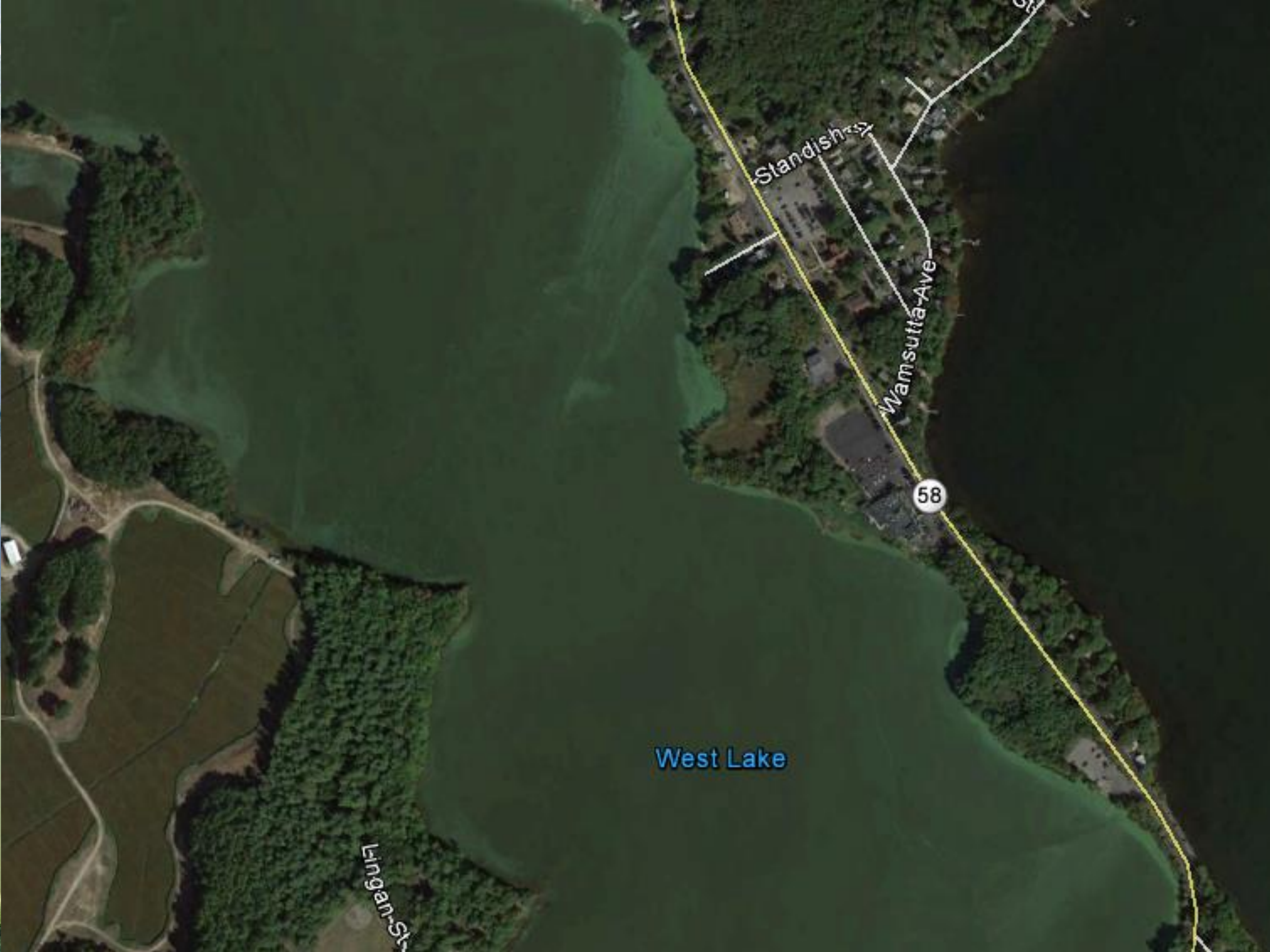
Town Of Halifax, MA

Presentation on:

Supervisory Control and Data Acquisition (SCADA) Feasibility and Design Memorandum at the Stump Brook Dam

Agenda

- Project Background / Report Summary
- What are the Engineering Steps in Making this Happen?
- What are the Costs?
- Who Needs to Make Decisions?
- Next Steps?



Standish
Wamsutta Ave
58
West Lake
Lingan St

Ocean Ave
Short St
Upton St
Dwight St
Gold St
Bow St
Lake St
Standish St
Holly St
Wamsutta Ave
58
Monponsett St
West
Monponsett
Pond
East
Monpons
Pond
Lingan St
Richview Ave
13th Ave
12th Ave
Hillside Ave
Cross St
9th Ave
8th Ave
7th Ave
6th Ave
Lingan St
White Island Rd

Project Background / Report Summary

- Funded under the Massachusetts Department of Environmental Protection Sustainable Water Management Initiative (SWMI) as a follow up to previous SWMI funded work.

- Relates closely to the work performed by the Division of Ecologic Restoration under the Priority Project Program to establish appropriate stream flows for Stump Brook.

- Need of the project based on a more sustainable management approach of the dam and other man-made factors through the balance of:
  - *Maintaining flow for water quality improvements, both up and downstream*
  - *Consideration of fish passage*
  - *Flood control*
  - *Water supply management*
  - *Ease of operations*

Benefits of Automated Controls

- Provide a sustainable water withdrawal management approach for the City of Brockton; allowing them to better regulate the required pool elevation of Silver Lake while allowing excess diversion waters to flow naturally through the Stump Brook Dam.
- Reducing the frequency of overflow through the Jones River, in turn reducing potential floodwaters and excessive velocities for migratory species.
- Allow more consistent flow through Stump Brook, increasing the flushing time of the pond system (i.e. reduces idled waters that are more prone to algal blooms).
- Provide consistent flow downstream of the Stump Brook Dam, sustaining the receiving habitats.
- Provide optimal stream velocities through the existing fish ladder in the event migratory fish passage is restored.
- Streamline the City of Brockton’s operation and management responsibilities by not having to visit the dam site for manual raising or lowering of the gates.
- Better flood control in the event of significant forecasted rain events or storms.
- Will allow for operation of the gates in inclement weather or when snow cover prohibits manual operation. Using the winter of 2014-2015 as an example, there was a several month period where snow accumulation prevented access to the dam and manual controls.

Challenges of Automated Controls

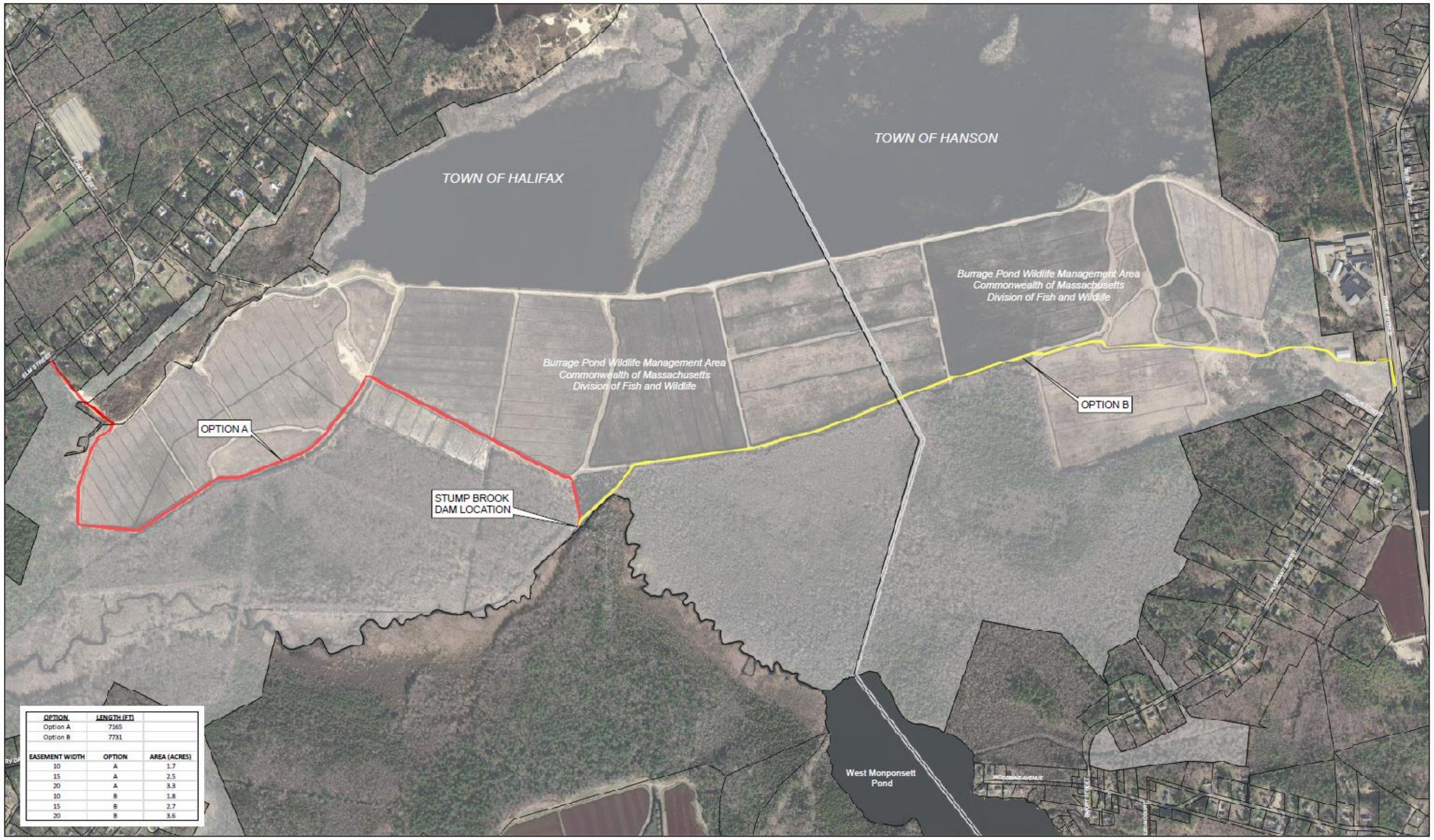
- Determine the final route of power to the dam site.
- Determine who will maintain the new controls and retain ownership of the electrical utilities installed.
- Acquire an easement from the Massachusetts Division of Fisheries and Wildlife to install power to the dam site.
- Acquire project funding, preferably through grants.
- Determine which party will apply for future grants.

Engineering Steps For Automated Controls

- Power to the Site: options reviewed included hydropower, renewable, generator and traditional approaches.

Engineering Steps For Automated Controls

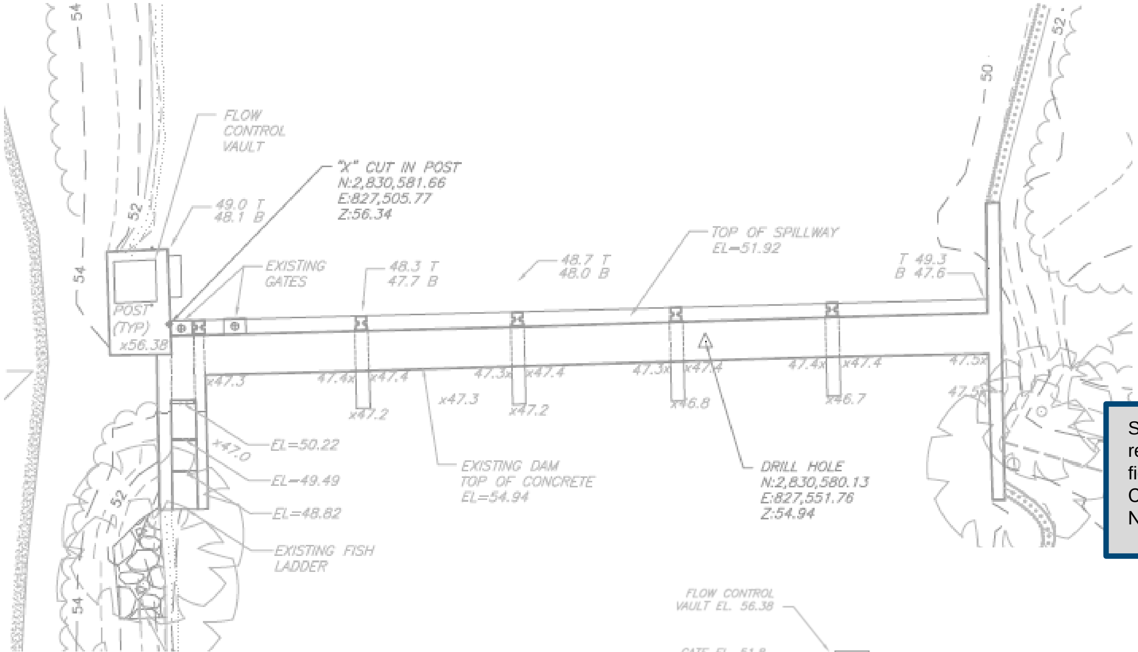
- Power to the Site: options reviewed included hydropower, renewable, generator and traditional approaches.

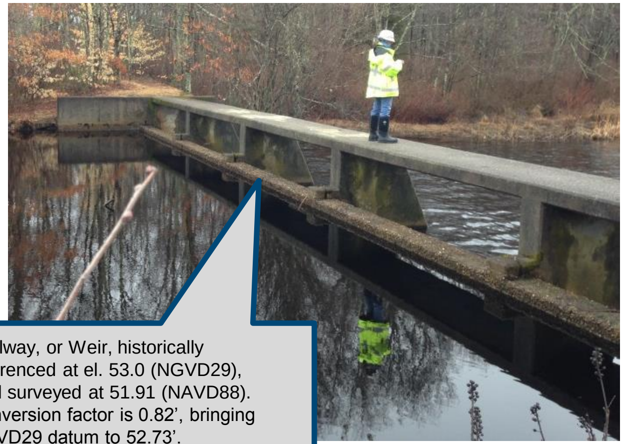


OPTION	LENGTH (FT)	
Option A	7165	
Option B	7731	
EASEMENT WIDTH	OPTION	AREA (ACRES)
10	A	1.7
15	A	2.5
20	A	3.3
10	B	1.8
15	B	2.7
20	B	3.6

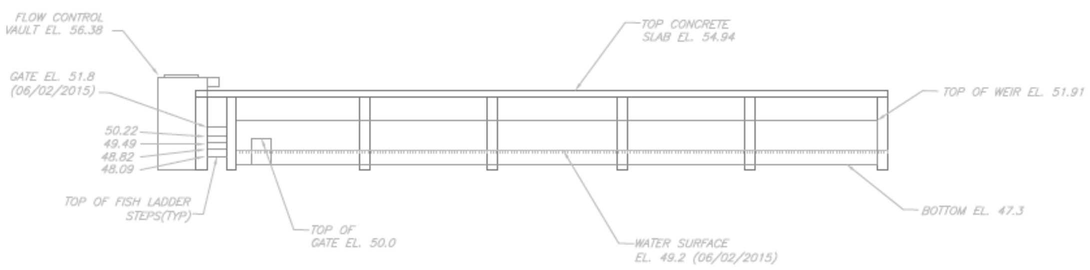
Engineering Steps For Automated Controls

- Review of sluice gate geometry, velocities and current elevations.





Spillway, or Weir, historically referenced at el. 53.0 (NGVD29), field surveyed at 51.91 (NAVD88). Conversion factor is 0.82', bringing NGVD29 datum to 52.73'.



SOUTH ELEVATION
SCALE 1"=10'

Engineering Steps For Automated Controls

- Review of sluice gate geometry, velocities and current elevations.

Halifax Dam 6/18/2015

All in 1988 Datum

Objective - Calculate the velocity of water at fish ladder and sluice gate. Compare if water velocity will be greater or less than fish speed.

Criteria (Per Marine Fisheries)

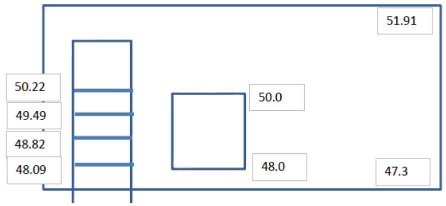
1. Adult river herring travel in schools at a cruising speed of 2.8 feet per second (ft/s) and can reach burst speeds of 6.8 ft/s.
2. American eels travel at a cruising speed of 2.4 feet per second (ft/s) and can reach a burst speed of 6.0 to 7.0 ft/s.
3. Marine Fisheries recommends a minimum water depth of 6 inches and a preferred range of 8-12 inches for the spawning migration of adult river herring.
4. For the juvenile herring emigration, Marine Fisheries recommends a minimum water depth of 2 inches and a preferred range of 4-8 inches.
5. Where these flows exceed maximum sustained swim speed, successful passage may still be possible, provided that fish can accomplish the needed swim speed without additional impendence such as low water depths.

Dam Info (from Survey June 2015)

Length	80	ft
Weir Elev	51.91	
Bottom of Dam Elev	47.3	

River Info (Upstream) (from Survey June 2015)

Top of Sediment Elev	49	Range from 48.3-48.7-49-49.3
Bottom of Sediment Elev	47.7	Range from 47.7-48
W.S.E. on 6/2/2015	51.4	



Sluice Gate Info

Quantity	1	
Top of Sluice Gate Elev	50	
Width	2.3	ft
Height	2	ft

Critical Depth (yc) Equation

yc = (q^2 / g)^(1/3) (M&E, Collection and Pumping of Wastewater)
q = (yc^3 * g)^(1/2)
Q = q * L

Fish Ladder Info (from Survey June 2015)

Quantity	1	
Top of Lowest Step Elev	48.09	
Top of Highest Step Elev	50.22	
Top of Gate Elev	51.8	
Width	2	ft

Broad Crested Weir Equation

Q = C * L * H^1.5 (reference MRD's Calcs from Cambridge WWTP)

Calculations

C	Length, L (ft)	Head, H (ft)	Flow Q (ft3/s)	Area A (ft2)	Velocity of Water (ft/s)	Higher than Cruising Speed?	Higher than Cruising Speed?	Higher than Burst Speed?	Higher than Burst Speed?	Critical Depth yc (ft)	Notes
Fish Ladder Top Step Only (Sluice Gate Fully Closed)						Herring	Eel	Herring	Eel		
2.65	2	1.69	11.64	3.38	3.45	Yes	Yes	No	No	1.02	Worst Case, 6' breadth, upstream w.s.e. up to dam weir elev.
2.65	2	0.80	3.79	1.60	2.37	No	No	No	No		
Sluice Gate (Fully Opened)											
3.3	2.3	2.00	21.47	4.60	4.67	Yes	Yes	No	No	1.39	Worst Case, 1' breadth, w.s.e. up to El. 50.00, all flow thru slide gate.
3.3	2.3	1.00	7.59	2.30	3.30	Yes	Yes	No	No		

Conclusion

Under worst case scenarios, velocity thru fish ladder or sluice gate exceeds the cruising speeds but does not exceed the burst speeds of both kinds of species.

- Summary of flow calculations indicate that at full pool (water level with top of wier) velocities through the fish ladder or sluice gate are 3.5 to 4.7 fps.

Engineering Steps For Automated Controls

- Installation of mechanical devices (actuators) and integration with existing SCADA system.
- New Programmable Logic Controller capable of:

- *Monitoring and historization of dam flowrate.*
- *Calculation of daily, monthly, and annual flow total.*
- *Monitoring and historization of weir gate position.*
- *Remote control of weir gate position from the WTP.*
- *Monitoring of communication status to the dam PLC.*

Engineering Steps For Automated Controls

- Solution requires the following scope of work:
- *Design, installation, and programming of a PLC-based control panel at the dam site.*
- *Installation of new flow monitoring sensors in the fish ladder section of the dam.*
- *Connection of permanent power to the new PLC to provide reliable power to the PLC, cellular modem, flow sensor, and weir gate actuator.*
- *Design, installation, and programming of a new cellular modem at the Brockton WTP to facilitate communication to the dam PLC. Modem may be connected to an existing PLC at the WTP.*
- *Modification of the Brockton WTP's existing Supervisory Control and Data Acquisition (SCADA) system to facilitate remote monitoring, historization, reporting, and control of the new dam flow sensor, actuator, and dam PLC.*

Project Costs – Order of Magnitude

Item	Order of Magnitude Cost
Power Supply	$200,000 - $300,000
Misc. Electrical Items (transformers, pull boxes, etc.)	$150,000
Remote Monitoring Equipment	$75,000 - $100,000
New Gate and Motor Operator	$30,000 - $50,000
Construction Unknowns/Contingency	$50,000 - $150,000 +
Preliminary Design	$50,000
Permitting	$50,000 - $100,000
Final Design	$75,000
Bidding	$5,000
Construction Administration	$50,000 - $100,000
Total (rounded to nearest hundred thousand):	**$700,000 - $1,100,000**

Decision Makers:

- **Central Plymouth County Water District**
- **City of Brockton**
- **Massachusetts Division of Fisheries and Wildlife:** Board of Directors

Next Steps:

- Have City of Brockton review and approve idea of automated controls at the Stump Brook Dam.
- Identify and advocate from the City of Brockton to serve as a liaison for this and future related grant opportunities as any future application will require approval and support from the City.
- Work, as a team (Halifax, Brockton and other Stakeholders such as Mass Audubon, DER, and other interested groups), with DFW to identify the most feasible conduit route and gain understanding of attaining the required utility easements.
- Pursue funding efforts for preliminary design, permitting, final design and construction.

www.ghd.com