



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Solid Waste Management
Fifth Floor, L. & C Tower
401 Church Street
Nashville, Tennessee 37243 - 1535

May 31, 2013

Tiffany Phillips, Chairperson
Rutherford County Public Works Committee
Room 101, County Courthouse
Murfreesboro, Tennessee 37130

VIA EMAIL ONLY

Dear Chairperson Phillips:

The TDEC Division of Solid Waste Management offers the following information to the Rutherford County Public Works Committee in an effort to address concerns regarding the two landfills the County maintains and operates. Specifically, the concerns regard suspected impacts to the East Fork of the Stones River by the landfills.

Background

Three solid waste landfills exist in close proximity to each other on the East Fork of the Stones River approximately two miles upstream of the Walter Hill dam. One landfill is privately owned and operated. The other two are operated by Rutherford County. One of the County landfills is a closed Class I (or sanitary) landfill; the other is an active Class III landfill. The Committee has expressed concern regarding the operation of the County landfills and the potential for adverse impact of the landfills on the river. At the Committee's invitation, Mr. Patrick Flood, Director of the TDEC Division of Solid Waste Management (Division), attended a Committee meeting on May 7, 2013 and shared information intended to answer the Committee's concerns and questions as much as possible. Since that meeting, additional information has been compiled and is provided to the Committee.

Status Update

The Division of Solid Waste Management continues to monitor the progress for the landfills to comply with state regulations. Since our presentation at last month's meeting, the County completed the groundwater monitoring well survey. As a result, wells one through three, five, and six B have been developed. The work of replacing well four is in the bidding stage. The County has received approval to install a leachate sump and progress on this effort is expected to proceed. The County is also in the process of cleaning one of the sediment ponds. Overall, we are satisfied with the recent steps taken to correct the issues and look forward to the continued cooperation of the County.

Water Quality Assessment

In assessing the general condition of the East Fork Stones River, TDEC performs regular biological and chemical testing of the River, checking chemical parameters that include: pH, field conductivity, dissolved oxygen, temperature, turbidity, flow rate, E. Coli and Fecal Coliform count, total hardness, ammonia, cadmium, copper, lead nickel, silver and zinc. TDEC monitors these parameters in most streams; however, the Division of Water Resources (DWR) added ammonia and the metals in 2006 specifically to monitor the potential impacts from the area landfills.

Biological surveys in the East Fork Stones River were conducted in 2002, 2009, and 2012. The site of these surveys is an established ambient monitoring point below the Walter Hill dam. It was selected in order to evaluate any impacts the nearby landfills may be having on the water quality of the Stones River.

All three surveys found the in-stream biota to be of sufficient health to be Fully Supporting the river's Designated Use for Fish & Aquatic Life propagation. Based upon the DWR's three surveys there were no indications that the river had been impaired by leachate potentially entering the river between 2002 and 2012. No toxic effects to the aquatic populations were observed by the DWR during these surveys.

In addition, TDEC collected water samples for laboratory analysis just below the Walter Hill dam on a monthly basis in 2006-2007 and are doing so again in 2012-2013. The results from the chemical and bacteriological analyses for the parameters tested were within ranges normally seen in streams in this area and were within acceptable levels, as set out in DWR's rules. The analytical data for the multiple sampling events are noted in the DWR trip report of May 9, 2013 which is attached. Based on the biological assessments, there is no indication that there has been any harm to the aquatic life in the Stones River from the landfills.

Dr. Wells' Report and Photographs

Several of the Committee's concerns were taken from a report from Dr. Marion Wells, entitled "A Study of Water Residue and Sediment from Three Collection Sites on the East Fork Stones River, Rutherford County, TN." Dr. Wells collected samples of water and sediment from the East Fork Stones River in the vicinity of the Rutherford County Landfills. His findings and photographs prompted the Division of Water Resources and the Division of Solid Waste Management to do additional inspections and testing, the findings of which are also included below.

Based upon review of the information provided by Dr. Wells, it was noted that the analysis of the samples he collected did not follow the applicable protocol outlined in EPA publication SW 846. This document, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, is the official compendium of analytical and sampling methods that have been evaluated and approved for use in complying with the Resource Conservation and Recovery Act (RCRA) regulations. SW-846 functions primarily as a guidance document setting forth acceptable, although not required, methods for the regulated and regulatory communities to use in responding to RCRA-related sampling and analysis requirements. RCRA is the basis for Tennessee's solid and hazardous waste regulations.

The methodology used by Dr. Wells in analyzing his samples included heating the samples to 60 °C to drive off the water, leaving crystals which he then identified using a Scanning Electron Microscope as specific elements (i.e., O, Ca, Mg, Na, Al, etc.). Dr. Wells' methodology caused any semi-volatile

organic chemicals (SVOC) or volatile organic chemicals (VOC) that may have been associated with the water or sediment sample to be volatilized or evaporate. Leachate associated with municipal solid waste landfills may contain SVOCs or VOCs and these parameters would typically be included in analysis when trying to identify whether leachate is present. This limits TDEC's ability to associate any impact from the closed municipal landfill through evaluating the analytical result.

Also, the data from the water and sediment samples collected and analyzed by Dr. Wells from the river water column do not have associated numeric water quality criteria as identified within the DWR Rules. That means the data presented by Dr. Wells cannot be compared to water quality criteria because there are no milligram-per-liter concentrations with which to compare the data to determine if values exceed established standards. Based on DWR biological surveys (more information will be presented on this in following paragraphs), there is no indication that there is a "substance present in such quantity as to impair or harm aquatic life". The DWR surveys have shown that the aquatic life is considered healthy in the river. Since Dr. Wells' methodology has eliminated many critical parameters and since the data cannot be compared to water quality criteria, the report is of limited usefulness in assessing potential leachate impacts in the Stones River.

Dr. Wells provided aerial photographs of the area of the Stones River adjacent to the Rutherford County landfill site. These photographs include a section in the river where a color change in the water was noted. Dr. Wells also noted a white material floating on the river in at least one photograph. These photographs were submitted to the Division by Dr. Wells, and subsequently this phenomenon was pointed out to Mr. Flood.

Based upon a review of the photographs by Division personnel trained and experienced in aerial photography, the time of day, and the method for taking the photograph, the white areas on the river are most likely the sunlight reflecting from the water surface. This condition, which can produce an intense flash of sunlight due to the angle of the sun relative to the camera lens, overloads the camera sensor. This results in a white or washed out area in the image. It is especially pronounced in areas where riffles occur. This phenomenon is called "reciprocity failure." The phenomenon can appear to move down or up the river in subsequent frames because of the changing angles of the sun and water surface relative to the camera lens in a moving aircraft.

Reproductions of some of the photographs are attached with blue reference dots added. Note that in one photo (Rutherford 3), the white signature in the river is absent, but in another photo (Rutherford 4), it becomes visible over the same area. The blue dot in each photo is located in the same geographic location. These perspectives show that there is an angle change between the camera, water surface and sun as the plane moved along. It is believed that this caused the reflection noted in the photograph.

It is also possible that some of the white material could be foam on the river surface. Foam has been observed on stream surfaces during high water levels and this can be caused by phosphates (possibly from fertilizer runoff) in the water. It is possible that the white areas are a combination of white foam and the sun's reflection. The river appears to be muddy in the photo, indicating a high flow, with a more turbulent environment than normal. This churning could have resulted in some foam. It should also be noted that TDEC believes the change in color of the River water is most likely the result of a change in elevation of the River's bottom. No measurements have been taken to verify this.

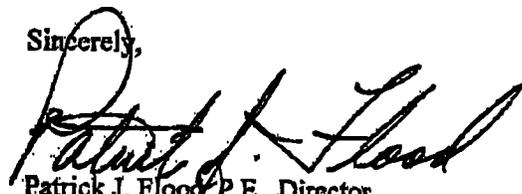
In order to better investigate the concerns about impacts to the East Fork Stones River in the vicinity of the landfills, including those outlined in Dr. Wells' report, DWR personnel conducted an on-site field investigation on May 9, 2013. A canoe reconnaissance of the stretch of river discussed in the report was performed making visual observations and measuring a variety of water quality parameters throughout

the reach. A trip report detailing the findings of this investigation is provided as Appendix A of the attached memo. To summarize these findings, no changes were detected in the character or quality of the river over the reach investigated, which ran from downstream of the points of potential impact noted in the report from Dr. Wells, to approximately 1/3 mile upstream of the points of potential impact. There were no observed or detected subsurface discharges, nor was there any significant trash along the river or the adjacent bank. Only one point of notable water discharge was observed by the DWR. The discharge point was in the wooded area along the landfill side of the river and did not appear to be negatively affecting the river's quality. The basis for this assessment is outlined in the attached trip report.

On May 2, 2013, Solid Waste Division personnel investigated the area between the landfill scale house and the river to document the surface conditions. Division personnel identified two small gullies in the area that lead to the river. One was completely dry and the other appeared to be a storm water conveyance. Nothing was observed that indicated the river was being impacted by this storm water discharge. It should be noted that the trip report for this event states these actions occurred on April 2, 2013. The report writer has verified that the trip occurred on May 2, 2013.

We hope that this information is helpful to the Committee. If you have any additional questions or concerns, please do not hesitate to contact our Regional Director for External Affairs, Meredith Benton, at Meredith.s.benton@tn.gov or 615-979-1865.

Sincerely,



Patrick J. Flood, P.E., Director
Division of Solid Waste Management

Attachments: Rutherford3.jpg
Rutherford4.jpg
Summary memo E Fk Stones nr landfills 5-24-13.doc

APPENDIX A**DWR FIELD INVESTIGATION -- MAY 9, 2013
EAST FORK STONES RIVER IN VICINITY OF MURFREESBORO AREA LANDFILLS****DIVISION OF WATER RESOURCES
Nashville Field Office
TRIP REPORT**

LOCATION : East Fork Stones River near Murfreesboro-area landfills
TYPE FACILITY : N/A
WATERBODY: East Fork Stones River **RIVER BASIN:** Stones
CITY : Murfreesboro **COUNTY :**
DATE : May 9, 2013 **PREVIOUS 7-DAY PRECIP.:** ~2", mainly on 5/3-5/4

PURPOSE OF VISIT : Investigation of landfill impacts to river
OTHER DWPC PERSONNEL PRESENT : Kim Sparks
INDIVIDUALS CONTACTED : none
SAMPLES TAKEN ? Field parameters only **PHOTOS TAKEN ?** yes

COMMENTS AND DISCUSSION :

In response to recent concerns centering around the possible effects of leachate, sediment, and trash associated with two landfills located on the right descending bank of the East Fork Stones River upstream of the Walter Hill dam near Murfreesboro, TN, DWR personnel Kim Sparks and myself conducted an on-site reconnaissance of the river by canoe on May 9, 2013.

We began our investigation at the boat ramp at Walter Hill Park, just upstream of the dam, and downstream of the areas of concern indicated in a report authored by Dr. Marion Wells of MTSU. We then proceeded upstream on the East Fork Stones River for a total of approximately 2.6 miles, which took us about 1/3 mile upstream of the report's areas of concern. Close observation of the right descending bank in particular was conducted over this entire reach, specifically looking for any indications of surface or subsurface discharges, erosion, garbage, or any other indicators of potential sources of pollution. In addition, water quality parameters and photographs were periodically taken over this reach. Parameters collected were temperature, conductivity, dissolved oxygen, ORP, pH, and turbidity. Photographs of the water color at each sampling location were taken, as well as pictures of any surface conveyance entering the river. A map of all noted features and sampling locations, as well as a summary of the data is attached to this trip report.

This stretch of the East Fork Stones River is well-used by local fishermen and boaters, and we observed several watercraft travelling the reach during our investigation. According to the nearby USGS gauge at Betty Ford Road, the river was flowing at around 666 cfs (5.96 ft stage height) at the time of our investigation. Due to the rains earlier in the week, the river had peaked

at around 7000 cfs (16 ft stage height) on May 6th, and we observed the resulting distinct high water sediment line on the bank vegetation. Median flow for this time of year is around 175 cfs. The river over this entire stretch was flat (no riffles / shoals), but with consistent flow movement downstream.

The color of the water at our downstream put-in (river mile 10.2) was an olive-green, and the color did not seem to change throughout the reach investigated. Only a slight amount of organic foam flecks were evident on the water surface through the reach, and these very likely were in part generated by the powerboat wakes. We did not observe any indications of subsurface discharges, either visually, or through our water quality measurements which stayed remarkably consistent throughout the 2.6 mile reach, and very typical of area streams. Very little trash was observed along the river and the right bank (landfill side), although some old tires and other garbage was seen in an isolated area on the left bank, which may have been a former dumping ground off the highway.

A total of four dry small wet weather conveyances were observed along the right bank. None of these showed any staining, sediment deltas, or other indications of conveying pollutants into the river. A moderate amount of active surface runoff was observed coming over rocks and into the river from a wooded area on the right bank at mile 11.45 (see attached map). The water entering the river was very clear, and I estimated the volume of discharge to be approximately a gallon every one to two seconds. (As a comparison, the flow in the river at that time was around 5000 gallons per second). Water quality parameters at the discharge point appeared to be normal overall, although the physical force of the water falling off the bank and into the river did stir up a small amount of fine silt which created a very small isolated area of brownish turbidity (approx. one by two feet in size). Other than this site, only two other very tiny seeps were observed entering the river at miles 12.37 and 12.39, the latter having a channel stained orange by iron-oxidizing bacteria. The volume of water trickling from these seeps was estimated at a gallon every two minutes or so. They did not produce any observable or measurable change to the quality of the water in the river.

In summary, we did not observe or measure any indications of impact, pollution, or violations of water quality criteria associated with the adjacent landfills or any other source during the course of this investigation.

INVESTIGATOR'S SIGNATURE :

Jimmy R. Smith

DATE : May 13, 2013

**Map of sampling and observation locations
May 9, 2013 DWR recon of East Fork Stones River**



0 0.050.1 0.2 0.3 0.4 Miles

Data from DWR East Fork-Stones field recon May 9, 2013
 All measurements taken approx. 1/4 channel width off of Right Descending Bank (RDB),
 except * taken against RDB where discharge enters river

| Lat DD | Long DD | Time | River Mile | Location | Depth | Temp deg.C | Cond. umohs/cm | pH s.u. | ORP mV | Diss Oxy mg/L | Turbidity N.T.U. | River Color visual |
|----------|------------|------|------------|------------------------------------|--------------|------------|----------------|---------|--------|---------------|------------------|--------------------|
| 35.94241 | -86.37455 | 1105 | 10.2 | Walter Hill Boat ramp | 1 Meter | 16.28 | 379 | 7.73 | 552 | 8.90 | 3.84 | Green |
| 35.94241 | -86.37455 | 1110 | 10.2 | Walter Hill Boat ramp | Bottom | 16.18 | 379 | 7.77 | 548 | 8.89 | n/a | Green |
| 35.93761 | -86.37422 | 1130 | 10.5 | | 1 Meter | 16.17 | 379 | 7.85 | 507 | 8.94 | 3.82 | Green |
| 35.93497 | -86.377139 | 1140 | 10.75 | | 1 Meter | 16.01 | 380 | 7.84 | 509 | 8.87 | 4.28 | Green |
| 35.93128 | -86.378611 | 1150 | 11 | | 1 Meter | 15.94 | 381 | 7.82 | 505 | 8.88 | 4.27 | Green |
| 35.92892 | -86.375833 | 1200 | 11.24 | 1st RDB WWC | 1 Meter | 15.92 | 380 | 7.85 | 504 | 8.94 | 3.94 | Green |
| 35.92892 | -86.375833 | 1200 | 11.24 | 1st RDB WWC | bottom | 15.89 | 380 | 7.84 | 504 | 8.95 | n/a | Green |
| 35.92822 | -86.373417 | 1222 | 11.39 | | 1 Meter | 15.90 | 380 | 7.85 | 497 | 8.97 | 3.84 | Green |
| 35.9279 | -86.37267 | 1210 | 11.45 | at RDB surface discharge* | near surface | 15.64 | 415 | 7.79 | 503 | 9.08 | 39.65 | Green |
| 35.92658 | -86.372861 | 1229 | 11.51 | 2nd RDB WWC | 1 Meter | 15.89 | 379 | 7.86 | 495 | 8.97 | 4.03 | Brown (isolated) |
| 35.92564 | -86.373222 | 1236 | 11.59 | 3rd RDB WWC | | | | | | | | |
| 35.92256 | -86.373278 | 1243 | 11.8 | | 1 Meter | 15.91 | 381 | 7.86 | 493 | 9.23 | 3.85 | Green |
| 35.92068 | -86.372583 | 1253 | 11.95 | Mboro Water plant LDB | | | | | | | | |
| 35.92086 | -86.370278 | 1257 | 12.1 | Across from Dry/Bear Br | 1 Meter | 16.02 | 378 | 7.9 | 490 | 9.34 | 4.15 | Green |
| 35.92292 | -86.368556 | 1304 | 12.25 | Near Wells "Collection site 3" | 1 Meter | 16.07 | 378 | 7.9 | 489 | 9.50 | 3.79 | Green |
| 35.92411 | -86.36675 | 1311 | 12.37 | Seep | | | | | | | | |
| 35.92406 | -86.366278 | 1316 | 12.39 | Seep w/ orange flocculant bacteria | | | | | | | | |
| 35.92333 | -86.365444 | 1320 | 12.46 | Near Wells "Collection site 2" | 1 Meter | 16.15 | 378 | 7.92 | 483 | 9.68 | 3.58 | Green |
| 35.92317 | -86.364944 | 1325 | 12.5 | 4th RDB WWC | | | | | | | | |
| 35.92144 | -86.362694 | 1330 | 12.68 | | 1 Meter | 16.27 | 377 | 7.94 | 485 | 9.87 | 3.98 | Green |
| 35.92117 | -86.360944 | 1340 | 12.81 | | 1 Meter | 16.38 | 377 | 7.96 | 483 | 9.97 | 3.62 | Green |

In short, our visual observations and measurements of water quality throughout this reach of the East Fork Stones River did not indicate any impact, pollution, or violations of water quality criteria associated with the adjacent landfills or any other source during the course of this May 9, 2013 investigation. As an added precaution, it would be advisable to conduct a similar river reconnaissance at low flow conditions in late summer or fall.

**TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES**

MEMORANDUM

TO: Al Majors, Division of Solid Waste Management, Nashville Field Office

FROM: Jimmy Smith, DWR, Nashville Field Office

DATE: May 24, 2013

SUBJECT: East Fork Stones River in vicinity of Murfreesboro area landfills
Rutherford County

Due to recent concerns over possible impacts to the East Fork Stones River from nearby landfills, the Division of Water Resources (DWR) was asked to undertake the following actions:

1. Provide technical input as to current knowledge of the water quality and ecological health of the river.
2. Review and comment on the findings from a report and study authored by Dr. Marion Wells.
3. Conduct a field investigation of the current condition of this reach of the river.

This memo, with the attached appendices, is designed to provide what information the DWR has ascertained regarding these issues.

Previous Data :

TDEC performs regular biological and chemical testing of our state waters, including the East Fork Stones River. Biological surveys in the East Fork Stones River below the Walter Hill dam (which is also just downstream of the nearby landfills), were conducted in 2002, 2009, and 2012. This site was selected in part to evaluate what, if any, impacts the nearby landfills might have on the water quality of the East Fork Stones River. Leachate of any appreciable volume entering the river upstream would affect the aquatic animal populations living in this stretch of the river. All three surveys found aquatic life having normal diversity and abundance, and of sufficient health to be considered Fully Supporting of the river's Designated Use for Fish & Aquatic Life propagation. This indicates that there was no chronic toxicity occurring in the river over this time span, at levels that would produce significant impact to the aquatic life living downstream.

It should be noted that the East Fork Stones River is of considerable size and volume at this point, so any potential contaminants entering the river would be highly diluted and their effect minimized. While significant toxic effects to the aquatic populations was not observed, more subtle effects on certain organisms or populations cannot be ruled out completely by these

results, due to the absence of any historical biological data collected prior to the establishment of these landfills. These effects, if any, would be below the detection threshold of DWR biological survey methodologies, and would not be considered significant enough to meet the definition of "impairment" or "pollution".

TDEC also collected water samples for laboratory analysis just below the Walter Hill dam on a monthly basis in 2006-2007 and are doing so again in 2012-2013. The results from the chemical and bacteriological analyses for the parameters tested all fell within very typical ranges normally seen in streams in this area and were generally all within acceptable levels. This data is shown in Appendix B. It should be noted however that other than some basic types of metals tested for in 2006-2007, TDEC did not test the stream for more exotic and possibly toxic chemicals that theoretically could be associated with a landfill. But to reiterate, based on our biological assessments there is no indication that any toxic chemicals or other materials are present in amounts significant enough to cause any discernible harm to the aquatic life. Since all the metals sampled for and analyzed during 2006 and 2007 were found to be at barely detectable or non-detectable levels typical for streams in this region, these parameters were not included in the 2012-2013 sampling of the river as a cost saving measure. However, some of the other parameters currently being analyzed, particularly conductivity, would detect any elevated levels of metals or dissolved materials including solids in the water column.

In addition, the U.S. Corps of Engineers also has an established chemical monitoring station just downstream of the Walter Hill dam, which they sample two to three times annually. Their analyses include a wider array of parameters than the TDEC sampling described above, including sodium, potassium, and sulfate. A review of their data collected from 2007-2012 did not reveal anything that appeared atypical for a stream of this size in this area, or that would point to discernible input of pollution from the landfills. This data is available in a spreadsheet upon request.

Finally, since the Murfreesboro water treatment plant (WTP), located at mile 11.95, lies within the reach of the river that could be potentially affected by the landfills, I conducted a review of records of their analyses of the raw water intake from January 2012 to April 2013. The WTP performs daily analysis of the pH, turbidity, hardness, and alkalinity of the water being withdrawn from the East Fork Stones River, as well as thrice-weekly analysis of iron and manganese. Review of the past 16 months of records showed that the average levels for all of these parameters fell at or below the average levels found at the Division's reference-quality stream dataset for this region of the State. No single daily maximum level of unusual significance for any of these parameters was recorded over these 16 months, except for a single pH value of 10.63, which since it is a single data point, may be simply a data entry error.

Evaluation of Dr. Wells' Report :

I reviewed the report from Dr. Wells concerning sampling done in the East Fork Stone River in the vicinity of the Rutherford Co Landfill near Walter Hill. It is difficult for me to draw much conclusion concerning the aerial photographs of the apparent discoloration of the river near the

landfill. However, I believe DSWM's Lennie Fottrell has provided a rather detailed analysis of these photographs.

As for the data from the water and sediment samples taken, none of the parameters analyzed for from the river water column (elemental O, Na, Mg, Al, Si, S, Cl, K, Ca, and Br) have associated numeric water quality criteria within the Division of Water Resources Rules. This means that even if the data was presented as a concentration (e.g. mg/L) of the total recoverable amount of the parameter (not the percentage of elements found in water column residue, which may be components of a variety of larger compounds), there are no numeric water quality criteria to compare the data to look for violations / exceedances. The parameters analyzed would come into play under the more generic narrative criteria that basically says a substance "... shall not be present in such quantity as to impair or harm aquatic life". And as stated above, our biological surveys have shown that the aquatic life is considered healthy in the river.

Finally, much of the analyses in the report concern the sediment at the bottom of the river. Similar to the water column residue data, the DWR does not have numeric criteria to use for comparison with the levels in the report, in order to determine if a violation is occurring. According to DWR rules chemicals in bottom sediment have narrative criteria which state a toxic substance may not be present in amounts that impair fish and other aquatic life, and again, at this time we have no evidence that this is occurring in the East Fork Stones River.

Field Investigation of Current Conditions :

In order to better investigate the concerns regarding the East Fork Stones River in the vicinity of the landfills, including those outlined in Dr. Wells' report, DWR personnel conducted a field investigation on May 9, 2013. We made a canoe reconnaissance of the stretch of river discussed in the report, making visual observations, and measuring a variety of water quality parameters throughout the reach. A trip report detailing the findings of this investigation is provided as Appendix A.

In summary, we could detect no change in the character or quality of the river over the reach investigated, which ran from well downstream of the points of impact noted in the report, to about 1/3 mile upstream of them. Field analysis conducted for temperature, pH, dissolved oxygen, conductivity, and turbidity revealed very consistent levels with no appreciable changes throughout this reach of the river. Conductivity analysis in particular would have detected any significant changes in suspended solids, dissolved solids, or metals in the water column. We did not observe or detect any subsurface discharges, color changes, nor any significant trash along the river or the bank adjacent to the landfill.

Only one point of notable water flow into the river was observed, coming from a wooded area along the landfill side of the river.. It is unknown whether this input is from a natural surface water feature or is associated with the landfill operations – further on-site investigation would be needed to identify the source of this water. However, the water was very clear, and did not appear to be negatively affecting the river's quality (see trip report).