NC Interagency Nutrient Management Committee (NC INMC)—January 23, 2012

Summary of Effort to Revise NC Waste Data Tables, Decisions and Discussion

- Beginning in September 2010, meetings have been held by the NC INMC to: (1) Review waste data analysis and findings compiled by Karl Shaffer in an effort to revise the current 1993 Barker waste tables, and (2) to assess waste data analysis and determine acceptance of Shaffer's data, provide opportunities for the group to ask questions and offer suggestions on presented data, and (3) ultimately come to a consensus on a proper and technically valid way to incorporate the data into waste management planning and associated practice design.

- INMC Meetings to specifically discuss waste data table revision effort and Shaffer's data analysis have been held September 21, 2010; October 25, 2010; November 30, 2010; March 1, 2011; May 6, 2011; July 26, 2011; and October 27, 2011. This document effectively records the group's evaluative waste data table revision process and also serves as INMC meeting minutes for the time period of the revision effort.

- Karl Shaffer presented data analysis and proposed revised waste table data to representatives of NC animal production integrators on December 1, 2011. Information presented by Shaffer to the integrator group is the final data table in this decision summary document.

- At its January 20, 2012 meeting, the INMC proposed a projected 'effective date' of July 1, 2012 for the revised table values. In order to be used for waste management planning, the revised data must be incorporated into existing NC Nutrient Management software, as well as into the still in-development NC Integrated Nutrient Management Planning Tool (projected to be released for use during 2012).

Data conclusions reached and group decisions made at Sept 21 meeting:

- Normal data distribution curves exist for 2005-09 analysis of irrigated anaerobic swine lagoon liquid (ALS), as over 62,000 samples were analyzed
- Other animal types and production phase information were not as consistent, though some had 'normal' statistical trends
- Nutrient data for ALS show that water conservation and feed additives to reduce P content in waste have been effective
- Very little difference in nutrient content in samples of stockpiled and whole house poultry litter
- Poultry numbers are problematic because of unknown variables in analyzed samples
- Imperative to have all available data analysis completed prior to making recommendations on how the new data should be compiled and used by field planners
- Discussion of potential consequences of INMC data recommendations with animal integrators and environmental community is vital
- A discussion of Plant Availability Coefficients needs to occur within the group

Data conclusions reached and group decisions made at October 25 meeting

- (ALS—Swine) Group comfortable with Shaffer review data (company farms) in terms of being similar to 5-year NCDA data, and being representative of entire industry data
- (ALS—Swine) Recommendation—standard deviation shows statistically significant data, not different than 5-year NCDA value of 1.8 lbs PAN/1000 gal, very small differences in production phases Fa/Fe, Fa/Fi, Fe/Fi, Nursery
- (ALS-Swine) Recommendation—*Do not differentiate in production phases, use 1.8 lbs PAN/1000 gal as 'swine lagoon liquid' standard value*
- (ALS-Swine, Phosphorus)—Very little difference in NCDA 5-year (0.98) and Shaffer-analyzed samples (0.9 w/out boars).
- (ALS—Swine, Phosphorus) Recommendation—*Group recommends use of slightly higher NCDA value of 1.0 lbs PAP/1000 gal for swine lagoon liquid, no differentiation in production phases*
- Poultry—Recommendation—*Due to data N content similarity to whole house clean out values, drop 'stockpile' value for broilers and breeders*
- Poultry—Recommendation—*Turkeys do not differentiate between production phases, no significant differences in stockpile and whole house analyzed values, thus one 'turkey litter' category only one needed*

Data conclusions reached and group decisions made at November 30 meeting

- Group accepts Shaffer data for swine, further discussion needed on format for data presentation. Tables would no longer be a part of 633 or 590 standard, but would be incorporated as a part of NCSU Nutrient Management website
- Future decisions needed on whether volumes, lagoon liquid accumulation, and average weights belong in revised waste table product
- Dilution of ALP (poultry lagoon) samples due to permitted inactive lagoons a concerned. More data needed on 'active' poultry lagoons to determine category and data validity
- Poultry—Recommendation—*Delete LSP (poultry lagoon slurry) as category due to scarcity of data*
- Recommendation—Clear descriptions of revised category groups needed
- Initial Waste Category Recommendations:
    - Swine
        - Swine Lagoon Liquid
        - Swine Sludge
    - Poultry
        - Broiler solids
        - Breeder solids
        - Turkey solids
        - Layer solids (Group agreed to use Breeder solids numbers until data from new category can be collected and analyzed)
        - Layer lagoon liquid (Necessity still being debated)
    - Dairy—Recommendation that 4 current codes continue to be used
        - Dairy Slurry
        - Dairy Scraped

        - Dairy Lagoon
        - Dairy Sludge
    - Beef
        - Beef solids (Scraped???)
- Group agreed to discuss swine volume inclusion in tables at future meeting (<u>also at March 1 meeting</u>)
- Group agreed to discuss changes in bird weights, growth intervals, swine waste volumes, and how (or whether) to incorporate this type of data in the new tables (<u>also at March 1 meeting</u>)

<u>Data conclusions reached and group decisions made at March 1, 2011 meeting</u>

- Group agreed to form a subcommittee to further discuss lab discernment parameters for sludge vs liquid samples, methodology for sampling of lagoon slated from closure, and whether respective methods of N determination, based on whether the sample is sludge or liquid, would provide similar results. This subcommittee would be chaired by Colleen Hudak-Wise, with Brenda Cleveland and David Crouse participating.

- For outdoor swine and poultry production farms, the group determined that, because nutrient management on these types of farms is performance-based, that data for waste management planning should be derived from national ASABE 'as-excreted' estimated manure production and characteristics.

<u>Data conclusions reached and group decisions made at May 6, 2011 meeting</u>

- After continued discussion on which poultry categories to include in the table, the committee agreed on the following poultry categories: breeder solids, broiler solids, layer solids, turkey solids, layer pullet solids, broiler pullet solids, and layer lagoon liquid. This decision added pullet-phase solids to the previously agreed to categories.

- Because of the extremely limited number of active operations (only 6 remain), as well as the uncertainty whether the active 'lagoons' are being managed as lagoons or holding ponds, the committee decided to remove dairy lagoon and dairy lagoon sludge as table categories. Categories remaining for dairy, as agreed to by the committee, are dairy slurry and dairy scraped

- The group determined that for livestock categories where sufficient data did not exist to revise the existing nutrient values (ie llamas, ducks, rabbits, etc.), that current NCSU BAE and NCDA Agronomic Division nutrient values will continue to be utilized in the nutrient management software for planning purposes. The planning nutrient table will be provided on the NC INMC web page (which will soon be a feature of the NC Nutrient Management web site), and sources of the data provided will be clearly identified.

- The group determined that waste generation information for each livestock category would also be a part of the tables. Shaffer received waste generation information only from the swine industry. However, waste generation amounts have decreased significantly for most livestock categories, and the group feels these decreases should be reflected in the new tables.

- The group agreed to continue to discuss whether to include swine waste volumes in the tables at the next meeting in July.

- The group agreed to discuss the relevance of changes in poultry production cycles and average bird weights to the tables at the July meeting.

Discussion, Data Conclusions, and group decisions made at July 26, 2011 meeting:

- The group confirmed that their only be one waste category for 'beef', and this would include both solid and slurry types of samples submitted

- Group consensus was that analyzed liquid nutrient values were ready for draft release. However, it was determined that the complete draft nutrient values (liquids and solids) should not be posted to the NC Nutrient Management web site until a resolution was reached on NCDA methodology for solid sample drying and multiplicative 'correction factors' for differences in air drying vs oven drying of solid samples were developed. Colleen Hudak-Wise updated the group on this effort, and said that correction factors would likely be ready for use by the September meeting. The correction factor will be applied only on solid waste samples. When the correction factor is incorporated, the result is likely to be a much higher N:P ratio waste material when compared to the roughly 1:1 ratio ratio reflected in the current tables

- The group discussed the need to invite industry contacts to discuss newly revised tables at a future meeting, likely to be held in October.

- Joseph Hudyncia noted a new swine category that should be added to the tables: Wean to Finish. Because the nutrient values for wean to feeder and feeder to finish are the same, adding this category will not affect the content of the new tables.

- The group continued to discuss nutrient plant availability coefficients. Deanna Osmond made a recommendation to the group that there be no coefficients for P & K, because of constant crop availability of both nutrients. Nitrogen PA coefficients range from .33 to .50 for the irrigated waste application method. Deanna asked Jot Smyth to present some of his work on plant nutrient availability at the September meeting.

- The group discussed inclusion of available generated waste volumes in the new tables, and instructed Karl Shaffer to develop new table showing compiled data for swine, as this is the only analyzed livestock data set with sufficient information to include in the new tables. Typically, the swine data shows a significant decrease in per head generated waste volumes from current tables, except for the nursery production phase. The group determined that because data is not available for revision, to use the current waste volume generation tables for other livestock categories.

- Group determined September meeting needed, with focus on the following:
    - Finalizing correction factors for solid waste samples
    - Review revised tables with volumes incorporated
    - Hear from Jot Smyth on crop nutrient availability coefficients

- Setting time for meeting with animal integrators
- Determining timeline on posting new data tables

- Next meeting data to be determined by September availability of members, Josh Spencer will send out meeting option dates

Discussion, Data Conclusions, and group decisions made at October 27, 2011 meeting:

- In needed follow up to previous group discussions on the potential affect of NCDA drying methods on the nitrogen content values of solid waste samples, Brenda Cleveland, Chief of the NCDA Agronomic Division's Plant Waste Solution Section, updated the group on just completed work by the Section to compare various sample types and drying methods. In terms of the waste data table revisions, the results of the comparative work would help to determine whether 'corrective factors' are needed to adjust nitrogen values for revised waste data tables.

    - Brenda presented the group with several handouts describing the methodology of the various drying methods used (with a control of no drying) on the solids samples, and the results of each method on nutrient values for each of the solid sample types: (1) Breeder, (2) Broilers, (3) Roasters, (4) Turkeys, (5) Pullets, (6) Dairy, (7) Beef, (8) Horse. Current NCDA drying method is drying waste sample materials at 80 degrees Celsius and grinding through 20 mesh screen

    - Results showed statistically relevant variations of N concentration for only diary samples when drying methods compared to no drying, as dairy samples had 33% higher N (wet weight basis) concentrations with no drying than with current NCDA drying method

    - Results showed no statistically relevant variations of N concentration values for any of the solid sample types (dry weight basis) when compared only among the various drying methods (no drying excluded)

    - Group took particular note that there were no statistical differences in poultry nitrogen concentration values on a wet weight or dry weight basis among various drying methods.

    - Group discussed potential causation of statistical nitrogen differences for dairy waste samples, and could not form a consensus of cause. Group suggested further NCDA analysis of dairy data before decision made on need for 'corrective factor' for dairy solid waste samples.

    - Based on the results of the NCDA study, the group determined to leave the N concentration values for solid waste materials 'as is' in the current Shaffer tables for all solid waste samples except dairy, with no corrective factor needed. NCDA agreed to further analysis of dairy waste samples. If further analysis reveals no statistical differences for dairy, group agreed to accept dairy values based on NCDA recommendation. If statistical differences remain, then group will have future conference call to determine potential corrective factor use for dairy values. The

committee thanked Brenda and the NCDA lab staff for their efforts and outstanding work.

- Osmond proposed meeting to present revised tables to swine and poultry integrator companies within the next couple of months. Group agreed that table revision effort is at work point where this is the next necessary step towards public release. Group agreed that meeting with integrators would take place on December 1 at the NCSU Lake Wheeler facility. Osmond agreed to send email notice to integrator company contacts that worked with Karl to gather data for the table revisions. Draft revised tables will be provided to company representatives prior to the meeting on December 1.

- The group discussed revisions of Plant Availability Coefficients as a committee initiative that will move forward in the next few months. The consensus of the group at this point, is that pending analysis of relevant data, that P and K PACs should be eliminated.

- The group continued discussion on waste volume tables compiled by Shaffer. "New" data gleaned from farm effluent volume applied records, analyzed by Shaffer. Group again accepted Shaffer compiled and analyzed swine data as best available data. Group noted largest differences in compiled volume data compared to current Barker table volume values for farrow to finish swine sow operations, where compiled volume generation is less than ½ of current Barker table values.

    - Group reiterated that because sufficient data is not available, and could not be complied for revision, to use the current waste volume generation tables for other livestock categories, with the understanding that current poultry waste generation values are problematic in waste storage structure design because of evolution of new production phases and clean out methods for poultry operations. Group agreed to include waste volume work in presentation to integrators on December 1, and to also provide this information to them prior to that meeting.

- Group agreed that once work is completed, the revised waste tables would not be a part of the NRCS 590 Nutrient Management standard, but would be posted as a pdf file on the NCSU Soil Science NC Nutrient Management website.

- Group discussed how to make new data 'public'. It was determined by group that new tables would be reported on at a future meeting of the 1217 Interagency Group.

FINAL WASTE CATEGORY RECOMMENDATIONS (As of October 27, 2011 meeting):

- Swine
    - Swine Lagoon Liquid (all categories except Farrow to Wean will utilize the same standard N, P, and K nutrient values due to the similarity of analyzed data sets)
        - Boar
        - Farrow to Feeder
        - Farrow to Finish
        - Feeder to Finish

        - Wean to Feeder (Nursery)
        - Wean to Finish (New category)
        - Farrow to Wean

    - Swine Lagoon Sludge

- Poultry
    - Broiler Solids
    - Broiler Pullet Solids (Group agreed to use Broiler solid numbers until sufficient data from this category can be collected and analyzed)
    - Breeder Solids
    - Turkey Solids
    - Layer Solids (Group agreed to use Breeder solids numbers until sufficient data from this category can be collected and analyzed)
    - Layer Pullet Solids (Group agreed to use Breeder solids numbers until sufficient data from this category can be collected and analyzed)
    - Layer Lagoon Liquid (Because of small number of active operations (11), NCDA will continue to collect and analyze samples identified as Layer Lagoon).

- Dairy
    - Dairy Slurry
    - Dairy Scraped

- Beef
    - Beef (may be solid or slurry materials)
    - Beef lagoons (only if further investigation reveals active lagoons being managed)
- Horses
    - Horse solids

<u>The attached tables were developed based on categories agreed on by the INMC membership, and through INMC discussion of nutrient information provided through Karl Shaffer's data analysis (*Complete Final Report available on the Nutrient Management in North Carolina website, or from NRCS*).</u>

- Note: Generally, where livestock categorical nutrient data were similar for collected and analyzed data, the group decided to collapse the data by mean and retain livestock type and management system groupings for planning purposes.

- References to nutrient values in the table imply total nutrient values for Nitrogen (N), Phosphorus (as P2O5), and Potassium (K) per NCDA waste sample report unit (ie per 1000 gallons, per ton, etc.). Accepted plant availability coefficients should be utilized with total nutrient values to determine plant available nutrients.

THIS TABLE REPRESENTS **TOTAL NUTRIENTS**

UNITS ARE POUNDS OF NUTRIENT PER THOUSAND GALLONS FOR LIQUID SYSTEMS (YELLOW HIGHLIGHT) OR POUNDS OF NUTRIENT PER TON FOR SOLID SYSTEMS (GREEN HIGHLIGHT)

Animal Species and Management System	Sample Number	N MEAN	N MIN	N MAX	P MEAN	P MIN	P MAX	K MEAN	K MIN	K MAX
Swine lagoon liquid (ALS)										
BOAR	37	3.6	0.42	4.4	1.4	0.2	1.11	8.3	1.38	4.88
FARROW TO FEEDER	279	3.6	0.54	10.4	1.4	0.37	5.57	8.3	2.38	22.0
FARROW TO FINISH	182	3.6	1.0	11.0	1.4	0.6	3.29	8.3	4.88	17.38
FEEDER TO FINISH	967	3.6	0.26	7.6	1.4	0.09	4.29	8.3	0.65	16.25
NURSERY	575	3.6	0.36	9.8	1.4	0.34	3.29	8.3	1.01	16.63
FARROW TO WEAN	1620	2.4	0.24	5.6	0.9	0.16	5.43	4.1	0.64	13.0
Swine lagoon sludge (ASS)	1132	20.4	0.07	421.6	30.6	0.13	1129.3	7.5	0.13	169.6
Chicken liquids: Layer Lagoon (ALP)	267	3.1	0.02	7.88	1.0	0.07	2.66	13.8	0.15	29.8
Chicken liquids: Lagoon sludge (ASP)	19	24.4	1.88	56.43	38.1	1.41	96.6	10.3	0.69	22.6

Animal Species and Management System	Sample Number	N MEAN	N MIN	N MAX	P MEAN	P MIN	P MAX	K MEAN	K MIN	K MAX
Chicken Breeder solids (HBB)	1313	47.6	4.72	154.2	44.7	2.75	111.38	39.5	0.43	81.35
Chicken Broiler solids:	5737	57.8	0.69	147.4	40.0	0.65	87.05	48.6	0.51	103.8
Turkey solids:	1753	54.0	1.16	135.9	48.2	0.72	86.7	33.8	0.93	76.9
Dairy liquids: Slurry (LSD)	2222	16.7	0.47	271.5	9.1	0.06	220.2	15.4	0.18	255.4
Dairy solids: Scraped (SSD)	621	11.2	0.22	45.6	7.0	0.18	61.1	9.8	0.39	55.9
Horse solids (SSH)	88	9.3	0.33	36.1	7.0	1.15	26.2	9.8	1.69	35.6
Beef	294	13.0	3.56	42.2	8.3	1.07	31.2	13.6	0.48	46.9

THIS TABLE REPRESENTS **PLANT AVAILABLE NUTRIENTS** BASED ON THE TYPICAL APPLICATION METHOD USED FOR THESE MATERIALS.

UNITS ARE POUNDS OF NUTRIENT PER THOUSAND GALLONS FOR LIQUID SYSTEMS (YELLOW HIGHLIGHT) OR POUNDS OF NUTRIENT PER TON FOR SOLID SYSTEMS (GREEN HIGHLIGHT)

Animal Species and Management System	Sample Number	N MEAN	N MIN	N MAX	P MEAN	P MIN	P MAX	K MEAN	K MIN	K MAX
Swine lagoon liquid (ALS)										
BOAR	37	1.8	0.21	2.2	1.0	0.14	0.78	6.6	1.1	3.9
FARROW TO FEEDER	279	1.8	0.27	5.2	1.0	0.26	3.9	6.6	1.9	17.6
FARROW TO FINISH	182	1.8	0.5	5.5	1.0	0.42	2.3	6.6	3.9	13.9
FEEDER TO FINISH	967	1.8	0.13	3.8	1.0	0.06	3.0	6.6	0.52	13.0
NURSERY	575	1.8	0.18	4.9	1.0	0.24	2.3	6.6	0.81	13.3
FARROW TO WEAN	1620	1.2	0.12	2.8	0.6	0.11	3.8	3.3	0.51	10.4
Swine lagoon sludge (ASS)	1132	9.4	0.03	193.96	21.4	0.09	790.53	6.0	0.08	135.67
Chicken liquids: Layer Lagoon (ALP)	267	1.5	0.01	3.78	0.7	0.05	1.86	11	0.12	23.8
Chicken liquids: Lagoon sludge (ASP)	19	10.5	0.81	45.14	26.7	0.99	67.62	8.2	0.55	18.07

Animal Species and Management System	Sample Number	N MEAN	N MIN	N MAX	P MEAN	P MIN	P MAX	K MEAN	K MIN	K MAX
Chicken Breeder solids (HBB)	1313	21.9	2.17	70.93	26.8	1.65	66.83	31.6	0.34	65.08
Chicken Broiler solids:	5737	26.0	0.31	67.79	24.0	0.39	52.23	38.9	0.41	83.03
Turkey solids:	1753	24.3	0.52	61.15	28.9	0.43	52.02	27.0	0.74	61.55
Dairy liquids: Slurry (LSD)	2222	7.2	0.2	116.76	6.4	0.04	154.12	12.3	0.14	204.28
Dairy solids: Scraped (SSD)	621	4.6	0.09	18.7	4.2	0.11	36.64	7.8	0.31	44.69
Horse solids (SSH)	88	3.9	0.14	15.16	4.2	0.69	15.73	7.8	1.35	28.45
Beef	294	6.5	1.78	21.09	5.8	0.75	21.82	10.9	0.38	37.49

Application Methods are:

Irrigation for swine lagoon liquids (ALS) and layer lagoon liquids (ALP)

Broadcast for swine lagoon sludge (ASS), layer lagoon sludge (ASP), chicken breeder and broiler solids, turkey solids, dairy liquids and solids, horse solids, and beef solids

MANURE WASTE GENERATION VOLUMES COMPARISON FOR THE 2010 STUDY, CURRENT NRCS 633 STANDARD, AND ASABE STANDARD. JULY 26, 2011

SPECIES	PRODUCTION SYSTEM	WASTE TYPE	2010 DATA AQUIRED				CURRENT 633 STANDARD	ASABE STANDARD
			SAMPLE SIZE (n)	MEAN	MIN	MAX		
BROILERS (*tons/1000 bird capacity /year)*	WHOLE HOUSE	LITTER	3	7.2	4.78	11.25	5.8	10.5
	CAKE	LITTER	1	4	NA	NA	2	NO REPORT
	STOCKPILED	LITTER	3	7.2	4.78	11.25	5.8	10.5
	ROASTER	LITTER	3	7.2	4.78	11.25	10	NO REPORT
	BREEDER	LITTER	NO REPORT	NO REPORT	NO REPORT	NO REPORT	24	NO REPORT
LAYERS (*gallons/ 1000 bird capacity/ year)*	Pullet non-layer	Lagoon Liquid	NO REPORT	NA	NA	NA	9110	NO REPORT
	Laying Pullet	Lagoon Liquid	NO REPORT	NA	NA	NA	22201	NO REPORT
	Layer	Lagoon Liquid	NO REPORT	NA	NA	NA	25373	18294
	Pullet non-layer	Lagoon Sludge	NO REPORT	NA	NA	NA	1659	NO REPORT
	Laying Pullet	Lagoon Sludge	NO REPORT	NA	NA	NA	4147	NO REPORT
	Layer	Lagoon Sludge	NO REPORT	NA	NA	NA	4739	NO REPORT
TURKEY (*tons/ 1000 bird capacity/ year)*	POULT	LITTER	NO REPORT	NA	NA	NA	5.3	NO REPORT
	HEN	LITTER	NO REPORT	NA	NA	NA	17	17.6
	TOM	LITTER	NO REPORT	NA	NA	NA	25	31.2
	BREEDER	LITTER	NO REPORT	NA	NA	NA	37	NO REPORT

SPECIES	PRODUCTION SYSTEM	WASTE TYPE	2010 DATA AQUIRED				CURRENT 633 STANDARD	ASABE STANDARD
			SAMPLE SIZE (n)	MEAN	MIN	MAX		
SWINE (*gallons/ animal/ year)*	wean-feeder.	Lagoon Liquid	16	231	87	378	191	104
	feeder-finish	Lagoon Liquid	33	524	266	867	927	344
	farrow - wean	Lagoon Liquid	36	2182	1203	4572	3203	2407
	farrow - feeder	Lagoon Liquid	9	2741	1555	4362	3861	2511
	farrow - finish	Lagoon Liquid	8	4949	1650	6474	10478	2855
	wean-feeder.	Lagoon Sludge	NO REPORT	NO REPORT	NO REPORT	NO REPORT	30	NO REPORT
	feeder-finish	Lagoon Sludge	NO REPORT	NO REPORT	NO REPORT	NO REPORT	135	NO REPORT
	farrow - wean	Lagoon Sludge	NO REPORT	NO REPORT	NO REPORT	NO REPORT	433	NO REPORT
	farrow - feeder	Lagoon Sludge	NO REPORT	NO REPORT	NO REPORT	NO REPORT	522	NO REPORT
	farrow - finish	Lagoon Sludge	NO REPORT	NO REPORT	NO REPORT	NO REPORT	1417	NO REPORT
HORSE * (*tons/ animal/ Year)*	adult	Scraped Manure	7.6	9.1	10.8		5.3	10.4
DAIRY COWS (*Tons/ head/ year)*	calf	Scraped Manure		NO REPORT			4.1	3.5
** gallons/ head/year*	heifer	Scraped Manure		NO REPORT			12	8.8

	milk cow	Scraped Manure		NO REPORT			17	27.4
	calf	LIQUID SLURRY		NO REPORT			1876*	3.5
	heifer	LIQUID SLURRY		NO REPORT			5535*	8.8
	milk cow	LIQUID SLURRY		NO REPORT			7749*	27.4
	calf	LAGOON LIQUID		NO REPORT			2270*	NO REPORT
DAIRY COWS (*gallons/ Head/ Year)*	heifer	LAGOON LIQUID		NO REPORT			6662*	NO REPORT
	milk cow	LAGOON LIQUID		NO REPORT			9327*	NO REPORT
	calf	LAGOON SLUDGE		NO REPORT			466*	NO REPORT
	heifer	LAGOON SLUDGE		NO REPORT			1375*	NO REPORT
	milk cow	LAGOON SLUDGE		NO REPORT			1925*	NO REPORT
BEEF (*tons/ animal/ Year)*	Stocker	UNPAVED SCRAPED		NO REPORT			1.5	1.68
	Feeder	UNPAVED SCRAPED		NO REPORT			2.2	1.68
	Brood Cow	UNPAVED SCRAPED		NO REPORT			3	1.68
BEEF* (*gallons/ head/ year*	Stocker	ANAEROBIC LAGOON LIQUID		NO REPORT			1979*	1.68
	Feeder	ANAEROBIC LAGOON LIQUID		NO REPORT			2878*	1.68

	Brood Cow	ANAEROBIC LAGOON LIQUID		NO REPORT			3782*	1.68
	Stocker	ANAEROBIC LAGOON SLUDGE		NO REPORT			545*	1.68
	Feeder	ANAEROBIC LAGOON SLUDGE		NO REPORT			793*	1.68
	Brood Cow	ANLAGOON SLUDGE		NO REPORT			1057*	1.68

* Data compiled from Cooperative Extension Bulletins: Ohio State University, Virginia Tech, Penn State, and the Midwest Plan Service Publication 18 (MWPS-18-S1D)

THIS TABLE REPRESENTS **TOTAL NUTRIENTS**

UNITS ARE POUNDS OF NUTRIENT PER THOUSAND GALLONS FOR LIQUID SYSTEMS (YELLOW HIGHLIGHT) OR POUNDS OF NUTRIENT PER TON FOR SOLID SYSTEMS (GREEN HIGHLIGHT)

Animal Species/ Management System	Sample Number	N MEAN	Existing Standard N	P_2O_5 MEAN	Existing Standard P_2O_5	K_2O MEAN	Existing Standard K_2O	Sample Number for previous data set
Swine lagoon liquid (ALS)	For swine-industry numbers. NCDA = 62406							
BOAR	37	3.6	NA	1.4	NA	8.3	NA	NA
FARROW TO FEEDER	279	3.6	3.4	1.4	1.3	8.3	3.3	364** (for all production areas)
FARROW TO FINISH	182	3.6	5	1.4	1.4	8.3	4.9	"
FEEDER TO FINISH	967	3.6	5	1.4	2	8.3	4.9	"
NURSERY	575	3.6	5	1.4	2	8.3	4.9	"
FARROW TO WEAN	1620	2.4	3.4	0.9	1.3	4.1	3.3	"
Swine lagoon sludge (ASS)	1132	20.4	24.5	30.6	52.9	7.5	6.6	109
Chicken liquids: Layer Lagoon (ALP)	267	3.1	6.6	1.0	1.7	13.8	9.9	56
Chicken liquids: Lagoon sludge (ASP)	19	24.4	26.7	38.1	92.9	10.3	12.6	2

Animal Species / Management System	Sample Number	N MEAN	Existing Standard N	P_2O_5 MEAN	Existing Standard P_2O_5	K_2O MEAN	Existing Standard K_2O	Sample Number for previous data set
Chicken Breeder solids (HBB)	1313	47.6	30.5	44.7	54.7	39.5	30.7	26
Chicken Broiler solids:	5737	57.8	73.2	40.0	78.7	48.6	45.3	638
Turkey solids:	1753	54.0	58.1	48.2	72.9	33.8	40	278
Dairy liquids: Slurry (LSD)	2222	16.7	22.7	9.1	14.3	15.4	21.4	282
Dairy solids: Scraped (SSD)	621	11.2	10	7.0	6.3	9.8	8.7	52
Horse solids (SSH)	88	9.3	12.4	7.0	10.9	9.8	15.6	16
Beef	294	13.0	26.1	8.3	15.7	13.6	19.0	46

SWINE DATA SUMMARY

Animal Species/ Management System	Sample Number	N MEAN	Existing Standard N	P_2O_5 MEAN	Existing Standard P_2O_5	K_2O MEAN	Existing Standard K_2O	Sample Number for previous data set
Swine lagoon liquid (ALS)	For swine-industry numbers. NCDA = 62406							
BOAR	37	3.6	NA	1.4	NA	8.3	NA	NA
FARROW TO FEEDER	279	3.6	3.4	1.4	1.3	8.3	3.3	364** (for all production areas)
FARROW TO FINISH	182	3.6	5	1.4	1.4	8.3	4.9	"
FEEDER TO FINISH	967	3.6	5	1.4	2	8.3	4.9	"
NURSERY	575	3.6	5	1.4	2	8.3	4.9	"
FARROW TO WEAN	1620	2.4	3.4	0.9	1.3	4.1	3.3	"
Swine lagoon sludge (ASS)	1132	20.4	24.5	30.6	52.9	7.5	6.6	109

POULTRY DATA SUMMARY

Animal Species / Management System	Sample Number	N MEAN	Existing Standard N	P_2O_5 MEAN	Existing Standard P_2O_5	K_2O MEAN	Existing Standard K_2O	Sample Number for previous data set
Chicken liquids: Layer Lagoon (ALP)	267	3.1	6.6	1.0	1.7	13.8	9.9	56
Chicken liquids: Lagoon sludge (ASP)	19	24.4	26.7	38.1	92.9	10.3	12.6	2
Chicken Breeder solids (HBB)	1313	47.6	30.5	44.7	54.7	39.5	30.7	26
Chicken Broiler solids:	5737	57.8	73.2	40.0	78.7	48.6	45.3	638
Turkey solids:	1753	54.0	58.1	48.2	72.9	33.8	40	278

DAIRY DATA SUMMARY

Animal Species / Management System	Sample Number	N MEAN	Existing Standard N	P_2O_5 MEAN	Existing Standard P_2O_5	K_2O MEAN	Existing Standard K_2O	Sample Number for previous data set
Dairy liquids: Slurry (LSD)	2222	16.7	22.7	9.1	14.3	15.4	21.4	282
Dairy solids: Scraped (SSD)	621	11.2	10	7.0	6.3	9.8	8.7	52

HORSE DATA SUMMARY

Animal Species / Management System	Sample Number	N MEAN	Existing Standard N	P_2O_5 MEAN	Existing Standard P_2O_5	K_2O MEAN	Existing Standard K_2O	Sample Number for previous data set
Horse solids (SSH)	88	9.3	12.4	7.0	10.9	9.8	15.6	16

BEEF DATA SUMMARY

Animal Species / Management System	Sample Number	N MEAN	Existing Standard N	P_2O_5 MEAN	Existing Standard P_2O_5	K_2O MEAN	Existing Standard K_2O	Sample Number for previous data set
Beef	294	13.0	26.1	8.3	15.7	13.6	19.0	46