7938 CMP Culvert (36"), Track #6, West End Covered by Vegetation



7955 CMP Culvert (36"), Track #6, West End Close Up of Vegetation

### **Location 20**

**Track #6, unknown type and size culvert, inside the LA fence, approximately 130 feet north of Texas Avenue, at approximate GPS coordinates 37.119069° N, 88.811962° W.** Both sides of this culvert are in radiological zones and extremely overgrown with vegetation and neither the inlet or outlet could be seen. However, the culvert is sufficiently long to provide a mowed area approximately 60 feet either side of the railroad track and there is no sign of erosion or sinkhole. This is a very active

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drainage ditch leading to Outfall 001 and it appears to be draining well. Recommend controlling the vegetation on either side of the track to allow inspection of this culvert. See photos 7891 and 7898.



7891 Track #6, Outfall Ditch 001, East Side, Unknown Size



7898 Track #6, Outfall Ditch 001, West Side, Unknown Size

### Location 21

**Track #6, one 60" CMP culvert inside the LA fence, approximately 260 feet east of 10<sup>th</sup> Street and 60 feet west of the 6-7 switch, at approximate GPS coordinates 37.119971° N, 88.809576° W.** This culvert appears to be in good condition, however, it has a plastic bag (or some other type plastic material) creating a 40% obstruction in the north end along with a moderate amount of ballast material. Recommend removing the plastic obstruction and ballast material from the north end of the culvert. See photographs 7151, 7160, and 7153.



7151 Corrugated Metal Pipe Culvert, (60"), Track #6, South Side of Culvert



7160 Corrugated Metal Pipe Culvert, (60"), Track #6, North Side of Culvert

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7153 Corrugated Metal Pipe Culvert, (60"), Track #6, Interior as Seen from South Side Looking North

### Location 22

**Track #6, one 60" CMP culvert inside the LA fence, approximately 300 feet east of 10<sup>th</sup> Street and 210 feet west of the 6-6 switch, at approximate GPS coordinates 37.120086° N, 88.809377° W.** This section of track is inactive. The culvert is just northeast of the Location 19 culvert and drains the North South Diversion Ditch into the C-760-A Surge Basin. This culvert is in acceptable material condition but partially plugged by heavy growth of vegetation. Recommend removing the vegetation. See photographs 7165, 7167, and 7172.



7165 Metal Culvert (60"), Track #6, Near C-760-A, Looking North



7167 Metal Culvert (60"), Track #6, Near C-760-A, Looking South

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*7172 Metal Culvert (60"), Track #6, Near C-760-A, Interior Looking South*

### Location 23

**Warren Road, northwest of Public Warning Siren 1A and 1B. This is a 48" RCP culvert beneath Warren Road, located at approximate GPS coordinates 37.099643° N, 88.837032° W and provides direct drainage from 0.14 square miles of surface area into the stream west of the sinkhole culvert (Culvert ID #5).** Though this culvert is not under the railroads, it provides critical access to public warning sirens A1 and A2 and indirectly provides controlled flow to the railroad culvert at location #5. The Warren Road culvert is deteriorating similar to the Culvert ID #5 railroad culvert, with the bottoms of the culvert beginning to erode away and the outside segments beginning to displace. One segment, on the west side, is displaced and a deep hole has been scoured on the east side. This culvert is most likely not sized correctly for the amount of area being drained and as a result, erosion has begun to occur upstream and downstream of Warren Road. In addition, with the bottoms having been scoured out, erosion may be occurring beneath the culvert. However, the segments have not separated inside the culvert. Recommend repositioning the outer segment on the west end, protecting this side with rip rap and filling the interior eroded bottom with concrete grout or some other permanent repair material. This culvert warrants additional periodic inspection as well as a review of the drainage requirements verses culvert size. See photographs 3450, 3459, and 3484.

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*3450 Concrete Culvert (48"), Warren Road, West End*



*3459 Concrete Culvert (48"), Warren Road, West End, Interior*



*3484 Concrete Culvert (48"), Warren Road, East End*