APPENDIX G
RESPONSE TO COMMENTS ON DRAFT REPORT

Comment Response Matrix
Middle Rio Grande Microbial Source Tracking Assessment Report
October 2005

Location			***Reviewer***	***Comment***	***Response***
Section	***Page***	***Line***			
General	--	--	LM	As a general comment, the report should include an appendix of all the samples and fecal bacteria concentrations that were taken as a part of the study at the various sampling points. A table by sampling point indicating sample data and the bacteria concentration should be included.	New Appendix G contains the fecal coliform concentration data.
General	--	--	AJF	Why did Parsons collect samples to build a local library, when MEI had a large library? Did Parsons or MEI determine that the additions of MRG strains to the MEI library improved the ability to type unknown isolates from MRG? How useful or necessary would it be to expand the library with local isolates again for another BST study in New Mexico?	Because the abundance of particular *E. coli* strains in animals is expected to vary with space and time, reliance on the MEI library alone would likely result in an unacceptably large percentage of E. coli with ribotypes for which sources could not be identified. In numerous studies, Dr. Samadpour has found that sources can be identified for approximately 60-70% of E. coli isolates based on his nationwide library alone, but that with a local library the identified percentage can be increased by 15 to 25%.
General	--	--	AJF	The challenges distinguishing categories within the avian supercategory suggest that some isolates which were not successfully typed (unknowns) could be strains which have been observed in very different animal taxa. To what extent are the unknowns strains which have been observed in very different taxa, versus strains for which no similar strains existed in the library?	Resolution of the avian source to the species level does not appear practical with ribotyping at this time. The E. coli strains of the avian gut have been commonly found in many different bird species. However, some strains of *E. coli* are only seen in waterfowl. Thus, avian strains may be categorized as the more specific "waterfowl" or the less specific "avian," but no identification to species level can be made with confidence. As the size of the known source library grows, it is possible that more species-specific strains will be identified.
General	--	--	AJF	Some effort at identifying watersheds contributing significant loading (utilizing bacteria concentrations and flow estimates) would further assist in prioritizing areas for source reduction actions.	Hydraulic modeling to estimate flow rates for storm events is beyond the scope of this study.

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General	--	--	AJF	The Adobe Acrobat version of the final report would benefit from the use of bookmarks to aid navigation.	Agree.
General	--	--	AJF	The raw data should be delivered with the report, preferably in Excel format. These will allow additional interpretation by stakeholders and individuals.	New Appendix G contains the fecal coliform concentration data. Excel spreadsheet will be provided.
General	--	--	DWH	Refer to the study as "MST" rather than "BST" – the report is correct in this regard – what was tracked was the "microbe" population, not the "bacterial" population.	Agree
General	--	--	DWH	The figure naming convention in the report is odd. Usually a figure is labeled or named below the figure, not above it. The report has the numerous photographs labeled above them.	Disagree
General	--	--	DWH	The normalized results are "surprising", as the report points out. However, no explanation is offered for this "surprise" – and it draws into question the appropriateness of the "normalization" approach. If the math was done correctly, it seems the "normalized" numbers should be different than the "raw" numbers – in any case, an explanation is needed.	The large number of samples collected and isolates characterized is one reason that the weighting scheme does not affect the results greatly. Thus, even though some sites or samples are weighted very heavily relative to others, those samples still represent only a fraction of the total sample count. Another reason is that the sources were somewhat consistent among sites and dates.
1	4	--	LM	The narrative indicates that load capacities are exceeded for fecal coliform for the TMDL, while the table indicates that load capacities are identical to the total maximum daily load values. To our knowledge, there is no data that shows that load capacities shown in the TMDL are exceeded.	The last sentence of first paragraph on page 1-4 was deleted.

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2	1	--	LM	The narrative needs further clarification on the main source of fecal coliform bacteria in the middle Rio Grande. For instance, for total annual loading in the river at any given point, is the major source of coliform bacteria loading contributed from total river flow or from stormwater contribution to the river?	The overall top *E. coli* contributors are wildlife (primarily avian) at 46 percent and pets at 24 percent. The two groups account for 70 percent of the *E. coli* detected in all the water samples. Humans and livestock contributed 16 and 14 percent, respectively. Parsons does not have any flow data that corresponds to fecal coliform data. Therefore, magnitude of fecal coliform loading is unknown for both dry and wet weather flow. The fecal coliform concentration in storm water runoff is 100 to 1,000 times higher than dry weather flow, but it does not rain very often. The fecal coliform concentration in dry-weather flow is much lower than storm water, but it is continuous. Reducing fecal coliform concentrations in dry-weather flow to below the water quality standard would make the biggest impact.
2	1	--	LM	Narrative indicates that impoundments effectively serve as settling basins for fecal bacteria. If appropriate data for this fact is available, it may be appropriate to include some data or the source for a reader of this report for acquiring the data to confirm.	No data was available. The paragraph was rewritten to not include the reference to settling basins.
2	--	Figure 2.1	LM	Figure 2.1 needs further clarification. Some of the mapping shown as "county line" may be confusing to someone who does not know the area. Also, the different colorations on the map need to be further identified for clarification.	Parsons did not create the GIS map. Parsons was provided an Adobe Acrobat (pdf) file of this map, which cannot be revised.
2	6	Figure 2.2	MKM	This Figure is difficult to interpret because it lacks any identifying markers as to the area being shown. We think that it would be beneficial to include details such as city limits, beginnings and endings of the reach, etc. to more clearly identify the area discussed. Also, what is the source and the date of this coverage?	The figure was revised.
2	7	--	LM	Is there year 2000 census data available that would give more recent data for household sewage disposal data?	No, household sewage disposal methods have not been addressed in the 2000 U.S. Census.

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2	7	First Paragraph	MKM	I am very concerned that the consultants utilized 1990 Census data to determine density, sewer hookups and so forth. This should be 2000 data and it should be cross referenced against know sewer connections, which both the City and the County have, and aerial photographs, which are also available. A great deal of the conclusions of this study may be inaccurate if they are based on 1990 data, due to the extensive growth in the North and South Valley, North Albuquerque Acres, the foothills and the Westside, and do to the 3,000 or so sewer connections that have been made available since 1990 in Bernalillo County. This failure to utilize current information will most adversely affect Bernalillo County, as this is where the most change has occurred, but will also impact the Westside results.	It is unfortunate that the wastewater disposal methods have not been published for the 2000 U.S. Census. Sewer connection data was obtained from Bernalillo County but was not compatible with the average census track density method used to determine population and sewer connections within each watershed. Nevertheless, Bernalillo County and the City of Albuquerque have expended considerable effort to extend new sewers into unsewered areas and reduce sewer system overflows. The conclusion of the MST report is 70% of the E. coli bacteria identified in water samples are from wildlife and pets.
2		Figures 2.4, 2.6	LM	Figure 2.4 and Figure 2.6 are identical. Is this an error in printing of the photographs, since the narrative indicates two different locations for the same photograph?	Figure 2.6 was not the correct picture. The correct picture is in the final document.
2	10	--	LM	The South Diversion Channel discharges into the Tijeras Arroyo, and the combination channel discharges directly to the river. The South Diversion Channel and the Tijeras Arroyo do not drain into the Riverside Drain.	The text has been corrected.
2	15	Map	MKM	The labels identifying the outfalls and the predominant color of the map are both yellow, making it difficult to read. The map should be edited for greater clarity and readability	Parsons did not create the GIS map. Parsons was provided an Adobe Acrobat (pdf) file of this map, which cannot be revised.
2	16	Table 2.2	MKM	What is the source and the citation (including age) of this data?	The citation and date have been added to the bottom of the table.
2	19	Table 2.3	MKM	What is the source and the citation (including age) of this data?	The reference to US Census data can be found at the bottom of the table.
2	23	--	LM	The listing of bird species in the middle Rio Grande area does not list some of the bird species that are very common to the middle Rio Grande area. Some of these birds that are not listed are Curved-Bill Thrasher, Ladder-Back Woodpecker, Hummingbirds, Fly-Catchers (various species), Oriels.	Agree.

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3	6	Table 3.1	LM	This table shows a summary of the fecal source sampling for development of the source library. The samples for "sewage" are all samples collected from wastewater sources. The question arises as to whether wastewater is an appropriate source bacteria for tracking human sources of bacteria, and whether or not interference may be generated by the types of bacteria variance that may be present in the wastewater stream. The introduction of interference from other sources of bacteria may be warping the proper identification of the true human source for bacteria concentrations, and could impact the results of actual human concentration in the bacteria population.	While sewage is believed to primarily consist of human waste, it is true that sewage may also contain fecal matter from a variety of non-human sources. In addition to sewage and septage, the MEI library also contains samples directly from human feces. This allowed identification of human generated *E. coli*. In cases where isolates matched a sewage source, it was reported as such, and not attributed to "human".
3	7	Large Carnivores	LM	They don't show any bears, nor any samples collected. Wondering what happened to bear, maybe, and also coyote.	The table identifies objectives established early in the project. Bear and coyote scat were collected for the local library. One E. coli strain attributed by a bear was detected in the water at Isleta Diversion Dam. Coyote E. coli were detected in five watersheds.
3	9	--	AJF	At least so far, the major weakness or criticism of the project would be the sample design – specifically, the placement of the sample stations and the frequency of sampling. On page 3-9, the statement is made that the location of the sample stations was determined by the stakeholders based on their information needs – this begs the question of sample station distribution – random versus specifically identified.	The eight sampling stations on the MRG are routine NMED water quality stations. The other 22 stations were picked because they are major tributaries of storm water runoff. The objective was to determine the mammalian sources of fecal coliform to the MRG, which required sampling at the selected locations.
3	13	Microbial Source Tracking Objectives and Methods	MKM	"Quantification of Accuracy and Precision in Ribotyping and ARA Source Determinations" Where is a discussion of the results of this Quantification. It would be better to include it here after a discussion of the process.	The Quantification of Accuracy and Precision in Ribotyping and ARA Source Determinations results are shown in Section 4.1.

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3	13		AJF	The report (p. 3-13) indicates that isolates from within the MEI library were typed to determine the accuracy and repeatability of the ribotyping method. The resulting high accuracy and repeatability may have resulted partly from the use of isolates that were still found within the library. The accuracy and precision of typing isolates from unknown sources would be better estimated by typing isolates from known sources NOT within the MEI library. This could be conservatively approximated with existing data by omitting known isolates, one at a time, from the library, and testing to see whether those isolates (preferably those from the Middle Rio Grande) are typed correctly based on the remaining isolates in the library.	The MST methodology relies on exact matches of ribotypes from unknown and known-source E. coli. If a particular ribotype is not present in the library, its source cannot be identified. Thus, we limited the QC study to isolates already within the library to test the method for routine precision and accuracy of identification. In two more intensive method comparison studies, the procedure has been tested with unknowns not from the library (see Griffith et al. 2003. J. Water Health 1:141-151, or Stoeckel et al. 2004. Environ. Sci. Technol.38: 6109-6117.) However, both of these studies were plagued with several confounding problems of their own which tended to complicate the interpretation and bias the results. These studies highlighted the difficulties of doing that kind of QC study, which is why we chose to limit the objectives of our study to test whether the method could reproducibly differentiate between ribotypes.
3	14		LM	The display of isolate numbers and duplicate samples, I'm assuming is representative of the correct correlation that was accomplished in the source determination techniques.	More explanation is provided.
4	3	Table 4.1	AJF	Table 4.1 indicates that 4 duplicates were collected, all at one site (Rio Grande at Isleta Diversion Dam). With so few data, the data themselves should be presented.	The data is in Appendix F.
4.2	5	3rd paragraph	MKM	"Although they drain *[sic]* adjacent watersheds, the levels of fecal coliform in the Isleta Drain were on average an order of magnitude higher than those in *[sic]* Los Padillas Drain after rainfall. The factors responsible for this difference are difficult to discern." One possible explanation is that the return flow from a lateral irrigation ditch enters the Isleta Drain just above the sampling point.	Modified text to mention this

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4.2	5	--	AJF	Regarding the differences in bacteria levels observed in Isleta and Padillas drains, because the sites were sampled on the same dates, and because they drain adjacent watersheds, differences in antecedent hydrology (e.g., period of time passed since the last precipitation event) probably had an insignificant effect on the results, making comparisons of the two sites more meaningful than they might otherwise be. Does the Isleta Drain watershed contain more of particular types of agriculture, such as dairies or poultry farms, than the Los Padillas Drain watershed?	Just the opposite. There are three permitted CAFOs (dairies) in the Isleta Drain watershed. There are no permitted CAFOs in the Los Padillas Drain watershed.
4.3.1	8		AJF	Section 4.3.1 starting on p. 4-8 describes categories of bacteria sources. This section should be expanded to discuss the rationale behind selection of categories. Of particular relevance is the use of one category for all birds. Why is waterfowl not listed as a category in sections 4.3.2.1 through 4.3.2.27? In Appendix B, waterfowl is provided as a category, but only "avian" is provided elsewhere. Were chickens part of the library, and if so, were they grouped with avian, or livestock? Knowing more about sources within the avian supercategory is very relevant for making management decisions to reduce bacteria loading. Appropriate approaches to address bacteria loading from pigeons, for example, would be quite different than approaches to address loading from waterfowl. A statement is made near the top of page 4-9 (Sec. 4.3.1) that some E. coli strains have been observed in both waterfowl and other bird species. What are the prospects of typing the strains in greater detail to allow greater differentiation? Discussion of this challenge may assist development of future studies. Also related to categories of sources, Appendix B includes separate categories for "bovine" and "cow". It may be that no bison occur in the watersheds of some sample sites, and therefore the analyst felt confident assigning these isolates to the category "cow". If so, this should be stated in Section 4.3.1. Similarly, the categories "dog" and "canine" both appear in Appendix B. Are these really one category?	Segregation of the avian source categories to the species level does not appear practical with ribotyping at this time. The *E. coli* strains of the avian gut have been commonly found in many different bird species. However, some strains of *E. coli* are only seen in waterfowl. Thus, avian strains may be categorized as the more specific "waterfowl" or the less specific "avian," but no identification to species level can be made with confidence. As the size of the known source library grows, it is possible that more species-specific E. coli strains will be identified. Identifications as cow were changed to bovine, and from dog to canine.
4	6	Table 4.2	LM	Table 4-2 needs additional legends to identify the columns.	Added legend and units
4	6-7	Table 4.2 Table 4.3	MKM	A legend for these tables, which includes units, should be provided.	Added legend and units

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4		Table 4.6 Table 4.7	DWH	Tables 4.6 and 4.7 (and perhaps others) should have sample sizes (number of samples analyzed, or something like that) along with the confidence intervals – a small number of samples with a given confidence interval is very different from a large number of samples with the same confidence interval – the interval is a surrogate for a more direct measure of the variance of the data.	Added sample sizes
4	21		LM	When reviewing the data and pie charts for the sources in the Rio Grande sampling stations, it would appear that canine percentage seems to decrease as you proceed downstream in the Rio Grande. What would be the explanation for that result; population of dogs decreasing and/or possible die-off of bacteria as one proceeds downstream?	The reduction in the relative importance of canine and feline sources of fecal coliform with the increasingly developed nature of the watershed runs counter to expectations. Parsons assumed that the sheer number of dogs in urban areas would cause an increase in canine fecal loading to water, in both absolute and relative terms, with increasing urbanization of the watershed. This was not observed. In addition, several of the relatively undeveloped small watersheds indicated a major canine source. It may be that a large population of canines in less developed portions of the watershed, and/or efficient dog waste cleanup in urban areas, may be responsible for the observations. It seems unlikely that coyotes are present in sufficient numbers in rural areas to overwhelm the urban dog influence.
4	29		LM	In general, some of the data shown in the pie charts and in the data tables for percentage of various sources seems to be confusing. A particular example is the data shown for the Hahn Arroyo just above the North Diversion Channel. The Hahn Arroyo is the highest percentage of developed land, and yet bovine shows as a significant percentage as a source of bacteria in that basin. What would be the explanation for the bovine concentration?	The presence of bovine sources was somewhat surprising in this urban watershed. It may be due to manure spread in gardens. It should be noted that four of the eight samples matched to bovine feces originated in a single water sample.
4.3.2.13	29	First Paragraph	MKM	What is the hypothesis for bovine sources?	See previous response

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4.3.2.26	37	First Paragraph	MKM	What is the hypothesis as to why birds and canines are the major sources at this site?	Many small farms with row crops are located adjacent to the Los Padillos Drain. More than one dog located on each farm is typical. Birds like the seeds.
5		Figure 5.1	LM	Figure 5.1 is a bar chart showing fecal coliform sources for the 8 monitoring sites on the Rio Grande. It is difficult to decipher on the chart what the left-hand scale is representing. Please clarify.	The y-axis has been labeled.
			AJF	Figure 5.1 early in section 5 needs its vertical axis labeled. The last sentence in the second paragraph in Section 5.1.1 (p. 5-1) should be expanded to read, "The number of unknown isolates are not included in the totals shown in Figure 5.1, or in the text below."	The y-axis has been labeled. The suggested sentence was added.
5	1		AJF	There are three page 5-1's	Corrected.
5.1.1.		Second Paragraph	AJF	The statement in the second paragraph of section 5.1.1 that "the fecal contribution of avian and non-avian wildlife [is] considered the background or natural concentration" is arguable. Bird feces running off of impervious surfaces may be significant, and as such urban stormwater management may have an effect on loading.	Parsons is regards background or natural fecal coliform contributions as non-anthropogenic.
5	4		LM	What information indicates overpopulation of dogs & cats?	The City of Albuquerque website located at: http://www.cabq.gov/pets/index.html. See "Affordable Spay Neuter". Additionally, the CABQ and Bernalillo County have past ordinances limiting the number of dogs at each residence.

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5.1.2	4	Second Paragraph	MKM	How is Parsons defining the "overpopulation of dogs and cats"? It would be appropriate to say there are many strays (number etc.), especially when compared to other communities, but what is the net impact of this on storm water quality? Also, the section indicates that both dogs and cats are a source yet only mentions the detrimental effects of dog waste (dogs being carriers of parasites). What are the hazards from cat waste?	The City of Albuquerque website located at: http://www.cabq.gov/pets/index.html. See "Affordable Spay Neuter". Additionally, the CABQ and Bernalillo County have past ordinances limiting the number of dogs at each residence. Hemolytic *E. coli* such as strain O157:H7, can cause serious illness in humans. The ribotypes of these hemolytic bacteria indicated that twenty-one and eight of the forty-seven hemolytic bacteria identified in water samples were from dogs and cats, respectively (Section 4.2).
5	5		LM	Indicate location and type of CAFOs that are in MRG.	Three CAFOs (dairies) are located in the Isleta Drain watershed. One CAFO (dairy) is located in the Rio Grande at I-25 watershed.
5.1.2	5	Seventh Paragraph	MKM	Livestock: Where is this CAFO located? What impact has it had on water quality in that drainage area?	Three CAFOs (dairies) are located in the Isleta Drain watershed. One CAFO (dairy) is located in the Rio Grande at I-25 watershed. The percent of *E. coli* associated with bovine were less than the overall average in the Isleta Drain watershed. This is most likely the result of these facilities capturing wastewater and storm water and storing it in ponds. The bovine contribution in the Rio Grande at I-25 watershed was slightly above the overall average, 9.4 percent verses 7.2 percent. Nevertheless, the E. coli associated with bovine upstream of the I-25 Bridge at the Rio Bravo Bridge was 11.4 percent.
5.1.2	6	Last Paragraph	MKM	Livestock: Contents of the proposed general permit for discharges from CAFOs were available on December 7, 2004, when the public notice was issued. This information can be found at http://www.epa.gov/region6/6wq/npdes/genpermt/cafoguidance.pdf	Thank you.

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5.1.2	6	First Paragraph	MKM	Untreated or Inadequately Treated Sewage: What is the basis for saying that contaminated groundwater should be investigated as a source. What justifies this statement?	The intent of the statement was to suggest groundwater be tested for fecal coliform to determine if it is contaminated. The paragraph has been revised.
5	6	--	LM	The discussion of untreated or inadequately treated sewage indicates that septic systems could be a contributor to fecal coliform bacteria in the Rio Grande. The report should indicate any available data from either the County or State sources that may address contaminated ground water associated with septic systems. Bernalillo County has been active in monitoring wells for various contamination sources, however, the use of that data in relation to actual septic waste may not be possible. Any available data should be researched and discussion contained within the final report.	The intent of the statement was to suggest groundwater be tested for fecal coliform to determine if it is contaminated. The paragraph has been revised.
5	6	--	AJF	On page 5-6 is a statement that includes the number "19.8 quadrillion." Perhaps more readers would understand the scientific notation ("19.8 x 10^15").	Agree
App D	2	--	DWH	Change "possum turd" to "opossum scat."	Agree

Reviewers:
(MKM) Mary K. Murnane, Water Resources Program Manager, Bernalillo County
(DWH) David W. Hogge, New Mexico Environment Department
(AJF) Abraham Franklin, New Mexico Environment Department
(LM) Loren Meinz, AMAFCA