CITY OF COOS BAY
Agenda Staff Report

MEETING DATE	AGENDA ITEM NUMBER
October 6, 2015	

TO: Mayor Shoji and City Councilors

FROM: Jim Hossley, Public Works Director

THROUGH: Rodger Craddock, City Manager

ISSUE: Presentation - North Spit Waste Water Treatment Plant Proposal by D.B. Western Texas, Inc. (DBWT)

BACKGROUND:

Representatives from D.B. Western Texas, Incorporated (DBWT), will present their proposal for a wastewater treatment plant on the North Spit. The proposal is that the City consider abandoning rebuilding WWTP#2 at Empire Blvd and Fulton Avenue and send the waste destined for that plant to the treatment plant DBWT would design, build and, potentially, operate on the North Spit. The latest proposal received by City staff is dated July 21, 2015. At the August 18, 2015 City Council meeting, a majority of Councilors voted to have DBWT present their proposal at a work session in the Library. As requested by some Councilors, representatives from the Oregon Department of Environmental Quality will be present at the meeting. There will also be members from the City's design team to answer Councilors' questions as well.

BUDGET IMPLICATIONS:

Budget implications depend upon the direction taken by the City Council. No details have been provided to support DBWT's stated cost for the North Spit proposal. No life cycle costs have been presented by DBWT for their proposed project. The proposed project on Empire Boulevard, prepared by the City's design team, includes back up data to support the cost estimate. In addition, life cycle costs were considered and decisions were made in some cases to select and use/install higher cost materials/equipment during the construction phase that will save the City money over the life of the project versus using certain lower cost materials/equipment during initial construction.

ADVANTAGES:

A single centralized wastewater treatment plant on the North Spit that discharges to the ocean could offer some operational advantages if waste from both City plants were to be treated at one plant. However, at this time it is unclear if this centralized plant would provide an immediate and long term cost saving advantage to our rate payers.

Work Session

DISADVANTAGES

Besides the unknown cost issues previously mentioned, other issues or unknowns present disadvantages. The City's procurement process cannot guarantee that the DBWT team (engineer, contractor, and/or operator) would be successful in competing for contracts. The availability and cost to acquire land to construct the North Spit plant is unknown. State Wide Planning Goal #11, and the availability and cost of an ocean outfall create other potential impediments.

ACTION REQUESTED:

This item is a work session presentation by DBWT; staff is not requesting any action.

Coos Bay North Spit Waste Treatment Plant 2

Presented by

DBWT, Inc.

July 21, 2015

Work Session

Table of Contents

		Page No.
I.	Introduction	3
II.	Executive Summary	3
III.	North Spit CB2 (NSCB2) Project Advantages	4
	A. Capital Cost Comparison and Project Schedule	4
	B. Engineering/Technology and Land Values	7
	C. NPDES Permit	16
	D. New Ocean Outfall Engineering, Cost, and Industry	17
IV.	Adverse Health Impacts to Citizens, Fish, and Shellfish	21
	A. CB1, CB2, and NB Effluent Infectious Disease Hazards	21
	B. CB2 Aerosol Potential Health Hazards	24
	C. Adverse Impacts to Oysters, Clams, and other Shellfish	29
	D. Adverse Impacts to Coho Salmon	35
	E. Adverse Impacts to Recreation and Tourism	35
V.	Waste Sludge Conversion to Class A Biosolids	37
VI.	Conclusion	38
VII.	Reference List	39

I. INTRODUCTION

DBWT is globally recognized for its business leadership, chemical engineering expertise, advanced technology and support for both U.S. and International customers. DBWT has successfully provided business development, planning, design engineering, contract administration, construction, operations and maintenance to its customers for 35 years, and valued at well over a billion dollars. DBWT has long term contracts for Operations and Supply with Koch Industries, Georgia Pacific, DuPont and others. DBWT is ISO 9001 Quality Certified for the Manufacture and Maintenance of Industrial Plants (60272-2009-AQ-USA-ANAB). DBWT is a Licensed, Bonded and Insured Commercial General Contractor CCB#150463. We can be found on the Web at www.dbwt.us where a summary and a full copy of this document will be posted.

Our purpose and goal is improving the water quality of our Coos Bay Estuary by initiating the development of a Regional Wastewater Treatment Plant on the North Spit with an ocean outfall. Our estuaries health is currently subjected to adverse impacts from three waste treatment plants in our community. We propose to start with the relocation of the proposed new Coos Bay Plant 2 from Empire to the North Spit, with resulting savings of $7,840,000 to Coos Bay's citizens. Health of our citizens and Marine Habitat will be improved, and hazardous Pathogen contaminated Class B sludge will no longer be spread on farm and forest lands.

II. EXECUTIVE SUMMARY

DBWT offers Environmental, Health, and Economic benefits for the "North Spit Coos Bay 2 Alternate Plan" (NSCB2) to locate the new proposed Coos Bay 2 WWTP (CB2) to the North Spit. A summary of the benefits of NSCB2 are as follows:

1. *Lower Capital Cost.* Save ratepayers $7,840,000 in monthly billings, while cost sharing with industry for developing a new ocean outfall.
2. *Lower Operations and Maintenance (O&M) costs.* Removing all sludge processing and provide more competitive bid to Coos Bay on total O&M costs.
3. *Environmentally Better Solution.* Prevent the CB2 effluent from discharging harmful human pathogens as viruses, bacteria, and parasites into our Bay.
4. *A New Ocean Outfall* for CB2, with a future goal of linking CB1 and NB1 for more favorable dilution and dispersion properties.
5. *Relocate CB2 to an Industrial Zone* .Increase property values, health, and livability in a residential and commercial area of Empire. Figure 1 shows the old and proposed new CB2. Figure 2 shows NSCB2.
6. *City of Coos Bay will own NSCB2, NPDS permits,* and will comply with Statewide Planning Goal 11 due to the health hazards demonstrated in this presentation.
7. *Relieve Adverse Impact to ESA "Threatened Species" Coho Salmon.* Also Green Sturgeon and Smelt (Eulachon).
8. *Reduce Negative Impact to Coos Bay's Recreational and Tourism Industry.*
9. *Reduce negative impact to Our Commercial Oyster, Recreational Shellfish Industries and Sports Fishing Industries.*
10. NSCB2 is the start of a Regional Solution producing legacy benefits to marine life in our estuary, our citizens, and future generations.
11. DBWT will follow DEQ's procedures throughout the designing, permitting, and engineering phases in compliance with DEQ for cities under 30,000 people.
12. DBWT will participate in the DEQ Design Build Operate competitive bid process for the construction of NSCB2.
13. DBWT will comply with Bacon-Davis Act union labor standards at plant construction site.

14. In the event that LNG does not materialize then an alternate funding source for the new ocean outfall could be justified by diverting current and future cost of sludge handling and processing by CB1 and CB2.

Coos Bay's citizens have always risen to every occasion to gather the leadership and action for the benefit of the greater community. Here is the opportunity for the City of Coos Bay to lead the city down a better path, resulting in lower current and future public infrastructure costs along with improving our environment.

III. NSCB2 PROJECT ADVANTAGES

A. Capital Cost Comparison and Project Schedule

Summary:

- *The total cost for CB2 is expected to be $37,400,000 with $32,450,000 currently needed to complete the proposed plant.*
- *NSCB2's fixed bid is $24,610,000, for a total savings of $7,840,000.(Table 1)*
- *A new ocean outfall is planned within NSCB2 master plan*
- *Industry to support the cost of this outfall. This new outfall is designed the total of CB1, CB2, NB1 and Industry.*
- *The completion schedule for NSCB2 is similar to CB2 and is estimated to be 12/17. (Table 2)*
- *CB2 has been delayed due to recent findings of the 42 year old asphaltic **Asbestos** coated pipe-diffuser failure.*
- *CB2 will provide a temporary fix—Complete fix comes later at substantial higher cost*

Capital Cost Comparison:

The City of Coos Bay's Empire WWTP Project (CB2) started in 2004 and was initially projected for a cost of $9,000,000. Figure 1 shows the old and existing site along with the proposed new CB2 location. Todays expected cost to finish is $32,450,000 and startup might occur in Dec. 2017. This expected cost is not a final bid but rather a "cost not to exceed" subject to change orders.

Additionally, on 4/16/15 City commissioned studies on the 42 year old asphaltic ***Asbestos*** coated corrugated metal pipe Outfall for a mixing zone evaluation and inspection of the physical condition of the outfall pipe and diffusers. Results concluded that the diffusers and the asphaltic ***Asbestos*** coated pipeline are badly corroded; requiring replacement, permits, delays; and the estimated cost in line item 13 in Table 1.

The City may have spent over $5,000,000 to date on CB2, in addition to the $32,450,000 needed to complete. Table 1 below shows that without further issues and CB2 spending, NSCB2 will save Coos Bay, Charleston and Bunker Hill ratepayers $7,840,000. Much of the value of past spending and project assets, such as facilities planning, value engineering, permitting, pre-engineering, and financing will be useful for construction of NSCB2. A summary of the important concepts are as follows:

1. DBWT will adhere to the same DEQ requirements as the City, which is the process required by DEQ for cities less than 30,000 people. Requirements that have been completed by City will accelerate the processes for NSCB2. DBWT included these steps mentioned above in our bid and scope of work.
2. DBWT will follow DEQ's mandate on the approval procedures acquiring permits at each step, including directional drilling of an 18 in. pipeline under the bay, and a 40 in. ocean outfall.
3. The City of Coos Bay will own the new NSCB2 plant, permits, and property.
4. DBWT will hire and pay Environmental Consultants and Professional Engineers, linking required environmental permits under one EA from the existing CB2 plant to an ocean outfall.
5. Waste Sludge from CB1, CB2, and North Bend to finished EPA Class A Biosolids will be financed, owned, operated and maintained by DBWT. NSCB2's bid does not require NB1 to participate.
6. Class A Biosolids plant will be designed to handle all of Coos County's waste sludge.

7. Cost for sludge operations and maintenance will be eliminated, including anaerobic digestion, equipment, pumping, storing at the Eastside lagoon, hauling and distribution for both CB1 and CB2.
8. DBWT will provide a Stainless Steel tank at CB1 and pick up on notice, for $32.00/ton.
9. Eastside Lagoons will be eliminated, and be phased out over time, relieving the city of future environmental liabilities and costs.
10. A Professional Consulting Engineer experienced in designing ocean outfalls has agreed to design a new 40 inch UHMW pipeline with a 36 MGD capacity for the entire flow of NSCB2, CB1, North Bend (NB1) and known industrial outfalls. [E10] This system will be at no cost to Coos Bay or its ratepayers.

20 Year Cost Savings

DBWT's advanced technology and engineering capabilities have driven this technical presentation within a very short time, working towards expanding the knowledge and engineering of NSCB2 in consideration of human health, environment, safety, UV disinfection; resulting in a cleaner effluent at a reduced cost, with less impact on people, the estuary, and "Threatened Species". In addition, we have worked with Industry to help fund the outfall for NSCB2 including future effluents volumes from CB1and NB1 and industry. Coos Bay's 20 year projected cost savings would include the following:

1. The savings of capital and interest on $7,840,000.
2. The savings in power by installing a more technologically advanced UV treatment system.
3. The savings of power from removing three pumping systems pumping sludge from CB2 over the hill to CB1.
4. The savings of power, carbon beds, maintenance of odor control systems. CB2's current design does not protect against the odors and aerosols from the aeration basins at Empire.
5. The savings of constructing an office and maintenance building with tools, equipment, power, upkeep and depreciation.

20 Year Cost Risk of CB2

1. Potential risk when DEQ implements future EPA mandates to remove current "Impairments" affecting marine life and recreation. These viral impacts will be included in new NPDES Ambient Water Quality criteria. Future upgrades may result in an Ocean Outfall costing $15M in today's dollars, but there is no industry to help with the cost.
2. Global warming issues are impacting our Estuary. CB1, CB2, and NB1 are creating added impacts of reduced dissolved oxygen (DO), higher temperature, ammonia, phosphates, drugs, estrogens and nutrients. These conditions and toxins are adversely impacting Endangered Species and other marine life, and are linked directly to the three WWTP. The future liability of costs to affect improvement of the above is staggering, and many cities are being required to upgrade to address these issues.
3. DBWT is working with EPA, the University of Illinois, and other WWTP technology companies involved with removing chemicals, estrogens, and drugs from effluents. DBWT plans to obtain grants to implement these new technologies into NSCB2 at no cost to ratepayers; resulting in Coos Bay becoming a National leader in cleaner effluents from WWTPs.

Taking all the above into account the projected 20 year cost of owning NSCB2 will be significantly lower than CB2 at Empire resulting in environmental restoration of the estuary.

Project Schedule

1. The Project Schedule in Table 2 is based upon a parallel path of permitting, planning, and engineering. DBWT's PE Engineers and Environmental consultants have confirmed that we can accomplish NSCB2 buildout on a similar time schedule as CB2.
2. The Port has indicated they will sell property to the City near the existing North Spit outfall. A two acre site would be needed for NSCB2 and the Class A Biosolids plant (Figure 4). Six acres is needed

for a "Regional Plant" incorporating future modules for NB1 and CB1 along with future NPDES process requirements (Figure 1). NSCB2 would be the first step to a "Regional WWTP" for all cities and current and future industries.

3. The known health impacts of CB1, CB2, and NB1, presented in this presentation, will provide sound scientific data as the basis for locating NSCB2 outside the city's urban growth boundary per Statewide Planning Goal 11. [E12]

The Coos Bay and North Bend Water Board is a great example of working together for the greater good of our community. This Board provided a regional solution for delivering water to the City's, North Spit industry, and the Port's industrial zoned property.

TABLE 1
Capital Cost Comparison

CAPITAL COST COMPARISON (MM$)				
		Empire CB2		NSCB2
No.	Item	(6)Total $M Cost	(7) Cost Now	(7)Total $M Cost
1	Engineering	4.20	(1)AE	2.00
2	Value Engineering	0.10	AE	0.06
3	Plant Construction	22.60	22.60	16.20
4	WAS Pumping System	2.70	2.70	(2)N/A
5	Other Costs	3.00	3.00	1.50
6	Land	0.65	AE	0.10
7	Land Credit	N/A	N/A	-0.75
8	Pump Station and Under Bay Pipeline	N/A	N/A	4.00
9	1.5 Mile Effluent Pipeline from WWTP to Outfall	N/A	N/A	1.10
10	Class A Fertilizer Plant	N/A	N/A	(3)N/A
11	Demolition of Old CB2	0.40	0.40	0.40
12	Waste sludge Digestion, Pumping, and Eastside Lagoon	(5)3.00	(5)3.00	N/A
13	Outfall rebuild for CB2	(8)0.75	0.75	N/A
14	New 40" Outfall	N/A	N/A	(4)N/A
	TOTALS	**37.40**	**32.45**	**24.61**

NOTES:

(1) AE = Already Expended

(2) N/A = Not Applicable

(3) DBWT will finance, build, own and operate a Class A Fertilizer facility to allow CB1 + CB2 to eliminate all sludge digestion, pumping to Eastside, and Eastside Lagoons. NB1 would be welcomed to the same program.

(4) $10M for a new 40" Outfall or rebuild existing 30" Outfall will be provided by Industry.

(5) Upgrade and Expand CB1 sludge process and storage.

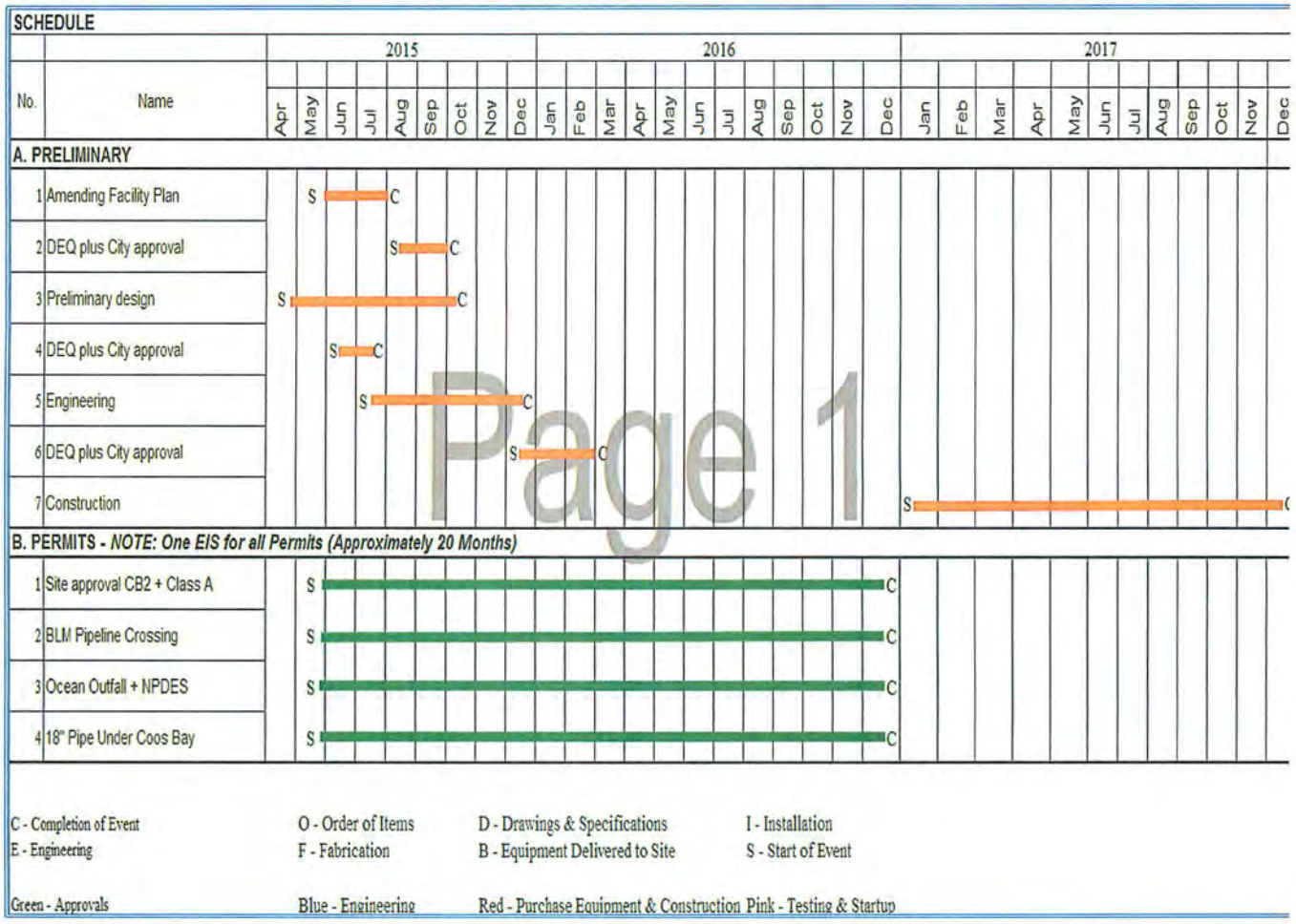
(6) Total cost including expended funds.

(7) Total cost starting 4/15/2015

(8) City Staff indicates only $100,000; however, we believe complete rebuilding to new condition will be closer to $750,000.

NSCB2 Net Savings = $7,840,000

TABLE 2
North Spit Site Preliminary Schedule



B. Engineering/Technology and Land Values

Summary:

- *Empire land values will increase with no CB2 with its odors and potential health issues*
- *Empire will have clean beaches suitable for tourism and local clamming.*
- *NSCB2's technology and engineering will produce a cleaner effluent than CB2*
- *NSCB2 is engineered to meet Tsunami Code, and CB2 is not.*
- *NSCB2 provides infrastructure for job creation through industrial development on the North Spit*
- *NSCB2 provides infrastructure for receiving future WWTP effluents from CB1 and NB1.*
- *DBWT provides processing all County waste sludge to Class A Biosolids.*
- *DBWT provides lower Operation and Maintenance cost.*
- *NSCB2 can meet Oregon Statewide Planning Goal 11 to locate on the North Spit.*

Land Values

1. The $650,000 (paid by the City) for the CB2 Empire property may be resold, plus creating additional revenue from property taxes. The Empire land is beautiful view property, but land values are depressed due to the odor and unsightly nature of CB2. After the old CB2 is removed from this area, land values will increase. Old CB2 property shown in Figure 1 is also beautiful property (without CB2) and may also be sold and added to the tax base or developed into a park and recreational area.
2. With odor, noise, and health impacts removed, along with disruptions by future expansions and upgrades, local residents and tourist visiting our estuary will appreciate our restored shoreline.
3. Digging clams on the Empire beaches can be experienced without the fear of virus and bacteria contamination from CB2.
4. Opponents of NSCB2 have cited Oregon Statewide Planning Goal 11 regarding urban growth boundaries as a reason to end a discussion on NSCB2. Goal 11 states that, "Except where the new or extended system is the only practicable alternative to mitigate a public health hazard and will not adversely affect farm or forest land." [E12]

Risk to public health are as follows:

- Locating a WWTP directly in a residential area with little buffer to residents.
- Viral and bacterial contamination of shellfish.
- Commercial oyster harvest restricted up to 100 days related directly to WWTPs.
- Coho Salmon adversely impacted by viruses.
- Class B Solids on farm and forest land.
- Infectious outbreaks.

5. Oregon State wide planning Goal 11's purpose is to prevent city commercial and residential growth outside their urban growth boundaries. There is no commercial or residential growth aspect to locating a WWTP for the city in the North Spit industrial zone.

Engineering and Technology

1. DBWT is offering the same Sanataire SBR Process as Empire CB2.
2. Cosmetic architectural for constructing a WWTP in a residential area are eliminated.
3. Fugitive odors and the Odor Control System with high capital and maintenance cost are eliminated.
4. CB2 business offices and maintenance buildings are eliminated; DBWT will utilize existing DBWT North Spit buildings and these facilities are included in the OM proposal.
5. Three raw waste sludge pumping stations for pumping sludge from CB2 to CB1 will be eliminated, along with cost, maintenance, and potential upsets with fugitive odors.
6. Capital cost of future upgrades will be much lower. These upgrades may be in excess of $15,000,000 (todays cost), assuming future NPDES permit requirements may involve an Ocean Outfall.
7. Current and future NSCB2 Operation and Maintenance (OM) cost will be lower. DBWT is guaranteeing CB2 O&M costs at 90% of the current fully loaded, allocated and projected CB2 OM cost. The city has contracted with CH2MHill for over 19 years with "No Competitive Bid" at cost plus 19%. We believe an audited OM cost for CB2 with allocated overhead and sludge handling will result in greater than the $550,000/yr offered by DBWT.
8. DBWT presents a firm and total bid, this is <u>not</u> a "cost not to exceed proposal". The City does not know the final firm or total cost of the project in Empire. It would be prudent for the City to stop spending money on their current plan until this lower cost alternative on the North Spit is professionally evaluated.
9. The NSCB2 Plant will produce a cleaner effluent exceeding EPA's NPDES Ambient Water Quality criteria for CB2 at Empire. DBWT's UV system will provide EPA Certified Log 3-4 disinfection (99.9 %) as opposed to CB2's old channel UV technologies with poorer disinfection and higher electrical cost, see EPA Table 3.

10. DBWT has designed NSCB2 to a higher engineering standard for earthquake and tsunami events at an elevation of 43 ft. The Empire CB2 site is in the Tsunami inundation zone and is not designed to sustain a major Tsunami, which may inflict catastrophic devastation and diseases from raw sewage.
11. DBWT has a 100,000 sq. ft ASME Code Fabrication Shop, Engineering Dept., Business Office, Accounting Dept., and Maintenance business on the North Spit. We fabricate and supply replacement equipment for manufacturing plants around the world, our engineering staff designs and produces complete industrial plants with fabricated equipment, training, operations, and startup. We also supply the Distributive control System (DCS) hardware, software, and programing systems.
12. NSCB2 will be engineered for earthquake and tsunami conditions with a laboratory, emergency generator, disinfection system, pumps, blowers, and controls at 43 ft. elevation. This advantage should allow for continued operation during and after a major tsunami.
13. Aeration Basins would have an engineered cover to reduce aerosol emissions which are health hazards for operators and personnel in the general vicinity. [C4]

FIGURE 1
Existing CB2 Empire Site and Proposed New CB2

FIGURE 2
New Site on North Spit

White Line = NSCB2
Red Line = Potential Future 36" Pipeline to Regional Plant

NSCB2 Basic Design

Figure 3 is a Basic Plan View of NSCB2. The building floor housing the blowers, UV systems, emergency generator, lab, electrical equip., I/O instrument remote panel, and all items required to keep the plant running are 16 feet above a 26 foot Tsunami surge wave. The top of the Aeration Basin and the floor of the building is 42 feet above Mean Low Water (MLW). NSCB2 is designed to maintain basic operations during a Tsunami. The primary pump station at Empire is designed with all controls and emergency electrical systems above the Tsunami surge level. CB2 in Empire is not designed to these standards.

Class A Biosolids production is integrated into NSCB2 and is designed to convert all Coos County waste sludge into a safe usable fertilizer certified by the EPA as "Exceptional Quality". Currently, CB1, CB2 and NB1 produce Class B sludge which still contains hazardous pathogens and their eggs.

The basic Sanataire SBR design is the same plant design as CB2 without the numerous outbuildings in CB2. Sanataire's professional team would be involved in design, startup, and operations. Fiber optic cable to DBWT's facilities 1.5 miles west and a DCS (Distributed Computer Control) and cameras as used in large modern industries and will monitor and control the plant. Maintenance and inspections will come from DBWT's facilities.

Figure 4 represents the same Sanitaire design for a Regional Plant including CB1 and NB1. Today's cost for CB1 in the new "Regional Plant" would be $36,000,000 and NB1 would be $14,000,000. These costs include the new UV system, DCS controls, and utilization of the new outfall paid for by Industry. Operation and Maintenance (O&M) for all three plants would be under $1,000,000/yr. This O&M would be about $2,000,000/yr lower than the combined cost of CB1, CB2 and NB1, or a savings over 20 years of $40,000,000, plus interest. DBWT will provide software for a preventative maintenance program.

These costs do not include the pipe line from NB1 and CB1 to the new Plant. Upgrades required in future NPDES permits will cost about 50% less with all three plants in one place along with the lower OM cost. We understand that Regional WWTP may have additional grant opportunities from the EPA, especially if the goals are to meet the EPA Clean Water Act. The Coos Bay Estuary is currently over two times the 14 /100ml FC contamination allowed under this Federal Act (Table 6).

FIGURE 3
NSCB2 Waste Treatment and Class A Biosolids Plants

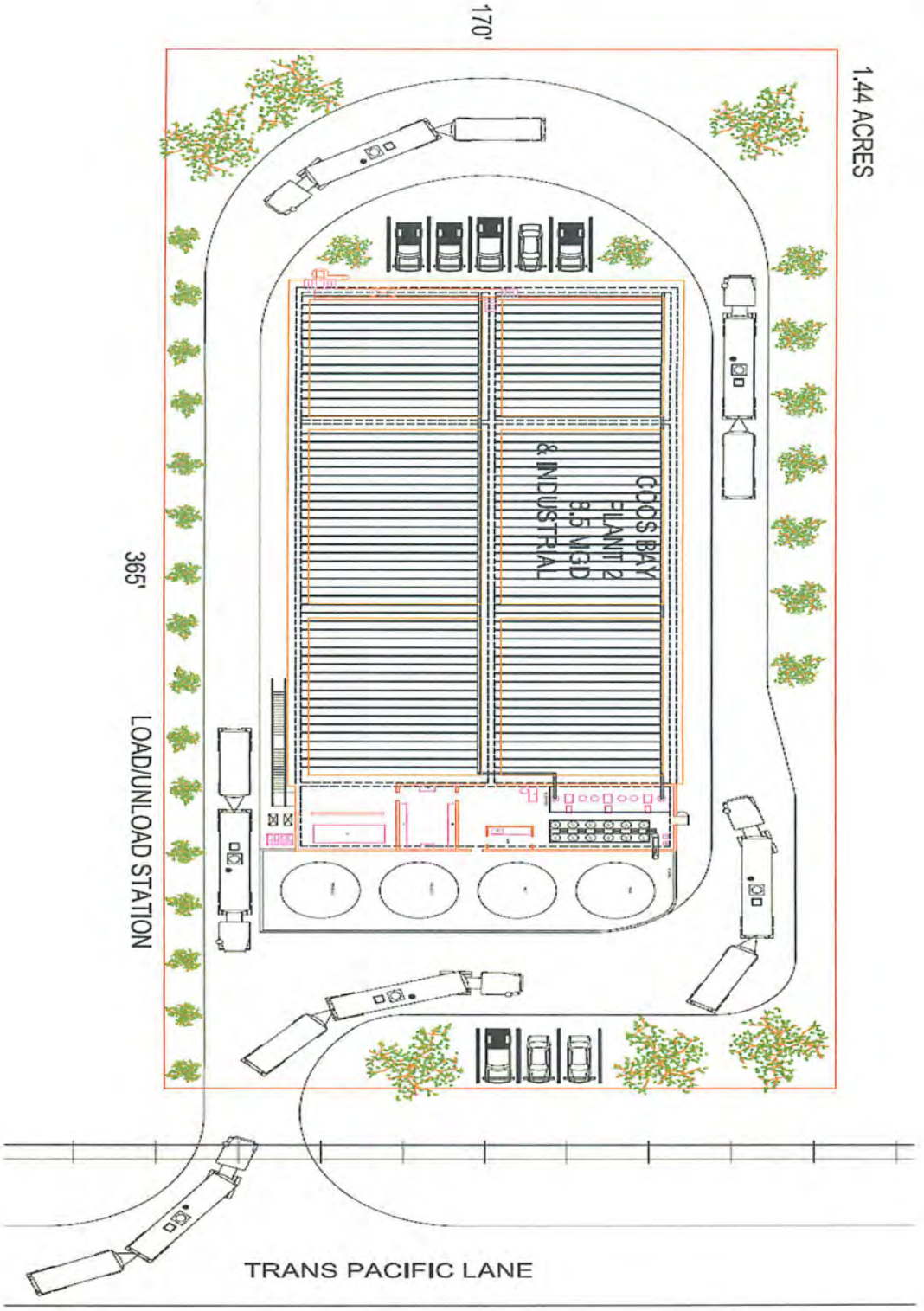
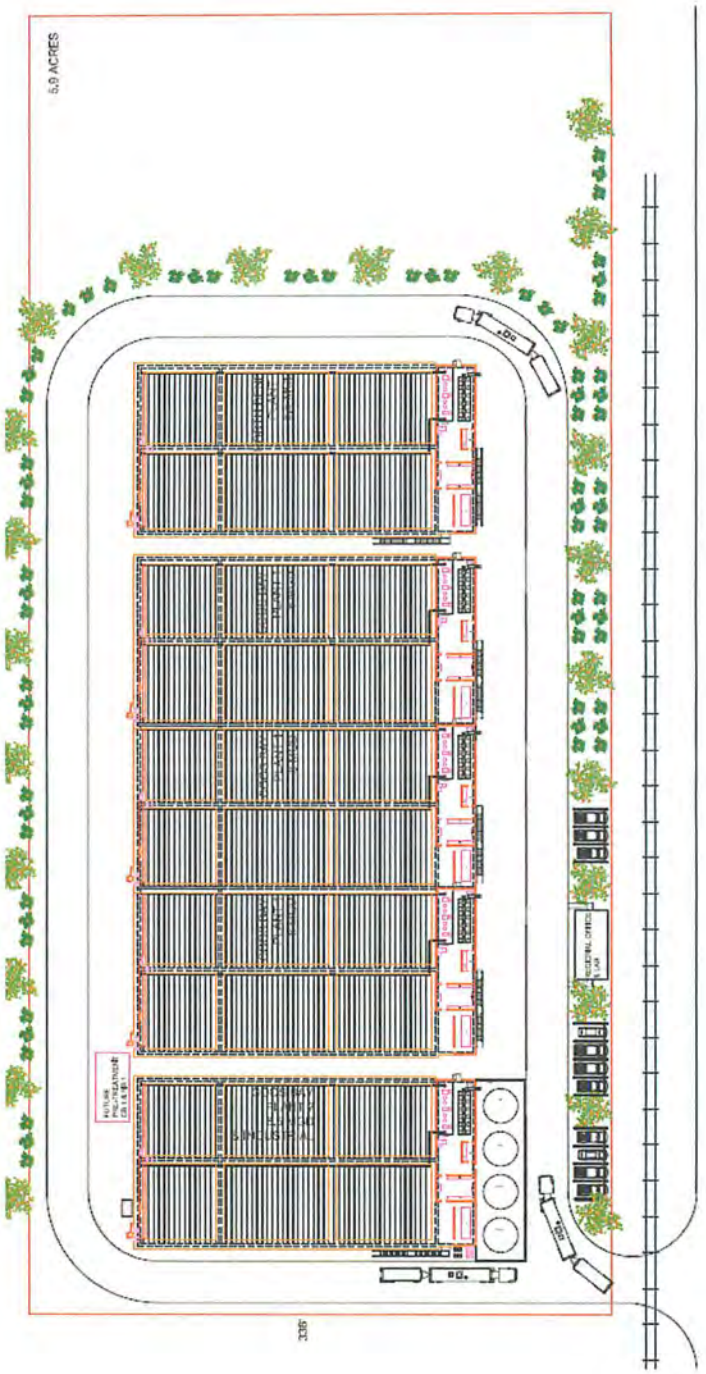


FIGURE 4
North Spit Regional Plant with NSCB2 and Class A Biosolids



UV Disinfection

Why is superior wastewater UV treatment needed for new facilities? EPA is considering the use of F-specific and somatic coliphages as viral indicators of fecal contamination in ambient receiving water." Virus indicators are what Greg Goblick of the US FDA (lead scientist) used in his study evaluating CB1 and NB1 (CB2 testing may be next). EPA and FDA have concluded that Fecal Coliform (FC) is no longer a good indicator for harmful Human Pathogens (see SECTION IV). FC levels are currently used by DEQ for WWTPs discharging into our estuary. However, harmful pathogens at much higher levels than FC are discharging into the Bay and bioaccumulating in our commercial and recreational shellfish at alarming levels as shown Figures 13 and 14.

Chlorine is used by CB1, CB2 and NB1 for disinfection which is effective for treating FC; but it is not as effective on viruses and other harmful pathogens which are adversely affecting the estuary. New UV technologies certified by EPA can kill 99.99% of these harmful pathogens as shown by EPA in Table 3, at Dosing levels above 140 mJ/cm2; high Reynolds Numbers; and Turbulent flows. New technology will be used by DBWT, at 186mJ/cm2. The proposed CB2 design at Empire will be using an older laminar flow and low Dose system (UVC), thus the effluent from NSCB2 will be much cleaner.

NSCB2 will also have added efficiency by installing covered equalization chambers to prevent algae growth, which impacts UV transmittance. In addition, these chambers are baffled and will infuse a small amount of disinfection to prevent the slime precursor to algae growth, which improves UV transmittance. The UV system in NSCB2 has a high Reynolds Number for turbulent flow and 186mJ/cm2 intensity lamps at a controlled band width. Table 3 shows data from the EPA, where NSCB2's 186 mJ/cm2 rates on EPA testing as compared to CB2. Due to the focused band width, the power is 10% of the old channel UV system and the kill rate of Pathogens viruses, bacteria, and parasites is vastly superior. This system is more expensive; however the kill rate results are well worth the cost.

TABLE 3
EPA Data Tables 21 and 22 on UV Disinfection with Dose Strength mJ/cm^2 [E3]

Table 21. UVC inactivation of F-specific RNA coliphage MS2.

Dose (mJ/cm^2)	Surviving density (PFU/mL)	Log survival (log PFU/mL)	Log_{10} inactivation (log PFU/mL)
0	1.00×10^7	7.0	0.0
20	1.12×10^6	6.05	0.95
40	6.76×10^4	4.83	2.17
60	1.95×10^4	4.29	2.71
80	4.37×10^3	3.64	3.36
100	1.20×10^3	3.08	3.92
120	7.08×10^1	1.85	5.15
140	1.48×10^1	1.17	5.83

Source: NWRI-WRF (2012)

Note: DBWT is providing 186mJ/cm^2

Table 22. Log_{10} reduction in coliphages and enteric viruses in secondary effluent after lagooning in sunlight or UVC treatment.

Microorganism	Log_{10} reduction (lagooning)	Log_{10} reduction (UVC treatment)
Somatic coliphages	0.8	0.5
F-specific coliphages	1.6	0.5
Enteroviruses	0.7	0.5

Source: Gomila et al. (2008)

This is what CB2 is going to use.

C. NPDES Permit

Summary:

- *CB1 and CB2 are under DEQ mandates (MAO) and must rebuild or replace to meet their new NPDES criteria.*
- *CB2 is the first to be approved for loans to build an entirely new plant with a new NPDES permit.*
- *CB2 has not obtained approval on their new NPDES and NMF approval is still pending.*
- *NMF preliminary finding is CB2 will "Adversely Impact Threatened Species of Coho Salmon."*
- *CB2 must resolve the recent findings of the Outfall diffuser and Asbestos coated piping failure, along with diffuser system buried in sand, shown in Figures 5 and 6.*
- *CB2's recent Outfall issues will delay the project schedule and cost more.*
- *The original design engineer confirmed to DBWT that the pipe is Asphalt lined, corrugated metal, with* ***Asbestos*** *Coating on the Outside. The divers confirmed the 5 tapered 6x12 inch nozzles with a velocity range from 2-10 ft/sec are mostly dysfunctional and the corrosion is continuous throughout the observed partially buried pipe. The wood piling after 43 years needs to be replaced along with any cross supports. The* ***Asbestos*** *may create further issues. The original drawing obtained by DBWT indicates the installation was not done to the drawings specifications shown in Figure 5.*
- *DBWT would like to bid on the design, build, install, and permitting the temporary replacement along with a bid for the final complete Outfall fix. This temporary fix may cost significantly more than the $100,000 estimate. The proper and permanent fix will be significantly higher.*
- *This temporary fix will allow a mixing study to be completed. This mixing study will demonstrate that 1000:1 diffusion recommended by FDA will NOT be met.* [B9]
- *DBWT will achieve a new NPDES using some of the existing CB2 NPDES material and integrate the under Bay drilling; NSCB2 plant; and the drilling of a new Ocean Outfall into one Environmental Analysis (EA).*
- *NSCB2 will produce a cleaner effluent; in an Industrial zone; with a vastly superior dispersion ocean Outfall—the NPDES should be more acceptable to governmental agencies.*
- *Our Professional Environmental Consultants inform us it will take 18 months for all permits is reasonable.*

Details:

EPA regulates WWTP effluents and their receiving waters through the NPDES permitting process mandated under the Federal Clean Water Act. DEQ is responsible to implement EPA rules through updated reviews of NPDES permits every three years and re-issue of NPDES permits each 5 years. DEQ is significantly underfunded and as a result the majority of NPDES permits are not current and are on Administrative Extensions statewide. The risk of building CB2 at Empire with older technologies; and outdated NPDES permit standards while discharging effluents into an Impaired Estuary; is when EPA/DEQ mandates new Ambient Water Quality criteria. Ratepayers of Coos Bay will fund these future improvements with still higher rates.

Under the current CB2 Empire NPDES permit plan of ***"Repair and Upgrade"***, the City is allowed to present only an EA and BE to evaluate the environmental impact for the receiving waters of Coos Bay. However, CB2 is an entirely ***New*** plant with higher flows of chemicals, estrogens, drugs, ammonia, phosphates, and impacts on temperature to the Bay. The 43 year old existing outfall pipe and diffuser system is intended to be used by this new CB2, thus not triggering a Sec. 404 Permit. This outfall is critical to CB2 and recently was found to have a failed and corroded pipe and diffuser system, which will increase costs for CB2 and push back the expected construction timetable. A temporary fix is planned, with a more costly correct and permanent fix put off to later, requiring a Sec. 404 Permit.

New permits may be required by new EPA NPDES criteria involving viral testing or the potential impacts of the Estrogenic and Viral impacts to ESA threatened Coho salmon as outlined in SECTION IV. We hope the City will curtail spending on CB2 until the issuing of a Sec. 404 application has been resolved; added

costs and delays are factored into the existing budget; and a professional peer review of the merits of NSCB2 are determined.

DBWT is encouraging the City to demonstrate the leadership to use this current and golden opportunity to provide the best technology in engineering at the lowest cost; and clean up our estuary prior to EPA/DEQ mandates cleaner effluents and an Ocean Outfall

EPA's future Virus Indicator for Harmful pathogens

EPA's new NPDES Ambient Water Quality Criteria (which within a few years will be used to determine NPDES permits standards) is suggesting wastewater treatment plants no longer use FC and Enterococcus (EC) as indicators of harmful pathogens, but instead use a virus testing similar to that used in the FDA Coos Bay Hydrographic Wastewater Treatment Plant Discharge Study.[B9] EPA is suggesting a virus which is harmless and attaches itself to bacteria, enters a new host and, uses the bacteria's DNA to replicate then is transmitted to another host. Viruses must enter a host to replicate and the TSS solids in the WWTP effluent provide an ample supply of hosts. FC and EC can multiply in an estuarine environment without a host, this is one reason our estuary is EPA 303 (d) listed "Impaired".

There is a difference between human FC from CB1, CB2, NB1 and FC from other non-point sources. The 2011 FDA study revealed human FC and human toxic viruses were from our CB1 and NB1, and not from non-point storm waters runoff or private septic systems.

D. New Ocean Outfall Engineering, Cost, and Industry

Summary:

- *FDA recommends 1000:1 minimum dispersion of a WWTP effluent near commercial Shellfish growing areas*
- *CB1, CB2, or NB1 do **Not** come close to meeting this 1000:1 criteria; it is less than 100:1*
- *New Ocean Outfall will Discharge 6000 feet Offshore*
- *New Ocean Outfall removes adverse impacts of CB2 and future CB1and NB1*
- *New Ocean Outfall will handle CB1, CB2, NB1, and Industry Wastewater Volumes*
- *New Ocean Outfall will **Not** cost Coos Bay ratepayers*
- *NSCB2 provides first step to future North Spit Regional Solution*

Details:

DBWT's goal is to remove wastewater effluents from the estuary, in addition discharge a cleaner effluent into the ocean. Improving the disinfection processes to remove most Pathogens was presented earlier. The new ocean outfall diffuser system will have a better dispersion model to prevent replication of viruses, bacteria and parasites in new hosts. This improved 1000:1 dispersion model is achieved by discharging effluents a mile offshore into the ocean at 60-70 foot depths with distributors discharging 90 feet apart. Viruses will die to a reasonably safe level within 60-120 days in the ocean with proper dispersion. The existing CB2 outfall has 5 distributors 11 feet below the surface at MLW and 7.5 feet apart. FDA measured the dispersion for NB1 and CB1 at less than 100:1, a significant reason for the high virus loading in sentinel oysters. Discharging effluents into the ocean will help restore marine habitat in our estuary and provide added incentives for other agencies to engage in environmental restoration to the benefit of local citizens and tourists.

This NSCB2 project would allow for the City to:

- *Reduce current and future capital cost, and reduce O&M of Coos Bay's WWTP overhead for ratepayers*
- *Own NSCB2 with a life span well into the future.*
- *Meet NPDES permit requirements well into the future*
- *Own NSCB2, which makes Port properties more valuable and appealing to industrial developers*

- *Help new and existing industry opportunities for creating family wage jobs.*
- *Become known for their environmental restoration effort to improve our estuary water quality from EPA 303 (d) listed "Impaired" to a cleaner bay, and be an environmental model for Oregon's Estuaries.*

The existing Weyerhaeuser ocean outfall is in poor condition and needs to be rebuilt or replaced. This Outfall, if rebuilt, only has a maximum capacity of 13MGD; while 36 MGD is required. Our proposed new 40 inch ocean outfall will have the capacity to handle all Cities' municipal waste and North spit industries.

The existing Coos Bay outfall was built in 1973 and does not meet NPDES mixing zone standards for commercial oyster operation dilution criteria regulated by US FDA regarding viruses. Viral impacts are compounded due to a 48 day "flush out" period in the Coos Bay Estuary as shown below in Table 4. This long flush out period directly effects virus bioaccumulation in shellfish and also exposing all other fish and marine life. FDA determined low slack tides caused CB1 and NB1 effluents to pool up, and then the incoming flood tides pushed the pool of undispersed viruses throughout the Bay as shown in Figures 12 and 13. This variable tidal flow from zero to an incoming and outgoing tide and the inefficient design of the outfalls is responsible for poor effluent dilution, mixing, and dispersion of the viruses as reported by the FDA.

TABLE 4
Coos Bay Flush Out Times [B4]

Calculated flushing rates using the modified Tidal prism method (Arneson 1976).					
Date	Tidal Range (Ft)	Flow (CFS)	Flushing Time (days)		
			RM 7.6	RM 17.3	RM 27.0
Sept. 13, 1973	7.9	28	9.7	22.9	40.3
Dec. 19, 1973	5.9	3814	6.2	11.8	13.4
Mar. 23, 1974	7.2	1074	8.2	14.4	15.9
June 12, 1974	3.3	431	19	41.3	48.5

FIGURE 5
CB2 Outfall Problems

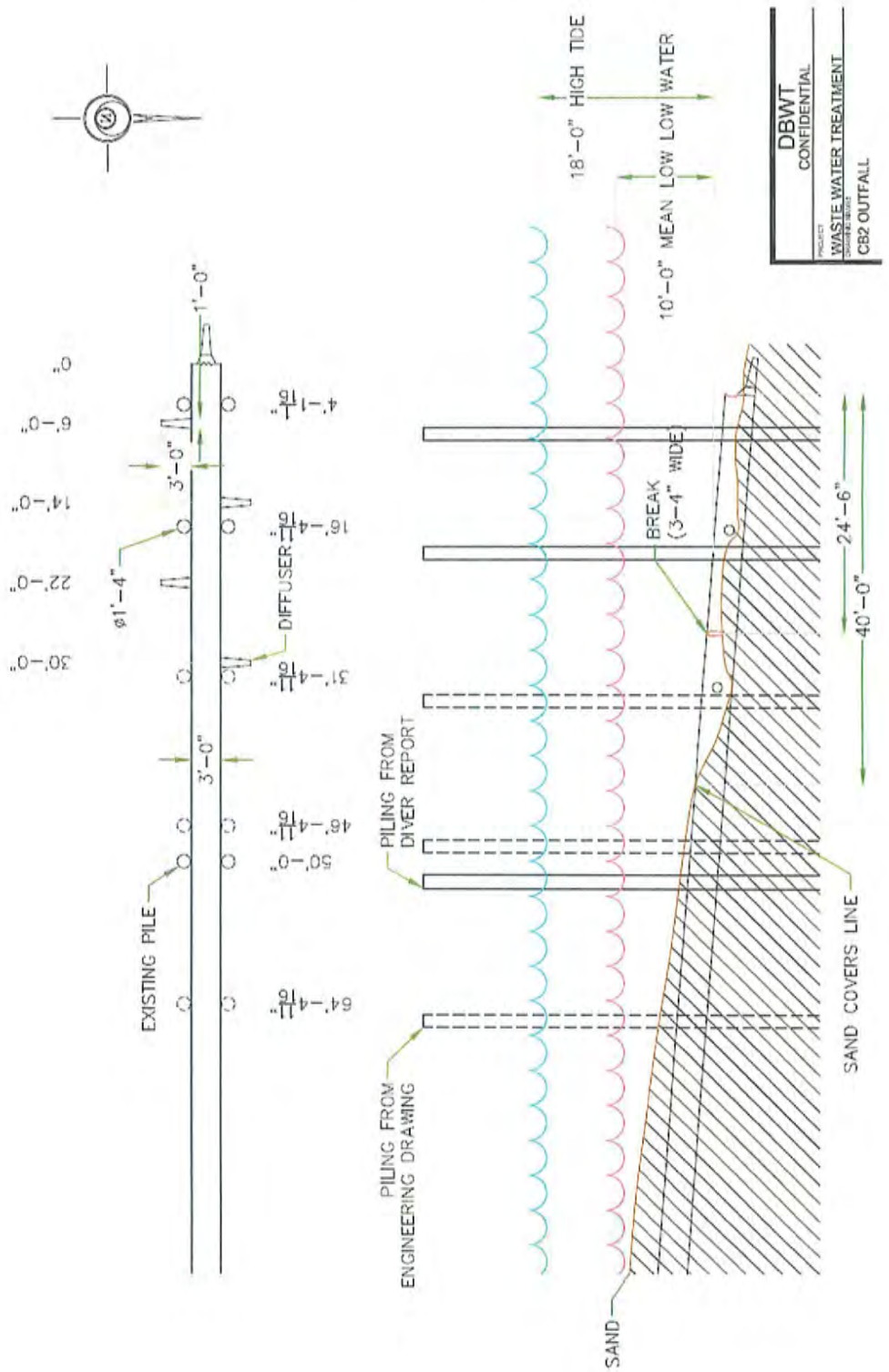
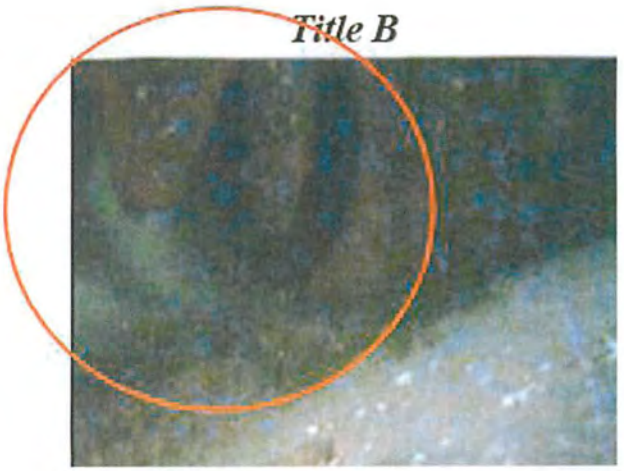


FIGURE 6
CB2 Failed Outfall Pipe and Diffuser Pictures

Title A

West end of 36" outfall at the start of the 12" end diffuser.

Title B



West end of 12" end diffuser.

Title C

3"- 4" break in the main 36" outfall, 24.5' from the west end.

Title D

Sand almost completely covering the 36" main outfall pipe between the first 2 sets of pilings.

IV. ADVERSE HEALTH IMPACT TO CITIZENS, FISH, & SHELLFISH

A. CB1,CB2 and NB Effluent Infectious Disease Hazards

Summary:

- *CB1,CB2,NB1 receive Harmful Human Pathogens –Table 4*
- *CB1,CB2,NB1 discharges Harmful Human Pathogens Tables 4&8*
- *CB1,CB2,NB1 discharges Harmful Pathogens thru Sludge, Effluents, and Bioaerosols*
- *Harmful Human Pathogens as viruses and bacteria are toxic to Humans*
- *Harmful Human Pathogens Bio accumulates in shellfish (oysters, clams, crab etc.)*
- *Infectious disease outbreaks can multiply pathogens by the trillions-Figure 7*
- *Medical antibiotic drugs, infected human waste, street drugs, chemicals, and estrogenic wastes are adversely impacting our fish, shellfish and other marine habitat.*

Details:

Wastewater treatment plants CB1, CB2 and NB are the confluence of deadly human pathogens, viruses, bacteria, parasites, infectious human waste, fungi, molds, yeasts, toxic chemicals, street drugs, antibiotic drugs, synthetic estrogens, and perfumes, as shown in Figure 7. Many of these pollutants will pass through CB2 to the Coos Bay estuary untreated. Some of these contaminants will find new hosts and mutate into new viral strains; some are absorbed in Bioaerosols; some pass into Class B sludge which is applied to upstream farm and forest lands; and some are deactivated in disinfection. These enter our estuary and can infect marine life, bio accumulate in shellfish, enter new hosts and replicate into new viral strains, contaminate our beaches as shown in Figures 12 and 13 ,or get washed out to sea.

When an "Infectious Outbreak" occurs these pathogens can over load the WWTP systems as the numbers in red in Figure 7 demonstrate. This pathogenic explosion into the WWTP effluents, Bioaerosols, sludge, may cycle back through the many pathways pathogens have to return to humans, animals and marine life as mutated organisms called "Strains". According to the CDC, "In the United States, approximately 21 million illnesses attributable to norovirus are estimated to occur annually". [H15] The FDA study shows Norovirus GII has been found in very large infectious quantities in oyster tests in Coos Bay. [B9]

Figure 7 shows paths of harmful pathogens, drugs, and chemicals into the environment from WWTPs'. Quantities in red illustrate during an infectious outbreak pathogens can reach in the trillions per 1 gram of infectious waste, as opposed to the thousands. WWTPs effluent may start the virus cycle, from sludge distribution, effluent outfall discharge, and fugitive Bioaerosols emissions leaving aeration basins. FDA and EPA studies in Tables 5 plus Figures 8, 9, 10, 12, 13, and 14 were not conducted during an "Infectious Outbreak" or a more severe "Pandemic." Figure 7 demonstrates the potential magnitude of toxic load entering and leaving a WWPT during an infectious outbreak.

Viruses and Infection

Effluent disinfection is a critical step in controlling viral infections. EPA has determined FC and EC are not effective indicators of good disinfection. FC and EC are easily killed to an acceptable level below 14/ 100ml, but Viruses (hundreds of different types) are much harder to kill and thousands pass through at levels toxic to humans, as shown is Table 7. Viruses may or may not be toxic to the host but can be transmitted to other hosts whom the virus may be toxic. Norovirus infections in the US are 21 million/yr and in Oregon they are increasing. [H15], [H6] The real infection rate is significantly higher as "Outbreaks" are defined as "two or more cases with symptoms clustered in time and space." [H19]

Deadly Viruses

Deadly viruses such as Bird Flu, Swine Flu, Meningitis, Cholera, West Nile, Polio, HIV 1 and 2, Infectious Salmon Anemia, and Ebola are often in the news today. What is most frightening is when we hear of one of the above, and then later we hear of a new strain or a mutation of the original virus. These are all transmitted thru human and animal wastes.

The current Bird Flu killing over 45,000,000 chickens and turkeys in the mid-west in the last 3 months is a new viral strain carried by wild birds from farm to farm. [H20] This same cross contamination can occur from human and animal waste that are being mixed in the aeration basins. Effluents from WWTP plants have not been treated and disinfected to kill all the pathogens and their eggs are discharged into our Estuary. CB1, CB2, and NB1, have effluents with significant levels of deadly pathogens and their eggs are *not killed*. The waste sludge from these plants has the highest concentration of these pathogens and their eggs. This sludge is treated, however many of the pathogens and eggs survive and this material is being applied to Coos Bay farms and forest lands.

These pathogens are being released into our Bay, Bioaerosols released into the air, and Class B sludge applied onto our farms and forest lands. DBWT's design and engineering of NSCB2 will address all three of these hazardous contaminants to our environment.

Medical professionals recommend washing your hands and surfaces with antibacterial agents to kill these viruses and bacteria; but CB1, CB2, and NB1 dump as much as 36,000,000 gallons per day of effluent into our Bay loaded with these same pathogens. Two semi-trucks of Class B Sludge from the same plants are spreading the waste sludge on farm and forest lands surrounding Coos Bay. This sludge contains the same deadly pathogens and their eggs.

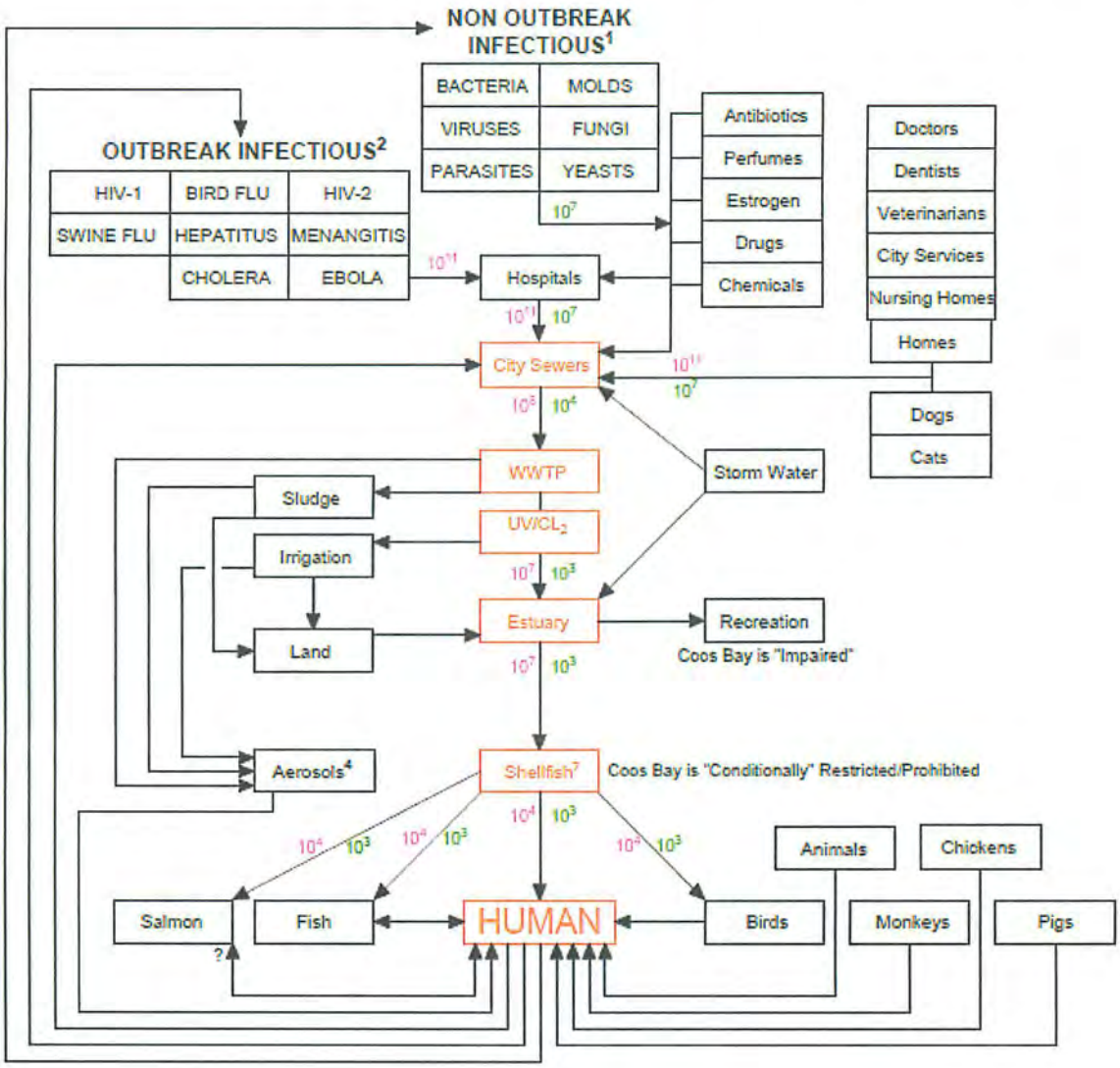
DNA Research

The scientific development of DNA analysis has revolutionized the study of Viruses, Bacteria, and Parasites and tracking their host and mechanisms of transfer from one host to another and the impact of the DNA of the host on variant mutations of Viruses. Viruses most often require a host to replicate and the virus uses the DNA of the host. We all recognize the adage of "What goes around comes around "may be very true in Viruses and Variant mutations or strains. Infectious transfer from Host to Host and potentially back to the same host as a Variant, is creating great concern in the scientific community.

DNA research helped determine that a large Meningitis Outbreak in the Scandinavian countries was caused by airborne viruses traveling from South Africa. HIV-1 is a strain transmitted from monkeys to man; however, a different strain was transmitted to the monkey from man thousands of years ago.

Viruses are deadly in that the new strains can be resistive to current vaccines and these new strains can be transmitted so quickly through a new host that may not even know they are carrying the new strain. Infection may not set in with the carrying host; however this unknowing host may infect another human being or animal.

FIGURE 7
Life Cycle of Infectious Bacteria, Viruses, Parasites



NOTE:

1. Non-outbreak, non-infectious cycle is 10^3.
2. Outbreak Infectious cycle is 10^{11}.
3. 10^{11} = 100,000,000,000 Viruses per 1 gram of excrement from one infected person.
   Norovirus, 95 x 10^9 = 95,000,000,000.
   What if several persons in "outbreak?"
4. WWTP aerosols and effluents are infectious and some always have infectious microbes however quantity can explode during "Outbreak".
5. 10^8 = 10,000:1 Dilution to WWTP
6. 10^7 based on 90% kill of viruses
7. Shellfish, Birds, & Insects are vector mechanisms.

B. CB2 Bioaerosols Potential Hazards

Summary:

- *Bioaerosols from the aeration basin of CB2 contain hazardous viruses and bacteria*
- *Bioaerosols with viruses and bacteria are most concentrated downwind and at night*
- *Bioaerosols in Figure 11 shows the path of harmful fugitive emissions from the proposed CB2*
- *Bioaerosols in Figure 8 shows the adverse health impact from a study in Michigan*
- *Bioaerosols in Figures 9 and 10 shows the adverse health impact from a study in Chicago.*

Details:

The proposed CB2 design in Empire will broadcast Bioaerosols containing viruses, bacteria, parasites, fungi, molds and yeasts pathogens from the aeration basins into the Empire residential neighborhood. These Aeration basins broadcast 1-10 micron size Bioaerosols or bubbles (like opening a can of pop). Bioaerosols have been the subject of many EPA and WHO (World Health Organization) sponsored research projects on human health effects downwind from WWTP's. The consequences of these potential health impacts have resulted in some cities installing buildings, demisters, screens, or a 30 ft. conifer tree buffer zone around these basins. A case history at an Elementary School in Tigard Oregon located 400 yards from an aeration basin and foam from the aeration basin on the playground equipment loaded with pathogens. After this WWTP began operating, a higher absenteeism in 1st and 2nd grade classrooms occurred. [C5] However, no detailed studies were engaged to prove cause and effect.

Another study in Michigan showed significant infections within 600 yards, however they discounted the data due to the people were poor, disadvantaged and less educated (Figure 8). Some residents have said, in public, that if the Empire area were a rich neighborhood the CB2 would not be built there.

Those most affected by these pathogens are our children, the Elderly, and those with immune deficiencies. Bioaerosols can contain 1000 fold higher pathogen load than the liquid in the aeration basin; more sustainable in the evening during higher humidity; and in the summer. [C4] Table 5 exhibits the before and after startup of a WWTP. Figures 9 and 10 shows the CFU/m3 of some Pathogens and their distance from WWTP. Bioaerosols with less than 2.5 um can freely enter the lungs and into the blood stream causing infections. [C7]

Figure 11 shows the Empire site, the proposed CB2 plant, and the rings of demonstrated Bioaerosols range. If you can smell the WWTP, most likely you are ingesting Bioaerosols. Would citizens want to have this WWTP in their backyard? The graph in Figure 8 shows the impact on young children in a Michigan study.

TABLE 5

Aeration Basin Data Tables 2 and 4 on Aerosol Impacts [C3]

TABLE 2. Aerosol densities of SPC bacteria and TABCP

Microorganisms	Density (CFU/m³)							
	Upwind		Downwind (m)					
			<150		150–250		>250	
	Day	Night	Day	Night	Day	Night	Day	Night
SPC bacteria								
Preoperation	43	26	49	55	32	65	52	60
Postoperation	157	297	220	1,325	102	410	194	262
TABCP								
Preoperation	141	76	65	102	113	104	163	270
Postoperation	79	52	272	373	115	175	194	191

Table 4. Micro-organisms identified in the atmosphere in and around a sewage treatment plant

Organism	*Sewage liquor*	*Inside aeration building*	*Inside aeration building stack*	*Downwind from aeration building*[1]
Mycobacterium ...	+	−	+	−
Klebsiella	−	+	+	+
Salmonella	+	−	−	−
Bacillus	−	−	−	+
Flavobacterium ...	−	−	−	+
Aeromonas	−	+	−	−
Moraxella	−	+	−	−
Alcaligenes	−	+	−	−
Streptococcus	−	+	−	+
Micrococcus	−	−	−	+

[1]No organisms identified upwind of the aeration building.
Note: − no organisms present, + organisms identified.

FIGURE 8
Impact of Acute Illness According to Age [C5]

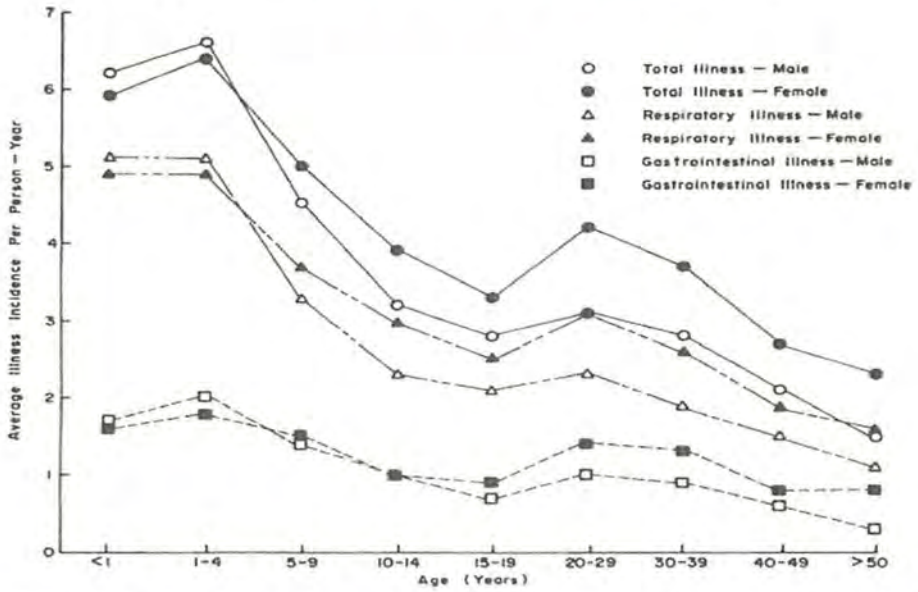


Figure 4. Average Acute Illness Incidence/Person-Year in Tecumseh Study Area, 1965 to 1971

FIGURE 9
Bacterial Infections vs. Bioaerosols Concentration [C1]

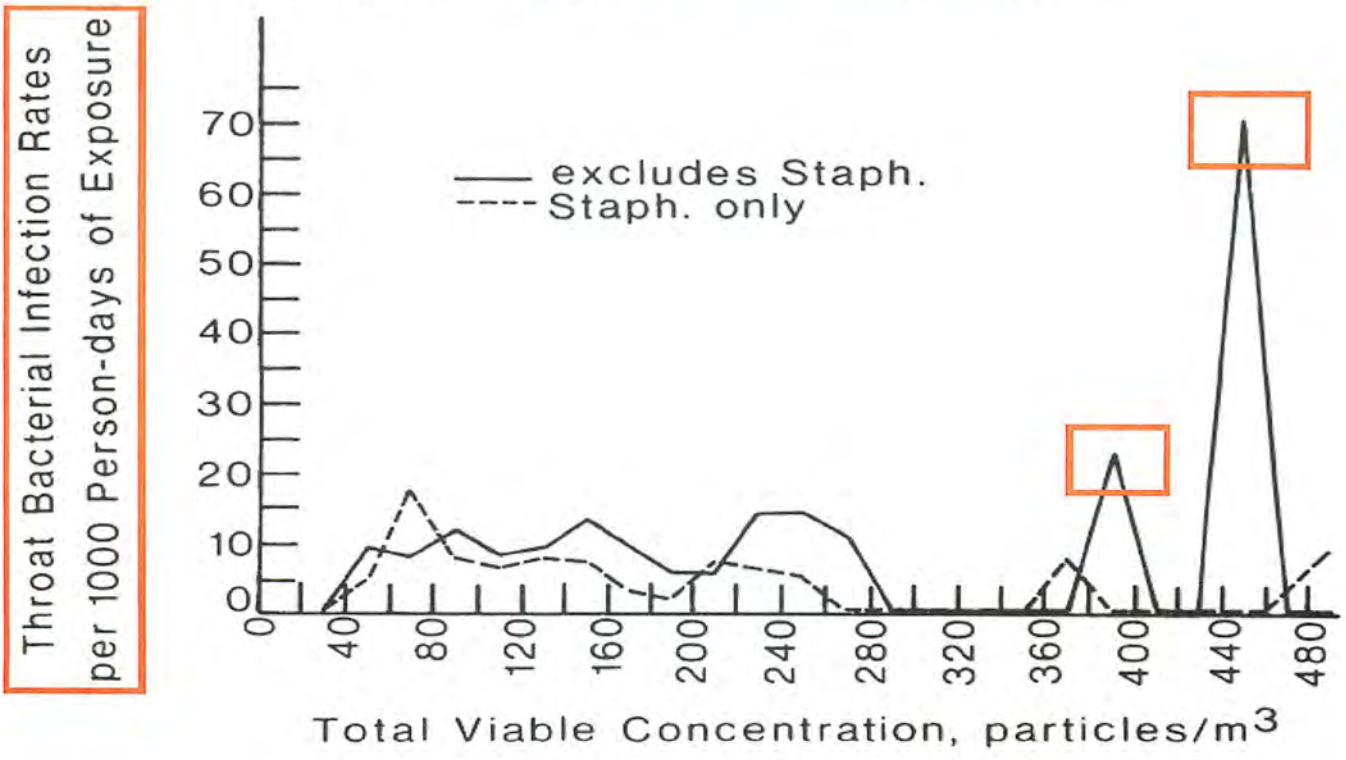
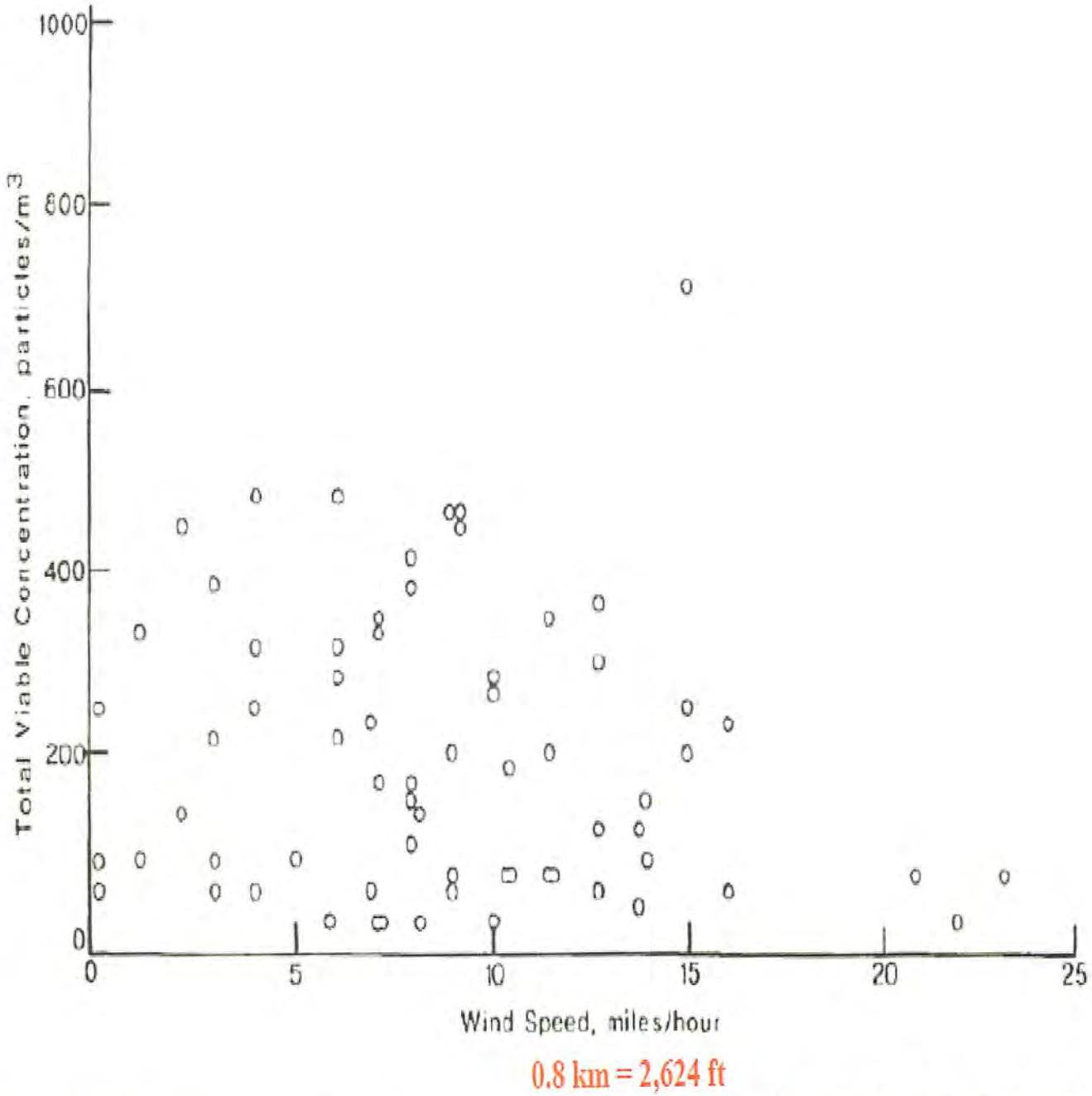


Figure 23. Respiratory infection rates versus total viable particle exposure.

FIGURE 10
Bioaerosols Concentration vs Wind Speed Downwind at 2624 feet [C1]



0.8 km = 2,624 ft

Figure 22. Total viable particle concentration 0.8 km downwind of the plant versus wind speed.

FIGURE 11
Bio-aerosol Trasmission Downmwind from CB2

C. Adverse Impacts to Clams, Oysters, and Other Shellfish

Summary:

- *Shellfish are being contaminated with human pathogens from CB1, CB2, NB1*
- *FDA provided a 16 day scientific study on 2/11/11 verifying contamination in oysters*
- *Human Pathogen levels in shellfish may be toxic and FDA recommends flushing in clean water as required in Europe. This is not done in the USA.* [B4]
- *EPA is proposing new future viral testing which will require future NPDES Ambient Water Quality criteria and increasing cost to Ratepayers.*
- *NSCB2 addresses all of the above issues and eliminates the negative impacts of CB1, CB2, and NB1 discharging into our Estuary.*

Details:

EPA and DEQ have listed the Coos Bay estuary as 303 (d) and Impaired due to FC contamination. Our Bay is over double EPA Clean Water requirements for Estuaries classified for Recreation and Shellfish, which includes both the upper and lower bays. However, it is much worse than Impaired, in that the harmful Virus, bacteria, and parasite loads are well above what the indicator FC has predicted. The primary reason for this anomaly is that FC and EC are easy to kill in the CB1, CB2, NB1 chlorine disinfection system, but not the harmful viruses that survive this treatment. DEQs position that the effluents discharged are cleaner than water in the estuary is based upon FC, and ignores the real toxic hazards of human pathogens (EPA definition).

In 2011 the US FDA did a 16 day scientific study of wastewater effluents in our estuary. This study we believe is part of the "12 year Sanitation Study" (SS) requirements of the National Shellfish Sanitation Program (NSSP) and International Shellfish Sanitation Program (ISSP). [B5] Oregon Department of Agriculture (ODA) is responsible for using these SS results and upgrading protocol for the beneficial health of the public. Table 7 and Figures 12 and 13 show clearly that CB1, CB2, NB1 are the major cause of the harmful human pathogen pollution of our estuary. These three plants are dumping up to 6,000 semi-trucks a day (36MGD) of waste effluents containing toxic human pathogens of viruses, bacteria, parasites, chemicals, medical wastes, into our Estuary. The FDA study demonstrated bioaccumulation into shellfish within 16 days with up to 4000 norovirus units/100grams.or over 100 times the infectious dose to humans.

The World Health Organization (WHO) and EPA have indicated 10 -100 units is toxic to humans. Scientists realize that shellfish are a "Vector Mechanism" to viral infectious diseases. If shellfish have a virus contamination and are not cooked correctly (pressure cooked), a person can become infected. A person may develop antibodies, depending on the virus, which protect them from sickness, but may still pass on the viral infection to our children, the Elderly, and people with immune deficiencies.

Citizens and tourists should have the right to harvest oysters, clams, crab, mussels and sports fish in our estuary without the threat of being harmed by waters contaminated by CB1, CB2 and NB1 discharged effluents.

Shellfish Industry

The Coos Bay oyster industry is the largest on the Oregon coast. The Oregon Department of Agriculture (ODA) is charged with administration of criteria when growers can harvest oysters due to fecal outbreaks originating from CB1, CB2, and NB1. FDA and ISSP set the guidelines. The FDA study mentioned above, demonstrated fecal contamination negatively impacts the oyster growing areas. The permitted growing areas were lowered from conditional to conditional restricted, and restricted harvest days can reach 100 days per year due to CB1, CB2, NB1 fecal upsets due to heavy rainfall. Figures 12 and 13 shows the restricted growing areas in the estuary, and Figure 14 and Table 7 show why. Oysters grown in Coos Bay are sold locally and exported, which adds great value to our economy. Coos Bay and North Bend advertise the unique attributes and natural beauty of the south coast, and tourists and locals expect fresh and safe seafood to be available.

FIGURE 12
FDA Classification for Shellfish in the Coos Bay Estuary [B9]

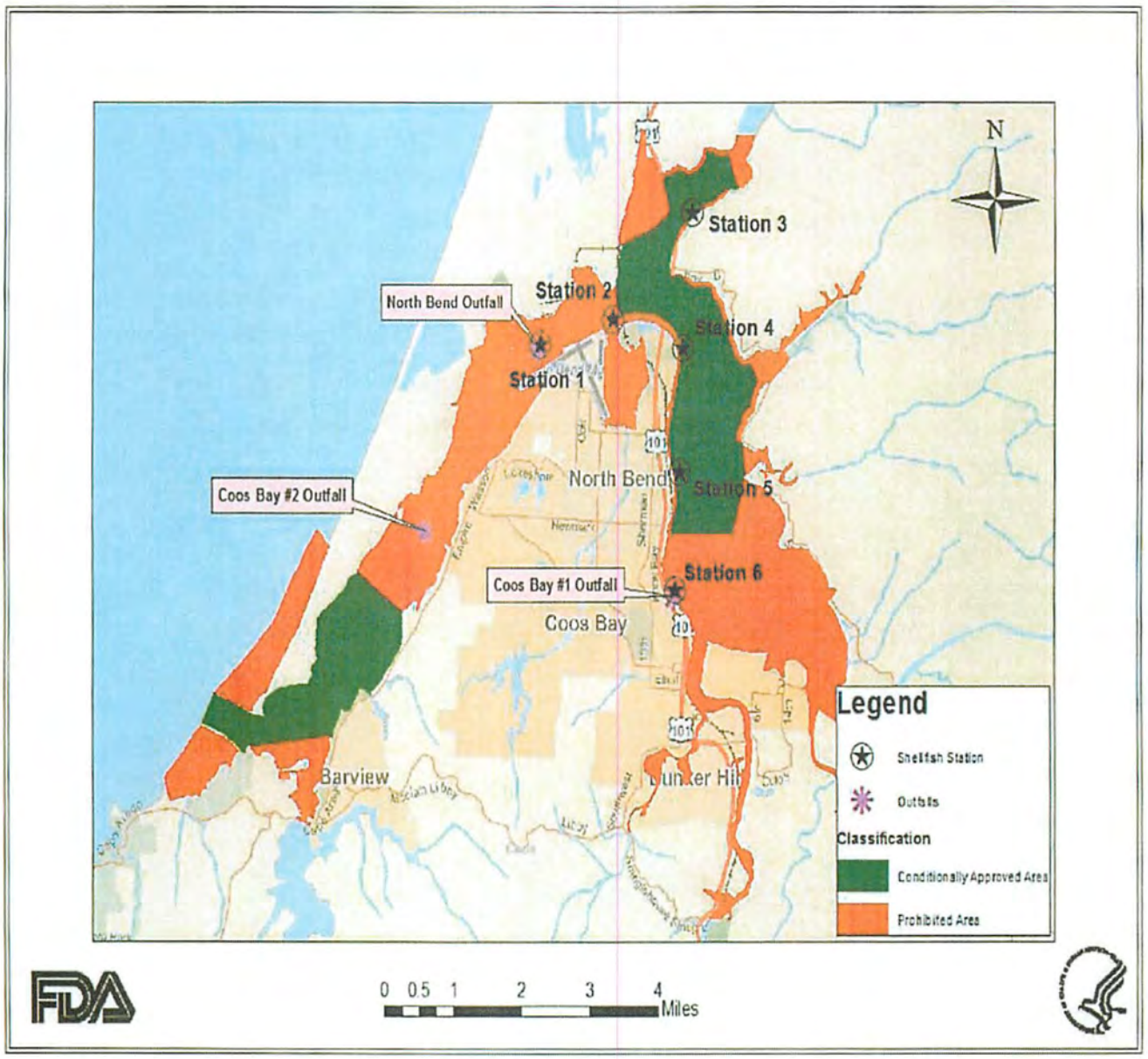


FIGURE 13
FDA Dilution and Virus Tracking February 2011 Study [B9]

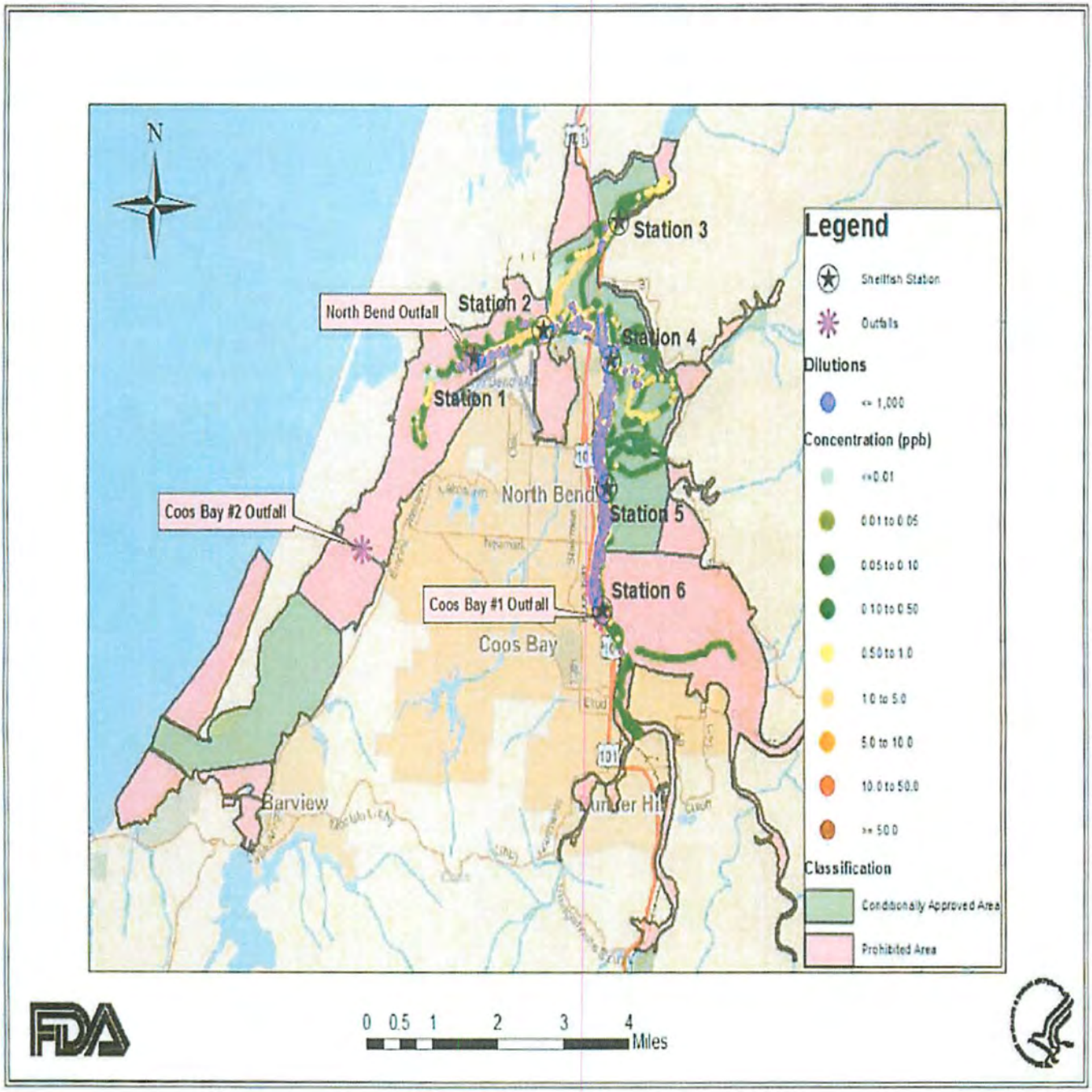


TABLE 6
Bacteria Levels at Coos Bay Shellfish Growing Areas 1999-2014 [B6]

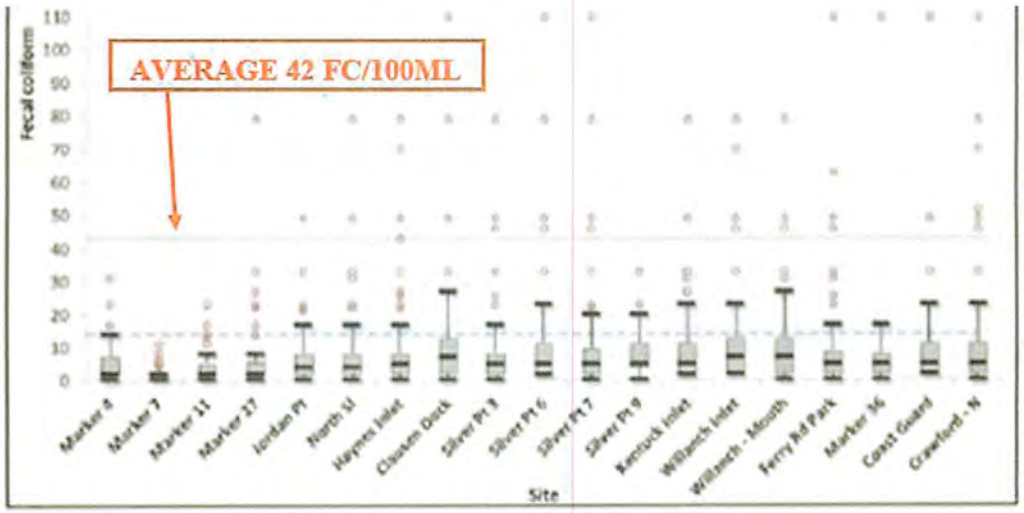
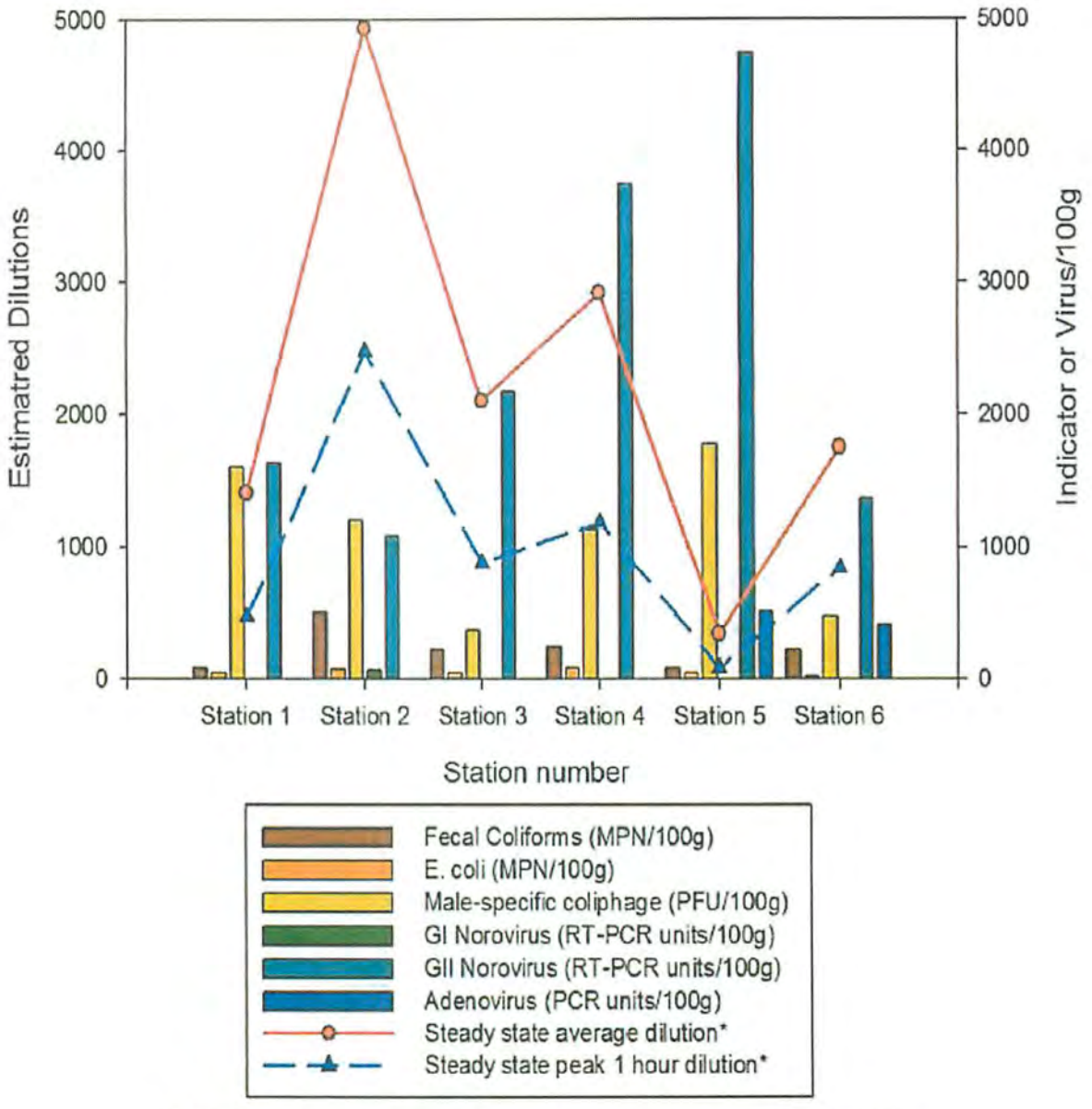


FIGURE 14
Toxic Virus's in Oysters in Coos Bay Estuary [B9]

Figure 15: Indicator Microorganism and Human Virus Levels in Oyster Sentinels Vs. Estimated Dilution Values Based on Impact from Both WWTPs in Combination at Stations 1 – 6



* Note: Dilution numbers are estimated based on two WWTP combination

TABLE 7
FDA Measurement of Human Pathogens in CB1 and NB1 [B9]

Table 1 - North Bend WWTP Influent Data

Date	Time	GI RT-PCR units/100 ml	GII RT-PCR units/100 ml	Adenovirus units/100 ml	MSC/100 ml	EC/100 ml	FC/100 ml
2/6/2011	1:00 to 6:00	<17	14,400	1,270	76,800	1,500,000	2,000,000
2/6/2011	13:00 to 18:00	<17	71,860	7,380	1,176,000	1,500,000	1,500,000
2/7/2011	1:00 to 6:00	24	47,330	1,120	212,000	600,000	600,000
2/7/2011	13:00 to 18:00	80	6,910	1,540	306,000	660,000	695,000
2/8/2011	1:00 to 6:00	<17	6,570	4,680	346,000	785,000	845,000
2/8/2011	13:00 to 18:00	<17	13,000	15,590	280,000	745,000	750,000

ND- Not Determined

Table 2 - North Bend WWTP Effluent Data

Date	Time	GI RT-PCR units/100 ml	GII RT-PCR units/100 ml	Adenovirus units/100 ml	MSC/100 ml	EC/100 ml	FC/100 ml
2/6/2011	1:00 to 6:00	<17	1,970	1,560	3,840	7.0	8.5
2/6/2011	13:00 to 18:00	ND	ND	ND	ND	<0.5	<0.5
2/7/2011	1:00 to 6:00	<17	3,260	530	ND	<0.5	<0.5
2/7/2011	13:00 to 18:00	<17	1,890	63	12,200	12.0	17.0
2/8/2011	1:00 to 6:00	<17	2,500	470	4,000	2.5	3.0
2/8/2011	13:00 to 18:00	<17	<10	1,680	2,000	<0.5	<0.5

ND- Not Determined

Table 3 - Coos Bay #1 WWTP Influent Data

Date	Time	GI RT-PCR units/100 ml	GII RT-PCR units/100 ml	Adenovirus units/100 ml	MSC/100 ml	EC/100 ml	FC/100 ml
2/10/2011	1:00 to 6:00	<17	5,580	4,580	92,000	925,000	955,000
2/11/2011	1:00 to 6:00	<17	3,310	2,731	154,000	850,000	865,000
2/11/2011	13:00 to 18:00	<17	780	6,260	128,000	1,185,000	1,190,000
2/12/2011	1:00 to 6:00	<17	13,610	5,600	108,000	105,000	115,000
2/12/2011	13:00 to 18:00	<17	77,000	25,900	128,000	ND	ND
2/13/2011	1:00 to 6:00	<17	840	990	136,000	1,600,000	1,700,000
2/13/2011	13:00 to 18:00	<17	2,007	890	76,000	2,400,000	2,800,000
2/15/2011	7:28 (grab)	ND	ND	ND	25,400	300,000	360,000
2/15/2011	12:08 (grab)	ND	ND	ND	62,000	1,500,000	1,650,000

ND- Not Determined

Table 4 - Coos Bay #1 WWTP Effluent Data

Date	Time	GI RT-PCR units/100 ml	GII RT-PCR units/100 ml	Adenovirus units/100 ml	MSC/100 ml	EC/100 ml	FC/100 ml
2/10/2011	1:00 to 6:00	<17	2,810	720	8,600	<0.5	<0.5
2/11/2011	1:00 to 6:00	<17	1,140	2,360	12,400	1.50	1.50
2/11/2011	13:00 to 18:00	<17	130	560	8,000	0.50	0.50
2/12/2011	1:00 to 6:00	<17	82	430	9,200	<0.5	<0.5
2/12/2011	13:00 to 18:00	<17	600	460	10,400	ND	ND
2/13/2011	1:00 to 6:00	<17	<17	<10	12,800	1.50	2.50
2/13/2011	13:00 to 18:00	<17	<17	146	17,200	1.50	1.50
2/15/2011	7:28 (grab)	ND	ND	ND	4,400	<0.5	<0.5
2/15/2011	12:08 (grab)	ND	ND	ND	2,200	3.50	3.50

D. Adverse Impacts to Recreation and Tourism

Summary:

- *Our Coos Bay Estuary is polluted mainly by CB1,CB2,and NB1 WWTPs*
- *CB2 and the new CB2 will continue to have an adverse impact to Tourism and our Estuary*
- *NSCB2 will create a Cleaner Bay and open a path to restoration of our Estuary*
- *Coos Bay can set a positive example for our children and visiting Tourists by protecting the environment*

Details:

Tourism is the life blood for many cities along the coast of Oregon. Coos Bay and North Bend expects modest growth through 2037 as our area moves away from much of the forest products heavy industry, while promoting eco-tourism and new industry. The south coast has an incredible amount of natural beauty that needs protection.

Our area has made great strides developing infrastructure such as the Bay Area Hospital, Coos Bay/North Bend Water Board, Coos Art and Maritime Museums, Southwestern Oregon Community College, Boys and Girls Club, Surfrider Foundation, Oregon Institute of Marine Biology Marine Life Center, South Slough National Estuarine Research Campus, and many other community driven organizations. These community driven resources help bring people who want to live here, and for visiting tourists to see this area as a beautiful and pristine place with a colorful past.

Into these great attractions enter the knowledge of our three WWTP's discharging hazardous viruses, bacteria, parasites, pharmaceutical antiviral, and street drugs, and chemicals into our Estuary, creating adverse impacts to Coho salmon, oysters, clams, other shellfish, and making the shoreline and water unfit for recreation. The DEQ states FC and EC are the only human pathogens CB2 is required to test to be in compliance with their NPDES permit. This would be true if FC was the only hazardous bacteria or virus in the effluents. Table 7 shows that FC is by far the least volume or harmful pathogen in these effluents. Viruses may be concentrated over 1000 times FC levels in effluents from these WWTPs.

It would be wonderful to walk along future boardwalks in Coos Bay and North Bend and observe expanded growing areas for our shellfish industry, more sports fishing boats, wind surfing, wading on the sandy beaches, and tourist marveling at our pristine environment. The above example is not the real world of our Estuary today. Is the current path of CB2 going in the direction its citizens wish?

E. Adverse Impacts to Coho Salmon and Other "Threatened Species"

Summary:

- *NSCB2 removes CB2's "Adverse Impact" to threaten species of Coho Salmon from our Estuary and DBWT offers a solution for removing these Adverse Impacts from CB1 and NB1.*
- *Viruses are infecting wild and aqua-cultured salmon throughout the world. An educational video called Farmed Salmon Exposed shows these viral impacts to salmon and other fish. This video can be found at http://articles.mercola.com/sites/articles/archive/2010/11/30/farmed-salmon-exposed.aspx or on YouTube.*
- *Estrogens from WWTP are impacting all fish including salmon by de-masculinization of the male species and preventing procreation.* [A5]
- *Specific amino acids from dead spawning salmon are the navigational tool used by salmon to find a particular river.*
  Perfumes and other odorants from the WWTP effluents interfere with this navigation.

Details:

US NMFS, (National Marine Fisheries Service) is responsible for protecting species listed under the Threatened and Endangered Species Act. NMFS has rendered a preliminary opinion stating that the new CB2

effluent will "Adversely Impact" known threatened species of Coho salmon migrating through our estuary. NMFS will study this issue and render a final opinion for the new CB2 in the coming months. NMFS may consider an NSCB2 alternate solution to discharging effluents into the estuary by using a North Spit Waste Water Plant with an Ocean Outfall.

Threatened and Endangered Species

Coho salmon are ESA (Endangered species Act) listed as a threatened species. Coho salmon enter and feed in the Coos Bay estuary. Young Coho salmon hatched in the Coos river system, feed in the Bay to prepare for their long jury in the Ocean. Coho salmon and their food supply are exposed to the effluents from CB1, CB2, and NB1, which elevates their mortality rate. Shellfish and other marine organisms are known to bioaccumulate viruses and pathogens known to be infectious to Humans, and are consumed by young and mature salmon. Salmon can transmit to humans, toxic viruses and salmon can transmit toxic viruses between each other and different salmon species. There are major salmon virus concerns in the world as both cultured and wild salmon viruses are mutating and spreading. The Coos Bay Estuary has long "Flush Out "times as long as 48 days and three Waste Treatment Plant discharging a host of viruses. This confluence of viruses, marine organisms, young and mature salmon, food supply for the salmon allows for opportunities for viral transmissions and creation of new strains.

Removing the effluents from the Bay with their adverse impacts of viruses, bacteria, dissolved oxygen, temperature, ammonia, phosphates, estrogens, and chemicals. This is a wise and prudent path since the NSCB2 is available at a lower cost.

Salmon Viruses

Viral disease issues may be associated with WWTP effluent discharge are emerging relating to juvenile salmon, both cultured and wild. Viruses can be preserved in frozen fish over 9 months, then discharged through human wastes to the WWTP then into our estuary. Juvenile salmon are most vulnerable to viral, bacterial, and parasitic organisms leaving WWTPs. Is it possible these viruses are infecting young salmon leaving the estuary and adult salmon upon return? WHO believes parasites and viruses from WWTP's are a major problem. There is mounting research on viruses, their variants, and a host transfer mechanisms within fish. The number of viruses and their ability to mutate into a variant strains is unlimited.

The Coos Bay estuary, with its extended flush out time (48 days in the summer) and three large WWTP's discharging effluents (36,000,000 MGD) loaded with toxins and synthetic estrogen into our waters where juvenile and adult wild salmon exist is of great concern.

Scientists are very worried about the rapid increase in viruses affecting fish, specifically salmon. In 1981 there were 15 deadly viruses recorded in fish, many in salmon. Now there are over 95 infectious viruses, many deadly to young salmon. [A2] Salmon also have toxic viruses which can be transferred to humans. Little has been studied regarding human consumption of fish and waste residues entering WWTP's. Are viruses incubating in the aeration basin infecting young salmon on their passage through an estuary?

Salmon and Estrogens

Major WWTP pollutants impacting fish, especially salmon, are odorants (perfumes etc.), and synthetic estrogens (hormone modifiers). [A12, A13, A14] Scientific research has well documented that synthetic estrogens can lead a fish species to extinction by altering the male fish hormone makeup, which demasculinizes the male to a point of preventing procreation. [A5]Also, estrogens and other odorants flowing through WWTP's can alter the salmon's sensory homing instincts away from their spawning stream. Scientist believe complex amino acids provide this sensory path for salmon to return to their spawning grounds. Interestingly, human male testosterone levels have significantly declined and environmental impacts appear to be an indicating factor. [H1] Viruses and toxic chemicals need to be removed from our estuary. NSCB2 will incorporate the best disinfection technology available and disperse effluents into the ocean one mile offshore.

V. Waste Sludge Conversion to Class A Biosolids

Summary:

- *DBWT will build at its own expense own and operate a Class A Biosolids Plant on the North Spit*
- *Class A Biosolids process kills all pathogens and eggs—**Class B does not***
- *All WWTP waste sludge in Coos County can be picked up by DBWT and converted to Class A Biosolids*
- *CB1 and CB2 can eliminate all future capital, operation, and maintenance cost for waste sludge digesting, storage, hauling, and application of Class B sludge.*
- *Eastside Lagoons may be eliminated*
- *DBWT will supply a tank and pumps at CB1 or any other WWTP.*
- *CB1,CB2,NB1 price is $32 per ton which includes freight to NSCB2*
- *Liability, Health, and environmental issues of Class B sludge are eliminated*
- *Many countries in Europe and Counties in California have banned Class B sludge application to land.*
- *"EPA cannot assure the public that current land application practices are protective of human health and the environment"* [D13]

Waste sludge and Class B Sludge Health

CB1, CB2 and NB1 currently process their waste sludge to Class B standards. Class B sludge still contains many of the harmful pathogens and their eggs. The EPA highly regulates where and how this sludge is applied to land and recognizes the inherent potential of spreading disease. This may be the reason several countries in Europe and several Counties in California and elsewhere have banned use of Class B sludge applied onto Land.

Most sludge is currently incinerated or converted to a Class A Biosolids. There are more large cities converting from incineration to Class A Biosolids for beneficial agricultural use. Some of the newer processes are using above 70 °C for a quicker and more complete kill of the pathogens and their eggs. DBWT will use 80 °C.

Benefits for Cities

CB1 and CB2 will have to spend a significant amount of capital in the coming years to handle and process their waste sludge to Class B. The city may wish to evaluate their total sludge handling cost of maintenance, operation, liability, odors, hauling to fields, Eastside lagoons, and health impacts. Over 18 cities in southwest Oregon are currently contracted to haul their waste sludge to Roseburg for $50-55 /ton and it is not being converted to Class A Biosolids but rather applied to a farmer's field, thus the liability of pathogens disease outbreaks or environmental issues still rest with the city as it is still the city's waste. Conversion to Class A Exceptional Quality removes that liability and concern.

Lawsuits over Class B land application and health hazards can researched by Googling "health hazards of Class B sludge on farms" along with the many very unhappy citizens living in the area of land application. Land owners must not allow domestic animal on the applied land for a month; however, many diseases are carried by insect, birds, cats, wild animals that a cattle fence does not screen out. Class A prevents all these possibilities, and more farms and forests will welcome its application. Table 8 shows the distribution of chronic diseases of residences living within one mile of Biosolids application. Coos County will benefit as DBWT has designed the facilities to handle all the raw waste in the county.

TABLE 8
Biosolids Diseases on Farms [D6]

Table 3.—Distribution of Chronic Diseases of Residents Living Within 1 Mile of Farm Fields Where Biosolids Application Was Permitted (Exposed) and Residents Living > 1 Mile From Such Fields (Unexposed)

	Exposed (n = 437)		Unexposed (n = 176)		
Disease/condition	n	%	n	%	p
Asthma	52	12.3	17	9.9	.406
Emphysema	12	2.9	1	0.6	*.025*
Crohn's disease	1	0.2	1	0.6	.582
Migraine headache	39	9.3	16	9.4	.956
Ulcerative colitis	4	1.0	0	0.0	.099
Chronic bronchitis	26	6.2	5	2.9	.066
Irritable bowel syndrome	30	7.1	16	9.4	.380
Allergies	129	30.5	50	29.2	.762
Multiple sclerosis	5	1.2	0	0.0	.065
Parkinson's disease	4	1.0	0	0.0	.099
Scleroderma	3	0.7	0	0.0	.153
Skin disease	22	5.2	10	5.9	.752
Poliomyelitis	3	0.7	2	1.2	.619
Autism	3	0.7	0	0.0	.153
Skin cancer	9	2.1	4	2.3	.868
Arthritis/osteoarthritis	12	2.8	1	0.6	.057

Note. The italicized p value is significant at .05.

VI. CONCLUSION

We offer this proposal for the purpose of providing a complete solution to the risks of CB2 on its current path. CB2 will cost the taxpayer more now and even more in the future. In addition, the heath of the residents in Empire are impacted along with their property values and rightful entitlement to dignity of living standards. CB2 will result in further adverse impacts to the health of the Bay and its many wonderful marine creatures including the Coho salmon, clams, oysters and other shellfish.

DBWT's effort and goal is for holistic solutions for our community:

1. ***Lower Capital Cost. Save ratepayers $7,840,000 in monthly billings***
2. ***Produce a cleaner effluent for the environment***
3. ***No longer discharge effluents to the Coos Bay Estuary.***
4. ***Reduce the hazards of Bioaerosols from the aeration basins***
5. ***Convert all waste sludge to a safe and environmentally friendly Class A fertilizer.***
6. ***Master plan for removing all waste effluents from our Estuary and hazardous waste sludge from our farms and forest lands***
7. ***Create Infrastructure for the North Spit to promote future job creation***
8. ***Improve the quality of life for all Coos County families and tourists***

Seldom has there been a time in the history of our area when there are mutual interests and an opportunity for the Cities, Port, and North Spit Industry to work together and build a better public infrastructure. This legacy project is a win, win and will benefit for citizens and future generation perpetually.

VII. REFERENCE LIST

Fish Related References:

A1. "Ecosystems & Environment: Wastewater Treatment." EPA. Environmental Protection Agency. Web. 8 May 2015. URL: http://www.epa.gov/research/endocrinedisruption/wastewater.htm

A2. Johnson, Lyndal L., Gina M. Ylitalo, Mary R. Arkoosh, Anna N. Kagley, Coral Stafford, Jennie L. Bolton, Jon Buzitis, Bernadita F. Analucion, and Tracy K. Collier. "Contaminant Exposure in Outmigrant Juvenile Salmon from Pacific Northwest Estuaries of the United States." *Environmental Monitoring and Assessment* 124.1-3 (2007): 167-94. Springer.com. Web. 14 May 2015. URL: http://link.springer.com/article/10.1007%2Fs10661-006-9216-7

A3. Novotny, L., L. Dvorska, A. Lorencova, V. Beran, and I. Pavlik. "Fish: A Potential Source of Bacterial Pathogens for Human Beings." *Vet. Med.* 49.9 (2004): 343-58. Web. 5 Mar. 2015. URL: http://www.vri.cz/docs/vetmed/49-9-343.pdf

A4. "Protecting Fish and Fish Farmers from Infectious Diseases." *Water Treatment, Quality Water Treatment.* Web. 14 May 2015. URL: http://www.xyleminc.com/en-us/industries/aquaculture/Documents/protecting-fish-and-fish-farmers-from-infectious-diseases.pdf

A5. Vajda, Alan M., Larry B. Barber, James L. Gray, Elena M. Lopez, Ashley M. Bolden, Heiko L. Schoenfuss, and David O. Norris. "Demasculinization of Male Fish by Wastewater Treatment Plant Effluent." *Aquatic Toxicology* (2011): 213-21. *Internet Archive.* Elsevier. Web. 14 May 2015. URL: https://ia601607.us.archive.org/20/items/readable-id-goes-here-archive/Demasculinization-of-male-fish-by-wastewater-treatment-plant-effluent-Vajda-et-al.-2011-Demasculinization-of-male-fish-by-wastewater-treat.pdf

A6. "Parasites Outweigh Predators in Pacific Coast Estuaries." *EurekAlert!* 23 July 2008. Web. 18 May 2015. URL: http://www.eurekalert.org/pub_releases/2008-07/nsf-pop072308.php

A7. Hayward, Lisa. "Related:" *Fish Virus May Help Save Human Lives.* 17 Oct. 2013. Web. 18 May 2015. URL: http://www.usgs.gov/blogs/features/usgs_top_story/fish-virus-may-help-save-human-lives/

A8. "Simon Fraser University Engaging the World." *Lethal Atlantic Virus Found in Pacific Salmon.* 17 Oct. 2011. Web. 18 May 2015. URL: http://www.sfu.ca/university-communications/media-releases/2011/lethal-atlantic-virus-found-in-pacific-salmon.html

A9. "Steelhead Trout (Oncorhynchus Mykiss)." *NOAA Fisheries.* Web. 21 May 2015. URL: http://www.fisheries.noaa.gov/pr/species/fish/steelhead-trout.html

A10. Baynes, Alice, Christopher Green, Elizabeth Nicol, Nicola Beresford, Rakesh Kanda, Alan Henshaw, John Churchley, and Susan Jobling. "Additional Treatment of Wastewater Reduces Endocrine Disruption in Wild Fish—A Comparative Study of Tertiary and Advanced Treatments." *Environmental Science & Technology Environ. Sci. Technol.* 46 (2012): 5565-573. Print. URL: http://pubs.acs.org/doi/abs/10.1021/es204590d

A11. Blanchfield, Paul J., Karen A. Kidd, Margaret F. Docker, Vince P. Palace, Brad J. Park, and Lianne D. Postma. "Recovery of a Wild Fish Population from Whole-Lake Additions of a Synthetic Estrogen." *Environmental Science & Technology Environ. Sci. Technol.* 49 (2015): 3136-144. Print. URL: http://pubs.acs.org/doi/abs/10.1021/es5060513

A12. Hallgren, Per, Alice Nicolle, Lars-Anders Hansson, Christer Brönmark, Lina Nikoleris, Murtaza Hyder, and Anders Persson. "Synthetic Estrogen Directly Affects Fish Biomass and May Indirectly Disrupt Aquatic Food Webs." *Environ Toxicol Chem Environmental Toxicology and Chemistry* 33.4 (2014): 930-

36. Print. URL: http://www.ncbi.nlm.nih.gov/pubmed/24615795

A13. Bjerregaard, Poul. "Estrogen Mimicking Effects of Xenobiotics in Fish." *Acta Veterinaria Scandinavica* 54.1 (2012): 1-2. Print. URL: http://www.actavetscand.com/content/pdf/1751-0147-54-S1-S12.pdf

A14. Kidd, K. A., P. J. Blanchfield, K. H. Mills, V. P. Palace, R. E. Evans, J. M. Lazorchak, and R. W. Flick. "Collapse of a Fish Population after Exposure to a Synthetic Estrogen." *Proceedings of the National Academy of Sciences* 104.21 (2007): 8897-901. Print. URL: http://www.pnas.org/content/104/21/8897.full.pdf

A15. *Coastal Watershed Factsheets - Estuaries and Your Coastal Watershed*. United States Environmental Protection Agency, 1998. 1-7. Print. URL: http://water.epa.gov/type/oceb/fact5.cfm/

A16. *Fact Sheet: EPA Action on Toxics Water Quality Criteria to Protect Aquatic Life*. Portland, OR: State of Oregon Department of Environmental Quality, 2013. Print. URL: http://www.deq.state.or.us/wq/standards/docs/toxics/EPAactToxics.pdf

A17. Bay Area Hospital Pharmaceutical Disposal Policy. Print.

A18. "Viral Hemorrhagic Septicemia." *Wikipedia*. Wikimedia Foundation. Web. 18 May 2015. URL: http://en.wikipedia.org/wiki/Viral_hemorrhagic_septicemia

Shellfish Related References:

B1. "Native Oysters." *Partnership for Coastal Watersheds Native Oysters Comments*. Web. 15 May 2015. URL: http://www.partnershipforcoastalwatersheds.org/native-oysters/

B2. Bosch, A., R.m. Pintó, and F. S. Le Guyader. "Viral Contaminants of Molluscan Shellfish: Detection and Characterisation." *Shellfish Safety and Quality* 167 (2009): Pages 1-11. Print. URL: http://archimer.ifremer.fr/doc/00066/17768/15284.pdf

B3. "Outbreak of Vibrio Parahaemolyticus Infections Associated with Eating Raw Oysters -- Pacific Northwest, 1997." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 12 June 1998. Web. 18 May 2015. URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/00053377.htm

B4. Roye, Cyndi. *Natural Resources of Coos Bay Estuary*. 6th ed. Vol. 2. Portland, Or. Research and Development Section, Oregon Dept. of Fish and Wildlife, 1979. 13. Print. URL: http://oregonstate.edu/dept/ODFW/freshwater/inventory/pdffiles/Natural%20Resources%20of%20Coos%20%20Estuary%20No.6.pdf

B5. *National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish*. 2013 Revision. ed. U.S. Dept. of Health and Human Services, Public Health Service, Food and Drug Administration, 2013. Print. URL: http://www.fda.gov/downloads/Food/GuidanceRegulation/FederalStateFoodPrograms/UCM415522.pdf

B6. "Chapter 3: Water Quality in the Coos Estuary and Lower Coos Watershed." *Coos Estuary Inventory Project*. Partnership for Coastal Watersheds. 94. Print.

B7. Kundu, Pijush K., and J. S. Allen. "Some Three-Dimensional Characteristics of Low-Frequency Current Fluctuations near the Oregon Coast." *Journal of Physical Oceanography J. Phys. Oceanogr.* (1976): Page 181. Print. URL: http://journals.ametsoc.org/doi/pdf/10.1175/1520-0485%281976%29006%3C0181%3ASTDCOL%3E2.0.CO%3B2

B8. CB2 Outfall Pilings and Clamming Photo

B9. U.S. Food and Drug Administration, *Hydrographic Studies of Wastewater Treatment Plant Discharges in Coos Bay, Oregon, FDA Technical Assistance and Research Project.* February 2011. Pages 25, 26, 36, 58. PDF file.

B10. Ohrel, Ronald L. "Chapter 17: Bacteria Indicators of Potential Pathogens." *Voluntary Estuary Monitoring a Methods Manual*. 2nd ed. Washington, DC: U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds, 2006. Pages 17-1 - 17-20. Print. URL: http://water.epa.gov/type/oceb/nep/upload/2009_03_13_estuaries_monitor_chap17.pdf

B11. Beran, George W. *Handbook of Zoonoses*. 2nd ed. Boca Raton, Fla.: CRC, 1994. Print. URL: https://books.google.com/books?id=hDxeXDisYKEC&pg=PA538&lpg=PA538&dq=Can+fish+bioaccumulate+viruses&source=bl&ots=cY4NcimGJv&sig=KiUVHd8VTMCkIO4IBDYO-5bahZ8&hl=en&sa=X&ei=7HY0VYD-LNKvogTfuYDoBQ&ved=0CCcQ6AEwAQ#v=onepage&q=Can%20fish%20bioaccumulate%20virus&f=false

B12. Iwamoto, M., T. Ayers, B. E. Mahon, and D. L. Swerdlow. "Epidemiology of Seafood-Associated Infections in the United States." *Clinical Microbiology Reviews* (2010): 399-409. Print. URL: http://cmr.asm.org/content/23/2/399.full.pdf+html

B13. "Vibrio Infections." *Vibrio Infections*. Web. 18 May 2015. URL: http://www.foodsafety.gov/poisoning/causes/bacteriaviruses/vibrio_infections/

B14. Desenclos, J C, K C Klontz, M H Wilder, O V Nainan, H S Margolis, and R A Gunn. "A Multistate Outbreak of Hepatitis A Caused by the Consumption of Raw Oysters." *Am J Public Health American Journal of Public Health* 81.10 (1991): 1268-272. Print. URL: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1405303/pdf/amjph00210-0038.pdf

Aerosol Related References:

C1. Cincinnati, Ohio, and Bertram W. Carnow. *Health Effects of Aerosols Emitted from an Activated Sludge Plant*. Cincinnati, Ohio: Environmental Protection Agency, Office of Research and Development [Health Research], Health Effects Research Laboratory; 1979. 131, 136, 143. Print. URL: http://nepis.epa.gov/Exe/ZyNET.exe/9100PG2Q.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1976+Through+1980&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C76through80%5CTxt%5C00000018%5C9100PG2Q.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL#

C2. Pereira, M R, and M A Benjaminson. "Broadcast of Microbial Aerosols by Stacks of Sewage Treatment Plants and Effects of Ozonation on Bacteria in the Gaseous Effluent." *Public Health Reports* 90.3 (1975): 208–212. Print. URL: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1435663/pdf/pubhealthrep00160-0018.pdf

C3. Fannin, K F, S C Vana, and W Jakubowski. "Effect of an Activated Sludge Wastewater Treatment Plant on Ambient Air Densities of Aerosols Containing Bacteria and Viruses." *Applied and Environmental Microbiology* 49.5 (1985): 1191–1196. Print. URL: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC238528/pdf/aem00150-0175.pdf

C4. Brown, N. J. (1997). *Health hazards manual: Wastewater treatment plant and sewer workers*. Ithaca, NY: Cornell University, Chemical Hazard Information Program. http://digitalcommons.ilr.cornell.edu/manuals/2

C5. Pahren, H., and Ohio Cincinnati. *Wastewater Aerosols and Disease: Proceedings of a Symposium, September 19-21, 1979*. Cincinnati, Ohio: Office of Research and Development, U.S. Environmental Protection Agency; 1980. Page Xiii. Print. URL: http://nepis.epa.gov/Exe/ZyNET.exe/20008H2N.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1976+Through+1980&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C76through80%5CTxt%5C00000002%5C20008H2N.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL#

C6. Upadhyay, Nabin, Qinyue Sun, Jonathan O. Allen, Paul Westerhoff, and Pierre Herckes. "Characterization of Aerosol Emissions from Wastewater Aeration Basins." *Journal of the Air & Waste Management Association* 63.1 (2013): 20-26. Print. URL: http://www.ncbi.nlm.nih.gov/pubmed/23447861

C7. Korzeniewska, Ewa. "Emission of Bacteria and Fungi in the Air from Wastewater Treatment Plants - a Review." *Front Biosci Frontiers in Bioscience* (2011): 1-15. Print. URL: http://www.researchgate.net/publication/49719424_Emission_of_bacteria_and_fungi_in_the_air_from_wastewater_treatment_plants_-_a_review

C8. Scarlett-Kranz, JM, JG Babish, D. Strickland, RM Goodrich, and DJ Lisk. "URINARY MUTAGENS IN MUNICIPAL SEWAGE WORKERS AND WATER TREATMENT WORKERS." *AM J Epidemiol* 124.6 (1986): 884-93. Print. URL: http://www.ncbi.nlm.nih.gov/pubmed/3776971

Biosolids Related References:

D1. N, Annette. *Safe Management of Wastes from Health-care Activities*. Geneva: World Health Organization, 1999. Page 131. Print. URL: http://whqlibdoc.who.int/publications/9241545259.pdf

D2. Walker, John M., and Lynn Knight. "Pathogen and Vector Attraction Reduction Requirements." *A Plain English Guide to the EPA Part 503 Biosolids Rule*. Washington, DC: U.S. Environmental Protection Agency, Office of Wastewater Management, 1994. Page 109. Print. URL: http://water.epa.gov/scitech/wastetech/biosolids/upload/2002_06_28_mtb_biosolids_503pe_503pe_toc.pdf

D3. Lewis, David L., R.A. McElmurray, III, and G. William Boyce. *The Gatekeepers*. Marietta, GA: Hallman & Wingate, LLC, 2010. Print. URL: http://www.sludgefacts.org/Ref108.pdf

D4. City of Coos Bay Biosolids Report 2013

D5. City of North Bend Biosolids Report

D6. Khuder, Sadik, Sheryl A. Milz, Michael Bisesi, Robert Vincent, Wendy Mcnulty, and Kevin Czajkowski. "Health Survey of Residents Living Near Farm Fields Permitted to Receive Biosolids." *Archives of Environmental & Occupational Health* 62.1 (2007): 5-11. Print. URL: http://www.tandfonline.com/doi/abs/10.3200/AEOH.62.1.5-11?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed

D7. "How EPA Faked the Entire Science of Sewage Sludge Safety: A Whistleblower's Story." *Independent Science News Food Health and Agriculture Bioscience News*. 9 June 2014. Web. 21 May 2015. URL: http://www.independentsciencenews.org/health/how-epa-faked-the-entire-science-of-sewage-sludge-safety-a-whistleblowers-story/

D8. Lowman, Amy, Mary Anne Mcdonald, Steve Wing, and Naeema Muhammad. "Land Application of Treated Sewage Sludge: Community Health and Environmental Justice." Environmental Health

Perspectives 121.5 (2013): 537-42. Print. URL: http://ehp.niehs.nih.gov/1205470/

D9. Lewis, David L., and David K. Gattie. "Peer Reviewed: Pathogen Risks From Applying Sewage Sludge to Land." *Environmental Science & Technology Environ. Sci. Technol.* (2002): 287A-93A. Print. URL: http://pubs.acs.org/doi/pdfplus/10.1021/es0223426

D10. Reilly, Maureen. "The Case against Land Application of Sewage Sludge Pathogens." *Can J Infect Dis* 12.4 (2001): 205-07. Print. URL: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2094820/pdf/JID12205.pdf

D11. Jenkins, Suzanne R., Carl W. Armstrong, and Michele M. Monti. *HEALTH EFFECTS OF BIOSOLIDS APPLIED TO LAND: AVAILABLE SCIENTIFIC EVIDENCE*. 2007. Print. URL: http://www.vdh.virginia.gov/epidemiology/DEE/documents/biosolids.pdf

D12. Iranpour, R., H.H.J. Cox, R.J. Kearney, J.H. Clark, A.B. Pincince, and G.T. Daigger. "Regulations for Biosolids Land Application in U.S. and European Union." *Journal of Residuals Science & Technology* 1.4 (2004): 209-22. Print. URL: http://www.researchgate.net/profile/Glen_Daigger/publication/267549646_Regulations_for_Biosolids_Land_Application_in_U.S._and_European_Union/links/546554e30cf25b85d17d28d7.pdf

D13. *Land Application of Biosolids*. Washington, D.C.: United States Environmental Protection Agency, Office of Inspector General, 2002. PDF. URL: http://www.epa.gov/oig/reports/2002/BIOSOLIDS_FINAL_REPORT.pdf

Permitting:

E1. Green, Emily. *"Underwater: Oregon's Agency Responsible for Monitoring Waterway Polluters Is the Most Backlogged in the Country."* Street Roots News 24 Feb. 2015. Street Roots. Web. URL: http://news.streetroots.org/2015/02/24/underwater-oregons-agency-responsible-monitoring-waterway-polluters-most-backlogged

E2. Andersen, Keith. *"Re: Relocation of City of Coos Bay Wastewater Treatment Plant #2 WQ Coos County/File No. 19821/NPDES Permit Number 100771."* Letter to Mr. Jim Hossley. 13 Mar. 2015. MS. Department of Environmental Quality, Eugene, OR.

E3. *Review of Coliphages as Possible Indicators of Fecal Contamination for Ambient Water Quality*. Washington D.C.: Environmental Protection Agency, 2015. Print. URL: http://water.epa.gov/scitech/swguidance/standards/criteria/health/microbial/upload/coliphages-literature-review-report-2015.pdf

E4. *Biological Evaluation Coos Bay Wastewater Treatment Plant No. 2 Expansion and Upgrade Project City of Coos Bay, Oregon*. Portland, OR: CH2MHill, 2014. Pages 1-2 - 1-3. Print.

E5. *Environmental Assessment Coos Bay Wastewater Treatment Plant No. 2 Expansion and Upgrade Project*. Coos Bay, OR: SHN Consulting Engineers & Geologists. Page 2. Print.

E6. "Chapter 6 Water Quality-Based Effluent Limits." *NPDES Permit Writers' Manual*. Washington, D.C.: United States Environmental Protection Agency, Office of Water, 1996. Pages 87, 104-108, 111. Print. URL: http://water.epa.gov/polwaste/npdes/basics/upload/chapt_06.pdf

E7. "Chapter 6 Water Quality-Based Effluent Limitations." *National Pollutant Discharge Elimination System (NPDES) Permit Writers' Manual*. Washington, DC: U.S. Environmental Protection Agency, Office of Wastewater Management, 2010. Print. URL: http://water.epa.gov/polwaste/npdes/basics/upload/pwm_chapt_06.pdf

E8. *NPDES Permits Unit 2013-2015 Strategic Plan*. United States Environmental Protection Agency, 2013. 1-25. Print. URL: http://www.epa.gov/region10/pdf/npdes/npu_unit_plan_2013.pdf

E9. *Wastewater Treatment Plant #2 Facilities Plan Amendment Volume 1: Report*. Coos Bay: Civil West Engineering Services, 2012. ES-4 - ES-5. Print. URL: http://coosbay.org/uploads/PDF/WWTP_2_-_FPA_-_Volume_1_Report_-_Part_1_Nov_20_2012.pdf

E10. "CEE Faculty Profile." *School of Civil and Environmental Engineering*. Web. 20 May 2015. URL: http://www.ce.gatech.edu/people/faculty/861/bio

E11. *CITY OF COOS BAY FACILITIES PlAN FOR WASTEWATER TREATMENT PLANT NO.2*. Coos Bay, OR: West Yost Associates Consulting Engineers, 2007. Print. URL: http://coosbay.org/uploads/PDF/Coos_Bay_WWTP2_Facilities_Plan_Oct07.pdf

E12. "GOAL 11: PUBLIC FACILITIES AND SERVICES." Oregon.gov. Web. 7 July 2015. <http://www.oregon.gov/lcd/docs/goals/goal11.pdf>.

UV:

F1. *Disinfection Profiling and Benchmarking Guidance Manual*. Washington, D.C.: United States Environmental Protection Agency, Office of Water, 1999. Pages A-3, D-28, D-33. Print. URL: http://nepis.epa.gov/Exe/ZyPDF.cgi/20002249.PDF?Dockey=20002249.PDF

F2. ATS Model ATS-186K-480 Ultraviolet System

F3. ASV-186K_Manual

F4. ATS 186K Series Flyer

Cost:

G1. City vs. DBWT Cost

G2. *Evaluation of DB Western's Proposal Regarding the Construction of a Treatment Plant on the North Spit*. Coos Bay, OR: City of Coos Bay Public Works, 2015. Print. URL: http://coosbay.org/uploads/PDF/NEWS/2015/DBWT/WWTP_2_N_Spit_Working_Copy_042715_version__final_%282%2905-13-2015_for_City_Web_Site.pdf

Human Health:

H1. Travison, Thomas G., Andre B. Araujo, Amy B. O'Donnell, Varant Kupelian, and John B. Mckinlay. "A Population-Level Decline in Serum Testosterone Levels in American Men." *The Journal of Clinical Endocrinology & Metabolism* 92.1 (2007): 196-202. Print. URL: http://press.endocrine.org/doi/pdf/10.1210/jc.2006-1375

H2. Blake, Pamela. *South Coast Basin Water Quality Status*. Portland: Oregon Dept. of Environmental Quality, 2013. 40-41. Print. URL: http://www.deq.state.or.us/wq/watershed/Docs/SouthCoastBasinWAReport_Final_Web_Doc.pdf

H3. *Disinfection of Treated Wastewater*. Southbank, Vic.: EPA Victoria, 2002. 6. Print. URL: http://www.epa.vic.gov.au/~/media/Publications/730.pdf

H4. Barich, Jeffrey. *Norovirus Presentation*. Print

H5. "Norovirus Settings, 2008-2014." *Oregon Health Authority*. Oregon Health Authority, 2014. Web. 7 May 2015. URL: https://public.health.oregon.gov/DiseasesConditions/DiseasesAZ/calicivirus/Documents/J-ModieTable.pdf

H6. "Oregon Norovirus Watch March, 2015." *Oregon Health Authority*. Oregon Health Authority, 2015. Web. 7 May 2015. URL:

https://public.health.oregon.gov/DiseasesConditions/DiseasesAZ/calicivirus/Documents/NoroWatch/NoroWatch-mar2015.pdf

H7. "Gastroenteritis Outbreaks in Long-term Care Facilities and Hospitals." *Gastroenteritis Outbreaks in Long-term Care Facilities and Hospitals*. Oregon Health Authority, 2015. Web. 7 May 2015. URL: https://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/Outbreaks/Gastroenteritis/Pages/gastro.aspx

H8. "Norovirus: Facts for Food Handlers." *Oregon Health Authority*. Oregon Health Authority. Web. 8 May 2015. URL: http://www.cdc.gov/norovirus/downloads/foodhandlers.pdf

H9. Bosch, Albert. "Human Enteric Viruses in the Water Environment: A Minireview." *International Microbiology* 1 (1998): 191-96. Web. URL: http://www.im.microbios.org/03setember98/04%20Bosch.pdf

H10. Akpor, O.B., and M. Muchie. "Environmental and Public Health Implications of Wastewater Quality." *African Journal of Biotechnology* 10.13 (2011): 2379-387. *Academic Journals*. Academic Journals. Web. 14 May 2015. URL: http://www.academicjournals.org/article/article1380874205_Akpor%20and%20Muchie.pdf

H11. Carey, By. "Marine Mammals Suffer Human Diseases." *LiveScience*. TechMedia Network, 23 Feb. 2006. Web. 18 May 2015. URL: http://www.livescience.com/7055-marine-mammals-suffer-human-diseases.html

H12. "Reported Infections with Variant Influenza Viruses in the United States since 2005." *Centers for Disease Control and Prevention*. Centers for Disease Control and Prevention, 11 May 2015. Web. 18 May 2015. URL: http://www.cdc.gov/flu/swineflu/variant-cases-us.htm

H13. "Viruses, Bacteria, and Parasites in the Digestive Tract." *University of Rochester Medical Center*. Web. 18 May 2015. URL: http://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=90&ContentID=P02019

H14. Fong, T.-T., and E. K. Lipp. "Enteric Viruses of Humans and Animals in Aquatic Environments: Health Risks, Detection, and Potential Water Quality Assessment Tools." *Microbiology and Molecular Biology Reviews* 69.2 (2005): Pages Abstract, 357-359, 361. Print. URL: http://mmbr.asm.org/content/69/2/357.full.pdf+html

H15. Hall, Aron J. Updated Norovirus Outbreak Management and Disease Prevention Guidelines. 3rd ed. Vol. 60. Atlanta, GA: U.S. Dept. of Health and Human Services, Centers for Disease Control and Prevention, 2011. Pages 1, 3-6. Print. URL: http://www.cdc.gov/mmwr/pdf/rr/rr6003.pdf

H16. Atmar, Robert L., Antone R. Opekun, Mark A. Gilger, Mary K. Estes, Sue E. Crawford, Frederick H. Neill, and David Y. Graham. "Norwalk Virus Shedding after Experimental Human Infection." Emerg. Infect. Dis. Emerging Infectious Diseases 14.10 (2008): 1553-557. Print. URL: http://wwwnc.cdc.gov/eid/article/14/10/pdfs/08-0117.pdf

H17. "Surveillance for Foodborne Disease Outbreaks—United States, 2009-2010." *Morbidity and Mortality Weekly Report* 62.3 (2013): 91-93. Print. URL: http://www.cdc.gov/mmwr/pdf/wk/mm6203.pdf

H18. Life Cycle of Infectious Bacteria, Viruses, Parasites

H19. "Gastroenteritis Outbreaks in Long-term Care Facilities and Hospitals." *Gastroenteritis Outbreaks in Long-term Care Facilities and Hospitals*. Web. 16 July 2015. URL: https://public.health.oregon.gov/DiseasesConditions/CommunicableDisease/Outbreaks/Gastroenteritis/Pages/gastro.aspx

H20. Lempert, Phil. "Bird Flu Hits: Just As Eggs Finally Get A Break." *Forbes*. Forbes Magazine, 23 May 2015. Web. 21 July 2015. URL: http://www.forbes.com/sites/phillempert/2015/05/23/bird-flu-hits-just-as-eggs-finally-get-a-break/