Lewes BPW
electric, water and sewer utility

Lewes WWTF
Long-Range Planning Study

Lewes BPW Public Meeting
April 12, 2023

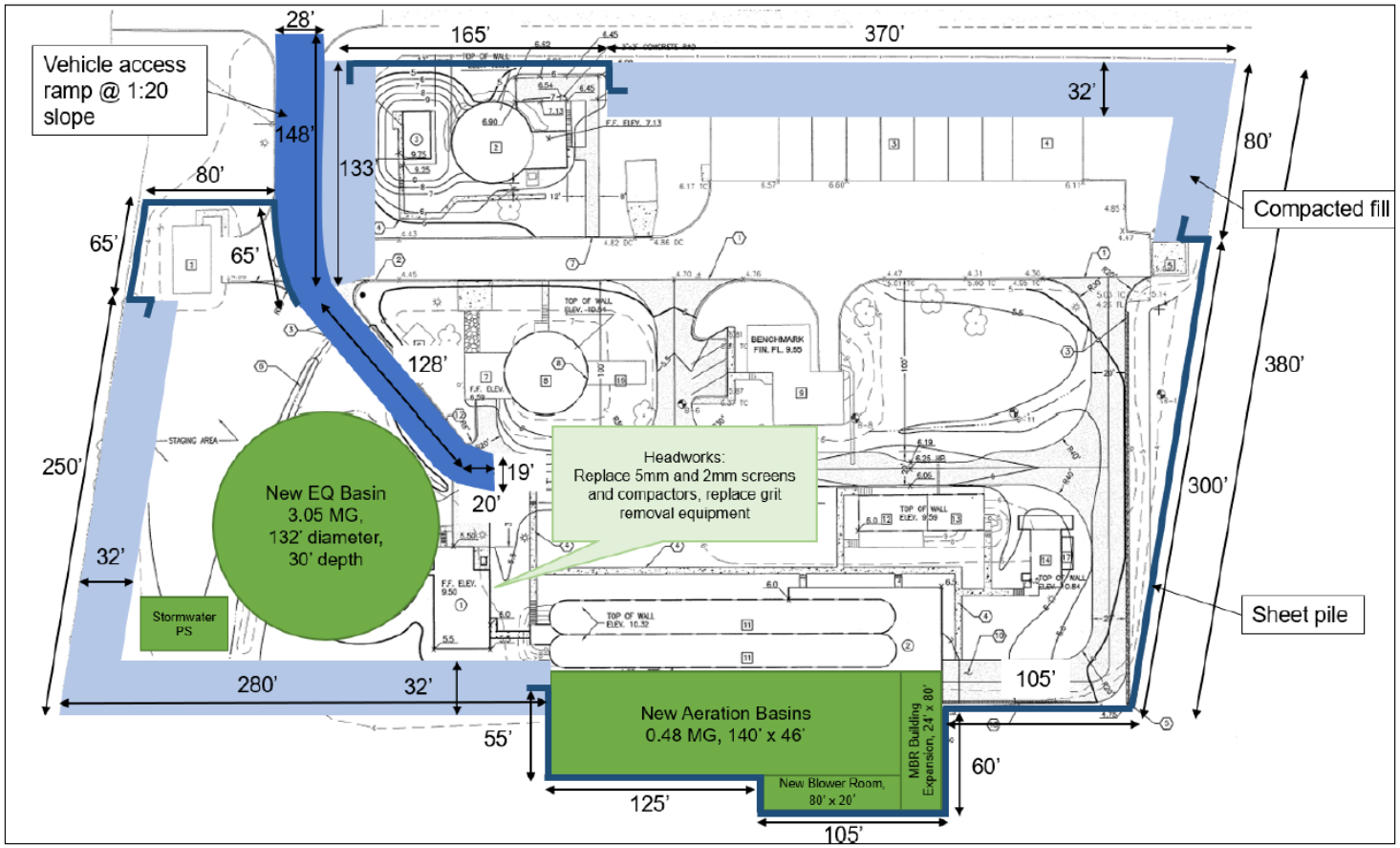
Agenda

1. Option 1 Visualizations
2. Cost Estimates
3. Water Quality Criteria

Cape Gazette – Nick Roth Photo

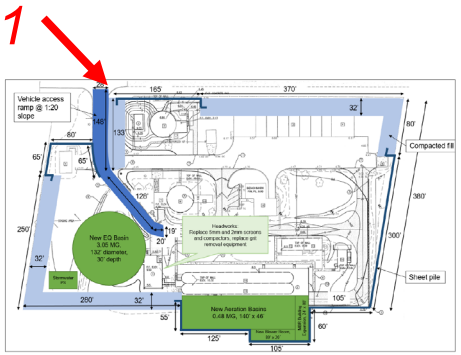
1. Option 1 Visualizations

- Option 1 (Existing Site Hardening) upgrades include a new perimeter flood barrier and new treatment structures
- BPW has worked with GHD to generate visualizations for how the site would look following implementation of the Option 1 upgrades



1. Option 1 Visualizations

- View No. 1 – site entrance viewed from American Legion Road

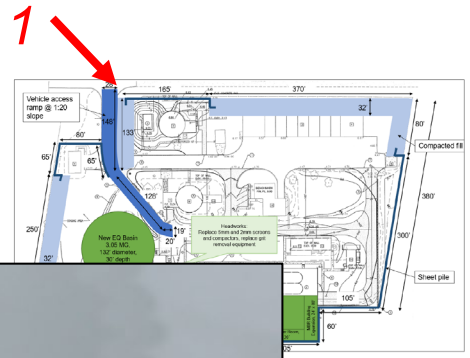


BEFORE

AFTER

1. Option 1 Visualizations

- View No. 1 – site entrance viewed from American Legion Road



NEW 3.05 MG Flow Equalization Tank

NEW Site Fence

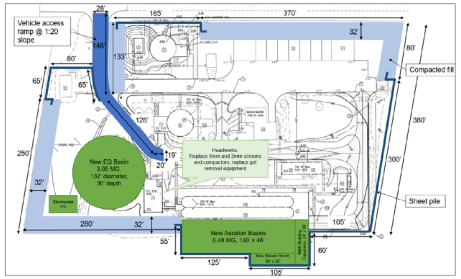
NEW Perimeter flood barrier: compacted earth fill

NEW Vehicle access ramp

1. Option 1 Visualizations

- View No. 2 – site perimeter viewed from E. Savannah Road

2 →



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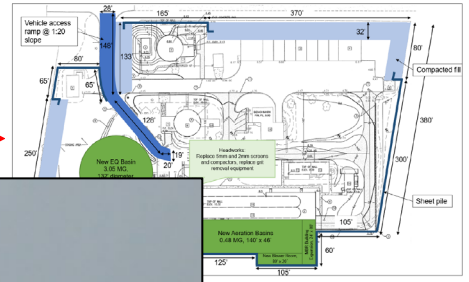
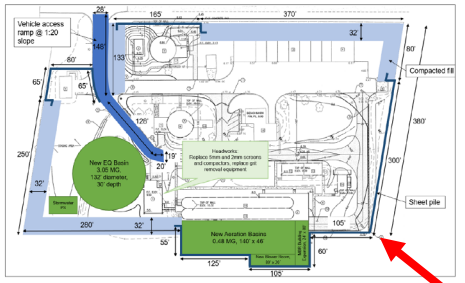
1. Option 1 Visualizations

- View No. 2 – site perimeter viewed from E. Savannah Road



1. Option 1 Visualizations

- View No. 3 – site perimeter viewed from Theo C. Freeman Memorial Highway (Rt. 9)



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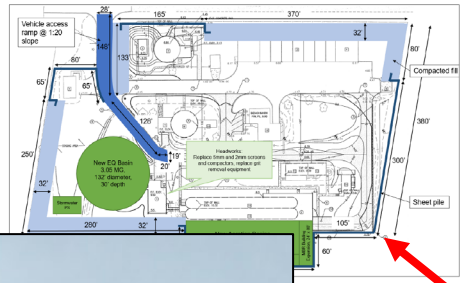
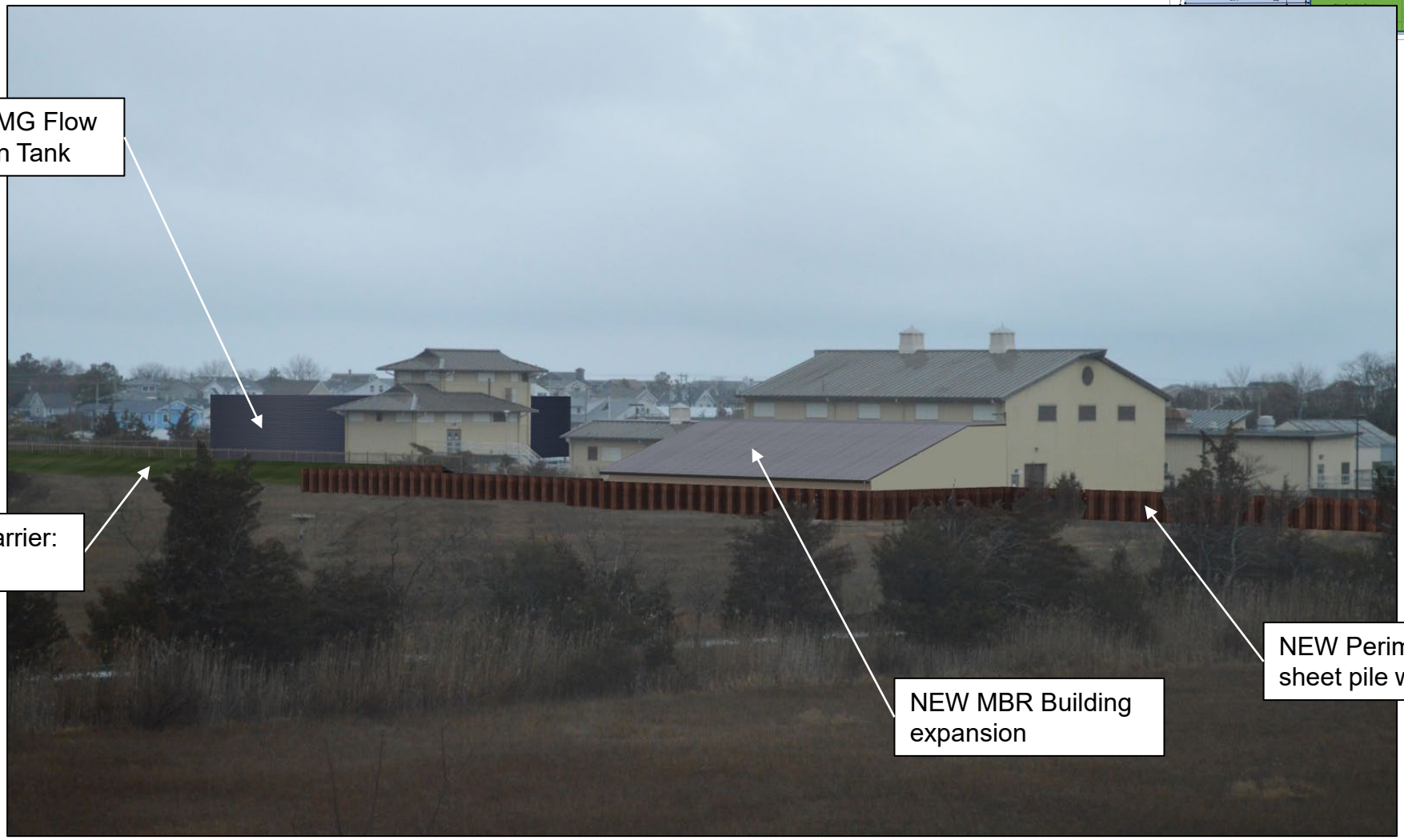
1. Option 1 Visualizations

- View No. 3 – site perimeter viewed from Theo C. Freeman Memorial Highway (Rt. 9)





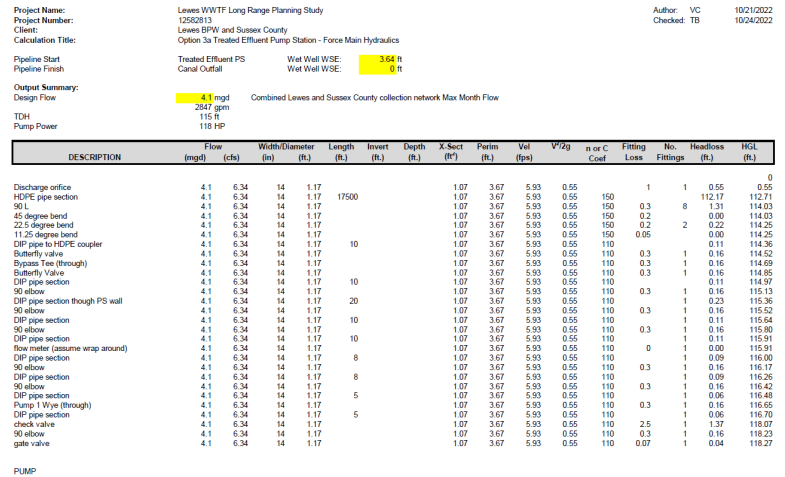
2. Cost Estimates

- The approach used to develop the Preliminary Capital Cost Estimates was as follows

1. **Engineering analysis and calculations**
   - Establish key technical parameters for flood defenses, treatment equipment, storage tanks, pumping stations, pumps and pipelines using established industry standards and best practice
   - For detailed calculations and sizing assumptions refer to:
   - Option 1 Process Upgrades: Report Section 3.2.2
   - Option 1 Flood Defenses: Report Section 3.2.3
   - Option 2 Treatment Plant: Report Section 3.3.2
   - Option 2 Network Hydraulics: Report Section 3.3.3 and Appendix C
   - Option 3 Network Hydraulics: Report Section 3.4.4 and Appendix C
2. **Physical Process Sizing and Land Use**
   - Use the critical parameters identified in step 1 to develop physical dimensions for proposed upgrades
   - Estimate land areas required for Option 2 sites (including access roads, treatment facilities, treated effluent storage and treated effluent distribution)
   - Estimate land areas required for pumping station upgrades
   - Estimate pipeline lengths for flow transfers

Table 14 Treatment Stage Sizing

Item	Treatment Stages	Sizing Approach	WWTF Site, sf
1	Headworks	Sized for Peak Hour Flow. Includes grit removal, 5 mm screen and compactor	2,000
2	Aeration Lagoon	Assume 2 units (rectangular). Size so that combined volume gives a 24-hr hydraulic retention time at Average Day flow. Sidewater depth 15 ft.	15,600
3	Secondary Clarifiers	Assume 2 circular units. Sized based on 10 States Standards (surface overflow rate and side depth). Sized using Max Month Flow as peak flow. Assume 12ft side depth.	2,100
4	Effluent Filter and UV Disinfection Building	Assume 2 units each of effluent cloth disc filters and UV disinfection system. Sized for the Max Month flow.	2,700
5	Effluent Storage Lagoons	Required for land application of treated effluent only. Assume 4 units (rectangular). Sized so that combined volume gives a 45 day hydraulic retention time at Average Day flow (per DNREC requirements). Sidewater depth 15 ft. Depth adjusted to balance cut and fill.	810,000
6	Flow EQ Tanks	Sized to store 24-hrs of equalized flow. Equalized flow = Peak Hour flow – Max Month flow.	27,100
7	Sludge Handling Building	Includes sludge dewatering and thickener.	3,000



Project Name: Lewes WWTF Long Range Planning Study — Author: VC 10/21/2022
Project Number: 12582813 — Checked: TB 10/24/2022
Client: Lewes BPW and Sussex County
Calculation Title: Option 3a Treated Effluent Pump Station - Force Main Hydraulics

Pipeline Start: Treated Effluent PS — Wet Well WSE: 3.64 ft
Pipeline Finish: Canal Outfall — Wet Well WSE: 0 ft

Output Summary:
Design Flow: 4.1 mgd (2847 gpm) — Combined Lewes and Sussex County collection network Max Month Flow
TDH: 115 ft
Pump Power: 118 HP

DESCRIPTION	Flow (mgd)	Flow (cfs)	Width/Diameter (in)	Width/Diameter (ft.)	Length (ft.)	Invert (ft.)	Depth (ft.)	X-Sect (ft²)	Perim (ft.)	Vel (fps)	V²/2g	n or C Coef	Fitting Loss	No. Fittings	Headloss (ft.)	HGL (ft.)
																0
Discharge orifice	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55		1	1	0.55	0.55
HDPE pipe section	4.1	6.34	14	1.17	17500			1.07	3.67	5.93	0.55	150			112.17	112.71
90 L	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	150	0.3	8	1.31	114.03
45 degree bend	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	150	0.2		0.00	114.03
22.5 degree bend	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	150	0.2	2	0.22	114.25
11.25 degree bend	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	150	0.05		0.00	114.25
DIP pipe to HDPE coupler	4.1	6.34	14	1.17	10			1.07	3.67	5.93	0.55	110			0.11	114.36
Butterfly valve	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	114.52
Bypass Tee (through)	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	114.69
Butterfly Valve	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	114.85
DIP pipe section	4.1	6.34	14	1.17	10			1.07	3.67	5.93	0.55	110			0.11	114.97
90 elbow	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	115.13
DIP pipe section though PS wall	4.1	6.34	14	1.17	20			1.07	3.67	5.93	0.55	110		1	0.23	115.36
90 elbow	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	115.52
DIP pipe section	4.1	6.34	14	1.17	10			1.07	3.67	5.93	0.55	110		1	0.11	115.64
90 elbow	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	115.80
DIP pipe section	4.1	6.34	14	1.17	10			1.07	3.67	5.93	0.55	110		1	0.11	115.91
flow meter (assume wrap around)	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0	1	0.00	115.91
DIP pipe section	4.1	6.34	14	1.17	8			1.07	3.67	5.93	0.55	110		1	0.09	116.00
90 elbow	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	116.17
DIP pipe section	4.1	6.34	14	1.17	8			1.07	3.67	5.93	0.55	110		1	0.09	116.26
90 elbow	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	116.42
DIP pipe section	4.1	6.34	14	1.17	5			1.07	3.67	5.93	0.55	110		1	0.06	116.48
Pump 1 Wye (through)	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	116.65
DIP pipe section	4.1	6.34	14	1.17	5			1.07	3.67	5.93	0.55	110		1	0.06	116.70
check valve	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	2.5	1	1.37	118.07
90 elbow	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.3	1	0.16	118.23
gate valve	4.1	6.34	14	1.17				1.07	3.67	5.93	0.55	110	0.07	1	0.04	118.27

PUMP

2. Cost Estimates

- Continued:

3. Estimate Base Costs for Construction, including:

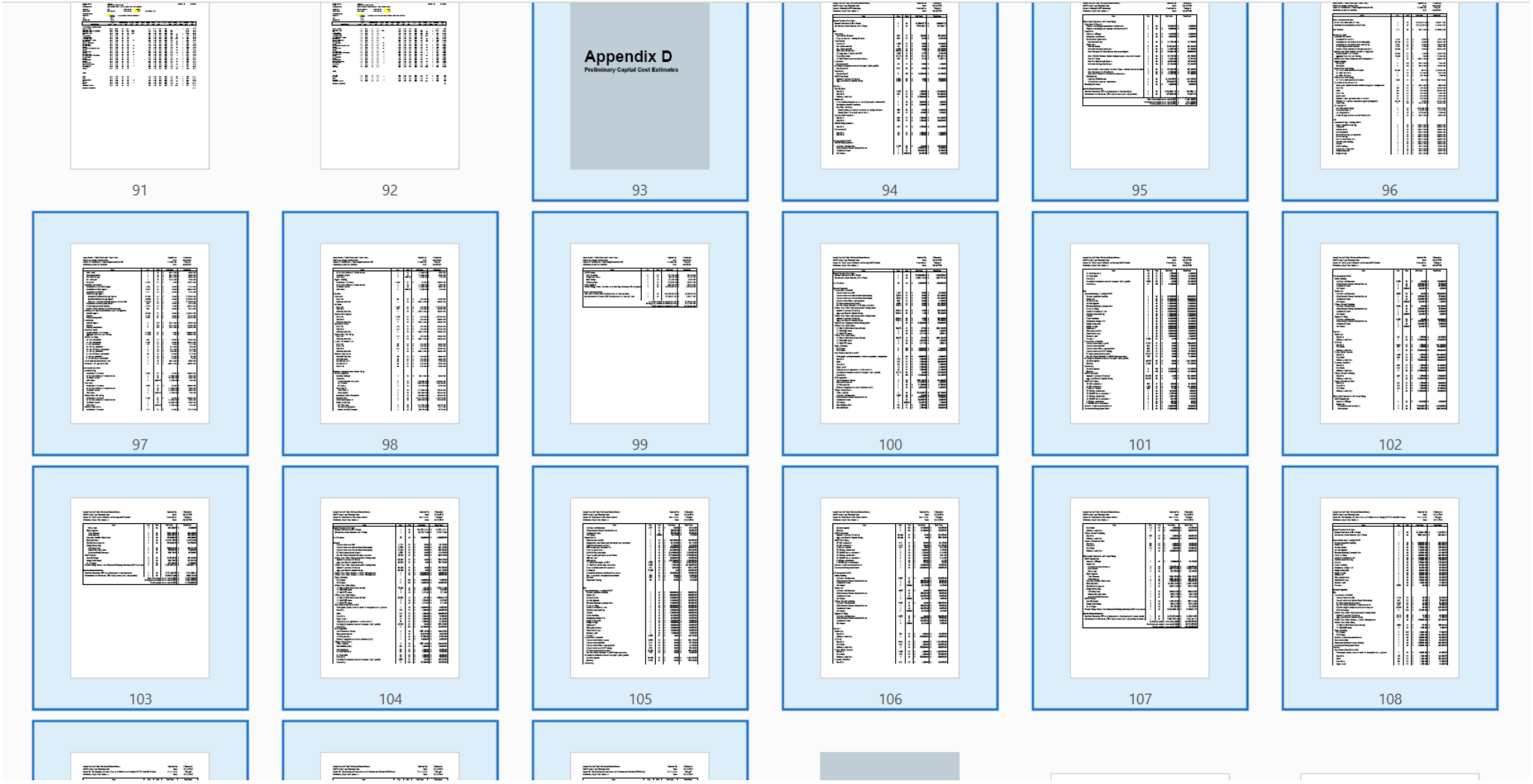
  - Quantify extent of demolition work required
  - Estimate temporary facility requirements (excavation supports, groundwater pumping, traffic management, stormwater management facilities etc.)
  - Calculate earthworks quantities
  - Calculate pipeline diameters and trench dimensions
  - Calculate paving reinstatement required for existing public roads
  - Calculate concrete volumes for new structures
  - Estimate Architectural costs for new buildings (building superstructures, cladding and finishes, heating, ventilation and cooling)
  - Coordinate with equipment suppliers to specify and request quotes for major process equipment, including: flow transfer pumps, screens, grit removal, blowers, clarifier mechanisms, UV reactors, sludge dewatering equipment
  - Apply uplifts for General Contract Conditions, Electrical and Instrumentation works based on recent, observed market trends

4. Apply Uplifts for Project Delivery

  - 35 % Construction Contingency; allows for funding risk associated with, for example: ground conditions, material cost fluctuations and contractor availability (among others)
  - 25% Legal, Administration and Engineering costs; typical value observed for large capital projects

2. Cost Estimates

- Itemized cost estimates – showing quantities and rates – are provided in Appendix D of the GHD report:



2. Cost Estimates

- Some examples of key capital cost differentiators between differing options are provided in the upcoming slides:

Table 24 *Preliminary Capital Cost Estimates*

	Option 1	Option 2a	Option 2b	Option 2c	Option 3a[1]	Option 3b[2]
General Conditions	$2,000,000	$13,500,000	$10,000,000	$16,000,000	$1,500,000	$1,500,000
1 Land Purchase	$0	$12,500,000	$1,000,000	$1,000,000	$0	$0
Demolition – Ex. Facility	$0	$3,500,000	$3,500,000	$3,500,000	$3,500,000	$3,500,000
2 Network Upgrades	$0	$9,500,000	$13,500,000	$49,000,000	$4,000,000	$4,000,000
Civil – WWTF	$1,500,000	$14,500,000	$4,500,000	$4,500,000	$0	$0
Arch/HVAC	$500,000	$2,000,000	$2,000,000	$2,000,000	$0	$0
Structural Concrete	$3,000,000	$7,500,000	$7,000,000	$7,000,000	$0	$0
Mech/Equipment	$4,000,000	$13,500,000	$13,000,000	$13,500,000	$0	$0
Electrical	$2,500,000	$15,500,000	$13,000,000	$14,000,000	$2,500,000	$2,500,000
Construction Subtotal	**$13,500,000**	**$92,000,000**	**$67,500,000**	**$110,500,000**	**$11,500,000**	**$11,500,000**
Contingency (35%)	$4,700,000	$32,400,000	$23,700,000	$38,700,000	$4,100,000	$4,100,000
Construction Total	**$18,200,000**	**$124,400,000**	**$91,200,000**	**$149,200,000**	**$15,600,000**	**$15,600,000**
Legal, Admin., and Eng. (25%)	$4,600,000	$31,200,000	$22,800,000	$37,300,000	$4,000,000	$4,000,000
TOTAL	**$22,800,000**	**$155,600,000**	**$114,000,000**	**$186,500,000**	**$19,600,000**	**$19,600,000**

Notes:
1. Cost Estimates presented for Option 3a are for Lewes BPW's component of the total project cost only; The total project costs, excluding the WWTF upgrades, would be $34,500,000; Sussex County's component of the project costs would be $14,500,000.
2. Cost Estimates presented for Option 3b are for Lewes BPW's component of the total project cost only; The total project costs, excluding the WWTF upgrades, would be $22,500,000; Sussex County's component of the project costs would be $3,000,000.

2. Cost Estimates

- Example Cost Differentiator # 1: Land Purchase

Table 24 Preliminary Capital Cost Estimates

	Option 1	Option 2a	Option 2b	Option 2c	Option 3a[1]	Option 3b[2]
General Conditions	$2,000,000	$13,500,000	$10,000,000	$16,000,000	$1,500,000	$1,500,000
Land Purchase	$0	$12,500,000	$1,000,000	$1,000,000	$0	$0

1

- **Option 1:** Requires an increase in the WWTF site area of approx. 0.3 acres to accommodate new aerations basins and MBR building extension. Lewes BPW owns the land around the existing WWTF and therefore **no additional land purchase is required for Option 1**.
- **Option 2a:** Entirely new plant requires a 250 acre site, including 230 acres for spray irrigation at an application rate of 2 inches per acres per 7 day period. **Land purchase represents 13.6% of the Construction Subtotal for Option 2a**.
- **Option 2b and 2c:** Entirely new plant requires a 20 acre site. Treated effluent is discharged via canal or ocean outfall respectively and therefore spray irrigation area is not required. **Land purchase represents 1.5% and 0.9% of the Construction Subtotals for Option 2b and Option 2c, respectively**.
- **Option 3a and 3b:** The new County WWTF would be constructed on land already owned by the County and would not require a capital cost contribution from Lewes BPW. Therefore, **no additional land purchase is required for Option 3a or 3b.**

2. Cost Estimates

- Example Cost Differentiator # 2: Network Upgrades

2

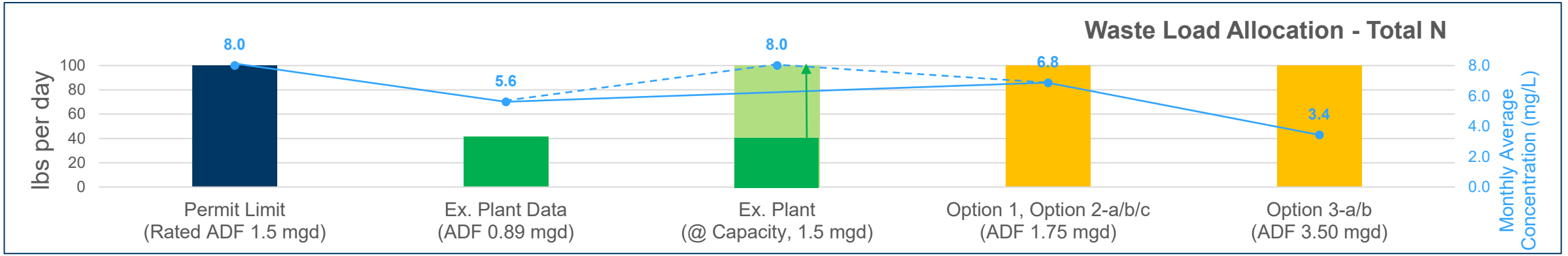
Table 24 Preliminary Capital Cost Estimates

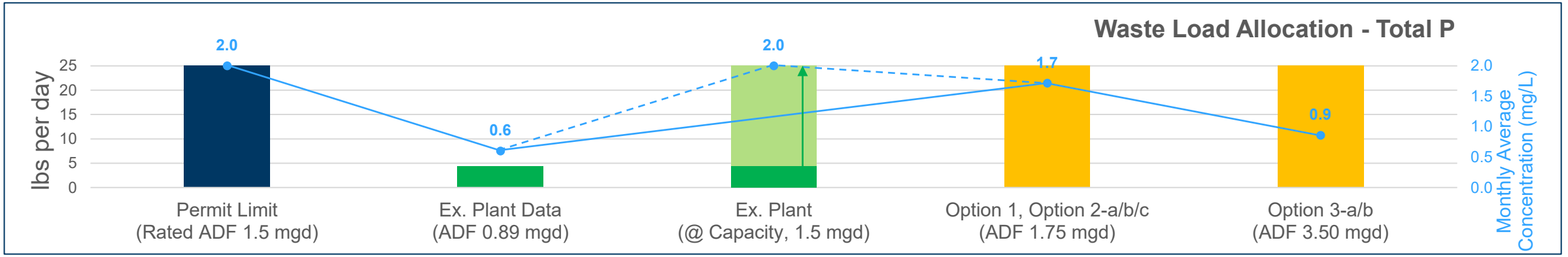
	Option 1	Option 2a	Option 2b	Option 2c	Option 3a[1]	Option 3b[2]
Network Upgrades	$0	$9,500,000	$13,500,000	$49,000,000	$4,000,000	$4,000,000

- **Option 1:** existing lift stations will remain operational, therefore **no additional network upgrades are required for Option 1**.
- **Option 2a:** a new raw wastewater pump station is required to transfer network flows to new WWTF site. Treated effluent is discharged via spray irrigation, close to the WWTF site. **Network Upgrades represent 10.3 % of the Construction Subtotal for Option 2a**.
- **Option 2b:** a new raw wastewater pump station is required to transfer network flows to new WWTF site and a treated effluent pump station is required to transfer treated effluent back to the existing canal outfall. **Network Upgrades represent 20.0 % of the Construction Subtotal for Option 2b**.
- **Option 2c:** a new raw wastewater pump station is required to transfer network flows to new WWTF site and a treated effluent pump station is required to transfer treated effluent to anew ocean outfall, which requires horizontal drilling and a section of marine open-cut trench. **Network Upgrades represent 44.3 % of the Construction Subtotal for Option 2c**.
- **Option 3a and 3b:** BPW are only responsible for a new raw wastewater pump station and raw wastewater delivery main up to the existing BPW/ County scope boundary. **Network Upgrades represent 34.8 % of the Construction Subtotal for Option 3a and 3b**.

Item	Qty	Unit	Unit Cost	Total Cost
Architectural Allowance	625	SF	$ 150.00	$ 93,750.00
AC for Control/Blower/Electrical Rooms	1	LS	$25,000.00	$ 25,000.00
Ventilation System	1	LS	$35,000.00	$ 35,000.00
Unit Heater	1	1000 SF	$1,500.00	$ 1,500.00
Ocean Outfall				
Maintenance of traffic	1	LS	$ 195,000.00	$ 195,000.00
Staging area, beach dune and land based site restoration	1	LS	$ 59,150.00	$ 59,150.00
Sediment and erosion control	1	LS	$ 19,500.00	$ 19,500.00
HDD monitoring/Fluid specialist	1	LS	$ 104,000.00	$ 104,000.00
Concrete thrust collar	1	LS	$ 162,500.00	$ 162,500.00
Outfall diffuser assembly	1	LS	$ 2,210,000.00	$ 2,210,000.00
Concrete piling and pile caps at diffuser	1	LS	$ 3,770,000.00	$ 3,770,000.00
HDD entry pit	1	LS	$ 130,000.00	$ 130,000.00
HDD exit pit	1	LS	$ 1,326,000.00	$ 1,326,000.00
16" HDPE outfall pipe via HDD	3,000	LF	$ 1,885.00	$ 5,655,000.00
16" HDPE via marine open-cut trench	3,000	LF	$ 6,240.00	$ 18,720,000.00
Concrete ballast collars for open-cut	165	EA	$ 4,810.00	$ 793,650.00
Parking lot	70,000	SF	$ 2.60	$ 182,000.00
Connection between outfall and force main	1	LS	$ 130,000.00	$ 130,000.00
Misc. excavation and replacement of sand	100	CY	$ 130.00	$ 13,000.00
Silt fence	300	LF	$ 32.50	$ 9,750.00
Beach sand fencing	50	LF	$ 130.00	$ 6,500.00

3. Water Quality Criteria





Permit Limit represents the expected performance of the existing WWTF at the rated capacity (1.5 mgd).

It corresponds to the **design criteria for the WWTF**.

Ex. Performance (Sep '20 to Sep '21) when Average Daily Flow was 0.89 mgd (60% capacity).

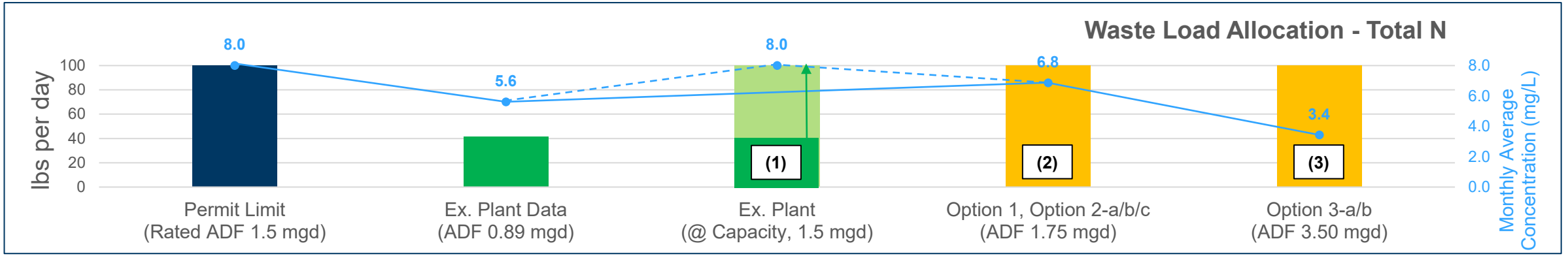
As flows increase towards the rated capacity, nutrient monthly average concentrations will **trend towards permit limits** due to reduced retention time in the aeration basins.

The **future WWTF will meet all the conditions of the existing discharge permit**.

In order to maintain the total waste loads within the existing permit limits at the 2050 Basis of Design flow rates, the **new WWTFs will need to maintain TN and TP concentrations below the stated permit limits**.

For Option 1 & 2 concepts, this will result in TN and TP concentrations higher than the existing performance data. However, the WWTF currently operates at only 60% of the rated capacity.

3. Water Quality Criteria



- Example Calculation (1) – Existing Plant at Design Capacity, Treated Effluent Total Nitrogen Concentration:

  [**100 lbs per day** Total Nitrogen] ÷ [**1.5 million gallons per day** treated flow] = 66.7 lbs Total Nitrogen per million gallons treated per day

  Convert lbs/ MG to mg/L: divide by 8.34 **= 8.0 mg/L Total Nitrogen**

Waste loads – consistent for all options

Consistent waste load allocation, **increasing** flow rates → → → **decreasing** nutrient concentrations

(lowest for Option 3-a/b)

- Example Calculation (2) – Option 1 & Option 2-a/b/c, Treated Effluent Total Nitrogen Concentration:

  [**100 lbs per day** Total Nitrogen] ÷ [**1.75 million gallons per day** treated flow] = 57.1 lbs Total Nitrogen per million gallons treated per day

  Convert lbs/ MG to mg/L: divide by 8.34 **= 6.8 mg/L Total Nitrogen**

Flow Rate – varies between options

- Example Calculation (3) – Option 3-a/b, Treated Effluent Total Nitrogen Concentration:

  [**100 lbs per day** Total Nitrogen] ÷ [**3.50 million gallons per day** treated flow] = 28.6 lbs Total Nitrogen per million gallons treated per day

  Convert lbs/ MG to mg/L: divide by 8.34 **= 3.4 mg/L Total Nitrogen**

Tour of Wolfe Neck

- Sussex County has graciously allowed for a tour of the Wolfe Neck Treatment Facility on Friday April 28th starting at 3:30pm. If you would like to attend, you must RSVP with the Lewes BPW. Attendance will be limited.

Photo taken by the Cape Gazette and Nick Roth