Presentation to

Easton Beach Stakeholders

Preliminary Design - UV Disinfection

October 16, 2008

FUSS & O'NEILL

Disciplines to Deliver

Agenda

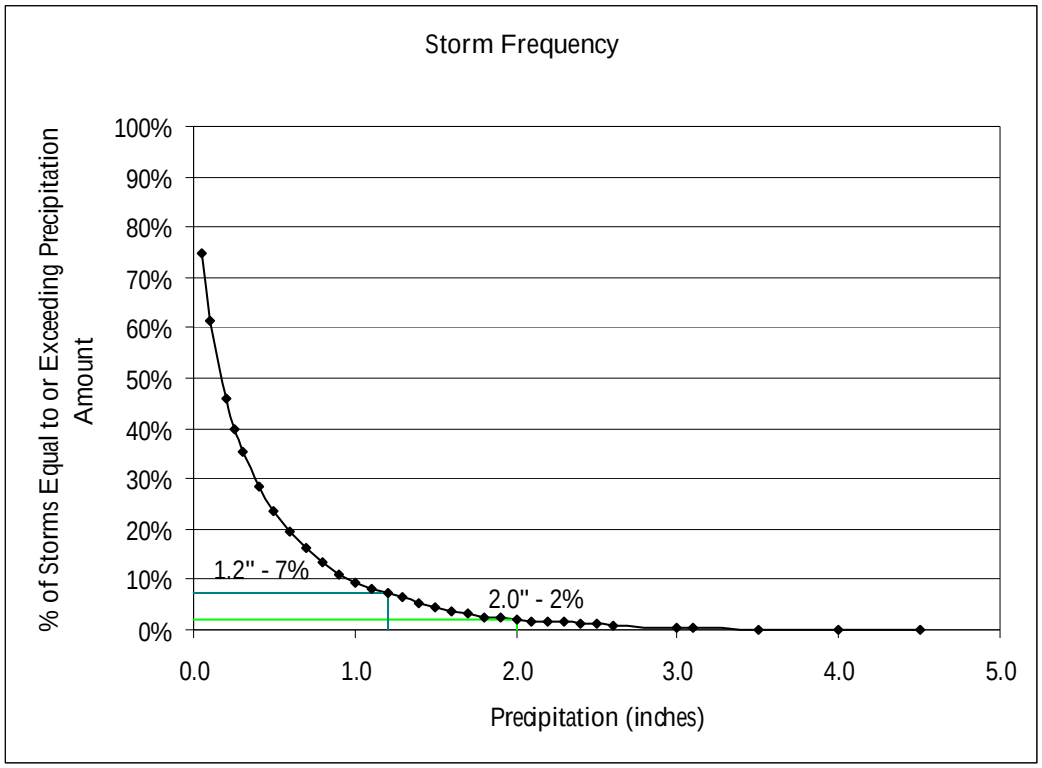
- Technical Issues
- Preliminary Design of System
- Capital and Operation/Maintenance Costs
- Implementation

Preliminary Design Goals

- Identify and resolve remaining technical issues
  - e.g. Moat flooding, shoaling, pretreatment, UV technologies, etc…
- Develop preliminary design documents
  - Understand how this system will be built and work
- Update capital and life cycle opinions of cost
  - Based on what was learned during preliminary design

Technical Issue-Design Storm

- Design based on treating 100% runoff from storm with 1.2-inches of precipitation.
- Storm equals or exceeds 93% of storm events in Newport
- Average of 9 storms per year exceed 1.2-inches/24 hours.

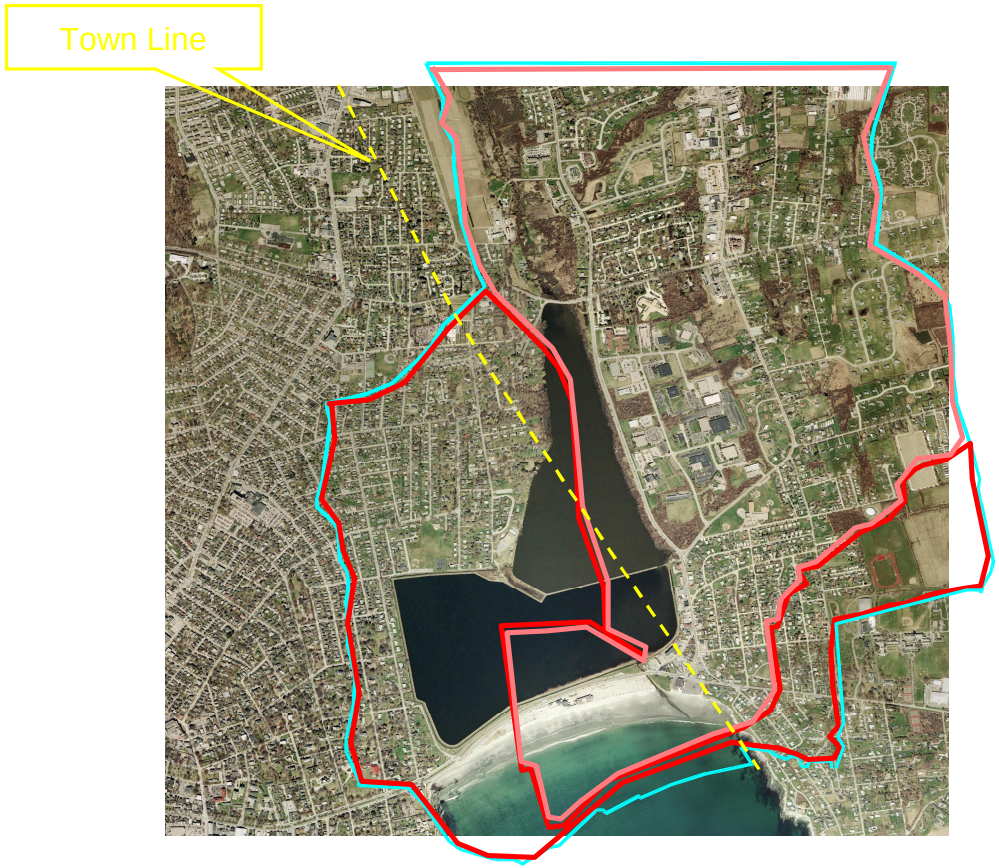


Technical Issue-Design Flows

- Hydrologic and hydraulic models calibrated based on data collected between May and July 2008.

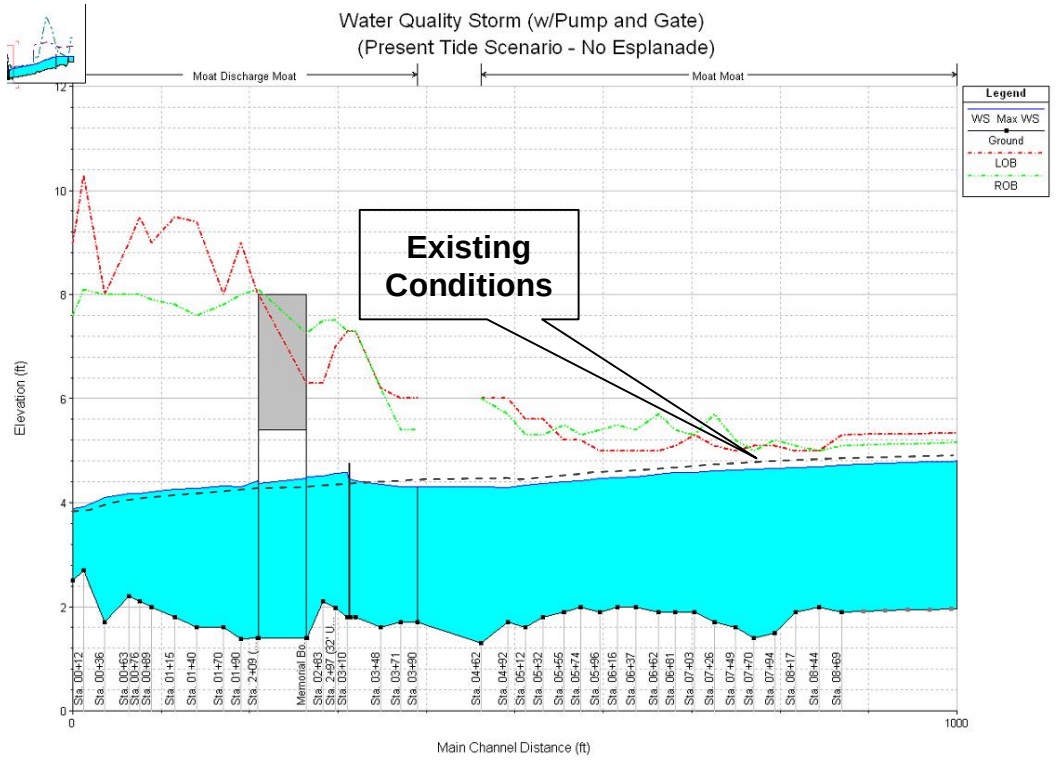
Item	Moat Discharge	Esplanade Discharge
Design Peak Flow, cubic feet per second (cfs)	96 cfs	24 cfs
Percentage of Design Runoff from RIDOT/Middletown	20.6%	32.4%

Moat and Esplanade Watersheds



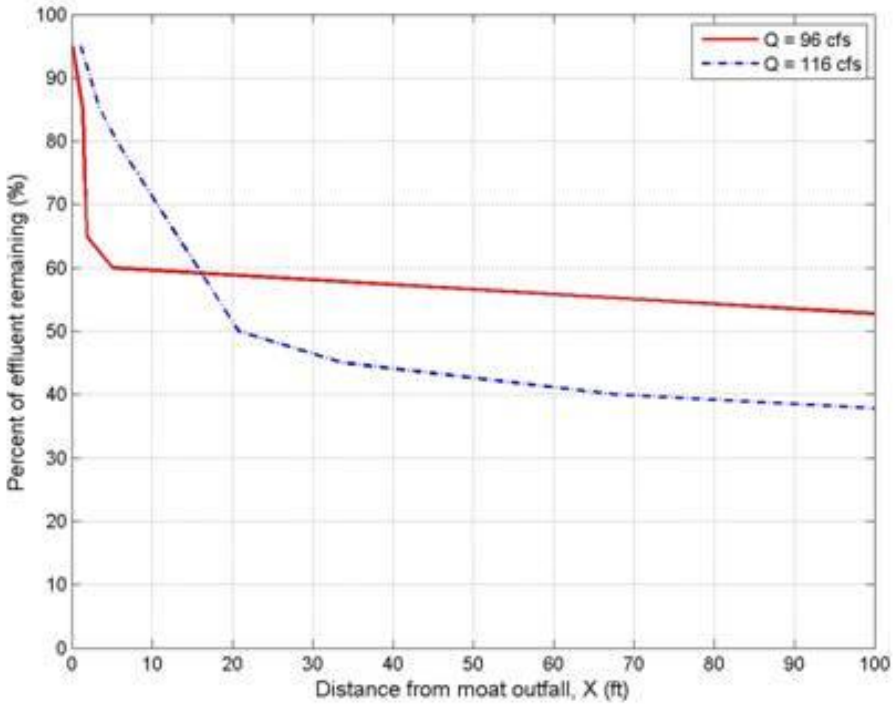
Technical Issue-Moat Flooding

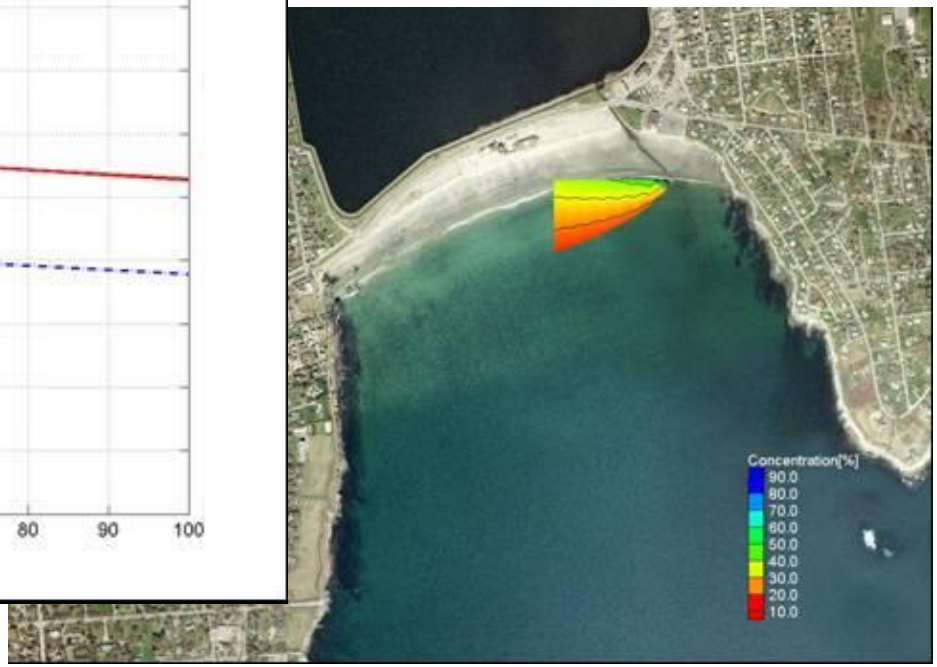
- Pumping will be required to prevent flooding in the Moat.
- Design considers future sea level rise (5 ft rise-Yr 2100).



Technical Issue-Bay Dilution

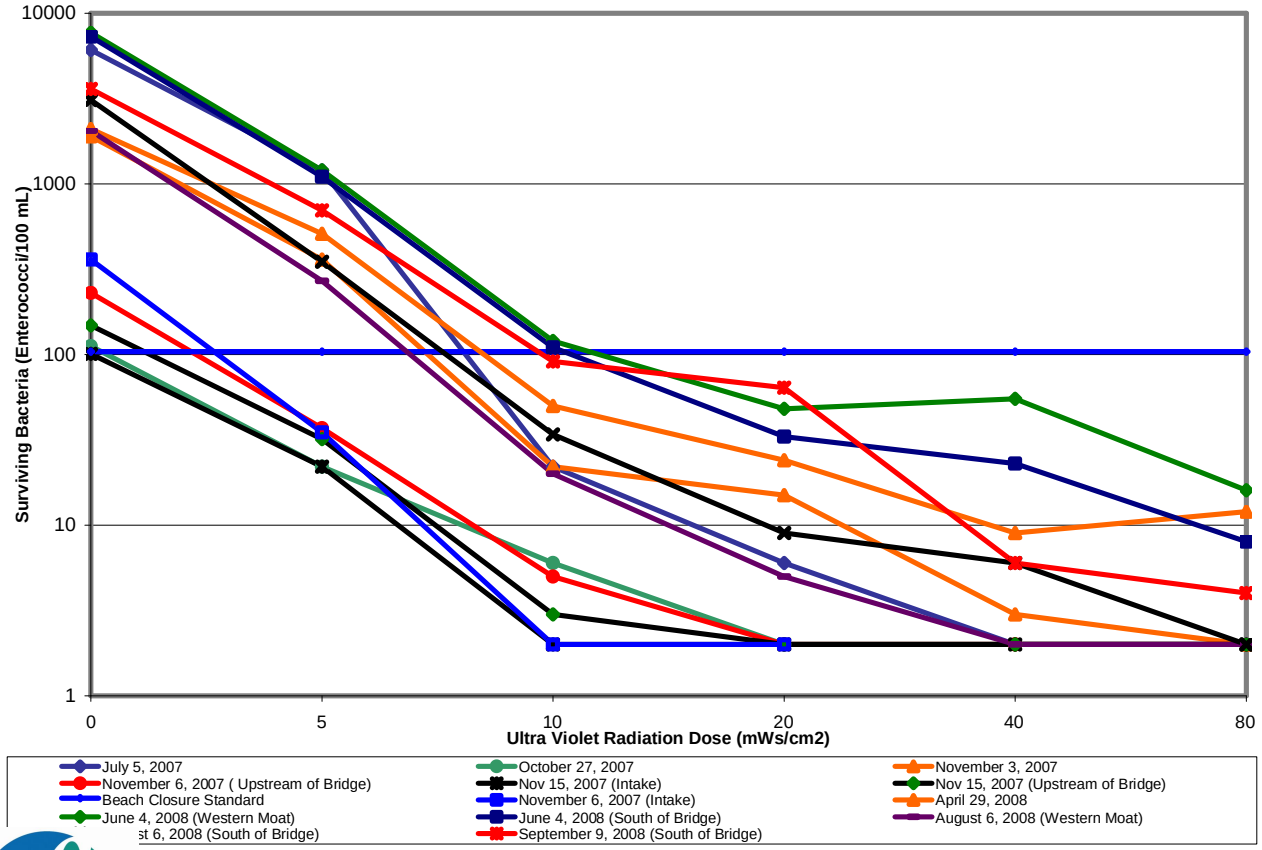
- Dilution is not significant enough to justify reducing UV treatment





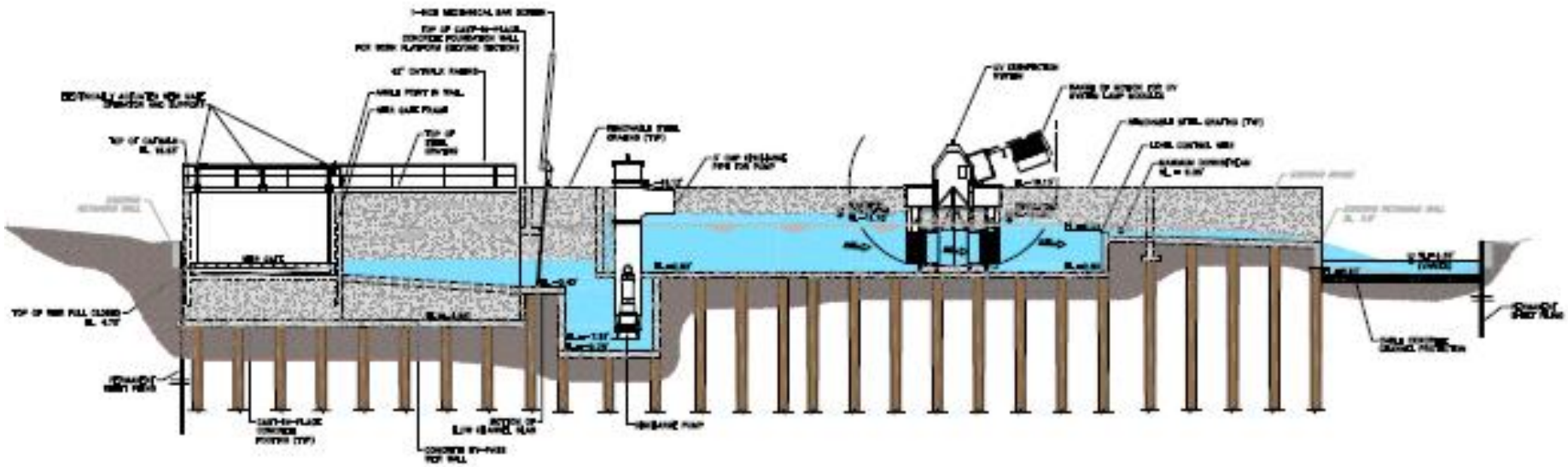
Technical Issue-Treatment

- Achieve 30-day geometric mean < 104 *Enterococci* per 100 mL



- Beach closure standard = 104 *Enterococci* per 100 mL.
- Geometric mean accounts for some dilution being available.
- Creating a “not-to-exceed” value will significantly add to project costs by adding risk.

Preliminary Design: PFD



- Moat Diversion Gate
- 1” Bar Screen
- Pump Station
- UV Channel & System
- Instrumentation and Controls
- Discharge by Gravity back to Moat

Design Issues: UV System

- UV Dose
  - Pilot and Collimated Beam Dose/Response Data was shared with Vendors
  - Vendors to determine system size and performance guarantee.
- Transmissivity of Fluid in Moat
  - 55% is Performance Guarantee Basis
  - Average value of Collimated Beam = 66%
  - Average value of Pilot = 66.5% (51-77%)
- Solids Content of Fluid in Moat
  - 30 mg/L is Performance Guarantee Basis
  - Average value of Collimated Beam = 19.25 mg/L
  - Average value of Pilot = 2-24 mg/L
- Shoaling: Pilot Data 588 mg TSS/L, 61% UV_T

Design Issues: UV System

BAU/HOPKINS
310 South Street
Plainville, MA 02762

TEL: 508-699-9300
FAX: 508-699-9047

July 2, 2008

Fuss & O'Neill, Inc.
317 Iron Horse Way
Suite 204
Providence, RI 02908

Attention: Mr. Andrew Lombard, P.E.

Subject: UV Disinfection System
Newport, RI

Thank you for considering Severn Trent Services on this project. After a thorough review of the specific job conditions, Severn Trent has concluded, that their current product offerings for their UltraDynamics (UV) product line and their MicroDynamics (Microwave) product line are not able to meet the requirements outlined in your RFI. Therefore, Severn Trent Services is unable to submit a proposal for this project.

Sincerely,

Robert Hopkins

- Microwave UV by Severn Trent Services

Design Issues: UV System

- Low Pressure (LP) vs. Medium Pressure (MP)
  - All lamps excite internal gas; difference lies in lamp power
  - (LP 40-180 Watt/bulb) vs. (MP 500-7,000 Watt/bulb)
  - LP can treat far less fluid than MP on a per-lamp basis, which is direct impact on system footprint.
  - LP are less expensive bulbs
  - MP able to treat large and poor quality flows, operate at extreme fluid temps.

Design Issues

- Hydraulic Design of UV Disinfection System
  - Pump feed required to prevent flooding
  - Inclusion of Esplanade flow significantly escalates UV system costs
- Pretreatment Needs
  - Prevent large solids from entering pump station and UV disinfection system.
- Location of System
  - Treatment effectiveness
  - Shoaling
  - Existing Utilities

Design Issues: UV Comparison

Comparison	Aquionics	Trojan	Calgon	Wedeco
Model	Inline 18000+	4000Plus	C^3500^{TM}	TAK55
Lamp Type	MP	MP	LP	LP
Capital Cost for 96 cfs	$1.992 M	$1.65 M	$3.05 M	$3.2 M
Experience @ Design Flow (# Installations)	<16 cfs (164) 16-77 cfs (17) >77 cfs (2)	<16 cfs (105) 16-77 cfs (153) >77 cfs (28)	<16 cfs (33) 16-77 cfs (2) >77 cfs (0)	<16 cfs (186) 16-77 cfs (54) >77 cfs (11)

Design Issues: UV Comparison

Comparison	Aquionics	Trojan	Calgon	Wedeco
Electrical Draw @100% Lamp Intensity	1,361 kW	1,408 kW	768 kW	700 kW
Equipment Warranty	18 mo from shipment, 12 mo from service	18 mo from shipment, 12 mo from service Ballast – 1yr	Not Offered in Response	18 mo from shipment, 12 mo from service Ballasts – 5 yrs but prorated after 1 yr
Performance Guarantee	Provide 40 mJ/cm2 or 3-log reduction.	To meet 30-day Geometric Mean for life of system.	Could be offered, typically 10 yrs.	“Shall guarantee specified doses.”

Design Issues: UV Comparison

Comparison	Aquionics	Trojan	Calgon	Wedeco
Lamp Replacement under normal operating conditions?	4-8,000 hrs $500/lamp	5,000 hrs $300/lamp	12,000 hrs $250/lamp	12,000 hrs $199/lamp
Power Supply to Lamps	Not ballasts, presumed transformers . No Cost data provided.	Ballasts $970 / ballast	Ballasts $400 / ballast	Ballasts $350 / ballast
System Layout	Pipe-mount	CIP Concrete around factory-fabricated steel insert.	Mount in open channels	Mount in open channels

Design Issues: Implementation

- Capital – Construction Cost

  $5.377 – 7.824 Million

- 20-Yr Life Cycle Cost

  $21.6 - 24 Million

  (6% interest rate)

  &

  Operating UV system during 54 Storms

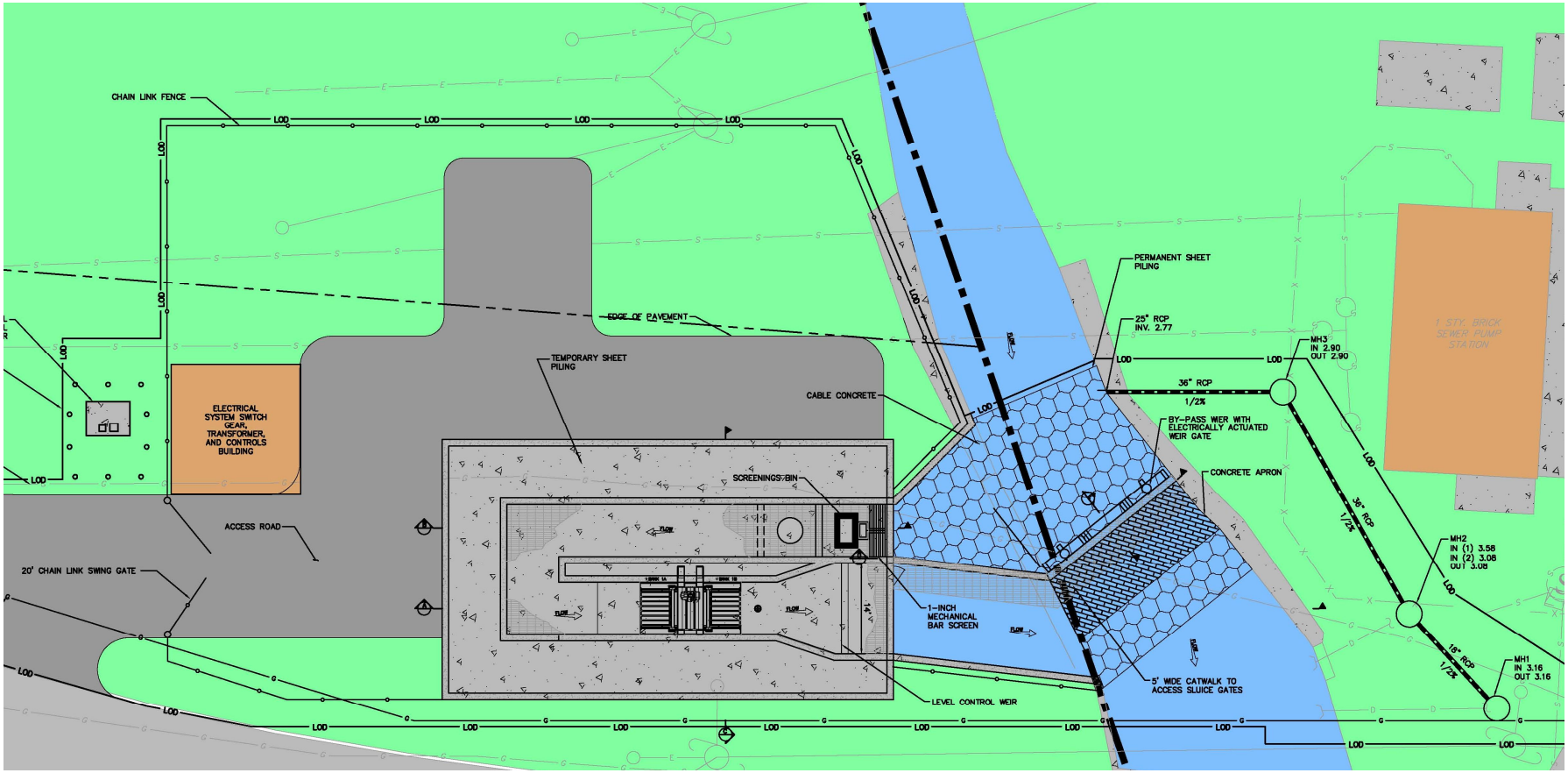
  @ 100% Lamp Intensity for 48 hours per Storm

Design Issues: Power Supply

- National Grid
  - Current Power Deficit on Island
  - Any UV System will require new Power Supply from NGrid
  - Preliminary Design
    - Estimated load 1,138 kVA @ 3 Phase, 480 VAC
    - 2000 Amp / 480 VAC Switchgear
  - NGrid Response
    - Work will be completed by NGrid, with NGrid's upgrades.
    - Some revenue justified against the proposed City of Newport UV project.
    - The cost to the City for this construction could be in the $150K to $200K

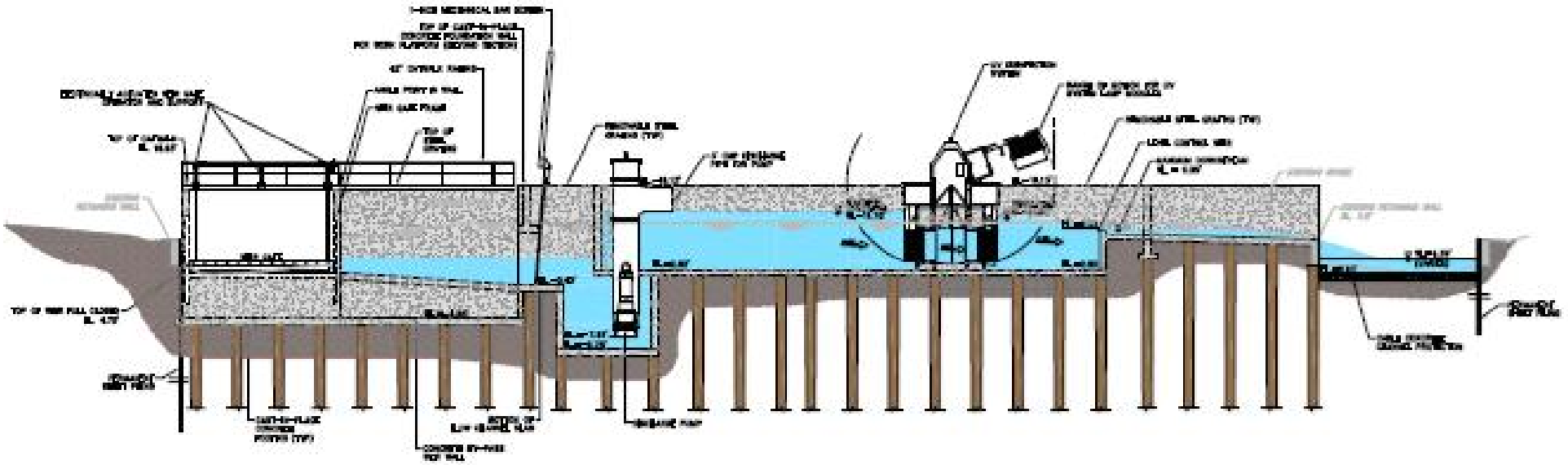
Design Issues – Location

Preliminary Design: Site Plan



Preliminary Design: Perspective

Preliminary Design: Section



Changes in Implementation Costs

Item	Cost Increase or Addition, Including Contingency
Deep Foundations	$145,000
Pump Station	$235,000
Pretreatment/Screening	$212,000
Switchgear Building	$55,000
New Electrical Service, NGrid	$478,000 (Original Est. $100,000)
Dewatering	$338,000 (Original Est. $75,000)
Relocation of Outfalls and Utilities	$44,000
Total Changes	**$1,407,000**

Opinion of Implementation Costs

Item	Cost in 2008 Dollars
Site Preparation/Improvements	$465,000
Disinfection System: Channel, Lamps, Gate, etc.	$2,640,000
Changes in Implementation Costs	$956,000
Ancillary Costs: Mob., Constr, Demob., etc.	$562,000
Final Engineering & Permitting	$265,000
Total Project (with 10% Contingency)	**$5,377,000**

Opinion of Op./Maint. Costs

Item	Cost in 2008 Dollars*
Power	$152,000 – 303,775
Lamp Replacement	$26,,000 - 52,000
Ballast Replacement	$16,000
Labor	$15,000 - 29,000
Total	**$210,000 – 402,000**

- BASIS: 54 Storms per year,
- Cost Range: 24 or 48 hour operation per storm

Implementation

- Funding
  - RIDEM grant application decision by January 2009.
  - Application for $2.8 million grant
- Final Design and Permitting
  - 3 to 4 months
- National Grid
  - 12 months for design and construction
- Bid/Award
  - 2 months
- Construction
  - 5 to 6 months