Appendix C: Answers to survey questions. For confidentiality, NPDES permit numbers and emails are not included. For wording of questions, see Appendix B. Questions separated by current conditions and processes (3-10) and changes from an increase of drinking water phosphorus residual to 2 mg/L as P (13-20). Number on left column provides an arbitrary ID WWTPs.

#	Discharge (MGD)	Question 3	Question 4	Question 5	Question 6	Question 7	Question 8	Question 9	Question 10
1	0.75	No		Activated Sludge; Aluminum Sulfate; Other	Aluminum Sulfate;	DelPac 15/25 is used instead of Alum		DelPac 1525 addition - We add approx 15,000 gal per year for an annual cost of approximately $20,000.	Landfill
2	11.00			Membrane Bioreactors; Aluminum Sulfate	Aluminum Sulfate; EPBR; Membrane Bioreactors			Alum - $275,000; Methanol - $120,000; Sodium Hypo - $70,000	Land Applicati on; Landfill
3	10.00	Yes	Unknown	Activated Sludge	Aluminum Sulfate				Landfill
4	0.50	No		Aluminum Sulfate	Aluminum Sulfate		PIPING AND PUMPS $5000	ADDITIONAL ALUM $11000	Landfill
5	0.12	No		Aluminum Sulfate	Aluminum Sulfate		PIPING AND PUMPS $5000	ADDITIONAL ALUM $11000	Landfill
6	0.14	No		Aluminum Sulfate	Aluminum Sulfate		PIPING AND PUMPS $5000	ADDITIONAL ALUM $11000	Landfill
7	1.00	No		Aluminum Sulfate	Aluminum Sulfate		PIPING AND PUMPS $5000	ADDITIONAL ALUM $11000	Landfill
8	0.20	No		Aluminum Sulfate	Aluminum Sulfate		PIPING AND PUMPS $5000	ADDITIONAL ALUM $11000	Landfill

9	0.70	No		Activated Sludge; Membrane Bioreactors; Aluminum Sulfate	Aluminum Sulfate; Membrane Filtration; Carbon Source	Carbon Source			Landfill
10	4.00	No		Activated Sludge; Filter Beds; Aluminum Sulfate	Aluminum Sulfate; BNR-5 stage BardenPho Process	BNR - 5-stage Bardenpho Process	$32.6 Million 6MGD Plant	Average of 145 Dry Tons of Aluminum Sulfate added annually. Annual cost average is $47,500.	Landfill
11	0.13	No		Activated Sludge; Aluminum Sulfate	Aluminum Sulfate; Minidisc filter	minidisc filter 10micron		aluminum sulfate $6200 annually	Landfill
12	54.00	Yes	1 mg/L	Activated Sludge	Aluminum Sulfate; Lime			$1.1Million	Land Application; Landfill
13	50.00	No		Activated Sludge	None	wastewater is phosphorus deficient and phosphorus is added.			Incineration
14	3.00	Yes	0.13 mg/L as P	Biological Aerated Filters; Aluminum Sulfate	Aluminum Sulfate		2013 Alum Feed System approximate installation cost: $166,000	Aluminum sulfate addition: 366 tons/year; 52,000/year	Landfill
15	0.72	No	No, but our aquifers used for potable water are naturally hight in	Activated Sludge; Extended Air Activated Sludge; Filter Beds; Aluminum Sulfate	Aluminum Sulfate; EPBR; 5-stage Bardenpho Process	5 stage Bardenpho Process ENR plant design, Alum is DEL Pac, Aqua Disc filter	Aqua disc and Del Pac chemical addition upgrade - Initial cost ~$2M	DEL PAC ALUM - $0.2475 a pound / ~220 lbs a day; $20,000 annually	Landfill

			Phosphorus (~8mg/L)						
16	6.00	Yes	0.3 mg/L	Activated Sludge; Extended Air Activated Sludge; Filter Beds; Aluminum Sulfate	Aluminum Sulfate; EPBR		27 million dollars for our BNR upgrade	$60.000 for Alum	Land Application
17	18.00	Yes	Unknown	Activated Sludge; Ferric Chloride	Ferric Chloride				Incineration
18	22.90	Yes	Unknown: dosed at 0.2 mg/L. approx 0.03 mg/L at tap	Activated Sludge	None				Landfill
19	8.00	Yes	1 mg/L as P	Activated Sludge; Filter Beds; Aluminum Sulfate	Aluminum Sulfate; EPBR		ENR - Up-front = $3.2M	No chemicals currently being added. PO4 removed biologically	Compost
20	5.40	Yes	1 mg/L as P	Activated Sludge; Filter Beds; Aluminum Sulfate	Aluminum Sulfate; EPBR		ENR - Up-front = $3.2M	No chemicals currently being added. PO4 removed biologically	Compost
21	0.60	Yes	Unknown	Other	None				Landfill
22	1.92	No		Activated Sludge; Filter Beds; Other	Sodium Aluminate	Addition of sodium Aluminate			Land Application; Landfill
23	8.00	Yes	Unknown	Other; Aluminum Sulfate; Extended air activated sludge;	Aluminum Sulfate; EPBR			We add about 600 tons of Aluminum Sulfate.	Landfill; Compost

				Activated Sludge					
24	2.00	No		Extended air activated sludge; Aluminum Sulfate	Aluminum Sulfate; EPBR; Parkson Upflow Sand filter	Parkson Upflow Sand Filters with Methanol Addition	2009 Upflow Sand Filters, Methanol and Alum addition, UV disinfection and recirculation $ 8 million	Alum = $60K, Methanol = $13K, Sand Filter Air lifts=$7K UV= $20K	Landfill
25	3.00	No		Activated Sludge; Ferric Chloride	Ferric Chloride		In 2011 we added sand filters, chem addition equipment for 13 million dollars	$50,000	
26	3.00	No		Activated Sludge; Other	Aluminum Sulfate; 5-stage Bardenpho	5 Stage - Bardenpho	Upgraded plant was put online in 2010 24 Million	Chemical addition 64K annual	Landfill
27	2.40	No		Extended air activated sludge; Aluminum Sulfate; Filter Beds	Aluminum Sulfate				Land Applicati on
28	4.00	No		Activated Sludge	None		None now. Plant upgrade is in current design phase. The upgrade to remove nitrogen and phosphorus will cost about $44,000,000.00		Landfill

29	1.60	No		Activated Sludge; Extended Air Activated Sludge; Filter Beds; Aluminum Sulfate; other	Addition of Aluminum Sulfate; Parkson Dynasand filter	Parkson Dynasand filter. Modified ludzak-etinger process	2010 $7,085,990.58 for nutrient reduction upgrade	Alum $13,041/year. Increase of electricity $80,659	Land Application
30	0.80	No		Extended air activated sludge; Filter Beds; Other	Aluminum Sulfate; 4-stage Bardenpho process	We utilize a 4 stage Bardenpho process with downflow gravity sand filters post secondary clarification. We have capability to implement a 5th stage to process to enhance EBPR	BNR upgrade2005 at a cost of $4.5 Million	Annual maint cost $97000.00 annual alum costs for 50 tons per year is $5000.00	Landfill
31	0.50	No		Activated Sludge; Aluminum Sulfate	Aluminum Sulfate			Alum - 3026.00 monthly	Landfill
32	15.00	Yes	Unknown	Activated Sludge; Filter Beds; Aluminum Sulfate; ferric chloride	Aluminum Sulfate; EPBR; ferric chloride; Deep Filter Beds	Deep Filter Beds to Remove Floc	Total nitrogen and phosphorus removal upgrade was $52 million in 2011.	Metal salt (alum) cost was ~$320,000 in 2012	compost
33	4.50	No		Activated Sludge	None				Compost
34	2.00	No		Extended Air Activated Sludge	none				Land Application

#	Discharge	Question 13	Question 14	Question 15	Question 16	Question 17	Question 18	Question 19	Question 20
1	0.75	Yes	Other; Increase of Aluminum Phosphate	We would need to increase the dosage of DelPac 1525 to offset additional phosphorus. Best guess of additional annual expense would be that the cost would double from $20,000 to $40,000 per year for chemical.	Yes	Increase in dewatering period; Increase in phosphorus Concentration; Increase in the amount of sludge produced		Increase in P concentration; Increase in amount of biosolid/sludge to be disposed; Other	Sludge production would be increased do to increased phosphorus and DelPac addition. Costs associated with this increase are unknown at this time.
2	11.00	Yes	Increase of Aluminum Sulfate	Alum cost increased from $275,000/yr to $350,000/yr	Yes	Increase in dewatering period; Increase in phosphorus Concentration; Increase in the amount of sludge produced	Sludge production would increase from 15 WT per day to $17 WT per day	Increase in the amount of biosolid/sludge to be disposed	$5,000/yr

3	10.00	No	Increase of Aluminum Sulfate		Yes	Increase in the amount of sludge produced		Increase in the amount of biosolid/sludge to be disposed	
4	0.50	Yes	Increase of Aluminum Sulfate	increase of alum would increase @ $5000	Yes	Increase in the Phosphorus concentration of the sludge		Increase to the amount of sludge/biosolids needing to be disposed	The amount of sludge being hauled from this plant to our larger plant to run through our belt press then to landfill disposal would increase. @ $10,000 yr
5	0.12	Yes	Increase of Aluminum Sulfate	The increase of alum @$5000	Yes	Increase in the Phosphorus concentration of the sludge		Increase to the amount of sludge/biosolids needing to be disposed	The amount of sludge being hauled from this plant to our larger plant to run through our belt press then to landfill disposal would increase. @ $10,000 yr
6	0.14	Yes	Increase of Aluminum Sulfate	The increase of alum @$5000	Yes	Increase in the Phosphorus concentration of the sludge		Increase to the amount of sludge/biosolids needing to be disposed	The amount of sludge being hauled from this plant to our larger plant to run through our belt press then to landfill disposal would increase. @ $10,000 yr
7	1.00	Yes	Increase of Aluminum Sulfate	The increase of alum @$5000	Yes	Increase in the Phosphorus concentration of the sludge		Increase to the amount of sludge/biosolids needing to be disposed	The amount of sludge being hauled from this plant to our larger plant to run through our belt press then to landfill

									disposal would increase. @ $10,000 yr
8	0.20	Yes	Increase of Aluminum Sulfate	The increase of alum @$5000	Yes	Increase in the Phosphorus concentration of the sludge		Increase to the amount of sludge/biosolids needing to be disposed	The amount of sludge being hauled from this plant to our larger plant to run through our belt press then to landfill disposal would increase. @ $10,000 yr
9	0.70	Yes	Increase of Aluminum Sulfate; implement Bioreactor	we built a new membrane wwtp approx. cost was about $28million	Yes	Increase in the amount of sludge produced; Increase in phosphorus concentration of the sludge		Increase to the amount of sludge/biosolids needing to be disposed	no data is possible
10	4.00	Yes	Increase of Aluminum Sulfate		Yes	Increase in the amount of sludge produced; Increase in phosphorus concentration of the sludge		Increase to the amount of sludge/biosolids needing to be disposed	
11	0.13	Yes	Increase of Aluminum Sulfate	increase aluminum sulfate addition $6200 per year	No				
12	54.00	Yes		Minimal cost impact, since high the ligh lime process is relatively insensitive to phosphorus loading	No	Increase in the Phosphorus concentration of the sludge	minimal	Change in the P concentration of sludge/biosolids needing to be disposed (hence limiting amount that may be applied at once).	minimal

13	50.00	Yes			No	Other. Not applicable. Phosphorus is added to our wastewater since it is phosphorus deficient	$0	Other. Not applicable -- solids are incinerated.	$0
14	3.00	No	Increase of Aluminum Sulfate; Other	Installation of tertiary cloth disk filter: $1,615,900 capital cost. Increase of $37,000 annual cost. Additional alum cost: $54,000/year	Yes	Increase in the amount of sludge produced; Increase in phosphorus concentration of the sludge	none	Increase in P concentration; Increase in amount of biosolid/sludge to be disposed	Alum addition could result in 230 tons additional sludge per year, costing approximately: $17,000 per year
15	0.72	Yes		No impact, as our potable water has phosphorus levels well above 2 mg/L already (naturally occuring due to phosphoclastic nature of the aquifer geology at our potable water well withdrawal points).	No				
16	6.00	No	Increase of Aluminum Sulfate; Implement EBPR		No	Increase in the Phosphorus concentration of the sludge		Change in the P concentration of sludge/biosolids needing to be disposed (hence limiting amount that may be applied at once).	

				We have no filtration at these plants, nor would we need to add it to meet our current limits. Cost increase for bio-P is negligible unless FeCl3 addition is required to manage the load increase. Same for solids production. If additional FeCl3 is needed, costs are quite variable depending on the plant and the dose required. An estimate for the increase in FeCl3 cost is $7500/year/MGD. For incinerator plants, the solids handling cost increase is negligible. For digester plants that use FeCl3 for P removal with composting or land app, costs are quite variable depending on the plant. An increase of 10-20% would be expected.				Increase to the amount of sludge/biosolids needing to be disposed; Change in P concentration (hence limiting the amount that can be disposed); Constraints on land application; Necessitate finding new sites for land application; Change to incineration as disposal technique; Other (change to incineration. maybe more composting)	
17	18.00	Yes	Increase of Ferric Chloride; Implement ation of EBPR		Yes	Increase in the amount of sludge produced; Increase in phosphorus concentration of the sludge			Negligible
18	22.90								
19	8.00	No	Increase of Aluminum Sulfate	$50 K	Yes	Increase in the amount of sludge produced	$40K	Increase in the amount of biosolid/sludge to	

								be disposed	
20	5.40	No	Increase of Aluminum Sulfate	$50 K	Yes	Increase in the amount of sludge produced	$40K	Increase in the amount of biosolid/sludge to be disposed	
21	0.60	Yes	Increase of Aluminum Sulfate; Increase of Ferric Chloride, Increase of Lime	Unknown	No				
22	1.92	No	Other		No	Increase in the Phosphorus concentration of the sludge		Change in the P concentration of sludge/biosolids needing to be disposed (hence limiting amount that may be applied at once).	
23	8.00	Yes		No Changes here	No		No Changes		No Changes
24	2.00								
25	3.00		Ferric Chlroide	$50,000 for more ferric chloride	Yes	increase in the amount of sludge produced, increase in phosphorus concentration, increase in dewatering period		Increase to the amount of sludge/biosolids needing to be disposed; Change in the P concentration of sludge/biosolids needing to be disposed (hence limiting amount that may be	$10,000

								applied at once); Constraints on land application; Necessitate finding new sites for land application	
26	3.00	No	Increase of Aluminum Sulfate	Water plant does not add any such chemical at this time. Therefore we do not need to do any specialized treatment.	Yes	Increase in the amount of sludge produced	Alum addition would increase depending on the amount of residual. Sludge could increase maybe 5 %	Increase to the amount of sludge/biosolids needing to be disposed	Unknown
27	2.40								
28	4.00	Yes	Increase of Aluminum Sulfate		Yes	Increase in the amount of sludge produced; Increase in the Phosphorus concentration		Increase to the amount of sludge/biosolids needing to be disposed; constraints on land application	Estimate $20,000-$30,000 a year
29	1.60	No	Increase of Aluminum Sulfate	Cost unknown at this time to add enough Alum to decrease phosphorus level from 2mg/L to 0.3mg/L for 750,000 GPD.	Yes	Increase in the amount of sludge produced; Increase in phosphorus concentration; Longer aerobic/anaerobic digestion period	unknown, but would likely increase polymer use in belt press, and increase labor to process and dewater	Increase to the amount of sludge/biosolids needing to be disposed; Change in the P concentration of sludge/biosolids needing to be disposed (hence	Unknown. Increased cost of labor, fuel, truck and loader maintenance.

							sludge.	limiting amount that may be applied at once); Constraints on land application	
30	0.80	Yes	Increase of Aluminum Sulfate; Implement EBPR	Double alum dose at an increase of $5000.00 per year	No	Increase in the amount of sludge produced	None we currently operate substantially bellow budget at this time	Increase in the amount of biosolid/sludge to be disposed	$0
31	0.50	Yes	Increase of Aluminum Sulfate; implement low-pressure membrane filter	increase cost of Alum to 4,500 monthly, cost of new filters 300,000.	Yes	Increase in the amount of sludge produced; Increase in the Phosphorus concentration		Increase to the amount of sludge/biosolids needing to be disposed	3,500
32	15.00	Yes	Increase of Aluminum Sulfate	Unknown. Probably negligible.	No				
33	4.50								
34	2.00	Yes			No				