TENNESSEE VALLEY AUTHORITY

KINGSTON FOSSIL PLANT

ANNUAL ASH POND DIKE STABILITY INSPECTION 2009

Prepared by: Chris Buttram
Date: January 12, 2009

General

The waste disposal areas at Kingston Fossil Plant were inspected for dike structural stability on October 20, 2008. The inspection was performed by Chris Buttram (EDS), John Albright (EDS) and Jamey Dotson (CCBP). The previous annual inspection was performed on December 4, 2007. The results of the annual inspection are listed below according to location.

Active Ash Disposal Area

Bottom ash is sluiced into a channel southwest of the active ash disposal area. The bottom settles out in the channel and is removed by dragline, which is subsequently used for dike construction.

Fly ash is sluiced into an adjacent channel to the bottom ash channel where it flows into the main ash pond. The fly ash channel was cleared of vegetation last year. Both channels flow northeast into the active ash pond. See Figure 1 and drawing API 2009.

Fig. 1 Sluice Channels to Ash Pond

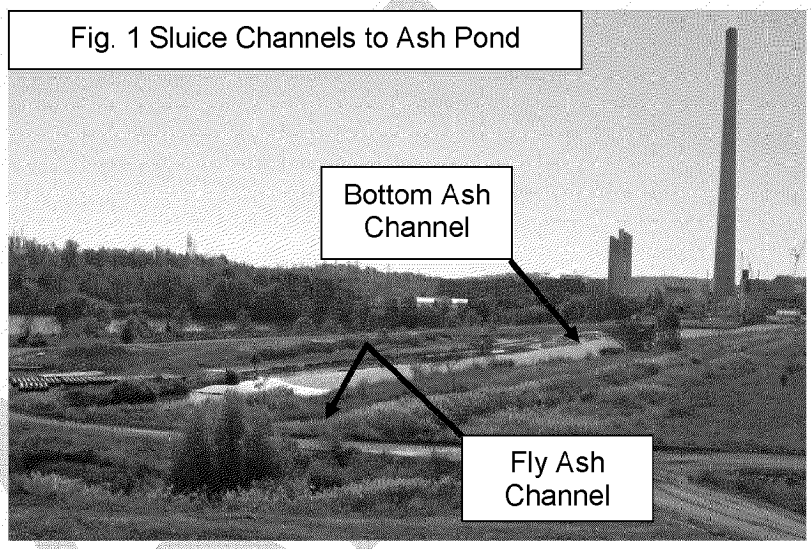
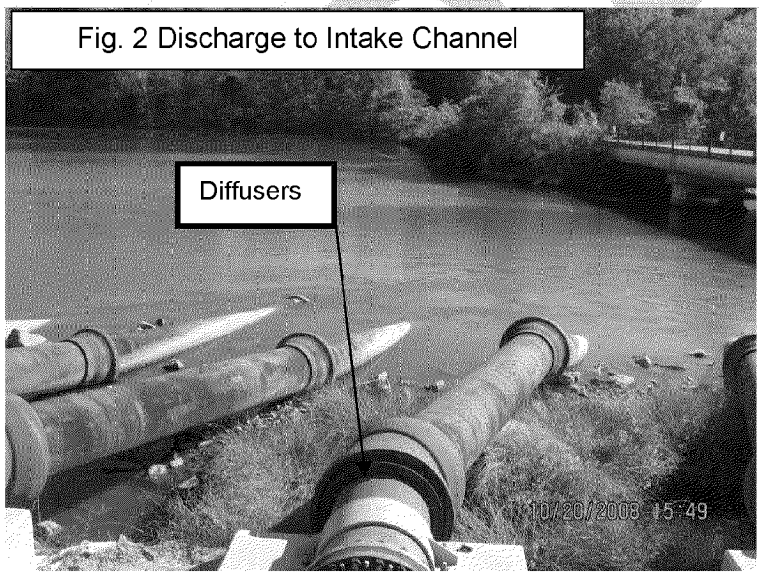


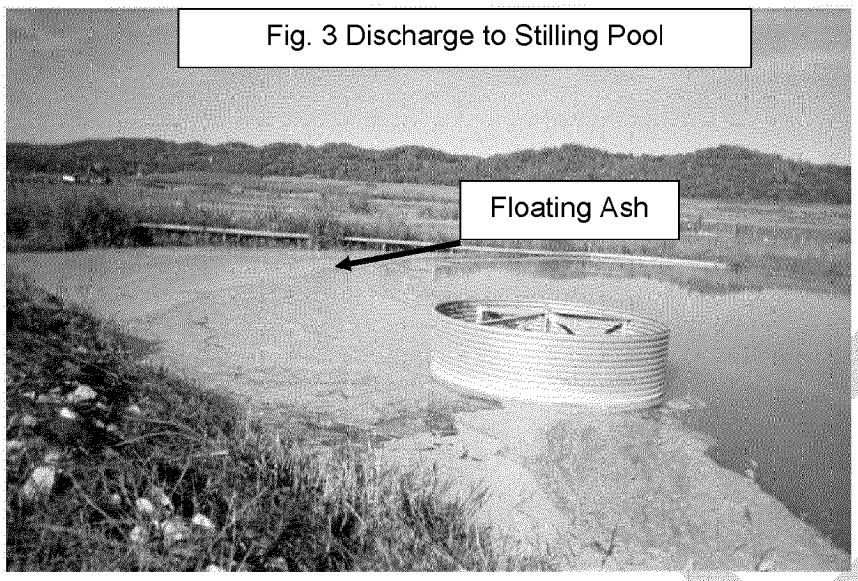
Fig. 2 Discharge to Intake Channel



Sluice water flows from the active ash pond into the stilling pond through the five spillways constructed in 2005. The old plant constructed spillway (Kennedy Weir) was taken out of operation at the same time. From the stilling pool, the water discharges into the plant intake channel via six standard spillways equipped with discharge diffusers (see Figure 2) constructed in November 2003. Many of these structures have vegetation and brush growing inside them, which needs to be removed.

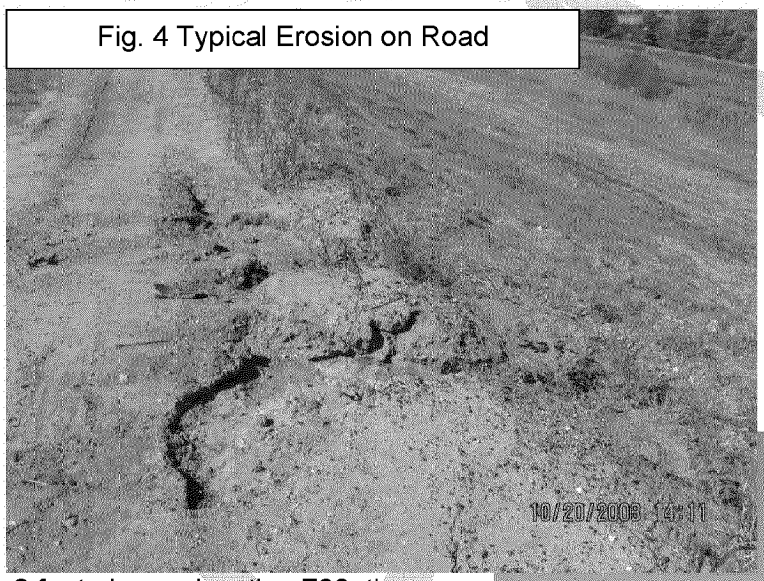
All exterior dike slopes around this area looked to be in stable condition and showed excellent vegetative cover. Continue to maintain and stabilize Dike "C" with riprap to prevent wave action erosion. The dikes had been mowed recently and were in very good condition.

Fig. 3 Discharge to Stilling Pool



Floating ash near discharge structures, as seen in Figure 3 below, should be removed immediately to prevent an accidental release. Check the floating skimmer booms and maintain them to keep floating ash away. The seeps reported on the bench of Dike "C" north of the intake skimmer have not been reported since wheel ruts were repaired a few years ago. No seeps or wets spots were seen in this area during the inspection.

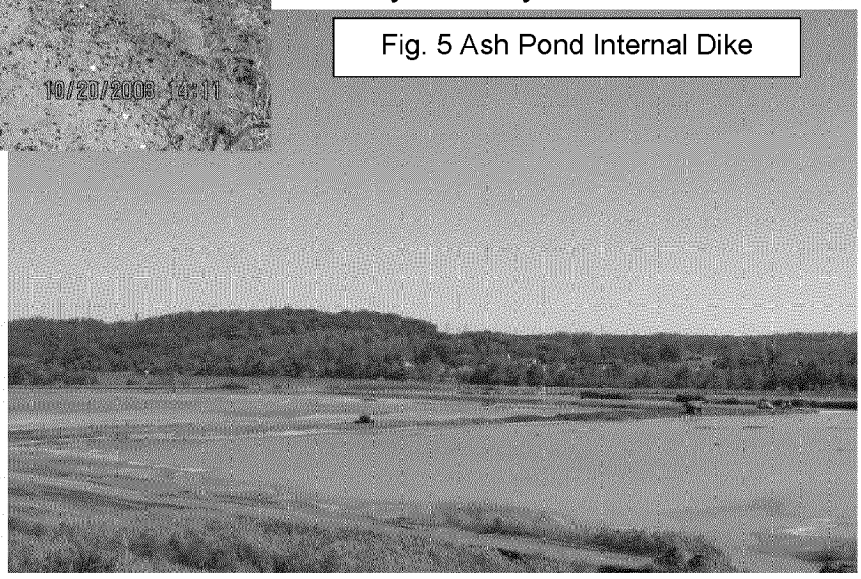
Fig. 4 Typical Erosion on Road



Some of the dike roads exhibit areas of erosion on the edges and some rutting, see Figure 4. This photo is typical of the eroded areas of the roads. Although it does not appear to be a significant problem, these eroded areas, as well as any ruts, should be graded out and the road covered with crushed stone to prevent larger erosion gullies.

Construction of an internal divider dike inside the active ash disposal area is currently underway. The dike is 1 foot to 2 feet above elevation 760, the elevation of the water in the pond. The divider dikes will be constructed to build a base of fly ash for a dredge cell expansion, which will eventually cover approximately half of the existing main ash pond. See Figure 5 to the right.

Fig. 5 Ash Pond Internal Dike



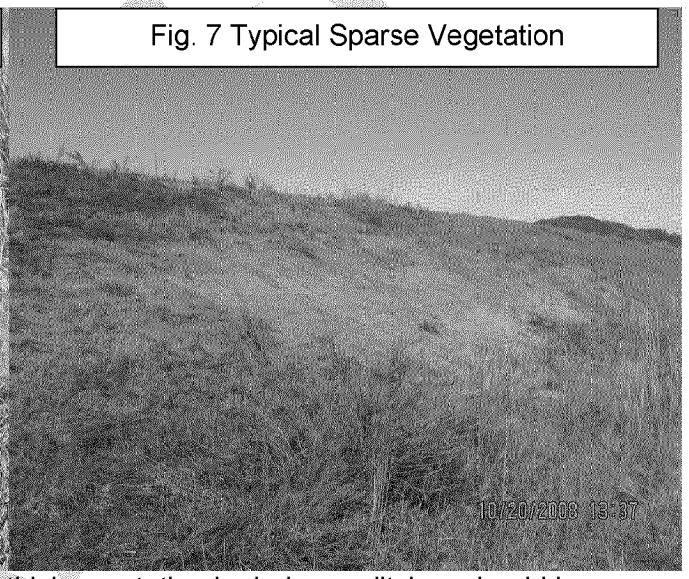
Dredge Cells

Prior to November 2003, the fly ash from the active ash disposal area was periodically dredged into raised dredge cells located in the western portion of the disposal area. In November 2003, dredging operations ceased because of a leak in the toe of the dike slope for Cells 2 and 3. Through 2004 and 2005, ash was dredged to a newly constructed interim cell while repairs were made to the original dredge cells. Dredging resumed to the original dredge cell location in early 2006.

The interim dredge cell capacity has been depleted; however decant water from the raised dredge cells flows through the interim cell to the main ash pond. Water flow into the interim cell is essential for dust control. The divider dike between this cell and the active ash pond appeared to be in stable condition. Some areas of sparse vegetation and poor bench drainage were spotted on this dike. These areas should be reseeded and fertilized per T-1, section 580. Areas with poor drainage should

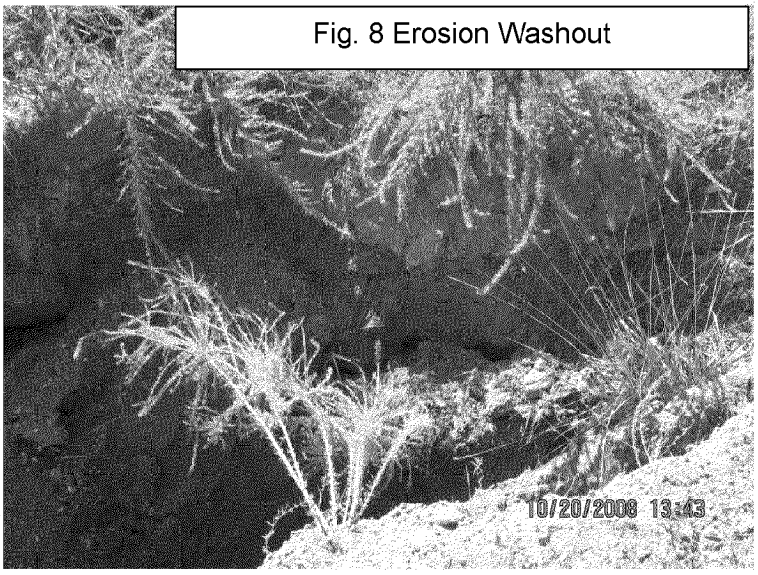
Fig. 6 Typical Blocked Drainage Path

Fig. 7 Typical Sparse Vegetation



be graded so they will drain, even if slowly. Also, thick vegetation in drainage ditches should be thinned out or removed to keep from blocking the water flow. See Figures 6 and 7 above. Wheel ruts on benches or in a road that are holding water should be filled with bottom ash and covered with stone. Due to extensive erosion in one area, an erosion washout of 2 feet wide by 20 feet long by 2 feet deep had formed. This area should be repaired immediately. See Figure 8. Fill bottom layer with 6 inch lifts of compacted bottom ash until clay area is reached. Cap with 1 foot of clay via 6 inch compacted lifts. It is recommended that an erosion control blanket be used in this area for quicker vegetation growth. Monitor this area, especially after rain events, to assure that no settling occurs.

Fig. 8 Erosion Washout



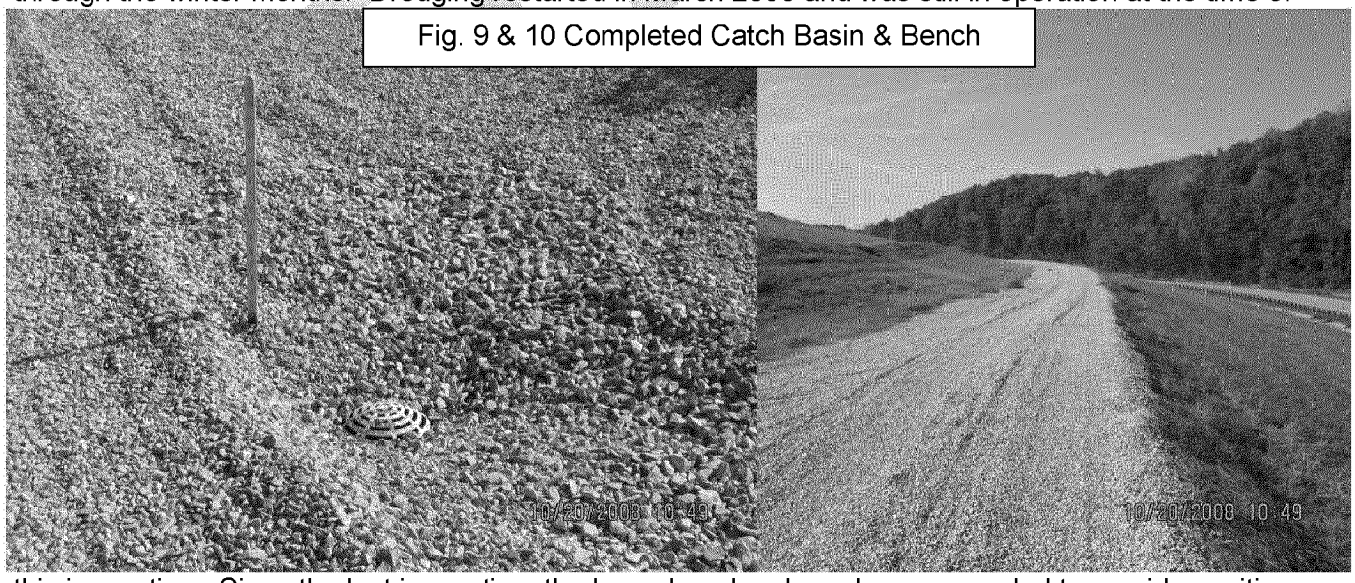
Construction of repairs for the 2003 slope failure was completed in October 2005. Underdrains were installed in the lower two benches to relieve water pressure.

The drainage ditch at the toe of the dike along Swan Pond Road was enlarged to accommodate the additional flow. This ditch has a high point approximately 400-feet north of the intersection with the plant access road. North of the high point, runoff and leachate drain into a sump pond, which is pumped to the ash pond, with an emergency overflow into Swan Pond Embayment. The pumps are electric powered with high water level alarm indicators at the control panel. South of the high point, runoff and leachate run south and east to the ash pond.

In November 2006, after the dredge cells had been back in operation for about 9 months, a localized failure occurred very near the 2003 failure. It was determined that the failures were caused by excessive seepage resulting from a combination of issues: inadequate internal drainage (addressed in 2005) and infiltration of surface water on the existing dike benches. Local anomalies in the subsurface conditions were likely increasing groundwater velocities and causing an upward gradient near the toe of the dike. A system of dewatering wells was installed in 2006, which helped ease the construction of a riprap toe buttress along the areas of this failure. The riprap allows a conduit for the water to leave the dike, lowering the phreatic surface. Approximately 30 shallow piezometers were also installed to monitor the water levels in the dike. Two spring boxes (36" diameter concrete pipes installed vertically over a bedding of gravel surrounded by filter fabric with a perforated drainpipe) were installed in the areas of the most saturation. Since last year's inspection, a third spring box has been added north of the first two to further help with relieving water pressure. These wells have a high capacity for allowing water to exit the dike. The dewatering wells were still in place for an extra monitoring point. These repairs are still reducing the near-surface groundwater elevations.

Previously, ash had been dredged into three separate cells, but in 2007, the ash reached levels that the divider dikes for Cell 3 were buried and now there are only two large cells (1 and 2). Dredging was stopped in mid-November 2007 based on recommendations from EDS and Geosyntec Consultants, Inc. This preventative measure was taken to reduce water levels in the dredge cell through the winter months. Dredging restarted in March 2008 and was still in operation at the time of this inspection. Since the last inspection, the lower benches have been re-graded to provide positive drainage to a series of catch basins which will divert the water collected to the lower drainage ditch. In addition to the catch basins and down drains, the benches were covered with a geomembrane, geotextile and then crushed stone to further reduce infiltration into the benches. See Figures 9 and 10 above.

Fig. 9 & 10 Completed Catch Basin & Bench



Outlets with valves were installed on the old dewatering wells to allow personnel to relieve some of the water in these wells. These outlets drain directly into the riprap channel along Swan Pond Road. At the time of the inspection, the valves on some outlets were closed in preparation for measurement and those wells showed water pressure above the dike slope. The valves of the other monitoring wells were open and they were flowing clear water to the drainage ditch. The inspectors noticed that some of these outlets had been broken (See Figure 11 below), possibly while the slopes were being mowed. These broken outlets should be repaired so that the water is not draining freely down the slopes.

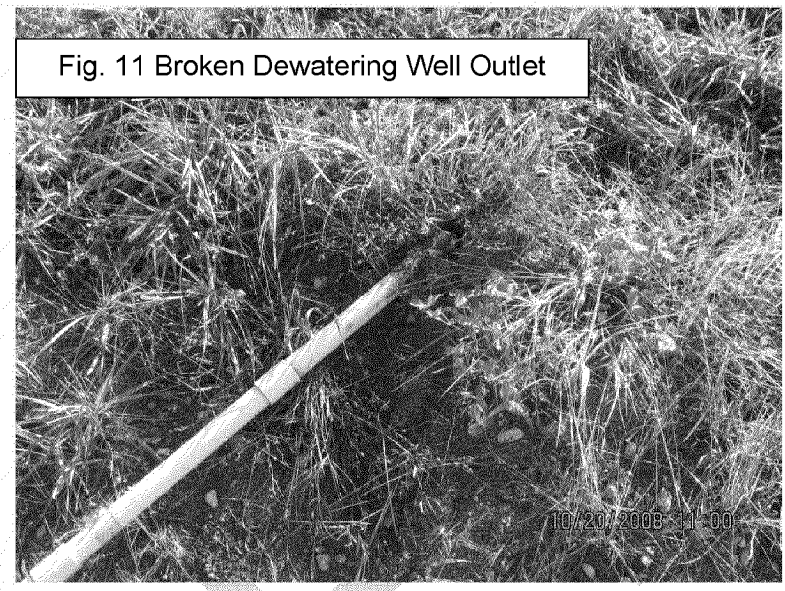
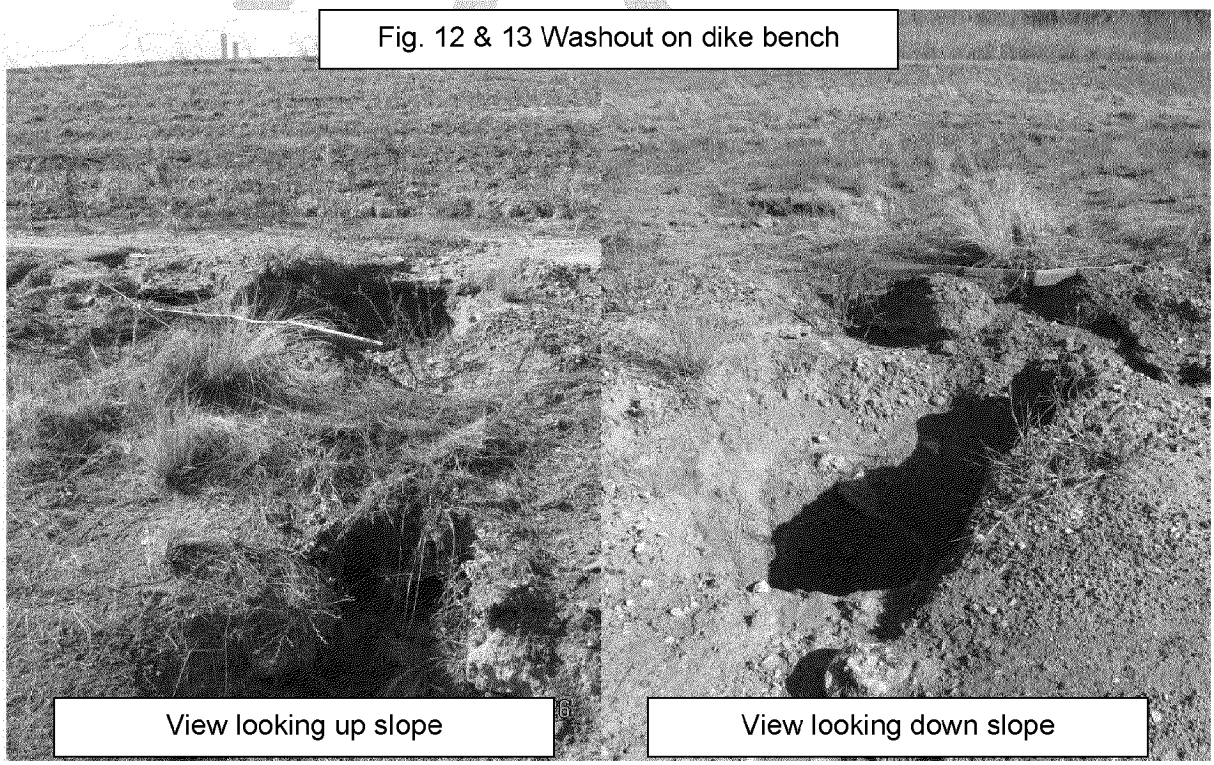


Fig. 11 Broken Dewatering Well Outlet

Plant operations have done a commendable job of mowing the dredge cell slopes. Small trees growing on the slopes have been cut level with the ground. If trees are too large to be mowed, the trees should be cut, the stumps removed, and the area backfilled with soil, compacted and seeded and fertilized. Several areas around the dikes of the dredge cells are in need of seeding and fertilizing. It is recommended these areas should be reseeded and fertilized per T-1, section 580. At the north end of the dredge cells, one of the lower dike benches has an area that has eroded and washed out (See Figures 12 and 13 below). This area should be repaired immediately by filling with clay in 6" lifts and compacting. After the area has been filled and compacted, reseed and fertilize per

Fig. 12 & 13 Washout on dike bench


View looking up slope

View looking down slope

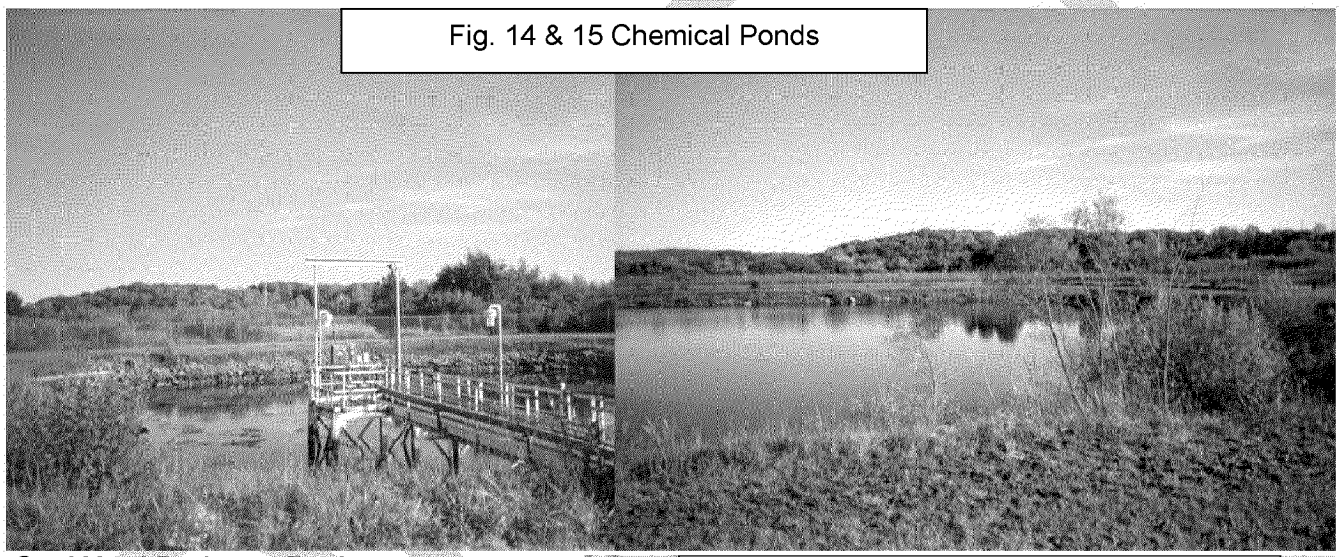
T-1, section 580. Also at the north end of Cell 2, a small wet spot was noticed at the toe of the bottom dike. This wet spot was roughly 4 feet by 4 feet and approximately 600 feet from the northwest corner of Cell 2. The area was not soft and was believed to be in the spot of an old underdrain. The drain was not located at the time of this inspection. This area should be monitored and if conditions worsen, contact Chris Buttram, 423-751-3574.

Besides the redwater wetlands, there was only one spot that showed flowing redwater. At first thought to be a seep, it was discovered that the redwater was flowing out of a dewatering well that had a closed valve. The water was flowing down the slope into the riprap ditch. The riprap ditch was also stained some at the outlet area for this dewatering well.

Chemical Treatment Ponds

The chemical treatment ponds (iron and copper) are located southwest of the active ash pond. Both ponds were excavated and have no exterior slopes. The internal dike slopes are covered with riprap. These slopes were in good condition with some trees present. See Figures 14 and 15. Sediment in the ponds was tested in FY 2004 and found to be non-hazardous.

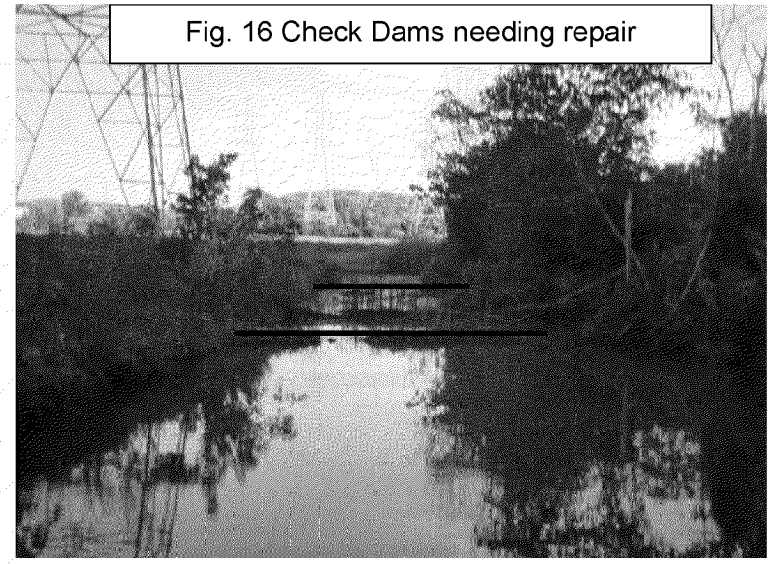
Fig. 14 & 15 Chemical Ponds



Coal Yard Drainage Basin

The coal yard drainage basin is located at the southwest corner of the coal pile. This basin was excavated below grade; therefore, there are no exterior dikes. The interior slopes appeared to be in satisfactory condition. Normal discharge from this basin is pumped into the fly ash discharge ditch and flows to the active ash disposal area. The basin was cleaned out in 2006, but is in need of another clean out. The bottom of the pond should be no higher than elevation 745 at the pump platform. Elevation 745 allows 2-feet of clearance below the pump intakes to prevent pumping solids. In addition, the "V-shaped" pond extensions added during the summer of 2001 to increase the pond storage volume contained coal yard sediment. Figure 16 to

Fig. 16 Check Dams needing repair

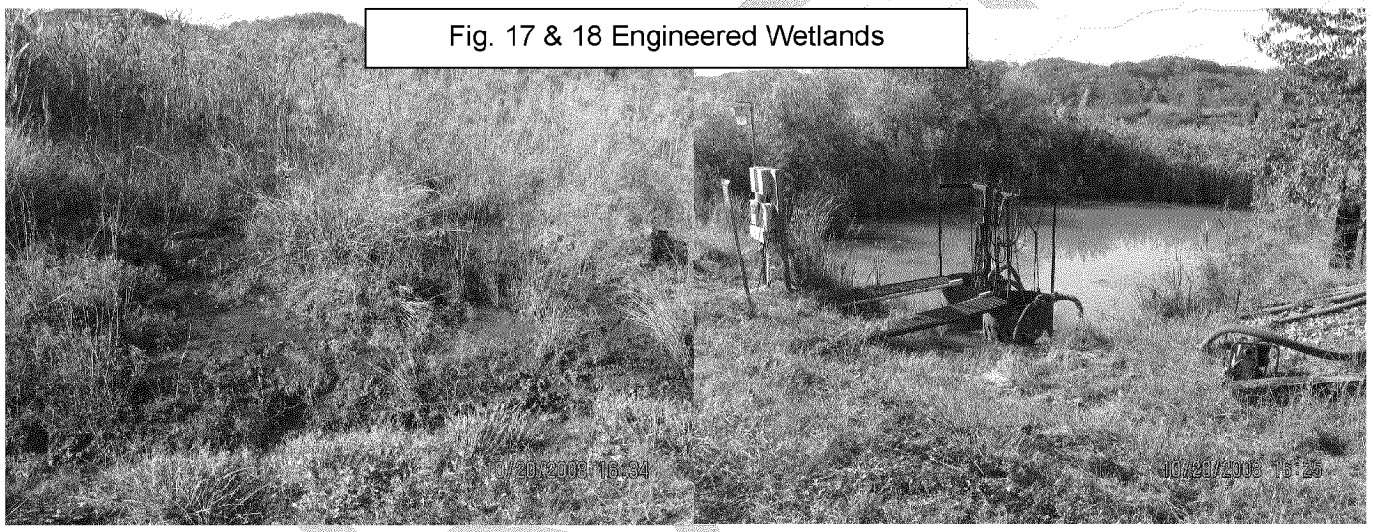


the right shows rock check dams built to keep the coal fines away from the pumps. The check dams appear to be in need of repair and cleaning out. If maintained properly, the check dams will keep sediment from reaching the pumps. TVA drawing 10W225-1 (attached as API 2009-2) shows the pond and its intended bottom contours. The Coal yard drainage basin should be cleaned out annually.

Engineered Redwater Wetlands

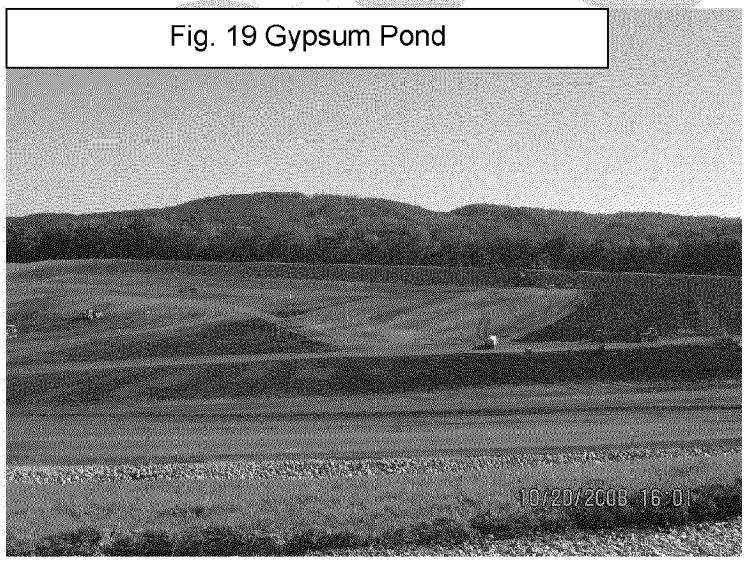
The engineered wetlands along the southwest dike receive seepage that collects in the anoxic limestone drain below the bottom ash trench. The wetland appeared to be functioning, but the discharge is still pumped via two pumps to the ash pond, see Figures 17 and 18 below. Vegetation within the pump structures should be removed so that the pumps do not become clogged. Several trees were noticed along the interior slopes and should be removed by pulling up the roots. Repair the damage by compacting soil into the damaged areas.

Fig. 17 & 18 Engineered Wetlands



Gypsum Pond

Fig. 19 Gypsum Pond



The gypsum pond is located on the peninsula, which is east of the plant. The pond was still being constructed at the time of this inspection, see Figure 19 below. Construction is scheduled to be finished on 6/01/08.

For more photos taken during the inspection, see the attached sheets at the end of this report.

Subsequent to the inspection and the writing of this report, a catastrophic failure at the north end of the dredge cells occurred. The cause of the failure is currently under investigation.

Actions Since Last Inspection

- Monitoring of the Dredge Cell dikes for seepages has continued.
- The interior of the Dredge Cells was sprayed with a polymer anti-dusting agent during May of 2008.
- Surface drainage repairs that began in January 2008 have been completed.
- A third spring box was installed on the side of the Dredge Cell paralleling Swan Pond Road. This was done to provide controlled relief of excess pore water pressure and allow an additional release of water from the dikes.

Recommendations

Active Ash Disposal Area

- Repair any dikes showing signs of erosion. Erosion ditches larger than a standard railroad crosstie should be repaired with compacted bottom ash or soil. Repeated repairs in the same location calls for riprap stabilization. EDS-Civil will assist in sizing the riprap and setting the limits if needed.
- Investigate the use of spraying to inhibit vegetation growth on the interior dikes of the stilling pond.
- Remove ash floating on the surface of the ash and stilling ponds, and check floating skimmer booms to ensure they are working properly.

Dredge Cells

- Monitor the limestone drain area and all exterior dike slopes (along Swan Pond Road in particular) for seepages, soft wet spots, animal burrowing, sloughing, etc., and report any changes to Chris Buttram of FPG Engineering Design Services, 423-751-3574.
- Dredge cell drainage ditches should be kept free of cattails so they will flow as well as possible. Any existing cattails should be removed.
- Remove trees from the slopes of the dikes. Mowing at least twice a year is recommended to control the size of the trees. Preventing the trees from getting larger than 1" in diameter at the ground is preferred. Any trees larger than 3" in diameter at the base must be pulled from the dikes, roots and all. Repair and reseed the damaged area.
- Repair rutting in the access and dike roadways, as well as benches. Fill with bottom ash and regrade as required to promote drainage.
- Repair broken dewatering well outlet pipes. These pipes should be draining directly into the lined ditch at the bottom of the cells.
- Repair the 2' x 20' area of erosion on the east slope of the interim dredge cell. Fill bottom layer with bottom ash in 6" lifts and compact. When the clay layer is reached, cap with 1' of clay via 6" compacted lifts. Lastly, cover with an erosion control blanket to help stabilize the damaged area. After repairs have been made, continue to monitor area until good vegetation has stabilized the area.
- Repair erosion washout on lower dike bench at North end of dredge cells. Repair eroded area by filling with clay in 6" lifts and compacting, then reseed and fertilize per T-1, section 580.
- Continue to monitor the wet spot at the north end of the dredge cells.

Coal Yard Drainage Basin

- Dredge the Coal Yard Drainage Basin to restore its design contours and protect the pumps from further damage. There is an estimated 2,800 cubic yards of sediment in the original pond and an extra 3,400 cubic yards in the "V" section that needs to be removed as soon as reasonable. See the attached copy of 10W225-2. Estimated at $62,000, depending on haul distance.
- Repair and clean out riprap check dams in the coal yard drainage basin to keep solids away from the pumps.

Engineered Redwater Wetlands

- Remove all vegetation from within the pump structures
- Remove trees from the interior slopes. Preventing the trees from getting larger than 1" in diameter at the ground is preferred. Any trees larger than 3" in diameter at the base must be pulled from the dikes, roots and all. Repair and reseed the damaged area.

Fig. 20 Typical Wheel Ruts

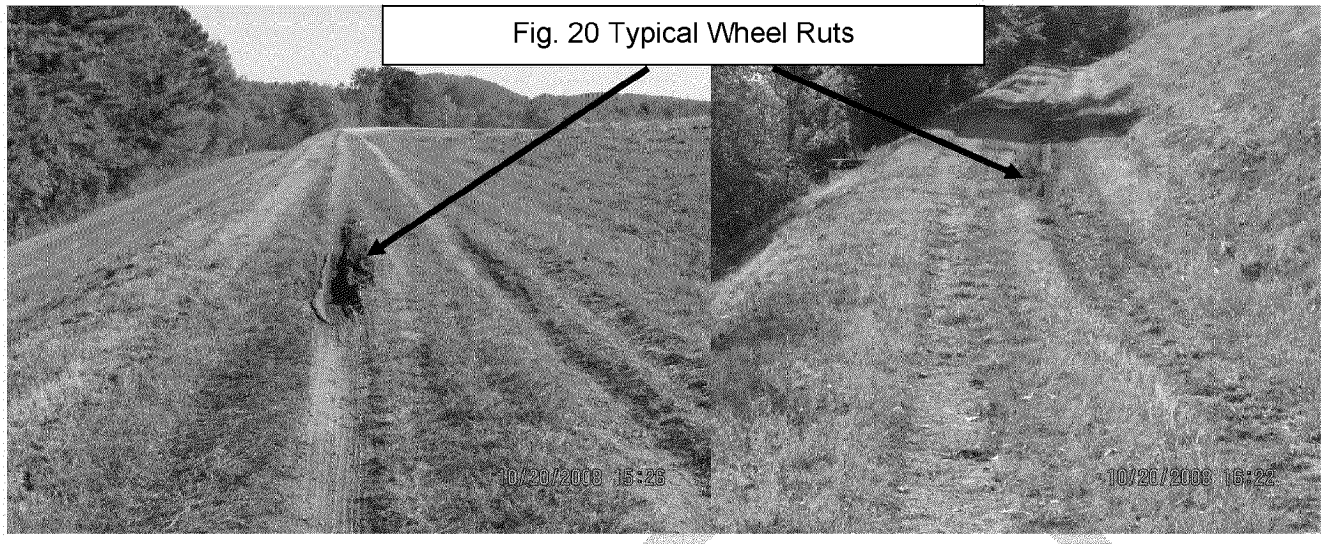


Fig. 21 Riprap ditch needs cleaning

Fig. 22 Spring boxes and piezometers

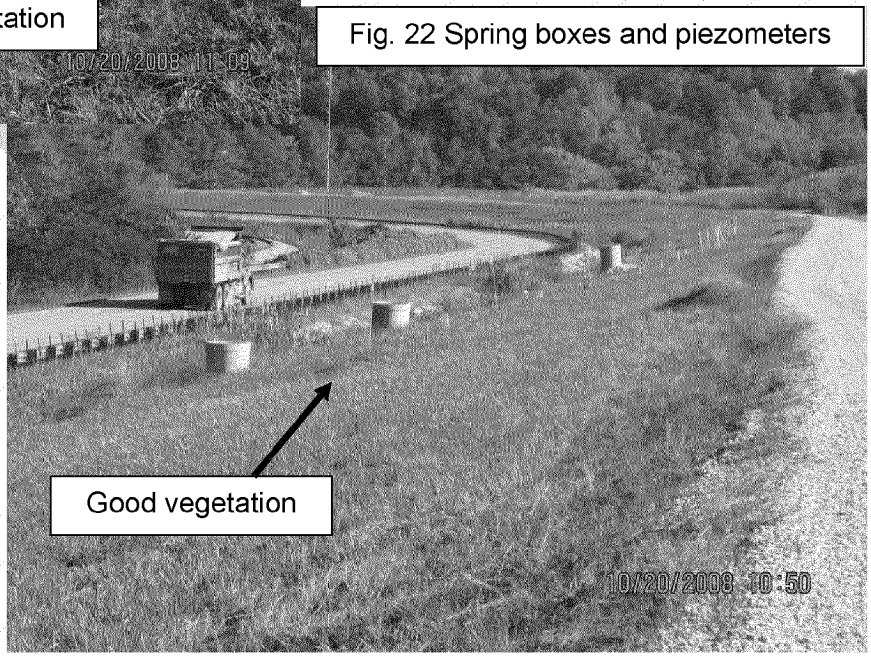


Fig. 23 Dewatering well overflowing redwater

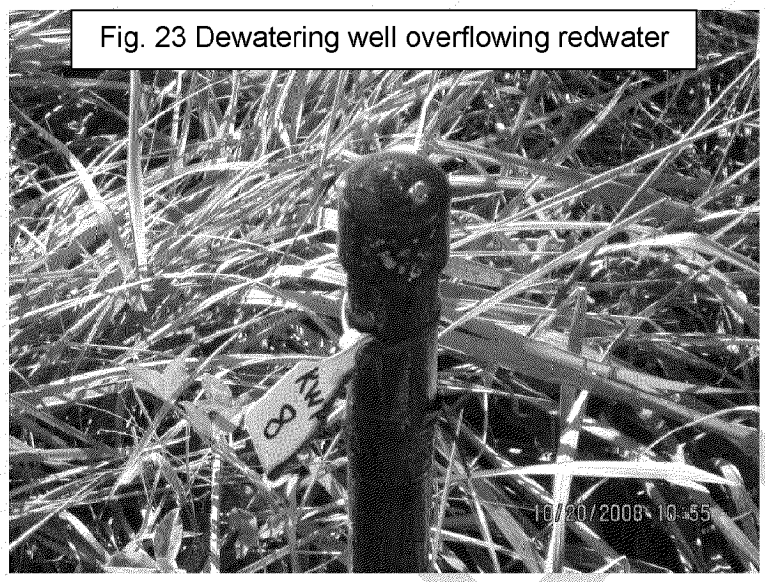
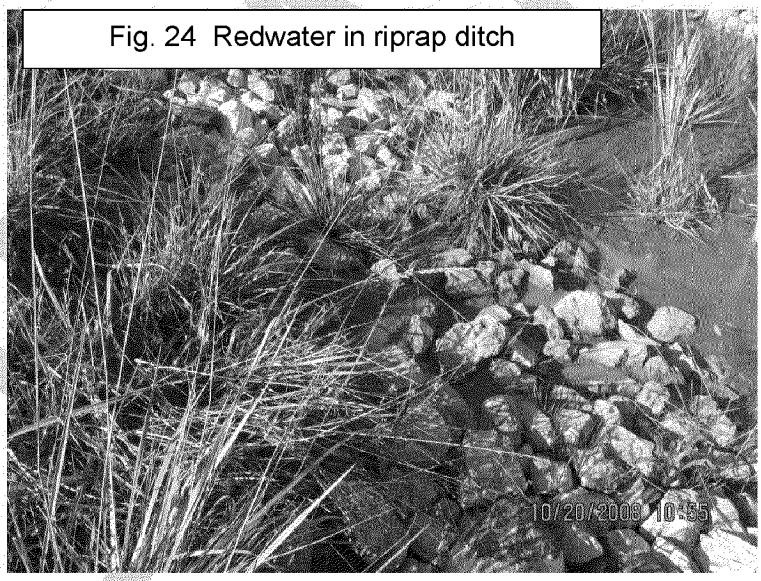
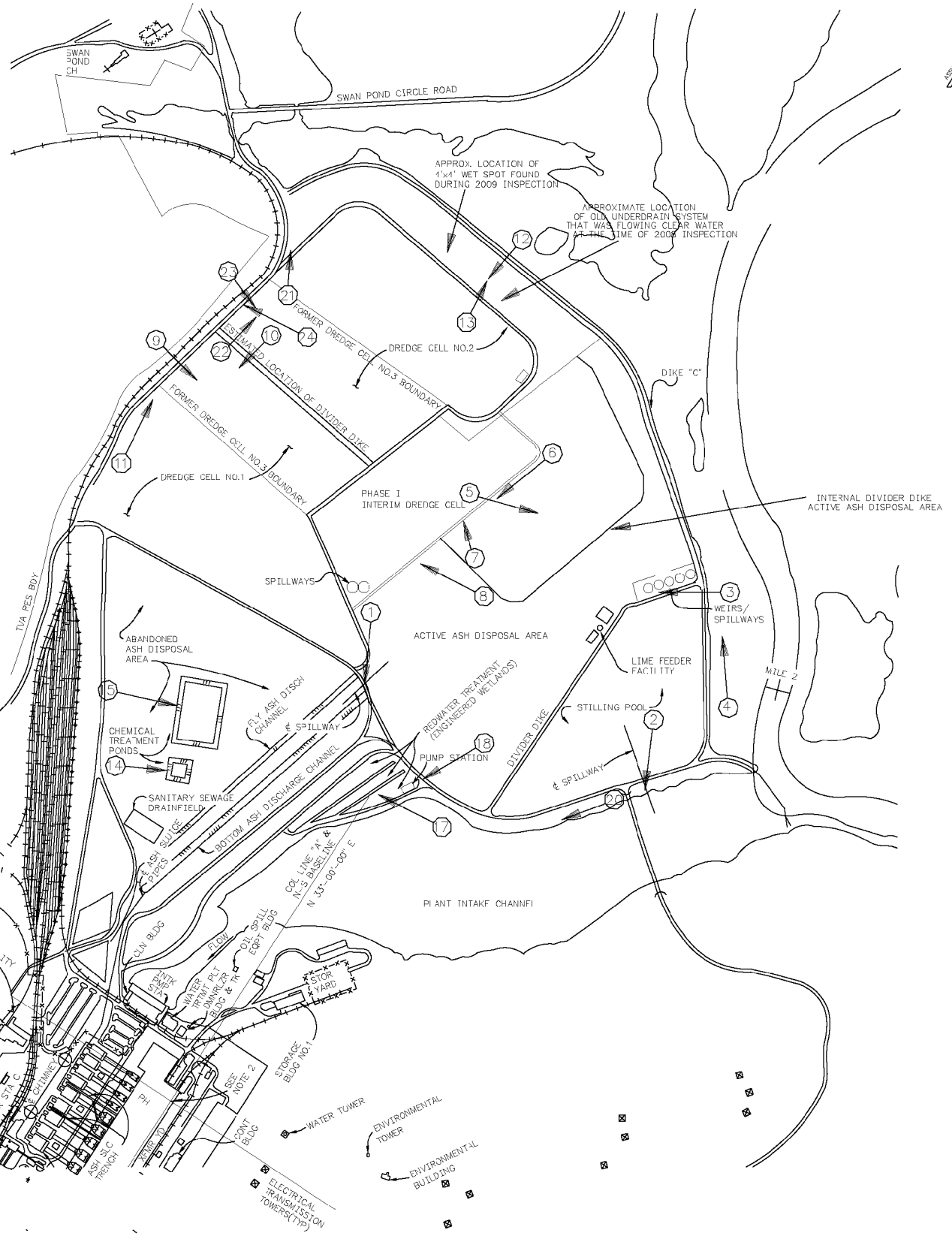
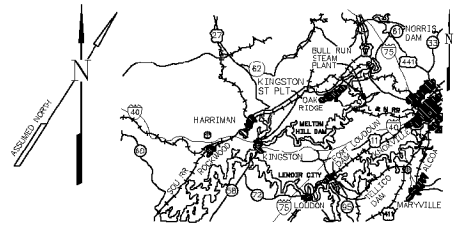


Fig. 24 Redwater in riprap ditch







LOCALITY MAP

NOTES:

1. TOPOGRAPHY TRACED FROM KELSH PLOTTED FROM APRIL 1974 AERIAL PHOTOGRAPHS AND FROM USGS 7.5 MINUTE QUADRANGLE (HARRIMAN, TN 123-NE AND LENOIR CITY, TN 130-SE) ENLARGED. CONTOUR INTERVAL SHOWN IS 10 FEET.
2. THE TENNESSEE STATE COORDINATES AT THE INTERSECTION OF THE N-S AND E-W BASELINES ARE NORTH 351,654.16 AND EAST 2,439,236.03.
3. FOR PROPOSED AND TEMPORARY FEATURES SEE DWG 10E202-01.

PHOTO TAKEN AT THIS LOCATION IN THIS DIRECTION.

TOPOGRAPHY TRACED BY M.P. TERMON 1/30/1981

R											
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YARD

ASH DISPOSAL AREA
2009 ANNUAL INSPECTION

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:

KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | DATE 04/28/11 | 36 | C | API 2009-1 | R

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W-TVA

C.A.D. DRAWING
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COAL INVENTORY AREA

COAL INVENTORY AREA

GATE

Parking

Parking

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KSP 103

KSP 104

KSP 105

KSP 106

KSP 107

KSP 108

KSP 109

KSP 110

KSP 111

KSP 112

AMBIENT AIR SAMPLER TOWER

STACK

STACK

COAL YARD RUN OFF POND

PHOTO TAKEN AT THIS LOCATION IN THIS DIRECTION.

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DISCIPLINE INTERFACE

SCALE: NONE — EXCEPT AS NOTED

YARD

COAL YARD DRAINAGE BASIN
2009 ANNUAL INSPECTION

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:

KINGSTON FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R00	DATE	36	C	API 2009-2	R 0

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DO NOT ALTER MANUALLY