TIDEGateway

Tidegate Inventory and Data Evaluation Gateway

Final Report

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12/17 Revised by MassBays

Prepared for:

MassBays NATIONAL ESTUARY PROGRAM

Massachusetts Office of Coastal Zone Management

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List of Acronyms

CZM	Massachusetts Office of Coastal Zone Management
AC	Advisory Committee
DEM	Digital Elevation Model
DER	Massachusetts Division of Ecological Restoration
MassBays	Massachusetts Bays National Estuary Program
NOAA	National Oceanic and Atmospheric Administration
QA	Quality Assurance
RTK	Real Time Kinematic
ZOI	Zone of Influence

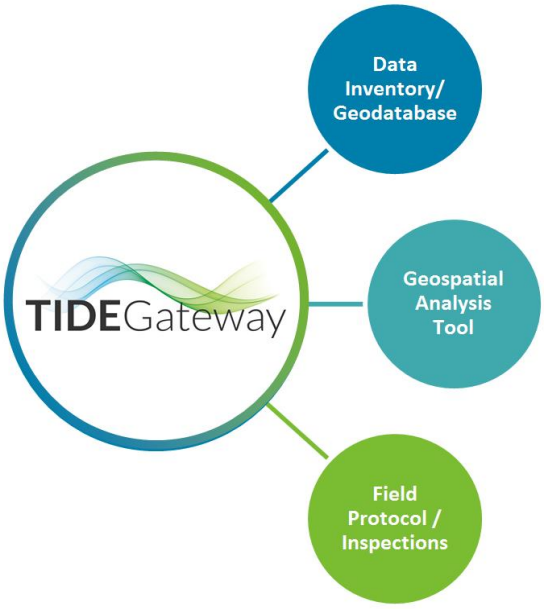
I. INTRODUCTION

A. Project Background

The purpose of TIDEGateway is to serve as a comprehensive and easy-to-use web-based platform for information and planning tools related to tide gates in the Massachusetts Bays region (Figure 1). The TIDEGateway includes:

- Geodatabase containing all known tide gate information, including locations, attributes, and related documents. The geodatabase contains a robust source tracking tool and interface which enables users to add new tide gates or modify existing tide gates when new information becomes available.

- Geospatial viewer which incorporates wetland delineation and allows users to locate and assess existing tide gates in relation to wetland ecology and FEMA floodplains, the better to inform the management of these structures.



TIDEGateway provides a fully integrated suite of GIS maps, attributes, data, modeling projections and planning tools.

B. Scope

The purpose of this report is twofold: 1) to summarize the project approach and results of all tasks that were performed during development of the TIDEGateway geodatabase and geospatial viewer, and 2) to provide recommendations and next steps.

Project tasks were performed under the direction of the Massachusetts Bay National Estuary Program (MassBays), the Massachusetts Office of Coastal Zone Management (CZM), their Regional Coordinators (RCs), and an Advisory Committee (AC) comprised of the National Oceanic and Atmospheric Administration (NOAA), Massachusetts Division of Ecological Restoration (DER) and others.

What is a Tide Gate?

For the TIDEGateway project, tide gates are defined as "*any conveyance of tidal flow with the ability to passively or actively manipulate water flow*." This definition includes self-regulating tide gates, manually controlled devices, or passive control structures such as flappers. Structures not included in this definition include, but are not limited to, conveyances installed for the sole purpose of conveying storm drainage.

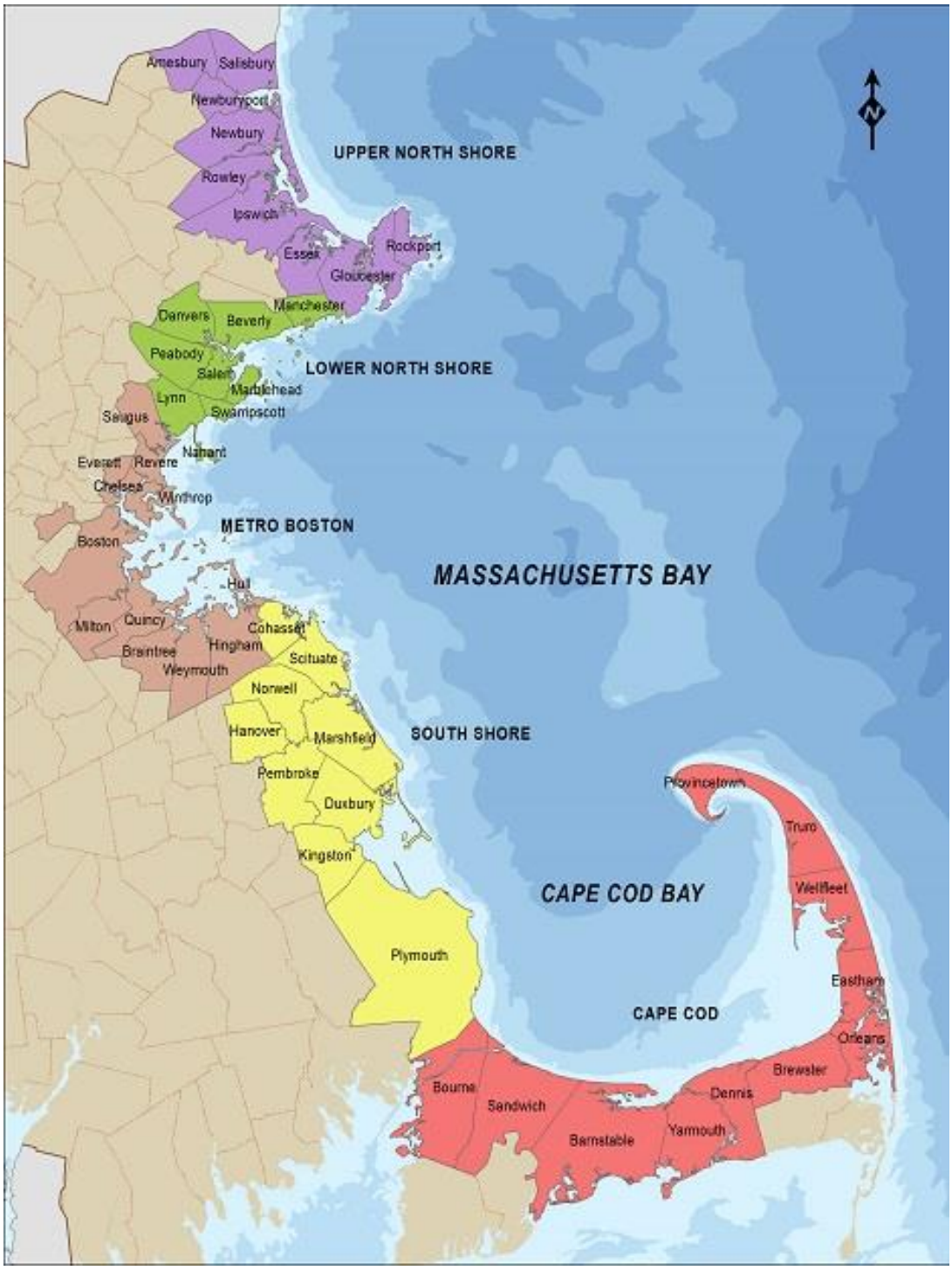


Figure 1. MassBays Program Planning Area

II. DATA INVENTORY AND GEODATABASE

The sections below summarize the methods used to perform the initial data inventory and to develop the geodatabase. An analysis of findings is also presented.

A. Initial Data Inventory

The initial data inventory involved the steps summarized in the flow chart below (Figure 2).

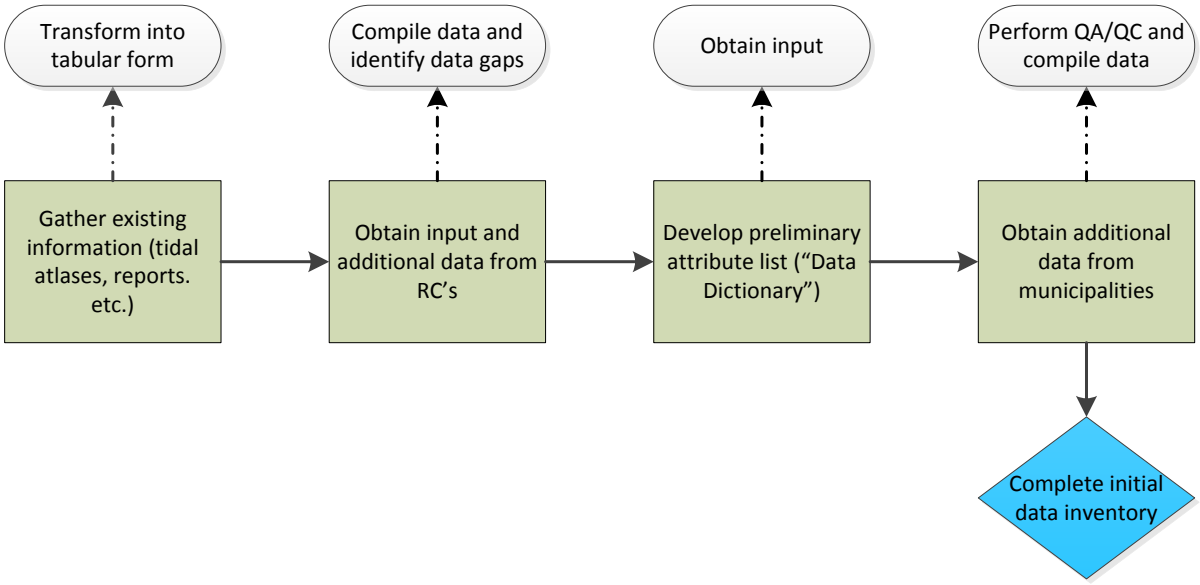


Figure 2. Initial data inventory development flow chart

The steps presented in Figure 2 are explained in detail in the following previously submitted project update memorandums:

- Gather existing information: "TIDEGateway – Initial Data Request for Data Inventory" dated 4/1/2015 (Appendix A).
- Obtain input from RC's and develop preliminary attribute list: "TIDEGateway – Data Inventory Updates and Discussion Points" dated 5/8/2015 (Appendix B).
- Obtain additional data from municipal contacts: "TIDEGateway – Data Inventory Municipal Contact Summary" dated 9/9/2015 (Appendix C).

B. Field Protocols and Inspections

Upon completion of the initial data inventory, the field data collection phase of the project commenced as summarized in the flow chart below (Figure 4).

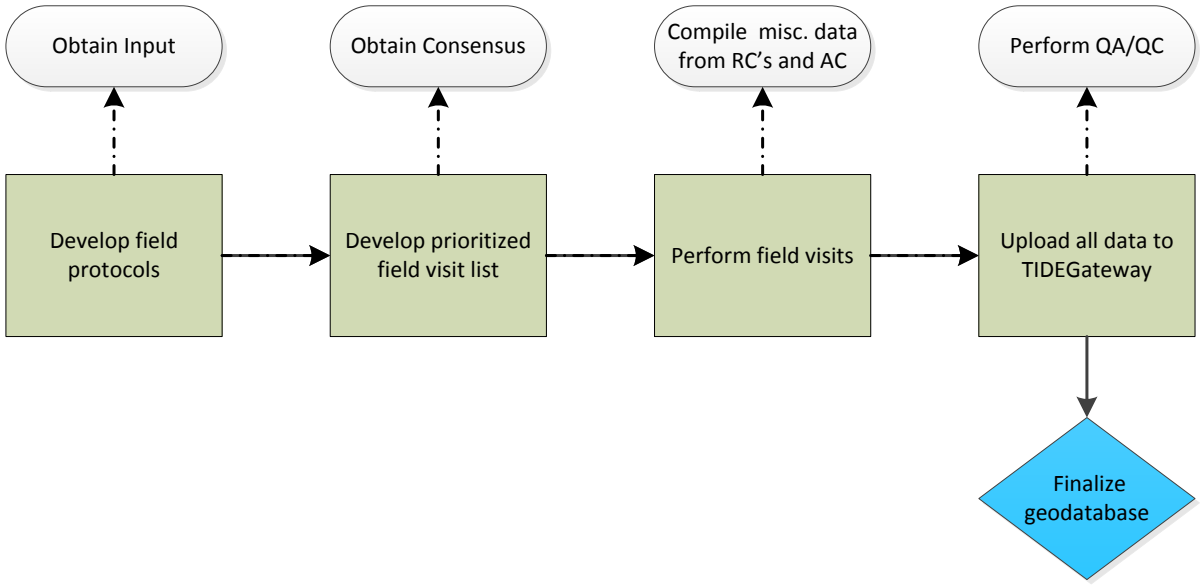


Figure 3. Field protocol and field visit flow chart

- **Field Protocols**: Field protocols for tide gate data collection were developed to provide a consistent methodology for MassBays, CZM and its partner agencies. The protocols include sections on safety, initial site selection and planning, data collection and entry, and upload and quality assurance (QA) procedures. The field protocols were designed to be performed in the absence of a GPS unit or other specialized equipment. The field protocols for tide gate data collection are included as Appendix D of this document.

- **Field Preparation**: A list of tide gates selected for field visit was developed based on the initial tide gate data inventory. The list was developed with input from the AC and included a distribution of tide gates across all of the MassBays regions. Tide gates were primarily selected for field visits based on data availability (i.e. tide gates with the least amount of existing data were prioritized over tide gates with the most existing data). Appendix E provides the initial field visit list. The list was compiled on 10/12/2015 and organizes the tide gates by a unique identifier, town, and region. The list includes a "comments" column describing the reason each tide gate was selected (or was not selected) for a field visit.

- **Field Visits**: Field visits were then performed in each MassBays region between 11/2/2015 and 12/18/2015 over the course of five field days. Regional CZM staff, MassBays RC's, and/or members of the AC were present during each field day to provide input and to allow for training of agency staff on the field protocols for tide gate data collection. A field visit personnel log is provided in Table 1.

Table 1. Field visit personnel log

Day	Region	Name	Organization
11/2/2015	Metro Boston	Lisa Engler	CZM
		Franz Ingelfinger	DER
		David Roman	Geosyntec
		Bob Hartzel	Geosyntec
11/3/2015	Metro Boston & South Shore	Jason Burtner	CZM
		David Roman	Geosyntec
		Hayley O'Grady	Geosyntec
11/4/2015	Metro Boston & South Shore	Jason Burtner	CZM
		David Roman	Geosyntec
		Hayley O'Grady	Geosyntec
12/2/2015	Upper & Lower North Shore	Bob Boeri	CZM
		Kathryn Glenn	CZM
		Barbara Warren	Salem Sound Coastwatch
		Peter Phippen	MassBays
		David Roman	Geosyntec
12/18/2015	Cape Cod	Steve McKenna	CZM
		Jo Ann Muramoto	MassBays / Association to Preserve Cape Cod
		April Wobst	Association to Preserve Cape Cod
		David Roman	Geosyntec
		Taylor Walter	Geosyntec

Once the field investigations were complete, additional tide gates were added and/or modified based on RC correspondence. For example, three tide gates were added at the Parker River National Wildlife Refuge area per correspondence with U.S. Fish and Wildlife Service. A summary of tide gates and "add-ons" by region is listed by Table 2 and shown by Figure 4. In total, 49 individual tide gates were visited in the field and an additional 18 were modified or added. Refer to Appendix F for a comprehensive list based on unique identifier of all tide gates that were visited or added to the database as part of the field data collection effort.

Table 2. Summary of tide gates visited by region

Region	Field Visits	Add-On's	Total
Cape Cod	6	1	7
South Shore	19	0	19
Metro Boston	13	13	26
Lower North Shore	6	0	6
Upper North Shore	5	4	9
Totals	49	18	67

- **Data Upload and Quality Assurance (QA)**: Once field visits were complete, all collected data was uploaded to TIDEGateway and QA review was performed on all entries. The QA review included review of naming conventions, spatial locations, photo uploads and captions, and consistency/quality of data entries (grammar, units, typos, etc.).

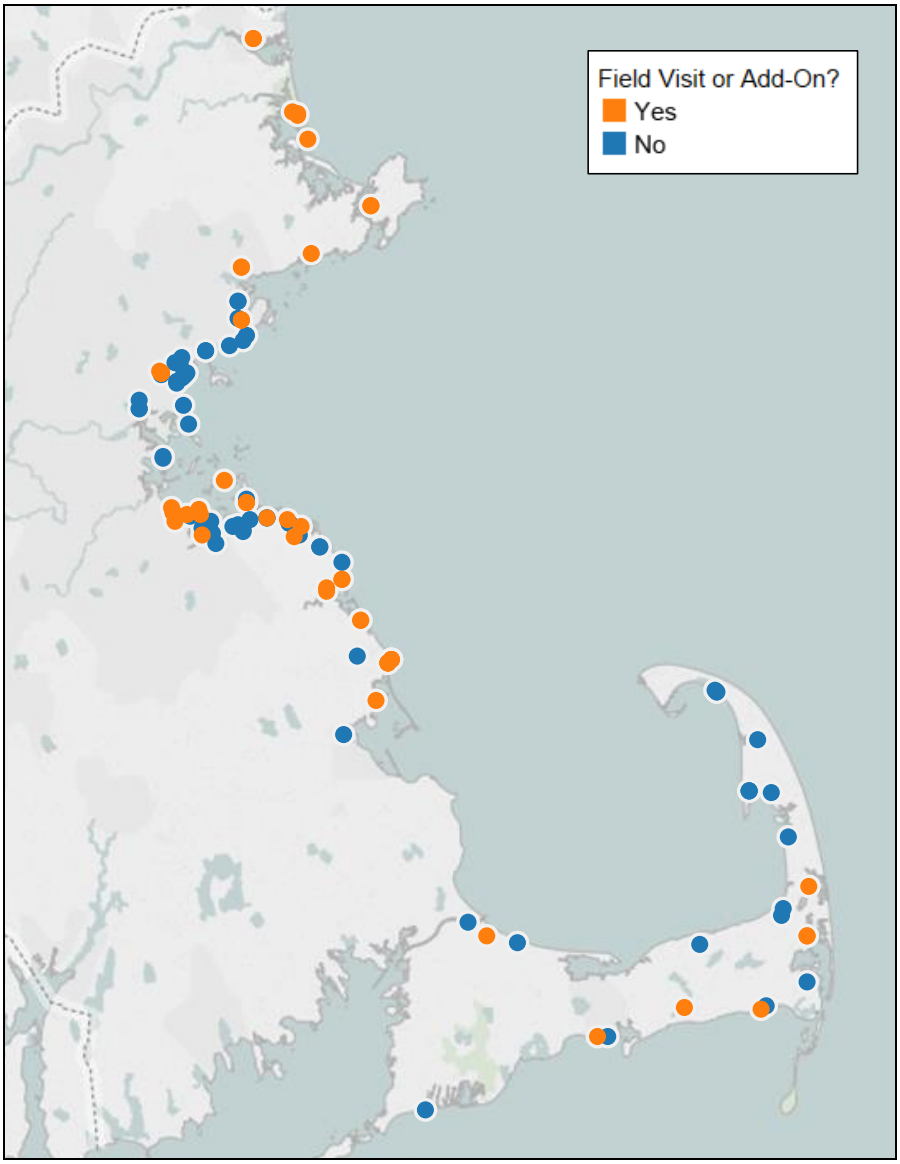


Figure 4. Depiction of tide gates visited during field effort or added-on based on RC correspondence

C. Final Geodatabase

The final tide gate geodatabase is accessible at www.tidegateway.com and contains the following features:

- **Attribute Access:** Information for each tide gate can be accessed in tabular form by using the "Tide Gate Geodatabase" button if the tide gate name or town is known. Alternatively, tide gate data can be accessed spatially by using the "Interactive Tide Gate Map" button. Finally, if a tide gate's unique identifier is known, its data can be directly accessed via URL. For example, tide gate Scituate-04 has a Unique ID of 77 and can be accessed via the following URL: http://www.tidegateway.com/editattribute.aspx?UNIQUE_ID=77. Full attribute information for each tide gate is presented in a printable "fact sheet" type format.

- **Fully Editable Data and Source Tracking**: All tide gate attributes can be directly edited once a user enters in their name, organization, email address, and data entry reason. Requiring users to enter in their contact information enables the database to track which attributes are modified and why. The database logs this information by means of a "tidegate source and change history" log. For example, if a modification was made to the Tide Gate Type for a specific tide gate, the database will indicate when the information was modified, by who, and the reason for the modification. Tide gates can also be deleted from and added to the database. Refer to Part III.D of the field protocols document for an explanation of tide gate naming conventions and instructions for entering specific attributes (Appendix D).

- **Downloadable Data:** The entire geodatabase can be downloaded at any time in a comma delimited (.CSV) file. This enables users to provide analysis in external software packages such as Microsoft Excel or to be imported into GIS-based packages via latitude and longitude coordinates. The database is also available through the Massachusetts Ocean Resource Information System (MORIS) at http://www.mass.gov/eea/agencies/czm/program-areas/mapping-and-data-management/moris/

- **External Data Files**: Each tide gate is also linked to a SharePoint folder containing additional information including monitoring data, operations and maintenance plans, permits, and other relevant files or reports. All scanned field logs have been uploaded to the relevant SharePoint folder for each tide gate.

- **Documentation:** Additional documentation on TIDEGateway can be accessed directly from www.tidegatway.com.

D. Training

As previously discussed, training of RC's and other personnel on implementation of the field protocols was performed on a region to region basis during the field inspections (see Table 1). Geosyntec provided additional training to staff of MassBays, CZM and other partners on the geospatial tool and how to update, modify, and add tide gate attributes and external files via TIDEGateway.

E. Data Analysis and Findings

General Findings and Statistics

Once the geodatabase was complete, an analysis of tide gate attributes was performed. This section summarizes general findings. Refer to Appendix G for complete findings, including figures and maps. Additionally, refer to Appendix H for a listing of current data gaps by field in the geodatabase as of January 19, 2016.

- **Counts:** The geodatabase contains 137 tide gates at 100 sites (37 sites contain two or more tide gates). Regionally, the metro Boston region has the most tide gates in the geodatabase (62) and the upper north shore region has the fewest (9). At the municipal level, Revere has the most tide gates in the geodatabase (21) and Marshfield has the second most (11).

- **Type:** Flap gates are the most common type of tide gate in the geodatabase (61 tide gates, 44%); 26 tide gate types are unknown.

- **Material and Size:** A majority of tide gates are comprised of metal (79 tide gates, 58%) and 19 are comprised of wood. Tide gate sizes vary widely throughout each region and generally range from an average diameter of 2.6 feet for circular tide gates to an average diameter of 5.4 feet for rectangular tide gates. There are 69 records of rectangular tide gates in the database compared to 26 records for circular tide gates.

- **Purpose and Status**: Most tide gates are in active use (109, 80%), while 24 are inactive, proposed, or removed. 51 tide gates are solely installed for flood protection, while only 14 serve a dual role of flood protection and restoration.

- **Operator Type:** Most tide gate operators are public. A larger proportion of private operators are present in Cape Cod than in other regions.

- **Culvert Material and Size:** Reinforced concrete is the most common culvert material (62 total, 45%). Other culvert material types include corrugated metal, ductile iron pipe, and granite block.

- **Restriction Surface:** Roughly half of the tidal restrictions in the geodatabase are the result of roadway crossings (67 total, 49%). Other restriction types include footpaths, railroad crossings, retaining walls, dams, and berms.

Condition Findings

The below comments provide a summary of general tide gate and culvert condition; refer to Appendix G for complete findings including figures and maps:

- **Tide Gate Condition**: A condition value was assigned to 38 distinct tide gates. Condition was generally good, although 32% of assigned tide gates were assigned a fair or poor value. Tide gate condition appeared to be evenly distributed across each region. The largest proportion of tide gates in fair or poor condition was located in the Metro Boston area.

- **Culvert Condition**: A condition value was assigned to 42 culverts associated with tide gates. Culvert condition was generally not as good as that of the tide gates, with 48% of assessed culverts assessed as fair or poor condition. Culvert condition appeared to be evenly distributed

across each region, although the largest proportion of culverts in fair or poor condition was located in the Metro Boston area.

Refer to Table 3 for a complete listing of tide gates and culverts found to be in poor or fair condition during the field assessments performed in November and December 2015 along with accompanying comments. Additionally, photographs of relevant comments for selected tide gates and culverts are provided by Appendix I[1]. Reasons for tide gates or culverts to be assessed as "fair" or "poor" condition ranged widely; common reasons are listed below:

- **Common tide gate condition findings**: Inoperable (sealed shut, missing required float, etc.), doesn't form seal (i.e., leaking observed), deformation, waterlogged and rotten wood, excessive corrosion, not secure in place (e.g., bolts falling off).

- **Common culvert condition findings**: Collapsing and/or deformed culvert, excessive sedimentation, culvert pipe bell separation, general deterioration. Additionally, a number of headwalls were observed to be in poor or fair condition. These findings were coupled with culvert condition findings to ensure proper tracking. Headwall findings were generally related to general deterioration including collapsing, spalling, cracking, exposed rebar, and scour. One recommendation for future work will be to include headwall specific fields in the geodatabase to enable better tracking of these structures.

[1] Note: A complete photograph log of tide gates can be accessed from TIDEGateway.com. Tide gate records can be directly accessed based on "UNIQUE ID". For example, UNIQUE ID 77: http://www.tidegateway.com/login.aspx?ReturnUrl=%2feditattribute.aspx%3fUNIQUE_ID%3d77&UNIQUE_ID=77

Table 3. Tide gate and culvert condition findings[2]

UNIQUE ID	TIDEGATE ID	REGION	TIDE GATE CONDITION	TIDE GATE COMMENTS	CULVERT CONDITION	CULVERT COMMENTS
12	Orleans-02A	CAPE COD	Fair	There were two tidal control structures located at the site. The first control structure was a rectangular metal flap gate installed on the downstream end of the restriction (Orleans-02A). Orleans-02A was in good condition and appeared to have been recently replaced as evidenced by new mounting hardware. At the time of the site visit (12/18/2015), the tide gate was inoperable and was sealed completely shut by fine grained sediment deposited in the channel. Dredging was required to restore proper functionality of the tide gate and to allow passage of upstream flow.	Good	The upstream and downstream ends of the 1' diameter CMP culvert appeared to be in good condition. There was another corrugated circular plastic culvert with a diameter of approximately 10" downstream of the restriction at the Namequoit Road crossing where the channel entered Paw Wah Pond. Scour and bank undercutting were observed along the channel between the restriction and Namequiot Road. It was unclear if the scour had been caused by tidal exchange, stormwater flows from the upstream impoundment, or some combination thereof.
14	Sandwich-01	CAPE COD	Fair	The square metal flap gate was located on the seaward opening of the culvert and was in fair condition. It appeared that the tide gate had recently been bolted back onto the culvert as evidenced by new mounting hardware; however, the metal comprising the flap gate was deformed and did not appear to form a tight seal against the culvert opening. A 3-5" gap was observed from which tidal exchange could occur. In addition, the bottom half of the tide gate was corroded and its operation was impeded by heavy algae growth. It was unclear if the tide gate would be able to fully open in the event of a storm event to pass heavy upstream flows.	Poor	The circular ductile iron culvert appeared to be in good condition; minimal to no corrosion was observed. The downstream end of the culvert was located at the bottom of an embankment comprised of well graded and recently installed gravel. The upstream end of the culvert was located at the bottom of a wooden retaining wall in poor condition. The retaining wall was beginning to collapse at multiple locations, excessive wood rot was observed, and upland vegetation was observed growing through the retaining wall - further compromising its structural integrity.
132	Beverly-01B	LOWER NORTH SHORE	Fair	Beverly-01B was located on the eastern end of the spillway and was a steel sluice gate operated by a handwheel. Grease was observed on the handwheel, so it appeared that the gate was periodically operated. The tide gate was in fair condition; the metal sluice gate was badly corroded and was leaking.	Good	There was no culvert at this location, the restriction was a concrete dam built in 1904. The approximate spillway dimensions were as follows: width 31'; height 5.5'. The spillway appeared to be in good condition with no visible signs of deterioration.
24	Manchester-01	LOWER NORTH SHORE	Good	There was a metal sluice gate with an electric actuator at this location. The tide gate was rusty but appeared to be in good condition with no evidence of corrosion. The actuator also appeared to be in good condition and appeared to be approximately 15 to 25 years old. Actuator and tide gate were located behind a chain link fence with a padlock; however, it was not locked at the time of the site visit. It appeared that power to the actuator was not locked out and could potentially be operated by anyone from the general public.	Poor	The culvert underneath the roadway was semi-circular granite block. It appeared to be in good condition on the downstream end; however, the upstream headwall was in poor condition - A chunk of the headwall had fallen into the channel, exposed rebar was observed, and a vertical crack was forming in the top middle of the headwall that extended almost down to the top of the culvert opening.
25	Salem-01A	LOWER NORTH SHORE	Good	There were three identical tide gates at this location - Salem-01A was located to the northwest, Salem-01B was located in the middle, and Salem-01C was located to the southeast. The tide gates were all rectangular wooden sluice gates with electric actuators. Access to the tide gates and actuators was limited by a locked chain link fence, so tide gate dimensions are approximate. All three tide gates appeared to be in good condition - the wood was weathered, but did not appear to be rotten and the actuators appeared to have been installed in the last 5-15 years and appeared to be operable.	Fair	There were three identical granite block culvert openings on the upstream side (all approximately 6’ wide by 4’ high) and two granite block culvert openings on the downstream side (approximately 10’ wide by 10’ high each). The granite block culvert appeared to be in good condition. Spalling and general deterioration of the upstream headwall was observed. In addition, the cribbing retaining the riprap embankment on the southwest upstream wingwall was collapsing. The downstream headwall appeared to be in good condition; however, sections of the bridge deck were being supported by wooden blocks.
130	Salem-01B	LOWER NORTH SHORE	Good	See above comment (Unique ID 130).	Fair	See above comment (Unique ID 130).
131	Salem-01C	LOWER NORTH SHORE	Good	See above comment (Unique ID 130).	Fair	See above comment (Unique ID 130).
36	Hull-02A	METRO BOSTON	Fair	Tide gate was a metal sluice gate operated by a manual jack screw. The tide gate appeared to be in fair condition; however, it appeared that it was inoperable and rusted in place. Significant rusting of the hinges and main structure of the tide gate was observed.	Fair	There were no apparent structural issues observed at the concrete box culvert; however, the headwalls on both the upstream and downstream end of the culvert were in poor condition. Significant spalling and exposed rebar was observed on both the upstream and downstream headwalls. Further, the access rungs leading from the top of the headwall down to the tide gate were corroded.

[2] Table contains tide gate and culvert pairs that were found to be in fair or poor condition during the field inspections performed November through December 2015.

UNIQUE ID	TIDEGATE ID	REGION	TIDE GATE CONDITION	TIDE GATE COMMENTS	CULVERT CONDITION	CULVERT COMMENTS
122	Hull-02B	METRO BOSTON	Good	Tide gate was a large wooden flap gate chained in place at the mouth of the culvert. Tide gate appeared to be in good condition.	Fair	See above comment (Unique ID 36).
38	Hull-04	METRO BOSTON	Unknown	Wedged flapper in manhole. Installed as part of MassDOT roadway project. Tide gate was inaccessible, diameter and shape assumed based on observed downstream culvert outfall.	Fair	Outfall to culvert was located below high water mark approximately 150' downstream of the tide gate. A metal (rebar) trash grate was installed at the outlet. The culvert was in fair condition - the culvert bell/segments were beginning to decouple and gaps were observed in the joints. It appeared that the cause of the decoupling was lowering of the beach profile (i.e. longshore sediment transport).
42	Quincy-04	METRO BOSTON	Unknown	Flap gate was located within stormwater infrastructure pipe. At the time of the site visit, the manhole was not accessible.	Poor	Reinforced concrete culvert was 36" at downstream end and 12" at upstream end. Outfall was located approximately 100' feet north of Bayswater Road on the beach and was partially exposed at low tide. Downstream end of culvert was severely deteriorated: most of the joints had separated and large 1'-2' gaps were observed in the pipe. Upstream end of culvert which entered the marsh off of Winthrop Street was in fair condition, but was partially buried and appeared to have the potential to get buried or silted in if not frequently maintained.
84	Quincy-06	METRO BOSTON	Good	Tide gate was recently installed and appeared to be in good condition and operable.	Fair	Downstream end of culvert was plastic (HDPE) and upstream end of culvert was corrugated metal. Downstream end of culvert appeared to be in good condition; however, upstream end was partially buried, thereby potentially limiting stormwater conveyance capacity.
58	Weymouth-02	METRO BOSTON	Poor	Large wooden flap gate was in poor condition. The bottom half of the tide gate was rotting. The tide gate was installed in such a way that a seal was not created against the headwall thereby allowing some level of tidal exchange at all tidal levels. The tide gate hinges appeared to be operable; however, the tide gate was so waterlogged that it was not possible to fully open.	Fair	Stone culvert appeared to be in fair condition. Longitudinal cracks were observed on upstream end of the headwall. Upstream end of the headwall had a steel trash screen installed across the culvert mouth. The bottom portion of the trash rack was corroded.
63	Cohasset-02	SOUTH SHORE	Not Applicable	It appeared that the previous tide gate fell off or was removed from the hinge located on the stone headwall. The metal hinge was corroding and did not appear to be robust.	Fair	Deformation of the corrugated metal culvert was observed on its downstream end indicating that it was potentially beginning to collapse. Significant spalling and cracking was also observed on the downstream concrete headwall.
28	Duxbury-01	SOUTH SHORE	Fair	The metal circular flap gate was operational; however, the bottom 10% of the flapper was beginning to corrode away.	Fair	The culvert ran through a rip rap seawall. The culvert was cast iron, covered in barnacles, and appeared to be in fair condition. The upstream end of the culvert was unable to be assessed as it was obstructed by collapsing riprap. A vertical crack was forming on the face of the downstream concrete headwall which extended appx. 3 foot down to the tide gate. In addition, the concrete wing walls were beginning to crack.
68	Marshfield-01A	SOUTH SHORE	Fair	There were two tide gates installed at this location. A metal self-regulating tide (SRT) gate was installed to the west (Marshfield-01A) and a metal flap gate was installed to the east (Marshfield-01B). The self-regulating tide gate was in fair condition and was inoperable; the bottom float which allows the tide gate to open was missing. As a result, it appeared that the gate was currently operating as a flap gate and limiting upstream tidal exchange. A hand operated winch and strap had been installed to operate the SRT and the strap was weathered. Additionally, the SRT's breather was clogged with debris and some leakage was observed around the flange connection to the headwall.	Good	Both culverts appeared to be in good condition. The upstream wingwall was in good condition, but appeared to be starting to slightly separate from the headwall.

UNIQUE ID	TIDEGATE ID	REGION	TIDE GATE CONDITION	TIDE GATE COMMENTS	CULVERT CONDITION	CULVERT COMMENTS
72	Marshfield-05A	SOUTH SHORE	Poor	There were two wooden flap gates at this location. Marshfield-05A was located to the north and Marshfield-05B was located to the south. The wood on both tide gates was heavily rotted and waterlogged with rusty wooden hinges. The northern tide gate was inoperable and was stuck shut; it appeared that the hinges were corroded shut. Additionally, the bolts securing the tide gate to the headwall were wearing through the wood. The southern tide gate was operable. Gaps were observed in the wooden backing behind each tide gate and it appeared that both tide gates did not create a watertight seal at high tide, thus enabling some level of upstream tidal flushing.	Poor	There were two identical oval CMP culverts for each tide gate. Both culverts appeared to be in poor condition. The culverts were separating from the concrete headwall and significant deterioration and rust was observed. The northern culvert (downgradient of the inoperable tide gate) was approximately half full of sediment presumably since the tide gate was rusted shut; presumably not letting sediment from upstream stormwater flows out. Both the upstream and downstream headwalls were also in poor condition and deterioration / spalling was observed in multiple areas. Finally, it appeared that the downstream headwall's weep holes had been filled with concrete.
124	Marshfield-05B	SOUTH SHORE	Fair	See above comment (Unique ID 72).	Poor	See above comment (Unique ID 72).
74	Scituate-01A	SOUTH SHORE	Poor	There were two tidal control structures at the site. A metal flap gate was installed on the downstream portion of the culvert (Scituate-01A). The downstream metal flap gate was in poor condition. It was rusted open approximately 3 to 4 inches, the bolts affixing it to the concrete headwall were corroded, and it appeared that someone had attempted to remove the tide gate as evidenced by loosened nuts (i.e., the nuts had been backed off the bolts).	Fair	The reinforced concrete pipe was in fair condition. It appeared that the mouth of the pipe was beginning to separate from the weir wall on the upstream side of the restriction. In addition, erosion was observed around the upstream concrete weir, presumably from stormwater runoff from the adjacent road, tidal influence, or some combination thereof. Erosion was also observed around the downstream headwall. The downstream headwall was in poor condition and appeared to "leaning" towards the channel towards the top, indicating mobilization of soils behind it. Additionally, spalling of the headwall was observed.
123	Scituate-01B	SOUTH SHORE	Good	There were two tidal control structures at the site. A concrete weir with wooden stop logs was installed on the upstream portion of the restriction (Scituate-01B). The upstream concrete weir and wooden stop logs appeared to be in good condition.	Fair	See above comment (Unique ID 74).
79	Gloucester-01A	UPPER NORTH SHORE	Good	There were three tide gates at the site. Gloucester-01A was an old sluice gate with a manual jack screw located at the bottom of the eastern portion of the headwall. All three of the tide gates appeared to be in good condition at the time of the site visit. Gloucester-01A was rusty, but corrosion was not evident and it appeared that the manual gear had recently been maintained and greased.	Fair	The culvert material was corrugated metal piping and was a semi-circle with an approximate width of 13 ft and an approximate height of 12 ft. The upstream portion of the culvert appeared to be in good condition with no apparent deterioration; however, the downstream portion was slightly separating from the headwall in places. Additionally, portions of the downstream culvert were jagged and appeared to pose a potential safety hazard.
116	Gloucester-01B	UPPER NORTH SHORE	Good	There were three tide gates at the site. Gloucester-01B was a newer combination metal sluice / flap gate. The sluice gate was able to operated via jack screw to be installed either at the invert of the headwall or towards the top. It was located towards the top of the headwall during the site visit, enabling low level tidal flushing through the bottom opening. All three of the tide gates appeared to be in good condition at the time of the site visit.	Fair	See above comment (Unique ID 79).
133	Gloucester-01C	UPPER NORTH SHORE	Good	There were three tide gates at the site. Gloucester-01C was a metal flap gate installed in the middle portion of the headwall. All three of the tide gates appeared to be in good condition at the time of the site visit.	Fair	See above comment (Unique ID 79).

Restoration Findings

The comments below summarize an analysis of findings related to restoration attributes in the geodatabase. Refer to Appendix G for complete findings including figures and maps.

- **Upstream Wetland Area:** Upstream wetland area estimates were obtained from previous tidal restriction atlases and are available for 21 sites in the geodatabase. Average total wetland area upstream of tide gate impoundments was 165 acres with a maximum of 1,400 acres (Tide Gate ID: Salem-02).

- **Restoration Status:** Restoration status for sites in the geodatabase was generally unknown or null (73 sites). However, 16 sites have restoration that is either completed, in progress, or proposed.

- **Extent of Tidal Influence:** As part of the field investigations, the extent of upstream and downstream tidal influence was approximated based on visible staining (see Appendix D). Out of the 67 tide gates that were visited, the extent of upstream and downstream tidal influence was collected at 17 individual tide gates. Results indicate that upstream tidal influence was less than downstream tidal influence by approximately 0.5 feet to 1.5 feet. The extent of upstream tidal influence was found to be greater than downstream tidal influence at Manchester-01; however, it is hypothesized that upstream staining at this site was a direct result of stormwater discharge. It is recommended that a Real Time Kinematic (RTK) GPS be used at select sites in the future to further improve accuracy of these findings to enable a more robust analysis.

- **Invasive Species:** Invasive species (e.g., *Phragmites*) were observed at a majority of sites that were visited (75%).

Refer to Table 4 for a listing of selected sites that were identified either in the geodatabase comments or during the field assessments performed in November and December 2015 to have restoration potential. Selected sites include commentary on general conditions of the upstream marsh, the presence of invasive species, observed low-lying properties, and other miscellaneous observations. Photographs documenting these observations for selected sites are provided in Appendix I.

Table 4. Selected tidal restriction restoration findings

UNIQUE ID	TIDEGATE ID	REGION	INVASIVE COMMENTS	RESTORATION COMMENTS
72	Marshfield-05A	SOUTH SHORE	Abundant *Phragmites* upstream.	No known restoration efforts or studies had been performed. Low lying properties including a dirt road and house were observed directly adjacent to the upstream impoundment.
124	Marshfield-05B	SOUTH SHORE	Abundant *Phragmites* upstream.	See above comment (Unique ID 72).
84	Quincy-06	METRO BOSTON	Flap gate limited all tidal flow. As a result, freshwater grasses and Phragmites were observed upstream.	At the time of the site visit, no known restoration efforts had been undertaken. The upstream area was large and appeared to have significant restoration potential. A number of homes were observed adjacent to the impoundment which might limit restoration options due to potential flooding.
147	Rowley-01A	UPPER NORTH SHORE	*Phragmites* abundant-- treated 3-5 year cycle, loosestrife present but somewhat in check by beetles.	Restoration is possible and is currently being evaluated by USFWS. Extensive data are being collected for future modeling scenarios.
7	Eastham-01	CAPE COD	*Phragmites* dominated the upstream and downstream portions of the restriction. Small patches of high marsh were observed downstream of the restriction.	The area appeared to have good restoration potential with minimal to no low-lying infrastructure observed. Note flap gate had been removed or fell off culvert at time of site visit (12/18/2015).
14	Sandwich-01	CAPE COD	The downstream portion of the marsh was comprised of a mixture of high marsh and *Phragmites* while the upstream portion of the marsh was predominately *Phragmites*. Upland vegetation was also observed along the railway embankment including wild cherry and sumac.	The site appeared to have good restoration potential; however, upgradient infrastructure (i.e. houses) were observed.
74	Scituate-01A	SOUTH SHORE	The impoundment was comprised primarily of high marsh and was fringed by *Phragmites*.	Houses were observed around the marsh; however, they appeared to be elevated.

UNIQUE ID	TIDEGATE ID	REGION	INVASIVE COMMENTS	RESTORATION COMMENTS
123	Scituate-01B	SOUTH SHORE	The impoundment was comprised primarily of high marsh and was fringed by *Phragmites*.	See above comment (Unique ID 74).
12	Orleans-02A	CAPE COD	The upstream impoundment appeared to be an entirely freshwater system as evidenced by cattails, Atlantic white cedar, and freshwater sedge.	The site had good restoration potential with minimal low lying infrastructure observed; however, restoration might be limited by the requirement to preserve Atlantic white cedar.
135	Orleans-02B	CAPE COD	See above comment (Unique ID 12).	See above comment (Unique ID 12).
63	Cohasset-02	SOUTH SHORE	The upstream impoundment was dominated by high marsh and was fringed with *Phragmites*.	Unknown if any restoration efforts had been performed at the site. Future restoration considering upsizing the culvert would need to investigate low lying areas including adjacent farm land directly to the south of the impoundment.
6	Dennis-01	CAPE COD	The upstream impoundment was mainly comprised of high marsh and was fringed with *Phragmites*. Upland vegetation was also observed directly to the south of the upstream culvert opening.	It appeared that the site would be a candidate for restoration; however, a potentially low lying barn and field was observed to the west of the restriction.
42	Quincy-04	METRO BOSTON	The upstream marsh had a mixture of *Spartina alterniflora* and *Spartina patens* and was bordered by *Phragmites*.	The marsh was previously studied for potential restoration by DER; however, it was concluded that low lying infrastructure would be a challenge. Future restoration would likely need to consider sizing culvert to accommodate the balance between stormwater outflows and tidal flushing.
40	Quincy-02	METRO BOSTON	There was a narrow channel on the upstream end of the restriction lined with an approximately 2' wide layer of salt marsh grass. From there, the salt marsh grass transitioned into mowed grass and *Phragmites*.	It appeared that no restoration efforts had been made at this location. There was an abundance of low lying infrastructure located at the upstream end of the restriction including houses, deck stairways, and concrete retaining walls.

UNIQUE ID	TIDEGATE ID	REGION	INVASIVE COMMENTS	RESTORATION COMMENTS
58	Weymouth-02	METRO BOSTON	Upstream area varied significantly. *Phragmites*, upland vegetation, and *Spartina alterniflora* islands were observed. Vegetation was indicative of some level of salt water influence, but not enough volume to inundate the marsh top which was mainly comprised of upland vegetation. It appeared that the marsh had potentially subsided over time.	Large upstream wetland area with good restoration potential. A marina worker indicated that upstream residents had complained of flooding in the past, but it was unclear if the flooding was a result of tidal inundation, stormwater influence, or a combination.
77	Scituate-04	SOUTH SHORE	Upstream impoundment was predominately comprised of *Phragmites*. Appeared that there was little to no tidal influence.	Would potentially be a good restoration candidate - minimal low lying infrastructure was observed; however, upstream area is used by the town as a drinking water well field.
36	Hull-02A	METRO BOSTON	Upstream marsh appeared to be relatively healthy with a mixture of low and high marsh species. *Phragmites* were observed at the fringes.	Previous water level logging was performed determine the relative extent of upstream restriction. Low lying properties including a cellular tower and guy wires were observed within and around the impoundment.
122	Hull-02B	METRO BOSTON	Upstream marsh appeared to be relatively healthy with a mixture of low and high marsh species. *Phragmites* were observed at the fringes.	See above comment (Unique ID 36).

Miscellaneous Findings

Refer to Table 5 for a listing of tide gates where future action items were identified based on review of the geodatabase and field assessment results. Action items include, but are not limited to: determine exact location of tide gates, obtain water level and relevant files from RCs or other local contacts, perform a re-visit of structures that could not be accessed during the field assessments (i.e., locked, etc.), etc.

Finally, refer to Table 6 for a listing of miscellaneous observations of interest that were identified during the field assessments. These observations vary widely and include sites were various wildlife or fish species were observed, potential overwash areas, and other miscellaneous comments.

An accompanying photo log of these observations is provided in Appendix I.

Table 5. Action item locations

UNIQUE ID	TIDEGATE ID	REGION	GENERAL COMMENTS AND MISC. FOLLOWUPS
4	Brewster-02	CAPE COD	Bridge replacement occurred from 2005-2008. Old flap gate may have been removed. Next steps: Determine if tide gate still exists at this location.
12	Orleans-02A	CAPE COD	Access to the site was located at the low point of Namequoit Road where a small conveyance channel enters Paw Wah Pond. The site was located approximately 100 feet up the channel to the north from the road. Orleans Conservation Trust (OCT) upgraded the system with NRCS. DER has tide data and a copy of OCT's management plan for the upstream Namaquoit Bog. Follow-up: Obtain data from DER.
135	Orleans-02B	CAPE COD	See above comment (Unique ID 12).
91	Swampscott-01	LOWER NORTH SHORE	Location of tide gate approximate based on review of aerial imagery (Google Earth, Bing bird's eye). Follow up: Determine exact tide gate location and perform field visit.
92	Swampscott-02	LOWER NORTH SHORE	Location of tide gate approximate based on review of aerial imagery (Google Earth, Bing bird's eye). Follow up: Determine exact tide gate location and perform field visit.
93	Swampscott-03	LOWER NORTH SHORE	Location of tide gate approximate based on review of aerial imagery (Google Earth, Bing bird's eye). Follow up: Determine exact tide gate location and perform field visit.
96	Chelsea-01A	METRO BOSTON	Location of tide gate approximate based on review of aerial imagery (Google Earth, Bing bird's eye). Follow up: Determine exact tide gate location and perform field visit.
119	Chelsea-01B	METRO BOSTON	Location of tide gate approximate based on review of aerial imagery (Google Earth, Bing bird's eye). Follow up: Determine exact tide gate location and perform field visit.
95	Chelsea-02	METRO BOSTON	Lat/Lon location could not be determined from municipal SharePoint contact. Additional clarification necessary to determined location. Follow up: Determine exactly tide gate location and perform field visit.
36	Hull-02A	METRO BOSTON	Site was easily accessible by walking northwards along a paved berm for approximately 500 feet off of Nantasket Road. Next steps: obtain preliminary water level data previously collected at the site from Jason Burtner (CZM).
122	Hull-02B	METRO BOSTON	See above comment (Unique ID 36).

UNIQUE ID	TIDEGATE ID	REGION	GENERAL COMMENTS AND MISC. FOLLOWUPS
38	Hull-04	METRO BOSTON	Tide gate is located in a locked subsurface vault adjacent to the intersection between Ocean Avenue and Main Street. At the time of the site visit, the tide gate could not be accessed. Additionally, upstream culvert was not located due to a dense Phragmites stand. Next steps: Contact Hull DPW to obtain access to tide gate for further investigation and locate upstream culvert during vegetation die off period.
39	Quincy-01A	METRO BOSTON	Tide gates are located under Quincy Shore Drive, a short walk south of Caddy Memorial Park. Follow up: Obtain additional site data: O&M, Engineering Plans, and Permits from when Tide Gates were installed.
120	Quincy-01B	METRO BOSTON	See above comment (Unique ID 39).
121	Quincy-01C	METRO BOSTON	See above comment (Unique ID 39).
40	Quincy-02	METRO BOSTON	The tide gate is located directly off of Edgewater Drive adjacent to the seawall and is located within a locked vault with an electrical enclosure sitting on top. Field crew was unable to access the interior of the vault. Next steps: Reach out to Town of Quincy and request a follow up visit for site access. Also ask how the tide is managed and ask if there are any O&M plans, permits, or plans associated with the tide gate.
42	Quincy-04	METRO BOSTON	Tide gate was located in a manhole adjacent to Winthrop Street and was not accessible. Follow-up with DER to obtain elevation data and with Town of Quincy to gain access to manhole to inspect tide gate.
87	Weymouth-05	METRO BOSTON	Review of aerials indicates that tide gate potentially located closer to shore, located in close proximity to tide gate unique id 89. Follow up: Determine exact tide gate location and perform field visit.
89	Weymouth-07	METRO BOSTON	Review of aerials indicates that tide gate potentially located closer to shore, located in close proximity to tide gate unique id 87. Follow up: Determine exact tide gate location and perform field visit.
62	Cohasset-01	SOUTH SHORE	Field crew was advised that access to site is on private property and access is challenging. As a result, this site was not accessed. Next steps: Jason Burtner of MA CZM indicated that he has data on this site including tide gate attributes and photos.
68	Marshfield-01A	SOUTH SHORE	Site is located directly off of Town pier Road and easily accessible. Next Steps: Jason Burtner of MACZM can provide permitting drawings and other relevant files and site information to further flesh out attributes.
125	Marshfield-01B	SOUTH SHORE	See above comment (Unique ID 68).
69	Marshfield-02A	SOUTH SHORE	See above comment (Unique ID 68).

UNIQUE ID	TIDEGATE ID	REGION	GENERAL COMMENTS AND MISC. FOLLOWUPS
112	Marshfield-02B	SOUTH SHORE	See above comment (Unique ID 68).
71	Marshfield-04A	SOUTH SHORE	Site is located directly off of Dyke Road and easily accessible. Note that Jason Burtner can provide permitting drawings and other relevant files and site information to further flesh out attributes.
126	Marshfield-04B	SOUTH SHORE	See above comment (Unique ID 71).
127	Marshfield-04C	SOUTH SHORE	See above comment (Unique ID 71).
128	Marshfield-04D	SOUTH SHORE	See above comment (Unique ID 71).
150	Ipswich-01	UPPER NORTH SHORE	Tide gate located at the Parker River National Wildlife Refuge at a berm not accessible by the general public. USFWS must be contacted to obtain access. Follow ups: Nancy Pau and USFWS can provide additional details with a field visit including tide gate and culvert dimensions, invert elevations, and upstream acreage.
147	Rowley-01A	UPPER NORTH SHORE	See above comment (Unique ID 150).
148	Rowley-02	UPPER NORTH SHORE	See above comment (Unique ID 150).
149	Rowley-03	UPPER NORTH SHORE	See above comment (Unique ID 150).

Table 6. Miscellaneous observations of interest

UNIQUE ID	TIDEGATE ID	REGION	MISCELANOUS COMMENTS
6	Dennis-01	CAPE COD	An abundance of live mussels was observed within the channel at the upstream end of the culvert.
25	Salem-01A	LOWER NORTH SHORE	The marsh immediately upstream appeared to be healthy and was comprised of a mixture of low and high marsh. Multiple invasive striped anemones were observed on the mudflat approximately 100 feet downstream of the downstream bridge opening.
130	Salem-01B	LOWER NORTH SHORE	See above comment (Unique ID 25).
131	Salem-01C	LOWER NORTH SHORE	See above comment (Unique ID 25).
42	Quincy-04	METRO BOSTON	A sewer manhole was located adjacent to the upstream end of the culvert in the marsh. Gravel had recently been placed around the manhole and evidence of previous scour was observed suggesting a history of overwash and stormwater inflows.
63	Cohasset-02	SOUTH SHORE	Area on the upstream side of the flapper was used for grazing years ago. The upstream channel was full of killifish.
65	Cohasset-04	SOUTH SHORE	Resident indicated that upstream impoundment used to be a pond; however, indicated that Town of Cohasset drains it for winter ice skating. Mowed cattails were observed throughout the upstream impoundment.
69	Marshfield-02A	SOUTH SHORE	Many killifish were observed on the downstream side of the tide gate.
112	Marshfield-02B	SOUTH SHORE	See above comment (Unique ID 69).

III. TIDEGateway

Information gathered through this effort are compiled online at TIDEGateway.com, accessible with password only. The site includes an Interactive Tide Gate Map, a Tide Gate Inventory, and Field Inspection Protocols.

Interactive Tide Gate Map: This viewer was designed as a web-based map interface that displays the geospatial data layers (for example, wetlands, land use, and ecological resources layers). The viewer was developed on the GeoCortex Essentials platform hosted on Geosyntec's Internet Information Services server, and utilizes services published to Geosyntec's ArcGIS Server.

Tide Gate Inventory: A listing of all tide gates in the database, hyperlinked to background materials – inspection reports, photos, and permits – available for that gate.

Field Inspection Protocols: Full protocols used for site visits and data-gathering efforts.

All data are also available through MORIS[3], folder: Infrastructure and Transportation, layer: Massachusetts Tide Gate Inventory.

[3] https://www.mass.gov/service-details/massachusetts-ocean-resource-information-system-moris

IV. RECOMMENDATIONS

This section provides recommendations for next steps. Recommendations are intended to be used as a framework for future work and planning efforts as it relates to further improving and expanding TIDEGateway.

- **Update geodatabase data dictionary with headwall specific attributes:** A number of headwalls were observed to be in poor or fair condition during the field assessments. These findings were coupled with culvert condition findings to ensure that data were stored and tracked. Headwall findings were generally related to general deterioration including collapsing, spalling, cracking, exposed rebar, and scour. An engineering analysis to add headwall-specific fields to the geodatabase would provide a more complete means to track overall condition of infrastructure at each site to better inform planning. A number of headwall specific fields can be included such as: qualitative condition, type (e.g., wingwall), and height.
- **Expand geodatabase format to include pipe and headwall geometry:** The geodatabase is currently comprised of "point" features representing locations of individual tide gates. Geodatabase geometry could be expanded to include separate geometry for pipes ("line features"), and headwalls ("area features"). Expanding geometry to be more representative of real-world conditions will enable more robust future modeling and data analysis on a site-by-site basis. For example, a user would be able to zoom in and visualize culvert alignments.
- **Perform field visits at all sites in the geodatabase:** As previously discussed, the field protocols were developed to be performed rapidly and without any specialized equipment. Performing field visits of all tide gates in the geodatabase will ensure continuity (e.g., uniform photographs) and improve attribute accuracy which will result in more informed future data analysis and subsequent management actions. Refer to Appendix E and Appendix F for detailed lists identifying sites that were visited during the field assessments in the fall of 2015.
- **Improve accuracy of elevation data via RTK GPS:** As previously discussed, elevation data including tide gate invert and extent of upstream and downstream tidal influence were collected in the field using staining as an indicator. In order to collect these attributes, measuredowns (i.e. top of headwall to invert of tide gate or staining mark) were obtained via a surveyors rod and transformed into elevations (in NAVD88) referencing LiDAR data. Utilizing an RTK GPS or survey equipment at high-priority sites would ensure more accurate elevations to better inform future planning decisions.
- **Natural resource and infrastructure management agencies should collaborate to communicate with operators/owners of tide gates and culverts found to be in poor or fair condition**: As presented in Section II, approximately 32% of tide gates and 48% of culverts visited during the field assessments were found to be in poor of fair condition, respectively. Informing owners/operators (i.e., municipalities, etc.) of these findings will enable additional structural and operational assessments to be performed at their discretion. Refer to Table 3 for a complete list of all tide gates and culverts found to be in poor or fair condition and Appendix I for accompanying selected photos.
- **Perform evaluation of potential restoration sites:** It is recommended that Table 4 and accompanying photographs found in Appendix I be used as a starting point to evaluate and develop a methodology to prioritize potential future restoration sites.
- **Perform miscellaneous identified follow-ups**: Perform miscellaneous follow-ups identified by Table 6. These include follow-ups to determine exact location of tide gates, obtaining relevant files from RC's and other local contacts, performing re-visits of structures that could not be accessed during the field assessments, etc.

- **Continue to perform outreach**: Continue with municipal and RC outreach to obtain information on site attributes. In particular, RC's can now upload tide gate specific files and data to TIDEGateway including water level monitoring data, permit, operation and maintenance plans, and other relevant files.
- **Configure geodatabase to provide live summary statistics**: The geodatabase is currently stored in a live Microsoft SQL server database and is configured to output a raw comma delimited file of live tide gate information. To improve this functionality, the live geodatabase can be linked to an external software package such as Tableau Software to automatically generate summary statistics and data visualizations at a pre-determined interval such as those presented as Appendix G. Automatically generated visualizations and statistics will provide managers with a constantly updated snapshot of existing tide gate information.
- **Expand field protocols**: There are a number of useful ways that the field protocols can be expanded to include additional analysis items of interest. For example, the protocols could be expanded to include a methodology for assessing salt marshes that have become degraded by reduced tidal flushing.
- **Develop a management plan template and recommended schedule for reviewing and updating plans**: Management plans should incorporate and reflect changing environmental conditions..
- **Develop construction cost estimates of selected tide gates**: In order to better inform future management of tide gates, it is recommended that planning level construction cost estimates of selected tide gates such as those in poor or fair condition be developed. Construction cost estimates would take a number of factors into account and could be developed at varying levels of complexity. For example, prioritization of sites for development of construction costs could be based on anticipated value of upstream infrastructure.
- **Expand tide gate data inventory to entire state of Massachusetts**: The tide gate geodatabase currently includes the MassBays planning regions and does not include tide gates in the Buzzards Bay area. The 2002 tidal restriction atlas for Buzzards Bay could be used as a starting point for expanding TIDEGateway into this region. Expanding to include Buzzards Bay would make TIDEGateway a resource for the entire Massachusetts coastline.
- **Expand TIDEGateway to include all tidal restrictions and not just tide gates:** TIDEGateway could easily be expanded to include all tidal restrictions. This would enable ease of future analysis, planning, and decision making to be performed from one platform. The database infrastructure for TIDEGateway has already been developed and implemented so expansion to include additional tidal restrictions would be straightforward.
- **Develop resiliency network to better inform site specific operation**: One additional way to leverage and expand the functionality of TIDEGateway would be to develop a site-specific resiliency network to enable optimal management of critical tide gates in the MassBays planning region. There are a number of ways that this could be performed; one avenue would be to monitor existing conditions (monitoring buoys, etc.), compute regional and site-specific risk based on anticipated storm surge and resulting upstream impacts, display information on a real-time dashboard accessible via TIDEGateway, and recommend risk mitigation actions. Recommended risk mitigation actions could be relatively simple (e.g., "close tide gate by 2pm in advance of predicted storm"). The resiliency network could also inform coastal managers when risk has decreased and remind them to open tide gates following storm events to enable tidal flushing.

Appendix A:

Initial Data Request

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Memorandum

Date: 1 April 2015

To: Lisa Engler, MassBays Program
MassBays and CZM Regional Coordinators

From: Robert Hartzel, Geosyntec Consultants
David Roman, Geosyntec Consultants

Subject: TIDEGateway – Initial Data Request for Data Inventory

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The purpose of this memorandum is to (1) summarize anticipated data needs for initial development of the TIDEGateway geodatabase under the "Data Inventory" task of the Tide Gate Inventory and Assessment Project, and (2) set the stage for a conference call amongst MassBays and CZM regional coordinators. The memorandum provides a brief overview of the data inventory task and summarizes anticipated data needs.

Data Inventory Task Summary: The initial purpose of the data inventory task will be to compile existing information about tide gate gates within the MassBays region into a comprehensive bibliography. Once complete, Geosyntec will review all available data and in coordination with MassBays and CZM, and develop a targeted list of applicable metadata categories and individual attributes of interest for each tide gate. Once a targeted list of attributes is developed, the initial TIDEGateway GIS data layer (i.e., geodatabase) will be developed based on gathered existing information. Major task deliverables will be a searchable bibliography of existing documents, an initial geodatabase and associated metadata, and a protocol for updating and maintaining the geodatabase.

Existing Information: Geosyntec currently has the following tide gate information from existing data sources:

- Tidal Restriction Atlases (PDF Form): Cape Cod, South Shore, North Shore;
- List of Tide Gates in MassBays Program, Cape Cod Region (7/29/2014);
- Preliminary list of municipal contacts within the MassBays region; and
- Additional site-specific information obtained from various published reports, maps and news articles (e.g., 2014 USEPA map of Rumney Marsh Restoration Areas)

Summary of Anticipated Data Needs: In order to complete the data inventory task, data from a variety of sources will be required. The intent of the initial data collection task is to coordinate with MassBays and CZM regional coordinators to obtain the most updated information that is available prior to coordination with municipal officials and other resources. The preferred data delivery medium which will increase efficiency and minimize any data entry errors is in the form of existing geodatabase files (i.e., shapefiles, etc.), spreadsheets, or other database type formats. However, additional file formats are also welcome, including paper maps, PDF documents, records of verbal communication with Town officials, field notes, etc.

Anticipated categories of data include:

- **Tide Gate Location:** Lat/Long or other means (i.e., paper map, road crossing location, etc.);
- **Tide Gate Attributes:**
  - Type (control/operational mechanism) and dimensions
  - Condition/Age
  - Upstream and downstream natural resources and water quality characteristics (e.g., upstream affected salt marsh area and total affected area)
  - Nearby infrastructure, adjacent low-lying topography and/or development,
  - Vertical data, including controlling elevations of water, historic upstream and/or downstream water level data (i.e., data logger or other records), tide gate invert elevations, road berm reference elevations, etc.
  - Existing state and federal permits for tide gate
  - Owner and current operational management
- **Restoration Status** (planned or recent)
- **Other**

As a starting point for discussion, and to help focus data collection efforts, the attached spreadsheet includes a very preliminary listing of tide gates by town. Most of this information is from the Tidal Restriction Atlases (*Note: The North Shore Atlas provides very little site-specific information compared to the other 2 atlases)*. For this project, tide gates are defined as any conveyance of tidal flow with the ability to passively or actively manipulate water flow. This definition includes self-regulating tide gates, manually controlled devices, or passive control structures such as flappers. Structures not included in this definition may include, but are not limited to, conveyances installed for the sole purpose of carrying storm drainage.

Please review the attached list and provide any additional information you have in whatever format is most convenient. We will arrange a conference call after April 20 to discuss the existing data, data needs, and questions resulting from the process.

Region	Town	Tidal Restriction Atlas ID #	Upstream Affected Salt Marsh Area (acres)	Upstream Total Affected Area (acres)	Lat (N)	Long (W)	Location (Water Body, Road)	Type of Engineered Flood Control Structure / Description	Restoration Status	Owner / Operator	Permit Status	Other
CAPE COD	Barnstable	BA-16	0	3.04	41 38' 13"	70 17' 58"	Halls Creek, Marchant Mill Road	stoplogs				
		BA-17	0	19.31	41 38' 15"	70 16' 89"	Stewart's Creek, Ocean Avenue	stoplogs				
	Brewster	BR-3	0	3.75	41 45' 25"	70 07' 46"	Quivett Creek, cranberry bog berm	flapper gate				
	Chatham	CH-6	0	34.58	41 42' 13"	69 58' 16"	Frost Fish Creek, Rt. 28/earthen berm	Infrastructure for stoplogs, used for many years and in disrepair.				
	Dennis	DE-3	3.14	4.11	41 40' 28"	70 10' 11"	Unnamed channel, Wheatfield Lane	tide gate				
	Eastham	EA-7	1.71	6.93	41 49' 04"	69 58' 03"	Abelino's Creek, Gov. Prence Road	tide gate				
		EA-9	6.31	16.51	41 52' 58"	70 00' 02"		tide gate				
	Falmouth	FA-2	0.75	1.64	41 32' 75"	70 35' 34"	Little Pond, Grand Avenue	stoplogs				
	Harwich	none listed										
	Mashpee	none listed										
	Orleans	OR-6	0	10.03	41 45' 42"	69 58' 18"	Pah Wah Pond, earthen berm	stoplogs				
	Provincetown	none listed										
	Sandwich	SA-5	0	2.07	41 45' 47"	70 29' 43"	Penn Central Railroad restriction of Dock Creek	3-foot pipe has a metal flapper-type tide gate on the seaward opening, restricting flow to 6-inch gap between pipe and gate (see Atlas). Tide gate is				
		SA-9	0	79.71	41 44' 95"	70 26' 41"	Ploughed Neck Road restriction of Long Creek/Cow River	tide gate; stoplogs	Restoration feasibility study was produced in June 2013 by the Cape Cod Conservation District, as part of the Cape Cod Water Resources Restoration Project			
	Truro	TR-3	0	152.38			Truro Center Road/Route 6A (Wilder Dike)	The seaward of two tidal restrictions on the Pamet River. This restriction is located at the Wilder Dike that supports Truro Center Road at Route 6A. The dike is fitted with a clapper valve (tide gate) at the	Funding is being sought by the town and DER.			
		TR-6	0	322.05	42 02' 04"	70 07' 02"	Pilgrim Lake, Rt. 6A/Rt. 6	Pilgrim Lake connects to Cape Cod Bay via a small channel with flow controlled by structures including a culvert with two flapper valves (coordinates for upstream side)	Upstream of Pilgrim Lake is what was once a vast intertidal salt marsh system known as Salt Meadow, delineated by the Wetlands Conservancy Program as 94.52 acres of shrub swamp and 50.94 acres of shallow marsh. In addition to sites TR-6 and TR-7 that restrict tidal flow into Pilgrim Lake, Salt Meadow is further restricted by 2 infrastructure crossings. First, by the extension of High Head Rd. that serves as a jeep trail to the beach, and second by a dike lying to the east of the jeep trai. If tidal flow is restored to the Pilgrim Lake system, most intertidal wetland benefits would be realized in the Salt Meadow wetland. These 2 upstream crossings should be included in restoration discussions			
		TR-7			42 03' 17"	70 07' 10"	Pilgrim Lake, High Head Road	weir and box culvert with stoplogs				
	Wellfleet	WE-5	0	19.33	41 55' 84"	70 01' 78"	Commercial St. restriction of Mayo Creek	1-way duckbill valve in flapper gate	Feasibility study done in 2009-2010. Town working group convened in 2014 to plan restoration.			
		WE-6	0.81	approx. 100	41 55' 87"	70 03' 87"	Herring River, Chequessett Neck Road	Flapper-type tide gates in two of the culverts and an adjustable sluice gate in a third culvert	Planning and permitting largely complete; fundraising for restoration construction is ongoing. Construction could occur in the next 5 years if funds are obtained			
	Yarmouth	none listed										
SOUTH SHORE	Braintree											
	Cohasset	COBB2			42 15' 00.73"	70 47' 21.40"	Treats Pond, Atlantic Avenue	culvert with flapper gate				
		COBB4			42 15' 26.68"	70 48' 46.23"	Richardson Brook, Jeruselum Road	culvert with flapper gate				
		COBB6			42 15' 14.87"	70 48' 37.23"	Inner Little Harbor, Nichols Road	tidegate				
		COBB9			42 14' 23.03"	70 47' 41.71"	James Brook, Spring Street	culvert with flapper gate				
		COBB13			42 14' 23.23	70 47 40.67	James Brook, Summer Street	2 flapper gates				
	Duxbury	DUDB18			42 02' 28.71"	70 40' 11.09"	Duxbury Harbor, Long Point Lane	dike with flapper gate				
	Hingham	HIHH9A			42 14' 59.55"	70 54' 02.54"	Broad Cove, Rt. 3A at police station	wooden flapper gate (poor condition)				
		HIHH10			42 14' 37.49"	70 53' 01.45"	Home Meadow, Water Street	tide gate				
		HIHH12			42 15' 29.36"	70 52' 28.15"	Worlds End, Martins Road	flapper gate **(replaced with box culvert in 2010/2011)**				
		HIWR19			42 15' 06.68"	70 51' 38.15"	Turkey Hill Run, Rockland Street	flapper gate				
	Hull	HUHB1			42 16' 56.29"	70 52' 47.33"	Hull Bay, Newport Road	wall with pumped outlet (with duckbill)				
		HUHB2			42 16' 42.98"	70 52' 38.86"	Hull Bay, Nantasket Road	tide gate (manual)				
		HUWR3			42 15' 37.36"	70 50' 41.05"	Straits Pond, Rt. 228	2 tide gates	tide gates replaced in 2010			
	Kingston	none listed										
	Marshfield	MAGH4A			42 05' 23.21"	70 38' 42.54"	Green Harbor, Town Pier Road	tide gate and flapper				
		MAGH4B			42 05' 21.18"	70 38' 40.60"	Green Harbor, Town Pier Road	tide gate and flapper				
		MASR16			42 05' 35.53"	70 42' 01.41"	South River, Rt. 139 (Library Plaza)	culvert with tide gate				
	Norwell	none listed										
	Plymouth	none listed										
	Quincy						Black's Creek tide gates					
							Edgewater Drive Sea Wall/Tide Gates	2 tide gates				
							Broad Street tide gate					
	Scituate	SCSH2A			42 11' 11.56"	70 43' 30.16"	Scituate Harbor, Kent Street	flapper gate				
		SCHR5			42 10' 36.54"	70 44' 52.65"	Herring River, Driftway	culvert with flapper gate				
		SCBB11			42 13' 31.69"	70 46' 26.47"	Musquashcut Brook, Hatherly Road	electric tide gate				
		SCHR20			42 10' 17.53"	70 45' 00.86"	Herring River, earthen dike	earthen dike with flapper gate				
		SCSH25			42 12' 22.50"	70 43' 22.82"	Cedar Point, Jericho road	culvert with flapper gate				
	Weymouth	WEWF1			42 14' 18.40"	70 56' 57.25"	Philips Creek, Pearl Street	large wooden flapper gate				
NORTH SHORE	Beverley											
	Boston											
	Cambridge											
	Chelsea						Pearl Street tide gate					
	Danvers											
	Essex											
	Everett											
	Gloucester				42°35' 58.27"	70°40' 37.92"	Mill Pond Tide Gate	2 tide gates	new tide gates installed in 2011			
	Ipswich											
	Lynn											
	Manchester							mouth of Sawmill Brook				
	Marblehead											
	Medford											
	Nahant											
	Newbury											
	Newburyport											
	Peabody											
	Revere						Route 1A Tidegate #1		missing top floats need to be replaced for flood control			
							Route 1A Tidegate #2		missing top floats need replacment; obstructed culvert			
							Route 1A Tidegate #3		crushed culvert outlet needs replacement			
							Route 1A Tidegate #4		grated vault covers stolen from 1-4 need replacment			
							Route 1A Tidegate #5	undersized culvert (24") with 48" SRT; replacement with a larger culvert needed				
							Route 1A Tidegate #6	completely obstructed 600' culvert				
							Linden Brook tide gate					
							Townline Brook tide gates					
							Copeland Circle tide gate					
							Central County Ditch tidegate		not being operated properly to maximize restoration; needs bottom float installation			
							Oak Island tidegate	Vandalized SRT was replaced with new combo gate in 2013				
	Rockport											
	Rowley											
	Salem											
	Salisbury						Town Creek	2 new (2013) culverts with tide gates				
	Saugus						Ballard Street tidegate	leaking temporary tide gate	future restoration project under design			
							Former Bristow Street tidegate	temporary blocked culvert - missing tide gate	future project under designto restore marsh			
							Seagirt Avenue Marsh tidegate	obstructed culvert and ditch - missing tide gate				
	Somerville											
	Swampscott											
	Winthrop						Winthrop Parkway tide gates (near Leverett Street), regulate flow to Belle Isle					

Appendix B:

Initial Data Inventory Updates

Geosyntec consultants

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Memorandum

Date: 8 May 2015

To: Lisa Engler, MassBays Program
MassBays and CZM Regional Coordinators

From: Robert Hartzel, Geosyntec Consultants
David Roman, Geosyntec Consultants

Subject: TIDEGateway – Data Inventory Updates and Discussion Points

Attachments:
1. Preliminary Bibliography
2. List of Existing Attributes and Data Gaps
3. Preliminary Data Dictionary
4. Example Fact Sheet from Proposal

The purpose of this memorandum is to provide a status update regarding initial development of the TIDEGateway geodatabase under the "Data Inventory" task of the Tide Gate Inventory and Assessment Project and to provide a listing of key points for discussion with the Regional Coordinators (RC's) during the meeting on Thursday 5/14/2015. Specific items covered as part of this memorandum include:

- Summary of Data Collection Efforts;
- Summary of Available Data and Identified Data Gaps;
- Preliminary List of Proposed Attributes for Inclusion in TIDEGateway; and
- Discussion Points and Requested RC Input.

Summary of Data Collection Efforts

An initial data request to all RC's on 4/1/2015 in a memorandum titled "TIDEGateway – Initial Data Request for Data Inventory". Since then, a number new data sources and information have been incorporated into the initial database and bibliography. In total, the initial database currently has fifteen (15) data sources covering all 5 MassBays planning regions, summarized as *Attachment 1* of this memorandum. The bibliography will be continually updated as new information is received and incorporated into the database.

Summary of Available Data and Identified Data Gaps

Most of the preliminary database is comprised of entries from the existing tidal atlases (e.g., South Shore, Cape Cod). However, a number of entries have been added and improved upon with added detail provided by the RC's. As part as the ongoing QA/QC process, a number of attributes (i.e. columns) from separate data sources have been merged (e.g., Restriction ID, Tide Gate Type, etc.) where applicable.

The preliminary database currently has entries for 77 tide gates and is split into 51 different attributes from the combined 17 data sources. Refer to *Attachment 2* of this memorandum for a detailed listing of all attributes in the database. The attachment lists all attribute names in "raw" form directly from the data source, lists the number of blank (i.e. missing) entries, and tabulates the overall completion percentage.

The following general observations have been made regarding the existing data:

- General information such as location, Town, and type of flood structure is generally complete.
- The database generally contains a good level of qualitative data such as restoration status, comments, and other general information.
- The database currently lacks quantitative data such as tide gate dimensions, material, shape, etc.

Preliminary List of Proposed Attributes

Using information from the initial database, a preliminary list of attributes ("Data Dictionary") that will comprise the TIDEGateway geodatabase was developed and is presented as *Attachment 3* of this memorandum. The attribute list is presented based on category (e.g., tide gate characteristics, natural resources, etc.) and provides additional information such as field names, domain values, and descriptive language. Note that all attributes in the initial database have not been included in the preliminary list of proposed attributes (e.g., USGS Quad Number). However, this information will be saved in a table that can be easily appended to the main geodatabase based on a common unique identifier.

Some additional attributes have been incorporated into the preliminary list to enable collection of vital information during field data collection. For example, attributes that will be critical for development of the geospatial analysis tool have been incorporated, such as controlling elevation and culvert characteristics.

Discussion Points and Requested RC Input

In particular, we are seeking input from the RCs on the following items:

1. Data collection next steps strategy discussion
    a. Best and most efficient means to address existing data gaps?
    b. Coordination with municipal staff
    c. Other suggestions?
2. Input on preliminary data dictionary
    a. Any additional items that RC's would like to see incorporated into the TIDEGateway geodatabase?
3. Initial thoughts on preferred information to be included on fact sheets to be generated for each tide gate?
    a. See *Attachment 4* for the example fact sheet (from Geosyntec's project proposal)
4. Field data collection methods
    a. Controlling elevation data collection
    b. Private vs. public property access issues
    c. Field data collection preference – paper form versus electronic data collection?
5. General comments

ATTACHMENT 1:

Preliminary Bibliography

Source ID	Description	Date	Source	Accessed On	Accessed From	Comments	Cape Cod	South Shore	Metro Boston	Lower North Shore	Upper North Shore	Link
1	Atlas of Tidal Restrictions on the South Shore of Massachusetts	12/1/2001	Metropolitan Area Planning Council	4/17/2015	http://maps.massgis.state.ma.us/czm/moris/pdfs/habitatatlas/south_shore_atlas.pdf	Detailed information on restrictions and tide gates in tabular form	0	1	1	0	0	Source 1
2	Cape Cod Atlas of Tidally Restricted Salt Marshes	12/1/2001	Cape Cod Commission	4/17/2015	http://www.capecodcommission.org/resources/coastalresources/TidalAtlas.pdf	Detailed information on restrictions and tide gates in tabular form	1	0	0	0	0	Source 2
3	Atlas of Tidally Restricted Marshes - North Shore of Massachusetts	12/1/1996	Massachusetts Wetlands Restoration & Banking Program	4/21/2015	http://www.mass.gov/envir/massbays/pdf/moris/north_shore_tidally_restricted_marshes_atlas.pdf	No available information in tabular form	0	0	0	1	1	Source 3
4	List of Tide Gates in MassBays Program, Cape Cod region	7/29/2014	Jo Ann Muramoto, Association to Preserve Cape Cod	4/21/2015	N/A	Updated list of Tide Gates sources from Cape Cod Atlas	1	0	0	0	0	Source 4
5	Great Marsh Restoration Plan Data	4/3/2015	Franz Ingelfinger, Division of Ecological Restoration MA DFG	4/3/2015	Personal email communication on 4/3/15	Two kmz files: (1) sites within the Great Marsh Restoration Plan in North Coastal area, and (2) potential restoration sites which were investigated during planning effort. Files in polygon form with Site ID, perimeter, and area.	0	0	0	0	1	Source 5
6	South Shore Tide Gate Info	4/14/2015	Sara Grady, MassBays National Estuary Program	4/14/2015	Personal email communication on 4/14/15	Edits to initial data request spreadsheet dated 4/7/2015	0	1	0	0	0	Source 6
7	Rumney Marsh Restoration: Status of Restorations Completed to Date and Potential Future Projects Involving Tide Gates	4/8/2015	Edward Reiner, USEPA New England	4/8/2015	Personal email communication on 4/8/2015	Power point presentation; includes locations of tide gates and conditions; see source 12	0	0	1	0	0	Source 7
8	Tide Gates_draft 04012015_forRCs Eric H	4/17/2015	Eric Hutchins, NOAA	4/17/2015	Personal email communication on 4/17/2015	Edits to initial data request spreadsheet dated 4/7/2015	0	1	1	0	1	Source 8
9	Tide Gates_draft 04012015_forRCs_FI_Notes	4/17/2015	Franz Ingelfinger, Division of Ecological Restoration MA DFG	4/17/2015	Personal email communication on 4/17/2015	(1) Edits to initial data request spreadsheet dated 4/7/2015; (2) kmz file with tide gate locations	1	1	0	0	0	Source 9
10	Tide Gates_draft 04012015_forRCs_FI_Notes-LowerNorth Shore	4/17/2015	Barbara Warren, Salem Sound Coastwatch	4/17/2015	Personal email communication on 4/17/2015	(1) Edits to initial data request spreadsheet dated 4/7/2015 (2) kmz file with tide gate locations	0	0	0	1	0	Source 10
11	Letter of support for removal of culvert boards at Namskaket Salt Marsh on the Brewster/Orleans town line.	4/21/2015	Jo Ann Muramoto, Association to Preserve Cape Cod	4/21/2015	Personal email communication on 4/21/2015	APCC letter to remove flash boards on two box culverts installed January 2007 in upstream section of Namskaket Salt Marsh in Brewster/Orleans	1	0	0	0	0	Source 11
12	Rumney Marsh GIS data	4/23/2015	Jori Bonner, USEPA New England	4/23/2015	Personal email communication on 4/23/2015	(1) GIS data with tide gate locations, restoration areas, and land fill in Rumney Marsh; (2) pdf of restoration areas and tidal restrictions in Rumney Marsh; (3) table of tide gate info (useful info, same tide gate info as pdf)	0	0	1	0	0	Source 12
13	Tide Gate Info	4/22/2015	Lisa Engler, Mass CZM (Boston Harbor Region)	4/22/2015	Personal email communication on 4/22/2015	Information about 3 tide gates (2 proposed) in Boston region; including attachments	0	1	1	0	0	Source 13
14	The City of Salem Climate Change Vulnerability Assessment & Adaptation Plan	12/1/2014	Kathryn Glenn, Mass CZM (North Shore)	4/23/2015	http://salem.com/Pages/SalemMA_DPCD/studies	Salem Climate Change Plan - does not go into detail, lists approx. location of two tide gates.	0	0	0	1	0	Source 14
15	RE Data Gathering - Tide Gate Inventory and Assessment	4/22/2015	Peter Phippen, MVPC	4/22/2015	Personal email communication on 4/22/2015	Confirmation on location of 2 tide gates.	0	0	0	0	1	Source 15

ATTACHMENT 2:

List of Existing Attributes and Data Gaps

Attribute ID	Raw Attribute Name	Number of Blank Entries	Complete (%)
1	Unique ID (Geo)	0	100%
2	Region	0	100%
3	Town	0	100%
4	County	55	29%
5	Tidal Restriction Atlas ID #	33	57%
6	Lat (N)	31	60%
7	Long (W)	31	60%
8	Lat (dec)	11	86%
9	Long (dec)	11	86%
10	USGS Quad	52	32%
11	Location (Water Body, Road)	2	97%
12	Water Level Controlling Elevation (tide gate invert elevations, etc.)	76	1%
13	Type of Engineered Flood Control Structure / Description	3	96%
14	Restoration Status	43	44%
15	Owner / Operator	48	38%
16	Permit Status	77	0%
17	Other	76	1%
18	Priority Code	52	32%
19	Anadromous Fishway	34	56%
20	Contiguous Open Space	34	56%
21	Shellfish Area	34	56%
22	Flood Structure	52	32%
23	ACEC	34	56%
24	Potential Upstream Benefits	52	32%
25	Feasibility	52	32%
26	Culvert Shape	52	32%
27	Number of openings	52	32%
28	# of Piers	52	32%
29	Structure Material	52	32%
30	Structure Condition	52	32%
31	Surface	52	32%
32	Ponded water on seaward side of restriction	52	32%
33	Ponded water on upstream side of restriction	52	32%
34	Proximity to Low Lying Area	52	32%
35	Date of site visit	52	32%
36	Site Photo	52	32%
37	Comments	52	32%
38	Wetland Area Affected	53	31%
39	Size of upstream affected area (salt marsh acres)	59	23%
40	Size of upstream affected area (total affected acres)	58	25%
45	Does the affected area include Priority Habitat or Rare Species (PH) or Estimated Habitat of Rare Wildlife (WH)?	59	23%
46	Are thererestricted sites upstream of this site (site number)?	59	23%
48	Restriction Width (feet)	59	23%
49	Restriction Length (feet)	59	23%
51	Notes	59	23%

Category	Field Name	Domain Value(s)	Description
General	UNIQUE_ID	#	Unique Identifier
	REGION	(e.g., South Shore, etc.)	MassBays Planning Region
	TOWN	-	Town
	LAT	#	Latitude
	LON	#	Longitude
	OPERATOR	-	Owning / Maintaining Agency
	PERMITS	-	Existing State or Federal Permits
	GEN_COMMENTS	-	General Comments
Tide Gate Characteristics	TYPE	Flapper / Sluice / SRT / Etc.	Tide Gate Type
	CNTRL_MECH	Actuator / Hinge / Other / Etc.	Tide Gate Control Mechanism
	GEOMETRY	Round / Rectangular / Other	Tide Gate Geometry
	TG_DIAMETER	#	Tide Gate Diameter (IF Rectangular THEN length)
	TG_HEIGHT	#	Tide Gate Height (If Rectangular)
	CNTRL_EL	#	Controlling Elevation
	INV_EL	#	Invert Elevation (measuredown)
	TG_MATERIAL	Wooden / Alumimum / Etc.	Tide Gate Material
	TG_CONDITION	Good / Fair / Poor	Qualitative condition assessment
	NO_GATES	#	Number of Tide Gates
	INSTALL_DATE	#	Installation Date
	STATUS	Active / Proposed / Abandoned / Uknown	Operational Status
	OP_COMMENTS	(e.g., closed before storm)	Operational Notes
	TG_COMMENTS	-	Misc. Tide Gate Comments
Culvert Characteristics	RESTRICT_TYPE	Dike / Berm / Dam / Etc.	Restriction type
	RESTRIC_SURF	Roadway / Earthen / Etc.	Restriction Surface
	CUL_GEOMETRY	Round / Rectangular / Other	Culvert Geometry
	CUL_DIAMETER	#	Culvert Diameter (IF Rectangular THEN length)
	CUL_HEIGHT	#	Culvert Height (IF Rectangular ELSE N/A)
	CUL_MATERIAL	Concrete / Stone / CMP / Etc.	Culvert Material
	CUL_MAT_BOT	Riprap / Sand / Stone / Etc.	Culvert Bottom Material
	CUL_CONDITION	Good/Fair/Poor	Qualitative Condition Assessment
	NO_PIPES	#	Number of Culverts
	CUL_COMMENTS	-	Misc. Culvert Comments
Natural Resources	ACEC	Y/N	Area of Critical Environmental Concern
	SHELLFISH	Y/N	Shellfish Area
	RARE_SPECIES	Y/N	Rare Species Area
	PRIORITY_HABITAT	Y/N	Priority Habitat Area
	ANDR_FISH	Y/N	Andronomous Fishway
	WQ_DATA	Y/N	Water Quality Available
Restoration Consideration	US_TOTAL	#	Total Upstream Affected Area
	US_MARSH	#	Total Upstream Affected Salt Marsh Area
	FEASIBILITY	H/M/L	Restoration feasibility
	US_INFRA	Y/N	Upstream Infrastructure
	REST_STATUS	(e.g., Removal pending)	Restoration Status
	REST_COMMENTS	-	Misc. Restoration Comments
Miscellaneous	VISIT_DATE	Date	Date of last site visit
	PHOTOID_1	#	Site Visit Photo ID 1
	PHOTOID_2	#	Site Visit Photo ID 2
	PHOTOID_3	#	Site Visit Photo ID 3
	PHOTOID_4	#	Site Visit Photo ID 4
	VISIT_COMMENTS	-	Misc. Site Visit Comments
Source Data	SOURCE_1	#	Primary Source ID
	SOURCE_2	#	Secondary Source ID
	SOURCE _3	#	Tertiary Source ID
	SOURCE_4	#	Fourth Source ID

ATTACHMENT 3:

Preliminary Data Dictionary

Category	Field Name	Domain Value(s)	Description
General	UNIQUE_ID	#	Unique Identifier
	REGION	(e.g., South Shore, etc.)	MassBays Planning Region
	TOWN	-	Town
	LAT	#	Latitude
	LON	#	Longitude
	OPERATOR	-	Owning / Maintaining Agency
	PERMITS	-	Existing State or Federal Permits
	GEN_COMMENTS	-	General Comments
Tide Gate Characteristics	TYPE	Flapper / Sluice / SRT / Etc.	Tide Gate Type
	CNTRL_MECH	Actuator / Hinge / Other / Etc.	Tide Gate Control Mechanism
	GEOMETRY	Round / Rectangular / Other	Tide Gate Geometry
	TG_DIAMETER	#	Tide Gate Diameter (IF Rectangular THEN length)
	TG_HEIGHT	#	Tide Gate Height (If Rectangular)
	CNTRL_EL	#	Controlling Elevation
	INV_EL	#	Invert Elevation (measuredown)
	TG_MATERIAL	Wooden / Alumimum / Etc.	Tide Gate Material
	TG_CONDITION	Good / Fair / Poor	Qualitative condition assessment
	NO_GATES	#	Number of Tide Gates
	INSTALL_DATE	#	Installation Date
	STATUS	Active / Proposed / Abandoned / Uknown	Operational Status
	OP_COMMENTS	(e.g., closed before storm)	Operational Notes
	TG_COMMENTS	-	Misc. Tide Gate Comments
Culvert Characteristics	RESTRICT_TYPE	Dike / Berm / Dam / Etc.	Restriction type
	RESTRIC_SURF	Roadway / Earthen / Etc.	Restriction Surface
	CUL_GEOMETRY	Round / Rectangular / Other	Culvert Geometry
	CUL_DIAMETER	#	Culvert Diameter (IF Rectangular THEN length)
	CUL_HEIGHT	#	Culvert Height (IF Rectangular ELSE N/A)
	CUL_MATERIAL	Concrete / Stone / CMP / Etc.	Culvert Material
	CUL_MAT_BOT	Riprap / Sand / Stone / Etc.	Culvert Bottom Material
	CUL_CONDITION	Good/Fair/Poor	Qualitative Condition Assessment
	NO_PIPES	#	Number of Culverts
	CUL_COMMENTS	-	Misc. Culvert Comments
Natural Resources	ACEC	Y/N	Area of Critical Environmental Concern
	SHELLFISH	Y/N	Shellfish Area
	RARE_SPECIES	Y/N	Rare Species Area
	PRIORITY_HABITAT	Y/N	Priority Habitat Area
	ANDR_FISH	Y/N	Andronomous Fishway
	WQ_DATA	Y/N	Water Quality Available
Restoration Consideration	US_TOTAL	#	Total Upstream Affected Area
	US_MARSH	#	Total Upstream Affected Salt Marsh Area
	FEASIBILITY	H/M/L	Restoration feasibility
	US_INFRA	Y/N	Upstream Infrastructure
	REST_STATUS	(e.g., Removal pending)	Restoration Status
	REST_COMMENTS	-	Misc. Restoration Comments
Miscellaneous	VISIT_DATE	Date	Date of last site visit
	PHOTOID_1	#	Site Visit Photo ID 1
	PHOTOID_2	#	Site Visit Photo ID 2
	PHOTOID_3	#	Site Visit Photo ID 3
	PHOTOID_4	#	Site Visit Photo ID 4
	VISIT_COMMENTS	-	Misc. Site Visit Comments
Source Data	SOURCE_1	#	Primary Source ID
	SOURCE_2	#	Secondary Source ID
	SOURCE _3	#	Tertiary Source ID
	SOURCE_4	#	Fourth Source ID

ATTACHMENT 4:

Example Fact Sheet

COBB13: Cohasset, MA

Fact Sheet Date: 1/02/2015

TIDEGateway

www.mass.gov/eea/agencies/mass-bays-program/tidegateway

General

Location: 88 Summer St., Cohasset MA
Lat/Long: 42.239640 / -70.794937
Permits: Unknown
Owner: Town of Cohasset

Tide Gate Characteristics

Type (Year Installed): Flapper (1985)
Control Mechanism: Passive backflow prevention
Controlling Elevation: 14' AMSL
Shape (Dimensions): Round (15" dia.)
Condition: Fair
Misc. Notes: Moderate rusting

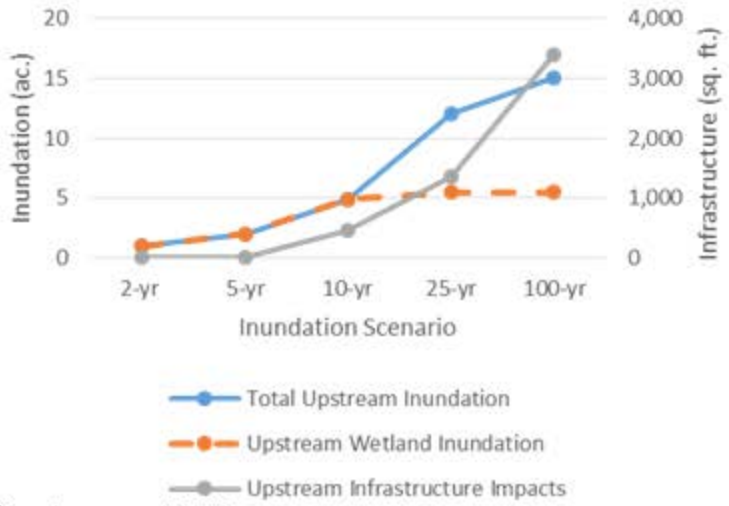
Restriction Characteristics

Type (Year Installed): Concrete Pipe (1960)
Shape (Dimensions): Circular (15" dia.)
Condition: Good
Misc. Notes: Misc. trash / debris observed

Natural Resources

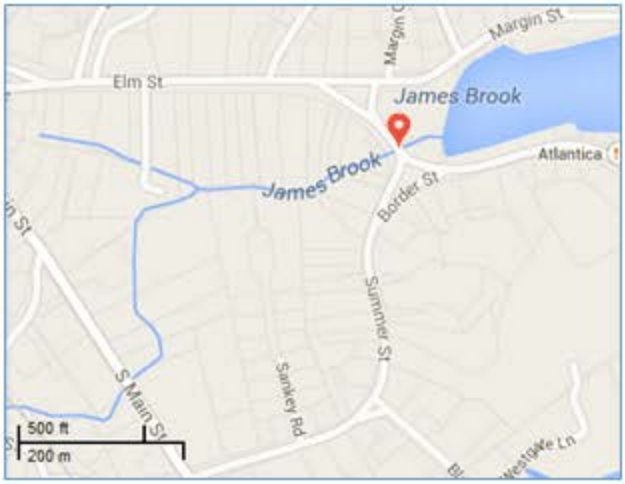
Water Quality: No data available
Wetland Notes: Abundant upstream Phragmites
Shellfish Resource Area: Yes
ACEC: No
Anadromous Fishway: Potential

Geospatial Analysis Tool Summary Results



*based on current MHHW

Maps / Photos



Location Map

Photo of tide gate dated 6/25/2015

Photo of upstream impoundment dated 6/25/2015

Appendix C:

Municipal Contact Summary

Geosyntec consultants

289 Great Road, Suite 105
Acton, Massachusetts 01720
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FAX 978.263.9594
www.geosyntec.com

Memorandum

Date: 9 September 2015

To: Lisa Engler, MassBays Program
MassBays and CZM Regional Coordinators

From: Robert Hartzel, Geosyntec Consultants
David Roman, Geosyntec Consultants
Taylor Walter, Geosyntec Consultants

Subject: TIDEGateway – Data Inventory Municipal Contact Summary

Attachments: 1. Municipal Tracking Sheet

The purpose of this memorandum is to provide a brief summary of the efforts and findings from the municipal contact portion of the TIDEGateway "Data Inventory" task. The purpose of the task was to collect and update the TIDEGateway geodatabase with additional information from town personnel prior to initiating field data collection. All 50 towns within the MassBays planning region were contacted via phone and email from July through August 2015.

Preparation

Prior to initiating the task, contacts were identified for each town including Conservation Administrators, Department of Public Works representatives, and other relevant personnel. In order to streamline the process, a SharePoint based website was created with functionality to enable identified town contacts to edit existing tide gate attributes (or add new tide gates). The SharePoint website had the additional benefit of providing an easy way to track all new data entries and provide QA/QC.

Once the SharePoint framework was created, an introductory email was sent to all identified town contacts. The introductory email included:

- A brief introduction to the TIDEGateway project and the project definition of a Tide Gate;
- The number of Tide Gates assumed for that specific town;
- A town specific SharePoint link for data entry; and
- Attached maps showing locations of known tide gates within each town.

Data Collection Summary

After sending the introductory email, Geosyntec made a follow-up phone call to a contact in each town. The purpose of the call was to provide additional guidance on how to update tide gate information on the SharePoint website, ensure that the proper personnel had been contacted, and to answer any questions. Many towns responded to voicemails left by Geosyntec made efforts to return calls, provided additional

contact information, and forwarded the introductory email to other people in their network to update the SharePoint information.

The table below details the Data Inventory response gathered during July and August 2015. Refer to **Attachment 1** of this memorandum for a list of all towns contacted during this task, including contact names and information, tracking information, and miscellaneous notes.

Data Inventory Town Response Summary	
Number of Towns Contacted Via Email	50
Number of Towns Contacted Via Call	50
Number of Towns that Answered or Returned Calls	40
Number of Towns with Responses	44
Number of Towns that Updated SharePoint	15
Number of Updated Tide Gate Records	25
Number of New Tide Gates	9

Notes:

1. *Four towns (Danvers, Dennis, Newbury, and Newburyport) did not provide a response and did not have any verified tide gates.*
2. *The towns of Kingston and Salem did not provide a response and had 3 and 1 presumed tide gates, respectively.*

In general, information provided by town contacts was informative and provided improvements to the data contained in the TIDEGateway geodatabase. A wide variety of attributes were updated for each of the 25 modified tide gate records. For example, town contacts:

- Verified tide gate operators;
- Identified relevant permits;
- Added various operational and general comments;
- Verified and updated tide gate and culvert dimensions and materials; and
- Verified operational purpose (e.g., flood protection), indicated if an operational plan was present.

Note that some municipalities provided feedback about structures that did not fit under into this project's working definition of a Tide Gate (e.g., conveyances installed for the sole purpose of carrying storm drainage). The City of Boston indicated that they did not have any Tide Gates that fit the working definition, but indicated that they had as many as 200 backflow prevention type devices. The Town of Lynn also indicated an existing device in their town which also do not meet this project's definition of a tide gate. A Lynn representative indicated on an entry in the SharePoint Site that "the purpose of the Tide Gate is to inhibit flow of tide from entering into sewer drain system".

Once information was received by towns, QA/QC was performed where all data were reviewed for consistency (e.g., location, units, typos, etc.) prior to being integrated into the geodatabase.

ATTACHMENT 1:

Municipal Tracking Sheet

Region	Town	Tide Gates?	# Of TGs	Conservation Agent (or other Town contact)	Public Works/Highway/Engineering Dept.	Other Contact Name / Info	Initial Contact Email Sent?	E-mail Send Date	Follow-up Call Made?	Call Date	Did Town Respond?	Updated Sharepoint?	Notes
CAPE COD	Barnstable	YES	2	Rob Gatewood Conservation Adminstrator conservation@town.barnstable.ma.us 508-862-4093	Dale Saad, Senior Project Manager DPW; dale.saad@town.barnstable.ma.us ; 508-790-6400 x4941		YES	7/9/2015	YES	7/23/2015	YES	YES	Dale Saad was indicated as the best contact and he was left a voicemail.
CAPE COD	Bourne	NO	0	Brandon Mullaney, BMullaney@townofbourne.com 508-759-0615 Option 6	Mike Leitzel, Town Engineer; MLeitzel@townofbourne.com; 508-759-0615 Opt. 2		YES	7/9/2015	YES	8/4/2015	YES	NO	Brandon Mulaney indicated over the phone Bourne does not have any Tide Gates.
CAPE COD	Brewster	YES	2	Jim Gallagher, Conservation Administrator conservation@town.brewster.ma.us 508-896-3701 X1135	Robert Bersin, PE, Supt. dpw@town.brewster.ma.us 508-896-3212		YES	7/9/2015	YES	7/23/2015	YES	YES	Jim Gallagher updated some information over phone. He indicated he may be able to update in the future.
CAPE COD	Dennis	YES	1	Josepth Rodricks, Town Engineer, jrodricks@town.dennis.ma.us; 508-760-6166x364	David S. Johansen, Director of DPW, djohansen@town.dennis.ma.us; 508-760-6220		YES	7/9/2015	YES	7/23/2015	NO	NO	Joseph Rodericks and David Johansen were both left a voiecmail message but no response was recieved.
CAPE COD	Eastham	YES	2	Jeff Thibodeau Environmental Planner/Conservation Administrator conservation@eastham-ma.gov 508-240-5971	Neil Andres Superintendent nandres@eastham-ma.gov 508-240-5973		YES	7/9/2015	NO		YES	YES	Neil Andres, Superintendent, updated the sharepoint site to show 2 inactive Tide Gates
CAPE COD	Orleans	YES	2	Nathan Sears, Natural Resources, nsears@town.orleans.ma.us; 508-240-3755	Mark Budnick Manager highway@town.orleans.ma.us 508-240-3700 X470		YES	7/9/2015	YES	7/22/2015 & 8/6/2015	YES	NO	Mark Budnick emailed Lisa Engler abut the Tide Gates in Orleans but did not follow up after additional voicemail and intro email were sent to him.
CAPE COD	Provincetown	NO	0	Brian Carlson 508-487-7000 X537	Richard J. Waldo Director of Public Works rwaldo@provincetown-ma.gov 508-487-7060		YES	7/9/2015	YES	7/22/2015	YES	NO	Jane, DPW secretary, indicated that no Tide Gates exist.
CAPE COD	Sandwich	YES	3	Mark Galkowski; naturalresources@townofsandwich.net 508-833-8054	Paul Tilton Director dpw@townofsandwich.net 508-833-8002		YES	7/9/2015	YES	8/4/2015	YES	YES	Mark Galkowski updated the sharepoint site.
CAPE COD	Truro	YES	3	Patricia Pajaron, Conservation Agent (508) 349-7004 x32	Paul Morris; dpwdirector@truro-ma.gov Michael; dpwclerk@truro-ma.gov 508-349-2140		YES	7/9/2015	YES	8/4/2015	YES	YES	Voicemail left for Patricia Parjaron. Spoke with Michael at the DPW and sent him the initial intro email for him to fill out. Sharepoint was updated by anonymous.
CAPE COD	Wellfleet	YES	2	Hilary Greenberg	Mark Vincent Director mark.vincent@wellfleet-ma.gov 508-349-0315	paul lindberg DPW paul.lindberg@wellfleet-ma.gov	YES	7/9/2015	YES	8/3/2015	YES	NO	Paul Lindberg returned a call to indicate he would update the sharepoint however the update did not occur.
CAPE COD	Yarmouth	NO	0	Kerry Muldoon Conservation Adminstrator kmuldoon@yarmouth.ma.us 508-398-2231 ext 1288	Robert Angell, Assistant Director rangell@yarmouth.ma.us 508-775-2516	natural resoucres group - Bill/Carl - 508-760-4800	YES	7/9/2015	YES	7/22/2015	YES	NO	Tim Parsons in Natural Resources confirmed that no Tide Gates exist in Yarmouth.
LOWER NORTH SHORE	Beverly	YES	1	Amy Maxner in Planning Department 978-921-6000	Michael Collins 978-921-6053 mcollins@beverlyma.gov		YES	7/9/2015	Yes	7/23/2015	YES	NO	The Tide Gate at Shoe Pond might be private. No new information available and no sharepoint update occurred.
LOWER NORTH SHORE	Danvers	NO	0	Susan Fletcher 978-777-0001 x3099 sfletcher@mail.danvers-ma.org	Aaron Cilluffo 978-762-0230 acilluffo@mail.danvers-ma.org		YES	7/9/2015	YES	7/23/2015	NO	NO	Calls placed but no response was recieved via email or additional messages.
LOWER NORTH SHORE	Lynn	NO	0	Judith Lewin Callahan (781) 598-4000 X 6816 jlewin@lynnma.gov	J.T. Gaucher 781-268-8000 jtgaucher@lynnma.gov	RaeAnna Hughes, Water and Sewer Department	YES	7/9/2015	YES	7/23/2015	YES	YES	RaeAnna Hughes indicated in sharepoint that the tidegate stopped tidal flow from entering the storm sewer. This is not considered for this project.
LOWER NORTH SHORE	Manchester	YES	1	Chris Bertonic 978-526-4397 bertonic@manchester.ma.us	Carol Murray 978-526-1242 murrayc@manchester.ma.us	Mary Rielly riellym@manchester.ma.us	YES	7/9/2015	YES	7/23/2015	YES	YES	Sharepint was updated by anonymous indicating that 1 Tide Gate does exist.

Region	Town	Tide Gates?	# Of TGs	Conservation Agent (or other Town contact)	Public Works/Highway/Engineering Dept.	Other Contact Name / Info	Initial Contact Email Sent?	E-mail Send Date	Follow-up Call Made?	Call Date	Did Town Respond?	Updated Sharepoint?	Notes
LOWER NORTH SHORE	Marblehead	NO	0	William Lanphear 781-631-1529 conservation@marblehead.org	David Donahue 978-631-1750 highway@marblehead.org		YES	7/9/2015	YES	7/23/2015	YES	NO	Amy Mchugh, Water and Sewer Department, was indicated as the best contact. A call and email was sent but no response.
LOWER NORTH SHORE	Nahant	NO	0	Ellen Steeves esteeves@partners.org 781-581-0088	Timothy T. Lowe tlowe@nahant.org 781-581-0026		YES	7/9/2015	YES	7/23/2015	YES	NO	Ellen Steeves indicated that no Tide Gates exist.
LOWER NORTH SHORE	Peabody	NO	0	Lucia DelNegro 978-538-5782 Lucia.DelNegro@peabody-ma.gov	Robert J. Langley 978-536-7123 Robert.langley@peabody-ma.gov	William Paulitc - Engineer at DPW	YES	7/9/2015	YES	8/5/2015	YES	NO	William Paulitc, Engineer at DPW, indicated that no Tide Gates exist.
LOWER NORTH SHORE	Salem	YES	3	Tom Devine 978-619-5685 tdevine@salem.com	John Tomasz 978-744-3302 jtomasz@salem.com	David Knowlton, Engineering Department; (978) 619-5673	YES	7/9/2015	YES	8/3/2015	NO	NO	Left voicemail and sent emails for Tom Devine and David Knowlton but no responses were received.
LOWER NORTH SHORE	Swampscott	YES	3	Nelson Kessler 781-596-8829	Gino Cresta Jr. 781-596-8860 gcresta@town.swampscott.ma.us		YES	7/9/2015	YES	7/22/2015	YES	NO	Gino Cresta indicated that 3 Tide Gates exist and would update the sharepoint but no update occurred.
METRO BOSTON	Boston	YES	2	Charlotte Moffat charlotte.moffat@cityofboston.gov 617-635-3850	Joanne Massaro publicworks@cityofboston.gov 617-635-4900		YES	7/9/2015	NO		YES	NO	Charlotte Moffat indicated that Charlie Jewellsaid none of the Boston Water and Sewer Commission's tidegates have two-way movement
METRO BOSTON	Braintree	NO	0	Kelly Phelan, Conservation Planner 781 794-8233 kphelan@braintreema.gov	Marlene Michonski, Office Manager 781-843-8097 mmichonski@braintreema.gov		YES	7/9/2015	YES	7/17/2015	YES	NO	Kelly Phelan indicated that no Tide Gate exist within Braintree's town limits.
METRO BOSTON	Chelsea	YES	2	John DePriest JDePriest@chelseama.gov 617-466-4180	Joe Foti 617-466-4200		YES	7/9/2015	YES	7/23/2015	YES	YES	Andrew B. DeSantis updated sharepoint and indicated that 2 tidegates exist. May also have ties with Revere.
METRO BOSTON	Everett	YES	1	Michael Gove Michael.Gove@ci.everett.ma.us 617-394-2262	Tony Sousa Tony.Sousa@ci.everett.ma.us 617-394-2385		YES	7/9/2015	YES	7/23/2015	YES	YES	Mike Gove updated Sharepoint with a Tide Gate that is not functional.
METRO BOSTON	Hingham	YES	6	Abby Pearsall piersalla@hingham-ma.gov 781-741-1445	Randy Sylvester 781-741-1430		YES	7/9/2015	YES	7/23/2015	YES	YES	Sharepoint was updated and indicated that 1/6 Tide Gates were inactive.
METRO BOSTON	Hull	YES	4	Anne Herbst aherbst@town.hull.ma.us 781-925-8102	Joseph Stigliani, DPW Director; 781-925-0051; jstigliani@town.hull.ma.us		YES	7/9/2015	YES	7/23/2015	YES	YES	Anne Herbst updated sharepoint for the town of Hull.
METRO BOSTON	Milton	NO	0	Kathy Bowen kbowen@townofmilton.org	John Thompson, Town Engineer; 617-898-4900x4869; jthompson@townofmilton.org		YES	7/9/2015	YES	7/23/2015	YES	NO	John Thompson indicated over the phone that no Tide Gates existed to the best of his knowledge.
METRO BOSTON	Quincy	YES	6	Shawn Hardy shardy@quincyma.gov 617-376-1367	Daniel Raymondi draymondi@quincyma.gov 617-376-1900	Peter Hoyt - DPW - phoyt@quincyma.gov Karen White - DPW Secretary - kwhite@quincyma.gov	YES	7/9/2015	YES	8/3/2015	YES	NO	Peter Hoyt is the tidegate administrator for the town of Quincy. He indicated that he would update the Sharepoint survey with his team. No update occurred.
METRO BOSTON	Revere	YES	11	Andrew DeSantis 781-286-8181	Joan LeBlanc joanleblanc@earthlink.net 781-286-8149		YES	7/9/2015	YES	7/31/2015	YES	NO	Andrew DeSantis indicated he would sharepoint to his ability and also forwarded the email around the department. No update was seen for Revere.
METRO BOSTON	Saugus	YES	3	Frank McKinnon 781-231-4129 fmckinnon@saugus-ma.gov	James Waugh 781-231-4145 jwaugh@saugus-ma.gov	Brendan O'regan - DPW Director 781-231-4144 boregan@saugus-ma.gov	YES	7/9/2015	YES	7/30/2015	YES	NO	Bredan O'Regan, DPW Director, indicated over the phone that he was not aware of any tidegates within the town limits.

Region	Town	Tide Gates?	# Of TGs	Conservation Agent (or other Town contact)	Public Works/Highway/Engineering Dept.	Other Contact Name / Info	Initial Contact Email Sent?	E-mail Send Date	Follow-up Call Made?	Call Date	Did Town Respond?	Updated Sharepoint?	Notes
METRO BOSTON	Weymouth	YES	3	Mary Ellen Schloss mschloss@weymouth.ma.us 781-340-5007	Kenan Connell 781-337-5100	Braydon Marot, Weymouth DPW Engineering Department	YES	7/9/2015	YES	8/3/2015	YES	YES	Braydon Marot - project engineer updated one tidegate in weymouth - no other information was provided for 2nd tidegate. Potentially a 3rd tidegate indicated by Mary Ellen.
METRO BOSTON	Winthrop	YES	2	Marsha Allen conservation@town.winthrop.ma.us 617-539-5821	Steven Calla scalla@town.winthrop.ma.us 617-846-1341		YES	7/9/2015	YES	8/4/2015	YES	NO	Marsha called back - requested to resend email over and she will forward to DPW.
SOUTH SHORE	Cohasset	YES	5	Paul Shea paulshea@cape.com (781) 383-4182	Brian Joyce bjoyce@cohassetma.org 781-383-0273	Nancy Noonan (781) 383-4182x118 conservation department	YES	7/9/2015	YES	7/23/2015	YES	YES	Paul Shea and Brian Joyce were both left voicemails. Anonymous Updated Sharepoint.
SOUTH SHORE	Duxbury	YES	0	Conservation-Administrator@town.duxbury.ma.us (781) 934-1100; EXT. 5471	Peter Buttkus Director Buttkus@Town.Duxbury.MA.US 781-934-1100 x5501 or x5502	Bruce O'neill - Highway Department DPW	YES	7/9/2015	YES	7/23/2015	YES	NO	Bruce O'Neill indicated that no tidegates exist in Duxbury. One used to exist at blue fish river but no longer exists.
SOUTH SHORE	Hanover	NO	0	Amy Walkey, Conservation Agent, 781-826-5000x1019;	Victor Diniak 781-826-3189; office@hanoverdpw.org		YES	7/9/2015	YES	7/23/2015 & 8/4/2015	YES	NO	Amy Walkey indicated that no Tide Gates exist in Hanover.
SOUTH SHORE	Kingston	YES	1	Maureen Thomas Conservation - 781-585-0537; mthomas@kingstonmass.org	Found email but no name srichards@kingstonmass.org		YES	7/9/2015	YES	8/4/2015	NO	NO	Email sent out to Maureen Thomas but no response was heard.
SOUTH SHORE	Marshfield	YES	5	Jay Wennemer Conservation Agent jwennemer@townofmarshfield.org 781-834-5573	Rod Procaccino Rprocaccino@townofmarshfield.org 781-834-5575		YES	7/9/2015	NO		YES	YES	Jay & Rod Responded and updated Sharepoint
SOUTH SHORE	Norwell	NO	0	Nancy Hemingway, Conservation Agent, 781-659-8022; nhemingway@townofnorwell.net	Paul Foulsham pfoulsham@townofnorwell.net 781-659-8042		YES	7/9/2015	YES	7/23/2015	YES	NO	Nancy Hemingway indicated that no Tide Gates exist in Norwell.
SOUTH SHORE	Pembroke	NO	0	Mary Guiney; 781-293-4674; mguiney@townofpembrokemass.org	Eugene Fulmine; Director of Public Works; 781-293-5620; efulminejr@townofpembrokemass.org		YES	7/9/2015	NO		YES	YES	Department of Public Works indicated Pembroke has no exsiting or proposed tide gates.
SOUTH SHORE	Plymouth	NO	0	David Gould dgould@townhall.plymouth.ma.us 508-747-1620 (ext. 139)	Jonathan Beder Director JBeder@townhall.plymouth.ma.us (508) 830-4162 x105		YES	7/9/2015	YES	7/22/2015	YES	NO	David Gould indicated over a phone call that no Tide Gates exist in the town of Plymouth.
SOUTH SHORE	Scituate	YES	5	Patrick Gallivan Conservation Agent (781) 545-8721	Kevin Cafferty kcafferty@scituatema.gov 781-545-8731		YES	7/9/2015	YES	8/3/2015	YES	NO	3 Separate calls placed to Scituate. DPW Secretary forwarded intro email to entire engineering department.
UPPER NORTH SHORE	Amesbury	NO	0	Laurie Pierce laurie@amesburyma.gov	Robert Desmarais, Director of Public Works; 978-388-8116;	John Lopez - conservation district - 978-388-8110	YES	7/9/2015	YES	8/4/2015	YES	NO	John Lopez Confirmed over the phone that no Tide Gates exist.
UPPER NORTH SHORE	Essex	NO	0	Deborah Cunningham, Administrative Clerk Bill Decie, Agent 978-768-2509; conservation@essexma.org	Mandy Davis Admin Clerk adavis@essexma.org (978)768-6262		YES	7/9/2015	YES	8/5/2015	YES	NO	Town of Essex indicated over the phone that no Tide Gates exist.
UPPER NORTH SHORE	Gloucester	YES	1	Lisa Press lpress@gloucester-ma.gov (978) 281-9781	Mark Cole, Michael Hale 978 281-9785	Ken Whittaker - Conservation	YES	7/9/2015	YES	7/23/2015	YES	NO	Left a message for Ken Whittaker - Conservation and sent out info email to Mike Hale
UPPER NORTH SHORE	Ipswich	NO	0	David Pancoast 978-356-6661;	Rick Clarke DPW Director 978 356-6612	Alicia Geilin AliciaG@ipswich-ma.gov	YES	7/9/2015	YES	7/23/2015	YES	NO	Alicia Geilin Indicated that no Tide Gates exist.
UPPER NORTH SHORE	Newbury	NO	0	Doug Packer 978-465-0862 ext. 310; conscom@townofnewbury.org	James Sarrette Foreman 978 465-0112		YES	7/9/2015	YES	7/23/2015	NO	NO	Doug Packer was left a voicemail but there was no response.

Region	Town	Tide Gates?	# Of TGs	Conservation Agent (or other Town contact)	Public Works/Highway/Engineering Dept.	Other Contact Name / Info	Initial Contact Email Sent?	E-mail Send Date	Follow-up Call Made?	Call Date	Did Town Respond?	Updated Sharepoint?	Notes
UPPER NORTH SHORE	Newburyport	NO	0	Julia Godtfredsen jgodtfredsen@cityofnewburyport.com 978-465-4400 ext.6;	(978) 465-4420 DPW # dps@cityofnewburyport.com	John-Eric White - Engineer DPW - 978-465-4464 ex 1710	YES	7/9/2015	YES	7/23/2015 & 8/6/2015	NO	NO	Left message for Julia, and John, and Eric but no response was received.
UPPER NORTH SHORE	Rockport	NO	0	Geralyn Falco 978-546-5005 gfalco@town.rockport.ma.us	Tim Olson 978-546-3525; tolson@rockportma.gov		YES	7/9/2015	YES	7/25/2015	YES	NO	Tim Olson responded to voicemail and his old email address was bad and said that no Tide Gates exist.
UPPER NORTH SHORE	Rowley	NO	0	Brent Baeslack 978-948-2330; Conservation@TownofRowley.org	Patrick Snow 978-948-2441 highway@townofrowley.org		YES	7/9/2015	YES	8/4/2015	YES	NO	Brent Baeslack indicated that no Tide Gates exist in Rowley.
UPPER NORTH SHORE	Salisbury	YES	1	Michelle Rowden (Cons. Agent); 978-499-0358; conservation@salisburyma.gov 978-463-0656;	Don Levesque (Hwy Dept.) dlevesque@salisburyma.gov		NO	N/A	NO		YES	NO	Michelle Rowden indicated that over the phone that 1 Tide Gate exists but did not have extraneous information.

Appendix D:

Field Data Collection Protocols

BD-15-1042-CZM-ENV40-00000002470

TIDEGateway

Tidegate Inventory and Data Evaluation Gateway

Field Data Collection & Database Update Protocols

October 2015

Geosyntec consultants

Contents

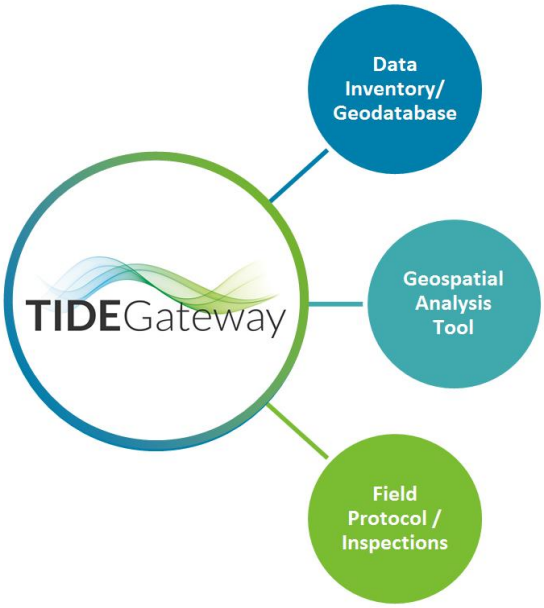
List of Appendices

I. INTRODUCTION

A. Background

The purpose of TIDEGateway is to serve as a comprehensive and easy-to-use web-based platform for information and planning tools related to tide gates in the MassBays region. The components of TIDEGateway include:

- Comprehensive geodatabase containing all known tide gate information, including locations, attributes, and related documents. The geodatabase contains a robust source tracking tool and interface which enables users to add new tide gates or modify existing tide gates when new information becomes available.
- Geospatial viewer which incorporates wetland delineation and allows users to locate and assess existing tide gates in relation to wetland ecology and FEMA floodplains, the better to inform the management of these structures.



TIDEGateway provides a fully integrated suite of GIS maps, attributes, data, modeling projections and planning tools.

B. Scope

The purpose of this document is to provide protocols for field data collection and for updating TIDEGateway. This reference documentation will ensure that information in the geodatabase can be readily updated and maintained by users.

C. Definitions

Tide Gates: For this document, tide gates are defined as "*any conveyance of tidal flow with the ability to passively or actively manipulate water flow*." This definition includes self-regulating tide gates, manually controlled devices, or passive control structures such as flappers. Structures not included in this definition include, but are not limited to, conveyances installed for the sole purpose of carrying storm drainage.

Vertical Datum: All vertical measurements referred to by this document should be converted and recorded based on the North American Vertical Datum of 1988 (NAVD88).

Existing Extent of Tidal Influence: The existing extent of tidal influence is defined here as the elevation (in NAVD88) that most closely matches the water surface elevation at the mean high water spring (MHWS) upstream and downstream of the tide control structure under existing conditions.

Tide Gate Invert Elevation: The lowest interior point of a tide gate (i.e. bottom) where tidal exchange can occur.

II. SAFETY

There are potential safety hazards associated with performing field work at tidally influenced areas. Individuals planning to conduct a tide gate field assessment based on these protocols should develop a site-specific Task Hazard Analysis (THA) or Health and Safety Plan (HASP) in accordance with their organization's policies. The safety precautions listed below are suggested for consideration in THA and HASP preparation:

- **Conditions** – Field activities should only be performed when conditions are safe. Do not attempt to perform activities during foul weather, abnormally high tide, or storm surge conditions. Always check the forecast prior to commencing field work.
- **Accessibility** – Field personnel should never enter the water or take unnecessary risks to access unsafe locations or negotiate challenging terrain to reach advantageous vantage points. If a tide gate is inaccessible due to access limitations or safety concerns, record it as not observable, note the specific reason(s), and move on to the next site.
- **Buddy System** – Field work should always be performed with a "buddy" and there should always be an additional person(s) in the office to act as an external safety contact. Site arrivals and departures should be communicated to the external safety contact.
- **Gear** – All field personnel performing work close to the water's edge should wear a buoyant life jacket or vest and be closely monitored by their "buddy". A reflective safety vest should be worn at all sites. In addition, bug spray and sunscreen should be available and applied as needed.

III. PROTOCOLS

The field data collection process involves four major activities including site selection, preparation, data collection, data upload procedures. The below sections provide step-by-step instructions for each of these activities. Note that in some instances, field data collection might not be required. For example, a new attribute might become available that does not require field verification. In this instance, Section B can be skipped and the user can proceed directly to Steps C and D to input the data directly into TIDEGateway.

A. Tide Gate Selection

Site selection will be largely contingent on the person(s), organization, or town conducting the inspection(s). For the purposes of these field protocols, the following guidelines are suggested for selection of sites:

- Tide gates with numerous or critical missing attributes (e.g. type, diameter, etc.);
- Tide gates that were not visited by Geosyntec in Fall 2015 during the field data collection phase (this information can be readily found based on the TIDEGateway "VISIT_DATE" attribute);
- Tide gates that are discovered, newly installed, or modified; or
- Instances where existing information needs to be verified based on new information.

Note: *Existing information and attributes of tide gates already included in the TIDEGateway geodatabase can be filtered by Town for review and printing at www.tidegateway.com.*

B. Pre-Visit Planning

Once tide gates have been selected for field verification and prior to leaving the office, field personnel should know where they are going, understand the information to be collected, and have the appropriate gear to complete the task. In particular, the following preparation steps are recommended:

1. Access TIDEGateway at www.tidegateway.com and print and review existing information and attributes for all tide gates that are planned to be visited. Area maps can be also be printed for individual tide gates or groups of tide gates based on a user-specified scale (i.e. zoom). The existing information and attributes for each tide gate can be printed directly from TIDEGateway.
2. Obtain approval from any private landowners if tide gates are located on private property and are not accessible by known easements or the right of way.
3. Review the data entry instruction form ***(Appendix A)***, existing attributes for each tide gate to be visited, and the protocols in this document to become familiar with all attributes and how they are collected.
4. Prepare a THA or HASP and review suggested safety procedures (Section II, above).
5. Identify a buddy, and inform direct supervisor or external safety contact prior to leaving and provide them with a planned schedule and site visit locations.
6. Use online or municipal-level paper maps to determine the best travel routes and identify any potential accessibility or safety issues (e.g., tide gate located on a busy road).
7. Gather required equipment and gear; see below for a suggested list:

- Digital camera and spare batteries
- Field data collection form for each tide gate
- Navigation & reference site maps
- Pencils & permanent markers
- Waterproof field notebook
- Data entry forms
- 100 foot field tape (i.e. reel) & standard 25 foot tape measure
- Folding 6 foot engineer's ruler and/or telescoping surveyor's rod
- Reflective vest
- Sunscreen and insect repellant
- Life jacket
- Mapping grade Global Positioning System (GPS), preferably Real Time Kinematic (RTK) (optional)
- Biodegradable flagging (optional)

Note: *A GPS unit is listed as optional on the gear list. The field protocols have been designed to be performed in the absence of a GPS unit or specialized equipment*

C. Data Collection and Entry

The below steps are recommended to be followed while on site:

1. Arrive on site, implement safety procedures, and gain orientation to the site.
2. Inform external safety contact of arrival on site.
3. Proceed with data collection per individualized data entry forms for each tide gate obtained from www.tidegateway.com.
4. Use ***Appendix A*** as a reference while collecting information on various tide gate attributes. Detailed supplemental instructions for several attributes are included below.
5. Collect and record data on as many attributes as possible following the prompts on the data entry form.
6. Prior to departing the site, inform external safety contact of departure.

Note*: A user has the option of logging on directly to TIDEGateway while on site and updating information while in the field. It is recommended that backup, hard-copy notes and data entry forms be kept in case of internet connectivity issues, inclement weather, or other unforeseen issues.*

D. Supplemental Data Collection Instructions

Tide Gate Naming Convention

There are three distinct tide gate identification fields present in TIDEGateway:

1. TIDEGateway's editable unique identification field ("TIDEGATE_NAME") based on town location;
2. A sequential numeric identifier automatically populated by the geodatabase and not editable by a user ("UNIQUE_ID"); and
3. The original tidal restriction atlas identifier assigned to a tide gate if applicable ("ORIG_ATLAS_ID") and not editable by a user.

Since the latter two identification fields are not editable, this section focuses on the "TIDEGATE_ID" field. The TIDEGATE_ID field is comprised of three parts based on the town name, sequential number of tide gates in each town, and sequential lettering if there are multiple tide gates at one location (i.e. restriction). For example, if there are 2 tide gates in a town, tide gates in the existing geodatabase are named as Town-01 and Town-02. If there are multiple tide gates at one location (e.g., multiple culverts going through the same restriction berm), sequential letters are appended to the tide gate number. For example, if tide gate 02 in town has three tide gates, the tide gates would be named Town-02A, Town-02B, and Town-03B.

Refer to Part E of this Section for instructions on how to edit or add new tide gates to the geodatabase.

Photograph Documentation

At least four standard photos should be taken at each site as shown below. In addition, there is an option to take up to 8 optional miscellaneous photos.

- Photo 1 - tide gate from downstream location;
- Photo 2 - tide gate / culvert from upstream location
- Photo 3 - area upstream of the tide gate from top of restriction (i.e. berm);
- Photo 4 - area downstream of the tide gate from top of restriction (i.e. berm); and
- Photos 5 through 12 - additional informative photo(s) of field personnels' choosing.

These photos will be accessible as individual hyperlinks on the TIDEGateway map view for each tide gate. See Section E for photo upload instructions.

Tide Gate Type and Control Mechanism

There are a number of different tide gate types and control mechanisms that can be entered into the geodatabase listed by ***Appendix A***. Refer to the below captioned photos[1] for typical examples of tide gate types and control mechanisms that will be found in the field during data collection.

[1] *Photograph sources from left to right, top to bottom: 1) Ed Reiner, EPA (http://www3.epa.gov/region1/neaeb2012/pdfs/1130_BR3_EdReiner.pdf); 2) Wicked Local (http://www.wickedlocal.com/article/20110824/News/308249567); 3) Online marine registry (www.omreg.net); 4) URI EDC (http://www.edc.uri.edu/restoration/html/tech_sci/restsalt.htm); 5) Golden Harvest (http://www.goldenharvestinc.com/products/tide_and_estuary/); 6) Ed Reiner, EPA*

Electric Actuator with Manual Hand Wheel in Foreground

Manual Hand Crank

Adjustable Concrete Stop Logs

Self-Regulating Tide Gate with Counterweights

Sluice Gate (actuator not pictured)

Top-Hinged Flapper Gate with no Control Mechanism

Tide Gate Condition

The purpose of the condition assessment is to provide a qualitative (i.e. best judgment) assessment of the tide gate's condition (Good, Fair, Poor) based on a visual inspection. The guidelines below can be used to determine condition entered as the "TG_Condition" attribute:

- **Good** – Minimal signs of disrepair, appears to be in good operating condition.
- **Fair** – Moderate signs of disrepair (rust, cracking, minor blockage), appears to generally be operable.
- **Poor** – Severe signs of disrepair (broken hinges, blocked or rusted closed), appears to be inoperable.

Culvert Condition

The purpose of the condition assessment is to provide a qualitative (i.e. best judgment) assessment of the culvert's condition (Good, Fair, Poor) based on a visual inspection. The guidelines below can be used to determine condition entered as the "CUL_Condition" attribute:

- **Good** – Minimal sign of disrepair, appears to be in good operating condition.

- **Fair** – Moderate signs of disrepair (minor debris accumulation, cracking or spalling), appears to generally be in operable condition.
- **Poor** – Severe signs of disrepair (severe debris accumulation, collapsed or partially collapsed).

Extent of Existing Tidal Influence (Upstream)

The extent of existing tidal influence is defined here as the elevation (in NAVD88) that most closely matches the water surface elevation at MHWS upstream of the tide control structure under existing conditions.

The steps outlined below provide a methodology to rapidly assess the existing extent of tidal influence of each tide gate using observed high water marks (i.e. staining) at culvert headwalls or restriction embankments as an indicator. This methodology is intended to provide *planning level* information (i.e., for general use only) in the absence of more precise information such as water level monitoring data, hydrologic/hydraulic modeling, etc. Within the TIDEGateway analysis tool, the *assessed* extent existing of tidal influence is converted into a polygon representing the planning level extent of existing tidal influence. This polygon is useful for management planning functions, for example to assess restoration potential by comparing the existing area of tidal influence to the existing extent of upstream wetlands.

***Notes**:*

1. If it is readily apparent based on the high water indicator that there is no tidal influence upstream of the tide gate (i.e., flap gate or tide gate is completely closed, culvert is completely blocked, etc.), field assessment of the tidal influence attribute is not necessary and the field can be left blank. Record the reason why this attribute is blank in the "TG_Comments" field.

2. It is recommended that the assessment of tidal elevation extent be carried out as closely as possible to spring tide conditions (and preferably at or near high tide). This will provide additional validation of the indicator. Note that in severely restricted sites, the time of high tide can lag an hour or more behind the forecasted downstream high tide.

The following steps can be used to determine a planning level extent of tidal influence using headwall / embankment staining as an indicator:

1. Walk to the upstream side of the tidal restriction.
2. If there is an upstream headwall or riprap embankment directly adjacent to the restriction, note if any staining (i.e. high water mark) is observed.
    a. If staining is observed, assess the tidal restriction and make a determination if the staining appears to be caused by tidal exchange. This might be readily apparent based on the presence of some common low marsh species such as *Spartina alterniflora* or readily observable tidal exchange through the restriction (e.g., culvert).
    b. Best judgment should be used when selecting the reference staining elevation. For example, it is possible that multiple levels of staining marks might be observable. If multiple marks or bands of staining are observed, it is likely that the marking will be lighter in the upper portion of the stained area, presumably due to less frequent inundation events such as storm surge or higher than average spring tides. If this is the case, it is recommended that the darkest portion of the stained area be selected to represent the zone of MHWS.

2. Once staining or a high water mark is identified, two methodologies can be employed to determine the extent of tidal influence in the NAVD88 datum.
    a. If available, record the staining elevation with a Real Time Kinematic (RTK) GPS unit. Enter the elevation into the "EX_TIDAL_INF_US" field of the TIDEGateway geodatabase in NAVD88 feet. Note that it is important that the utilized GPS unit is set to collect data in NAVD88. Depending on the model, a datum conversion might need to be performed.
    b. If an RTK GPS is unavailable, take a measure down using a folding engineer's ruler and/or telescoping surveyor's rod to the elevation of the staining from a prominent point observable from aerial imagery such as the top of a headwall or embankment. This measure down can then be later be post-processed into an elevation based on the Light Detection and Ranging (LiDAR) datasets readily available from the Massachusetts Office of Geographic Information (MassGIS) website.
        i. Once a determination of surface elevation is made via LiDAR, determine the extent of tidal influence based on staining using the equation: Tidal Influence ("EX_TIDAL_INF_US") = LiDAR Elevation minus Measuredown).
        ii. The final elevation would be entered into the "EX_TIDAL_INF_US" field of the TIDEGateway geodatabase in NAVD88 feet.

Extent of Existing Tidal Influence (Downstream)

The extent of existing tidal influence is defined here as the elevation (in NAVD88) that most closely matches the water surface elevation at MHWS downstream of the tide control structure under existing conditions.

In order to assess the extent of existing downstream tidal influence, replicate the steps provided above at the downstream side of the tide gate and enter findings into the "EX_TIDAL_INF_DS" field of the TIDEGateway geodatabase in NAVD88 feet.

Tide Gate Invert Elevation

The invert elevation is defined here as the lowest interior point of a tide gate (i.e. bottom) where tidal exchange can occur. Two methods can be used to determine the invert elevation in the NAVD88 datum:

1. If available, record the invert elevation of the tide gate with a RTK GPS unit. Enter the elevation into the "INV_EL" field of the TIDEGateway geodatabase in NAVD88 feet. Note that it is important that the utilized GPS unit is set to collect data in NAVD88. Depending on the model, a datum conversion might need to be performed.
2. If an RTK GPS is unavailable, take a measure down to the invert elevation of the tide gate using a folding engineer's ruler and/or telescoping surveyor's rod from a prominent point observable from aerial imagery such as the top of a headwall or embankment. This measure down can then be later be post-processed into an elevation based on the MassGIS LiDAR dataset.
    a. Once a determination of surface elevation is made via LiDAR, determine the invert elevation using the equation: Invert Elevation ("INV_EL") = LiDAR Elevation minus Measuredown.
    b. The final elevation would be entered into the "INV_EL" field of the TIDEGateway geodatabase in NAVD88 feet.

E. Post-Visit Procedures and Data Upload

Note: *Final QA/QC and data upload to TIDEGateway can be performed from any personal computer with a compatible web browser such as Microsoft's Internet Explorer or Google's Chrome by logging into www.tidegateway.com.*

Once data have been collected and entered into the data collection form for each tide gate, the process of performing QA/QC and uploading information to TIDEGateway can commence. Follow the steps below to upload data to the geodatabase using TIDEGateway's editing tool.

1. Transfer information for each tide gate from the data collection form to the web interface in TIDEGateway.
2. Use the web interface to upload photographs for each tide gate.
3. The editing interface has been configured to be self-explanatory and easy to navigate.
4. The interface has built in QA/QC checks to ensure consistency and minimize any input errors. These checks include: bounded data fields, constrained units, automatic naming of photos, etc.
5. Once information is updated, a final check should be performed to detect any general errors, especially: the tide gate location, all fields have been completed to the extent practical, photos are properly uploaded and named.

Attachment A:

Blank Tide Gate Data Entry Instruction Form

Tide Gate Data Entry Instruction Form

Attribute	Description	Data Entry Instructions	Response
Initial Data Entry Attributes			
MODIFICATION_DATE	Data Modification Date	The geodatabase will automatically populate when data or revisions are made.	
SOURCE_REASON	Field Visit or Data Entry Reason	Record reason for site visit or data entry (e.g., field visit to obtain updated attributes; revisions to tide gate based on new available information).	
SOURCE_NAME	Name of Data Entry Source	Record name of the person performing data updates.	
SOURCE_AFFILITATION	Affiliation of Data Entry Source	Record affiliation of the person performing data updates.	
SOURCE_EMAIL	Email of Data Entry Source	Record email of the person performing data updates.	
General Site Characteristics			
TIDEGATE_NAME	Unique Tide Gate Identifier	If adding a new tide gate, utilize the naming convention outlined by the **field protocols**.	
UNIQUE_ID	Unique Numeric Identifier	Unique ID to be auto populated by TIDEGateway upon upload.	
ORIG_ATLAS_ID	Original Tidal Restriction Atlas ID	Original Tide Atlas Reference Identifier. For reference purposes only; do not update.	
TOWN	Town	Record the Town that the tide gate is located in.	
LAT	Latitude (decimal)	Record the latitude of the tide gate. This can be done using a GPS unit, a smartphone, or back in the office using an online service such as Google Earth.	
LON	Longitude (decimal)	Record the longitude of the tide gate. This can be done using a GPS unit, a smartphone, or back in the office using an online service such as Google Earth.	
WATER_BODY	Reference Water Body at Tide Gate Location	If known, record the reference water body that the tide gate impounds.	
OPERATOR_TYPE	Operator Type	If known, record if the operator of the tide gate is a public or private entity.	
OPERATOR	Owning / Maintaining Agency	If known, record the entity responsible for maintaining the tide gate.	
PERMITS	Existing State or Federal Permits	If known, record if there are any permits associated with the tide gate.	

Attribute	Description	Data Entry Instructions	Response
GEN_COMMENTS	General Comments	Record any general comments about the site (e.g., challenging access). This field can also be used to add any observations regarding next steps or missing data (e.g., need keys to access tide gates, need to track down O&M plan, etc.)	
Tide Gate Characteristics			
TYPE	Tide Gate Type	Record the type of tide gate using the provided options on the form (flap gate, sluice gate, self-regulating tide gate, stop logs, or tide gate). If unsure what type of tide gate it is, select "Tide Gate" as the default entry and indicate identifying comments in the "Tide Gate Comments" field. See **field protocols** for typical examples.	
CNTRL_MECH	Tide Gate Control Mechanism	If applicable, record the tide gate control mechanism using the provided options on the form (N/A, counterweights, electric actuator, manual gear). For example a Self-Regulating Tide Gate will be controlled by counterweights, a sluice gate will typically be controlled by an electric actuator or manual gear, and a flap gate will not have a control mechanism. See **field protocols** for typical examples.	
GEOMETRY	Tide Gate Geometry	Record the shape of the tide gate (rectangular or round).	
TG_DIAMETER	Tide Gate Diameter	Record the diameter of the tide gate in feet. If the tide gate is rectangular in shape, record the width of the tide gate in feet.	
TG_HEIGHT	Tide Gate Height	If the tide gate is circular, leave this field blank. If the tide gate is rectangular, record the height of the tide gate in feet.	
EX_TIDAL_INF_US	Extent of Existing Upstream Tidal Influence	Perform the procedures outlined by the **field protocols** to determine the extent of existing upstream tidal influence of the tide gate in NAVD88 feet based on staining.	
EX_TIDAL_INF_DS	Extent of Existing Downstream Tidal Influence	Perform the procedures outlined by the **field protocols** to determine the extent of existing downstream tidal influence of the tide gate in NAVD88 feet based on staining.	
INV_EL	Tide Gate Invert Elevation	Perform the procedures outlined by the **field protocols** to determine the invert elevation of the tide gate in NAVD88 feet.	
TG_MATERIAL	Tide Gate Material	Record the construction material of the tide gate (metal, concrete, wood, other). If other material, indicate in comments (e.g., aluminum).	

Attribute	Description	Data Entry Instructions	Response
EL_COMMENTS	Elevation Comments	Record any comments used to determine tidal influence or invert elevation values. For example, measuredown values and LiDAR values can be recorded here for reference. Alternatively, comments can be added if other methods were used to determine elevations (e.g., plans, RTK GPS, etc.)	
TG_CONDITION	Tide Gate Condition	Record the qualitative (i.e. best judgment) condition of the tide gate (Good, Fair, Poor, Unknown) based on a visual inspection. See **field protocols** for guidelines.	
INSTALL_DATE	Installation Date	If known, record the installation date of the tide gate.	
STATUS	Operational Status	Record the current status of the tide gate (Active, Proposed, Inactive, Unknown, Removed).	
OP_PURPOSE	Purpose	If known, record the operational purpose of the tide gate (flood protection, flood protection and restoration, restoration, other).	
OP_PLAN	Operational Plan	If known, indicate if an operational plan is present for the tide gate.	
OP_COMMENTS	Operational Notes	Indicate any known operational notes about the tide gates. This can include the responsible party for operating the tide gate, references to any O&M manuals, permits, or other comments. For example, close prior to storm, open incrementally every year to enable incremental restoration, etc.	
TG_COMMENTS	Tide Gate Comments	Record any miscellaneous tide gate comments. This can include extraneous information on the tide gate condition, or operational status (e.g., hinge is broken and tide gate no longer appears to be operating).	
Culvert Characteristics			
RESTRIC_SURF	Restriction type	Indicate the restriction medium in which the tide gate is installed (beach, berm, dam, footpath, railroad, retaining wall, roadway, other).	
CUL_GEOMETRY	Culvert Geometry	Record the shape of the culvert (rectangular or round).	
CUL_DIAMETER	Culvert Diameter	Record the diameter of the culvert in feet. If the culvert is rectangular in shape, record the width of the tide gate in feet	
CUL_HEIGHT	Culvert Height	If the culvert is circular, leave this field blank. If the culvert is rectangular, record the height of the culvert in feet.	
CUL_MATERIAL	Culvert Material	Record the material of the culvert (concrete, corrugated metal, granite block, other). If other material, indicate in comments (i.e., vitrified clay).	
CUL_MAT_BOT	Culvert Bottom Material	If known, record the bottom material of the culvert (riprap, sand, stone, other).	

Attribute	Description	Data Entry Instructions	Response
CUL_CONDITION	Culvert Condition	Record the qualitative (i.e. best judgment) condition of the culvert based on a visual inspection (Good, Fair, Poor, Unknown). See field protocols for guidelines.	
CUL_COMMENTS	Culvert Comments	Record any miscellaneous culvert comments. This can include extraneous information on the culvert condition, or operational status (e.g., accumulated sediment observed).	
Miscellaneous Site Characteristics			
INVASIVE_SP	Invasive Species	Indicate if any invasive species are observed upstream of the tide gate (Yes or No).	
INVASIVE_COMMENTS	Invasive Species Comments	Indicate type of invasive species if known and any comments (e.g., abundant phragmites, purple loosestrife, etc.).	
US_TOTAL	Total Upstream Affected Area	This is the total affected area upstream of the tide gate based on tidal atlas data and is for reference purposes only.	
US_MARSH	Total Upstream Affected Salt Marsh Area	This is the total affected salt marsh area upstream of the tide gate based on tidal atlas data and is for reference purposes only.	
REST_STATUS	Restoration Status	If known and applicable, indicate the restoration status of the impounded area (Proposed, In-Progress, Complete).	
REST_COMMENTS	Misc. Restoration Comments	Record any miscellaneous restoration comments (e.g., *S. alterniflora* establishing itself on west bank)	
OTHER_COMMENTS	Additional Comments	Record any additional comments.	
Photograph Documentation			
PHOTOID_1	Tide Gate Photo (from downstream)	If accessible, record photo of tide gate standing downstream.	
PHOTOID_2	Tide Gate / Culvert Photo (from upstream)	If accessible, record photo of tide gate or culvert standing downstream.	
PHOTOID_3	Downstream Photo	If accessible, record a photo from the top of the restriction (i.e. berm) and looking downstream.	
PHOTOID_4	Upstream Photo	If accessible, record a photo from the top of the restriction (i.e. berm) and looking upstream.	
PHOTOID_5 through 12	Additional Photo(s)	If accessible or desired, record up to eight (8) additional informative photos of interest of the site.	
PHOTO_COMMENTS	Photo Comments	Record any photo comments (e.g., no safe means to photograph the tide gate, etc.).	

Attribute	Description	Data Entry Instructions	Response
External Data Files			
EXTERNAL_DATA	Hyperlink(s) to External Data	Upload relevant files (e.g., water level, published studies, permit documents, operation and maintenance plans, engineering drawings, etc.).	

Appendix E:

Initial Site Visit List

UNIQUE_ID	TIDEGATE_ID	ORIG_ATLAS_ID	TOWN	REGION	Site Visit (Yes, No, Maybe)	Site Visit Reason / Comments
1	Barnstable-01	BA-16	Barnstable	CAPE COD	YES	Per DER Guidance (9/27/2015)
6	Dennis-01	DE-3	Dennis	CAPE COD	YES	Per DER Guidance (9/27/2015)
7	Eastham-01	EA-7	Eastham	CAPE COD	YES	Per DER Guidance (9/27/2015)
12	Orleans-02	OR-6	Orleans	CAPE COD	YES	Per DER Guidance (9/27/2015)
14	Sandwich-01	SA-5	Sandwich	CAPE COD	YES	Per DER Guidance (9/27/2015)
22	Beverly-01		Beverly	LOWER NORTH SHORE	YES	Yes, need more attributes.
24	Manchester-01		Manchester	LOWER NORTH SHORE	YES	Yes, need more attributes.
25	Salem-01		Salem	LOWER NORTH SHORE	YES	Yes, need more attributes.
33	Hingham-05	HIWR19	Hingham	METRO BOSTON	YES	Yes, need more attributes.
36	Hull-02	HUHB2	Hull	METRO BOSTON	YES	Yes, need more attributes.
38	Hull-04	HUAH6	Hull	METRO BOSTON	YES	Yes, need more attributes.
39	Quincy-01		Quincy	METRO BOSTON	YES	Per DER Guidance (9/27/2015)
40	Quincy-02A		Quincy	METRO BOSTON	YES	Yes, need more attributes.
108	Quincy-02B		Quincy	METRO BOSTON	YES	Yes, need more attributes.
41	Quincy-03		Quincy	METRO BOSTON	YES	Yes, need more attributes.
42	Quincy-04		Quincy	METRO BOSTON	YES	Yes, need more attributes.

UNIQUE_ID	TIDEGATE_ID	ORIG_ATLAS_ID	TOWN	REGION	Site Visit (Yes, No, Maybe)	Site Visit Reason / Comments
84	Quincy-06		Quincy	METRO BOSTON	YES	Per DER Guidance (9/27/2015)
58	Weymouth-02	WEWF1	Weymouth	METRO BOSTON	YES	Per DER Guidance (9/27/2015)
62	Cohasset-01	COBB2	Cohasset	SOUTH SHORE	YES	Yes, need more attributes.
63	Cohasset-02	COBB4	Cohasset	SOUTH SHORE	YES	Yes, need more attributes.
65	Cohasset-04A	COBB9	Cohasset	SOUTH SHORE	YES	Per DER Guidance (9/27/2015)
111	Cohasset-04B	COBB9	Cohasset	SOUTH SHORE	YES	Per DER Guidance (9/27/2015)
28	Duxbury-01	DUDB18	Duxbury	SOUTH SHORE	YES	Yes, need more attributes.
72	Marshfield-05		Marshfield	SOUTH SHORE	YES	Yes, need more attributes.
74	Scituate-01	SCSH2A	Scituate	SOUTH SHORE	YES	Yes, need more attributes.
75	Scituate-02	SCHR5	Scituate	SOUTH SHORE	YES	Yes, need more attributes.
77	Scituate-04	SCHR20	Scituate	SOUTH SHORE	YES	Yes, need more attributes.
79	Gloucester-01A		Gloucester	UPPER NORTH SHORE	YES	Yes, need more attributes.
116	Gloucester-01B		Gloucester	UPPER NORTH SHORE	YES	Yes, need more attributes.
80	Salisbury-01A		Salisbury	UPPER NORTH SHORE	YES	Yes, need more attributes.
117	Salisbury-01B		Salisbury	UPPER NORTH SHORE	YES	Yes, need more attributes.
81	Boston-01		Boston	METRO BOSTON	MAYBE	Boston, pleasure Bay upstream. Unsure if site visit warranted. Attributes not populated

UNIQUE_ID	TIDEGATE_ID	ORIG_ATLAS_ID	TOWN	REGION	Site Visit (Yes, No, Maybe)	Site Visit Reason / Comments
82	Boston-02		Boston	METRO BOSTON	MAYBE	Boston, pleasure Bay upstream. Unsure if site visit warranted. Attributes not populated
44	Revere-01		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
45	Revere-02		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
46	Revere-03		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
47	Revere-04		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
48	Revere-05		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
49	Revere-06		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
50	Revere-07		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
51	Revere-08A		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
109	Revere-08B		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
110	Revere-08C		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
52	Revere-09		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
53	Revere-10		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
54	Revere-11		Revere	METRO BOSTON	MAYBE	Attributes already partially populated
55	Saugus-01		Saugus	METRO BOSTON	MAYBE	Attributes already partially populated
56	Saugus-02		Saugus	METRO BOSTON	MAYBE	Inactive tide gate
57	Saugus-03		Saugus	METRO BOSTON	MAYBE	Inactive tide gate
2	Barnstable-02	BA-17	Barnstable	CAPE COD	NO	Per DER Guidance (9/27/2015)

UNIQUE_ID	TIDEGATE_ID	ORIG_ATLAS_ID	TOWN	REGION	Site Visit (Yes, No, Maybe)	Site Visit Reason / Comments
3	Brewster-01	BR-7/OR-1	Brewster	CAPE COD	NO	Per DER Guidance (9/27/2015)
4	Brewster-02	BR-3	Brewster	CAPE COD	NO	Per DER Guidance (9/27/2015)
5	Chatham-01	CH-6	Chatham	CAPE COD	NO	Per DER Guidance (9/27/2015) [Originally Yes, but Town not in project scope]
8	Eastham-02	EA-9	Eastham	CAPE COD	NO	Per DER Guidance (9/27/2015)
9	Falmouth-01	FA-2	Falmouth	CAPE COD	NO	Per DER Guidance (9/27/2015) [Originally Yes, but Town not in project scope]
10	Harwich-01	HA-8	Harwich	CAPE COD	NO	Per DER Guidance (9/27/2015) [Originally Yes, but Town not in project scope]
11	Orleans-01	OR-3	Orleans	CAPE COD	NO	Per DER Guidance (9/27/2015)
15	Sandwich-02		Sandwich	CAPE COD	NO	Per DER Guidance (9/27/2015)
16	Sandwich-03	SA-9	Sandwich	CAPE COD	NO	Per DER Guidance (9/27/2015)
17	Truro-01	TR-3	Truro	CAPE COD	NO	Per DER Guidance (9/27/2015)
18	Truro-02A	TR-6	Truro	CAPE COD	NO	Per DER Guidance (9/27/2015)
103	Truro-02B	TR-6	Truro	CAPE COD	NO	Per DER Guidance (9/27/2015)
19	Truro-03	TR-7	Truro	CAPE COD	NO	Per DER Guidance (9/27/2015)
20	Wellfleet-01	WE-5	Wellfleet	CAPE COD	NO	Per DER Guidance (9/27/2015)
21	Wellfleet-02A	WE-6	Wellfleet	CAPE COD	NO	Per DER Guidance (9/27/2015)
104	Wellfleet-02B	WE-6	Wellfleet	CAPE COD	NO	Per DER Guidance (9/27/2015)
105	Wellfleet-02C	WE-6	Wellfleet	CAPE COD	NO	Per DER Guidance (9/27/2015)

UNIQUE_ID	TIDEGATE_ID	ORIG_ATLAS_ID	TOWN	REGION	Site Visit (Yes, No, Maybe)	Site Visit Reason / Comments
90	Lynn-01A		Lynn	LOWER NORTH SHORE	NO	Potentially just stormwater infrastructure upstream
118	Lynn-01B		Lynn	LOWER NORTH SHORE	NO	Potentially just stormwater infrastructure upstream
26	Salem-02A		Salem	LOWER NORTH SHORE	NO	Potentially just stormwater infrastructure upstream
106	Salem-02B		Salem	LOWER NORTH SHORE	NO	Potentially just stormwater infrastructure upstream
83	Salem-03		Salem	LOWER NORTH SHORE	NO	Potentially just stormwater infrastructure upstream
91	Swampscott-01		Swampscott	LOWER NORTH SHORE	NO	Inactive
92	Swampscott-02		Swampscott	LOWER NORTH SHORE	NO	Attributes already partially populated
93	Swampscott-03		Swampscott	LOWER NORTH SHORE	NO	Inactive
27	Chelsea-01		Chelsea	METRO BOSTON	NO	Potentially just stormwater infrastructure upstream - questionable location
95	Chelsea-02		Chelsea	METRO BOSTON	NO	Potentially just stormwater infrastructure upstream. Lat/Lon location could not be determined from municipal SharePoint contact. Additional clarification necessary to determined location.
96	Chelsea-03A		Chelsea	METRO BOSTON	NO	Potentially just stormwater infrastructure upstream. Lat/Lon location could not be determined from municipal SharePoint contact. Additional clarification necessary to determined location.

UNIQUE_ID	TIDEGATE_ID	ORIG_ATLAS_ID	TOWN	REGION	Site Visit (Yes, No, Maybe)	Site Visit Reason / Comments
119	Chelsea-03B		Chelsea	METRO BOSTON	NO	Potentially just stormwater infrastructure upstream. Lat/Lon location could not be determined from municipal SharePoint contact. Additional clarification necessary to determined location.
94	Everett-01		Everett	METRO BOSTON	NO	Inactive
29	Hingham-01	HIHH9A	Hingham	METRO BOSTON	NO	Per DER Guidance (9/27/2015)
30	Hingham-02	HIHH8	Hingham	METRO BOSTON	NO	Per DER Guidance (9/27/2015)
31	Hingham-03	HIHH10	Hingham	METRO BOSTON	NO	Per Jason Email (9/29/2015) - Removed
32	Hingham-04	HIHH12	Hingham	METRO BOSTON	NO	Per DER Guidance (9/27/2015)
34	Hingham-06		Hingham	METRO BOSTON	NO	Per Jason Email (9/29/2015) - Plans & Permits available
35	Hull-01	HUHB1	Hull	METRO BOSTON	NO	Primarily a pumping station
37	Hull-03A	HUWR3	Hull	METRO BOSTON	NO	Per DER Guidance (9/27/2015)
107	Hull-03B	HUWR3	Hull	METRO BOSTON	NO	Per DER Guidance (9/27/2015)
43	Quincy-05		Quincy	METRO BOSTON	NO	Proposed
85	TEST	2	Boston	METRO BOSTON	NO	test tide gate
100	Weymouth-01		Weymouth	METRO BOSTON	NO	Attributes already mostly populated
59	Weymouth-03		Weymouth	METRO BOSTON	NO	Proposed tide gate
86	Weymouth-04		Weymouth	METRO BOSTON	NO	Attributes already partially populated
87	Weymouth-05		Weymouth	METRO BOSTON	NO	Attributes already partially populated
88	Weymouth-06		Weymouth	METRO BOSTON	NO	Attributes already partially populated

UNIQUE_ID	TIDEGATE_ID	ORIG_ATLAS_ID	TOWN	REGION	Site Visit (Yes, No, Maybe)	Site Visit Reason / Comments
89	Weymouth-07		Weymouth	METRO BOSTON	NO	Attributes already partially populated
98	Weymouth-08		Weymouth	METRO BOSTON	NO	Attributes already mostly populated
99	Weymouth-09		Weymouth	METRO BOSTON	NO	Attributes already mostly populated
60	Winthrop-01		Winthrop	METRO BOSTON	NO	Potentially just stormwater infrastructure upstream - questionable location
61	Winthrop-02		Winthrop	METRO BOSTON	NO	Proposed tide gate
64	Cohasset-03A	COBB6	Cohasset	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)
101	Cohasset-03B	COBB6	Cohasset	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)
102	Cohasset-03C	COBB6	Cohasset	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)
66	Cohasset-05	COBB9	Cohasset	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)
67	Kingston-01	KITB8	Kingston	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)
68	Marshfield-01	MAGH4A	Marshfield	SOUTH SHORE	NO	Attributes already mostly populated
69	Marshfield-02A	MAGH4B	Marshfield	SOUTH SHORE	NO	Attributes already mostly populated
112	Marshfield-02B	MAGH4B	Marshfield	SOUTH SHORE	NO	Attributes already mostly populated
113	Marshfield-02C	MAGH4B	Marshfield	SOUTH SHORE	NO	Attributes already mostly populated
114	Marshfield-02D	MAGH4B	Marshfield	SOUTH SHORE	NO	Attributes already mostly populated
70	Marshfield-03	MASR16	Marshfield	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)
71	Marshfield-04	MAGH18	Marshfield	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)
76	Scituate-03A	SCBB11	Scituate	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)

UNIQUE_ID	TIDEGATE_ID	ORIG_ATLAS_ID	TOWN	REGION	Site Visit (Yes, No, Maybe)	Site Visit Reason / Comments
115	Scituate-03B	SCBB11	Scituate	SOUTH SHORE	NO	Per DER Guidance (9/27/2015)
78	Scituate-05	SCSH25	Scituate	SOUTH SHORE	NO	Per Jason Burtner Email (9/29/2015) - Service report available

Appendix F:

Field Visit and Database Update Log

VISIT DAY	ID	NAME	TOWN	REGION	COUNT	ADDED	REMOVED	NAME CHANGE	COMMENT
11/2/2015	39	Quincy-01A	Quincy	METRO BOSTON	1	N	N	Y	CHANGED TO QUINCY-01A FROM QUINCY-01
11/2/2015	120	Quincy-01B	Quincy	METRO BOSTON	1	Y	N	N	QUINCY-01B
11/2/2015	121	Quincy-01C	Quincy	METRO BOSTON	1	Y	N	N	QUINCY-01C
11/2/2015	40	Quincy-02	Quincy	METRO BOSTON	1	N	N	Y	CHANGED TO QUINCY-02 FROM QUINCY-02A
11/2/2015	108		Quincy	METRO BOSTON	1	N	Y	N	TG DOESN'T EXIST [JUST 1 TIDE GATE AT QUINCY-02 LOCATION]
11/2/2015	42	Quincy-04	Quincy	METRO BOSTON	1	N	N	N	
11/2/2015	41	Quincy-03	Quincy	METRO BOSTON	1	N	N	N	
11/2/2015	58	Weymouth-02	Weymouth	METRO BOSTON	1	N	N	N	
11/2/2015	84	Quincy-06	Quincy	METRO BOSTON	1	N	N	N	
11/3/2015	38	Hull-04	Hull	METRO BOSTON	1	N	N	N	
11/3/2015	36	Hull-02A	Hull	METRO BOSTON	1	N	N	Y	CHANGED TO HULL-02A FROM HULL-02
11/3/2015	122	Hull-02B	Hull	METRO BOSTON	1	Y	N	N	HULL-02B
11/3/2015	63	Cohasset-02	Cohasset	SOUTH SHORE	1	N	N	N	
11/3/2015	62	Cohasset-01	Cohasset	SOUTH SHORE	1	N	N	N	
11/3/2015	65	Cohasset-04A	Cohasset	SOUTH SHORE	1				
11/3/2015	111		Cohasset	SOUTH SHORE	1	N	Y	N	TG DOESN'T EXIST [jUST 1 TIDE GATE AT COHASSET-04 LOCATION]
11/3/2015	75	Scituate-02	Scituate	SOUTH SHORE	1	N	N	N	TG DOESN'T APPEAR TO EXIST AT LOCATION - LISTED AS "REMOVED" IN DATABASE
11/3/2015	74	Scituate-01A	Scituate	SOUTH SHORE	1	N	N	Y	Changed to Scituate-01A from Scituate-01
11/3/2015	123	Scituate-01B	Scituate	SOUTH SHORE	1	Y	N	N	Scitutae-02B
11/4/2015	33	Hingham-05	Hingham	METRO BOSTON	1	N	N	N	WRONG LOCATION IN INITIAL DATABASE - MOVED PER FIELD OBSERVATIONS
11/4/2015	77	Scituate-04	Scituate	SOUTH SHORE	1	N	N	N	
11/4/2015	72	Marshfield-05A	Marshfield	SOUTH SHORE	1	N	N	Y	CHANGED TO MARSHFIELD-05A FROM MARSHFIELD-05
11/4/2015	124	Marshfield-05B	Marshfield	SOUTH SHORE	1	Y	N	N	MARSHFIELD-05B
11/4/2015	68	Marshfield-01A	Marshfield	SOUTH SHORE	1	N	N	Y	CHANGED TO MARSHFIELD-01A FROM MARSHFIELD-01 [WRONG LOCATION - MOVED TO THE NORTH - USED TO BE CO-LOCATED WITH MARSHFIELD-02 IN DATABASE - CORRECTED]
11/4/2015	125	Marshfield-01B	Marshfield	SOUTH SHORE	1	Y	N	N	MARSHFIELD-01B [WRONG LOCATION - MOVED TO THE NORTH - USED TO BE CO-LOCATED WITH MARSHFIELD-02 IN DATABASE - CORRECTED]
11/4/2015	69	Marshfield-02A	Marshfield	SOUTH SHORE	1	N	N	N	
11/4/2015	112	Marshfield-02B	Marshfield	SOUTH SHORE	1	N	N	N	
11/4/2015	71	Marshfield-04A	Marshfield	SOUTH SHORE	1	N	N	Y	CHANGED TO MARSHFIELD-04A FROM MARSHFIELD-04
11/4/2015	126	Marshfield-04B	Marshfield	SOUTH SHORE	1	Y	N	N	MARSHFIELD-04B
11/4/2015	127	Marshfield-04C	Marshfield	SOUTH SHORE	1	Y	N	N	MARSHFIELD-04C
11/4/2015	128	Marshfield-04D	Marshfield	SOUTH SHORE	1	Y	N	N	MARSHFIELD-04D
11/4/2015	28	Duxbury-01	Duxbury	SOUTH SHORE	1	N	N	N	
12/2/2015	25	Salem-01A	Salem	LOWER NORTH SHORE	1	N	N	Y	CHANGED SALEM-01 TO SALEM-01A
12/2/2015	130	Salem-01B	Salem	LOWER NORTH SHORE	1	Y	N	N	SALEM-01B
12/2/2015	131	Salem-01C	Salem	LOWER NORTH SHORE	1	Y	N	N	SALEM-01C
12/2/2015	22	Beverly-01A	Beverly	LOWER NORTH SHORE	1	N	N	Y	CHANGED BEVERLY-01 TO BEVERLY 01A
12/2/2015	132	Beverly-01B	Beverly	LOWER NORTH SHORE	1	Y	N	N	BEVERLY-01B
12/2/2015	24	Manchester-01	Manchester	LOWER NORTH SHORE	1	N	N	N	
12/2/2015	79	Gloucester-01A	Gloucester	UPPER NORTH SHORE	1	N	N	N	

Note: Visit day N/A indicates that record was not visited in the field but was modified after the field effort.

VISIT DAY	ID	NAME	TOWN	REGION	COUNT	ADDED	REMOVED	NAME CHANGE	COMMENT
12/2/2015	116	Gloucester-01B	Gloucester	UPPER NORTH SHORE	1	N	N	N	
12/2/2015	133	Gloucester-01C	Gloucester	UPPER NORTH SHORE	1	Y	N	N	GLOUCESTER-01C
12/2/2015	80	Salisbury-01A	Salisbury	UPPER NORTH SHORE	1	N	N	N	
12/2/2015	117	Salisbury-01B	Salisbury	UPPER NORTH SHORE	1	N	N	N	
12/18/2015	14	Sandwich-01	Sandwich	CAPE COD	1	N	N	N	[WRONG LOCATION - CHANGED COORDINATES IN DATABASE TO CORRECT LOCATION]
12/18/2015	1	Barnstable-01	Barnstable	CAPE COD	1	N	N	N	
12/18/2015	6	Dennis-01	Dennis	CAPE COD	1	N	N	N	
12/18/2015	12	Orleans-02A	Orleans	CAPE COD	1	N	N	Y	CHANGED TO ORLEANS-02A FROM ORLEANS-02
12/18/2015	135	Orleans-02B	Orleans	CAPE COD	1	Y	N	N	
12/18/2015	7	Eastham-01	Eastham	CAPE COD	1	N	N	N	
N/A	137	Harwich-02	Harwich	CAPE COD	1	Y	N	N	ADDED PER L. ENGLER EMAIL ON 10/29/2015.
N/A	138	Quincy-07	Quincy	METRO BOSTON	1	Y	N	N	ADDED PER L. ENGLER EMAIL ON 10/29/2015 [REACHED OUT TO E. REINER ON 12/28/2015 REQUESTING ADDITIONAL INFORMATION]
N/A	110	Revere-08A	Revere	METRO BOSTON	1	N	N	Y	CHANGED FROM REVERE-08C TO REVERE-08A. MODIFICATIONS PER L. ENGLER EMAIL DATED 10/21/2015.
N/A	109	Revere-08B	Revere	METRO BOSTON	1	N	N	N	MODIFICATIONS PER L. ENGLER EMAIL DATED 10/21/2015.
N/A	51	Revere-08C	Revere	METRO BOSTON	1	N	N	Y	CHANGED FROM REVERE-08A TO REVERE-08C. MODIFICATIONS PER L. ENGLER EMAIL DATED 10/21/2015.
N/A	139	Revere-08D	Revere	METRO BOSTON	1	Y	N	N	ADD PER MODIFICATIONS FROM L. ENGLER EMAIL DATED 10/21/2015
N/A	140	Revere-08E	Revere	METRO BOSTON	1	Y	N	N	ADD PER MODIFICATIONS FROM L. ENGLER EMAIL DATED 10/21/2015
N/A	141	Revere-08F	Revere	METRO BOSTON	1	Y	N	N	ADD PER MODIFICATIONS FROM L. ENGLER EMAIL DATED 10/21/2015
N/A	142	Revere-08G	Revere	METRO BOSTON	1	Y	N	N	ADD PER MODIFICATIONS FROM L. ENGLER EMAIL DATED 10/21/2015
N/A	143	Revere-08H	Revere	METRO BOSTON	1	Y	N	N	ADD PER MODIFICATIONS FROM L. ENGLER EMAIL DATED 10/21/2015
N/A	144	Revere-08I	Revere	METRO BOSTON	1	Y	N	N	ADD PER MODIFICATIONS FROM L. ENGLER EMAIL DATED 10/21/2015
N/A	145	Revere-08J	Revere	METRO BOSTON	1	Y	N	N	ADD PER MODIFICATIONS FROM L. ENGLER EMAIL DATED 10/21/2015
N/A	146	Revere-08K	Revere	METRO BOSTON	1	Y	N	N	ADD PER MODIFICATIONS FROM L. ENGLER EMAIL DATED 10/21/2015
N/A	50	Revere-07	Revere	METRO BOSTON	1	N	N	N	UPDATED ATTRIBUTES PER L. ENGLER EMAIL DATED 10/21/2015
N/A	147	Rowley-01	Rowley	UPPER NORTH SHORE	1	Y	N	N	NEW TIDE GATE PER NANCY PAU OF USFWS
N/A	148	Rowley-02	Rowley	UPPER NORTH SHORE	1	Y	N	N	NEW TIDE GATE PER NANCY PAU OF USFWS
N/A	149	Rowley-03	Rowley	UPPER NORTH SHORE	1	Y	N	N	NEW TIDE GATE PER NANCY PAU OF USFWS
N/A	150	Ipswich-01	Ipswitch	UPPER NORTH SHORE	1	Y	N	N	NEW TIDE GATE PER NANCY PAU OF USFWS

Note: Visit day N/A indicates that record was not visited in the field but was modified after the field effort.

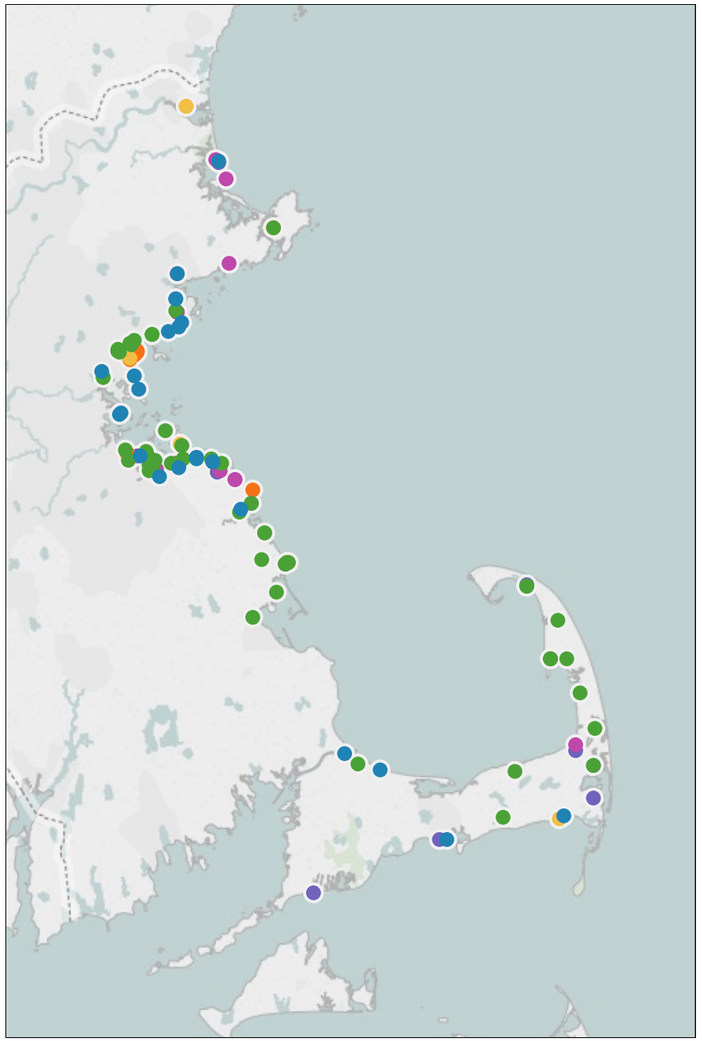
Appendix G:

Exploratory Data Analysis Findings

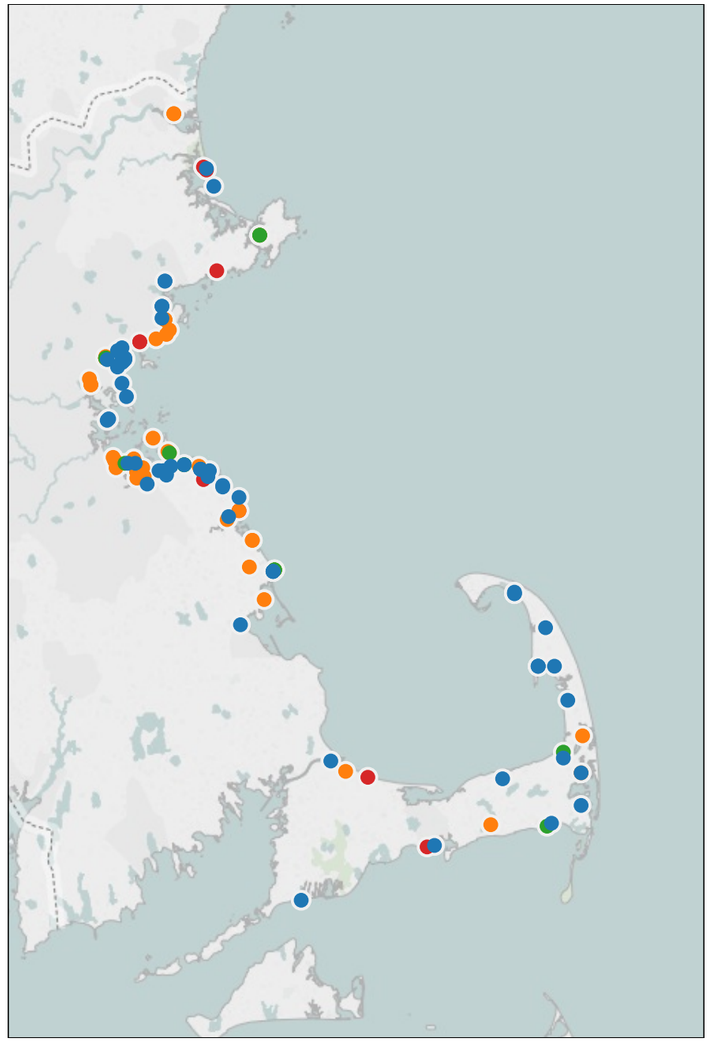
TIDEGateway Exploratory Data Analysis: General Findings

(Draft Final Report – February 2016)

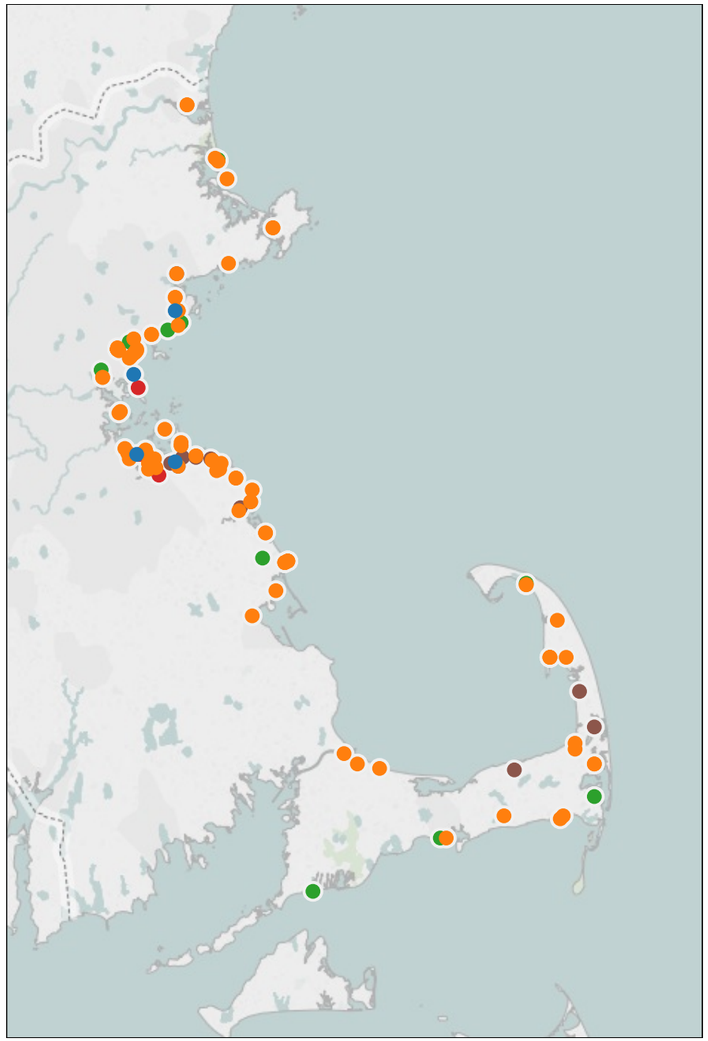
Tide Gate Type



Operational Purpose



Status



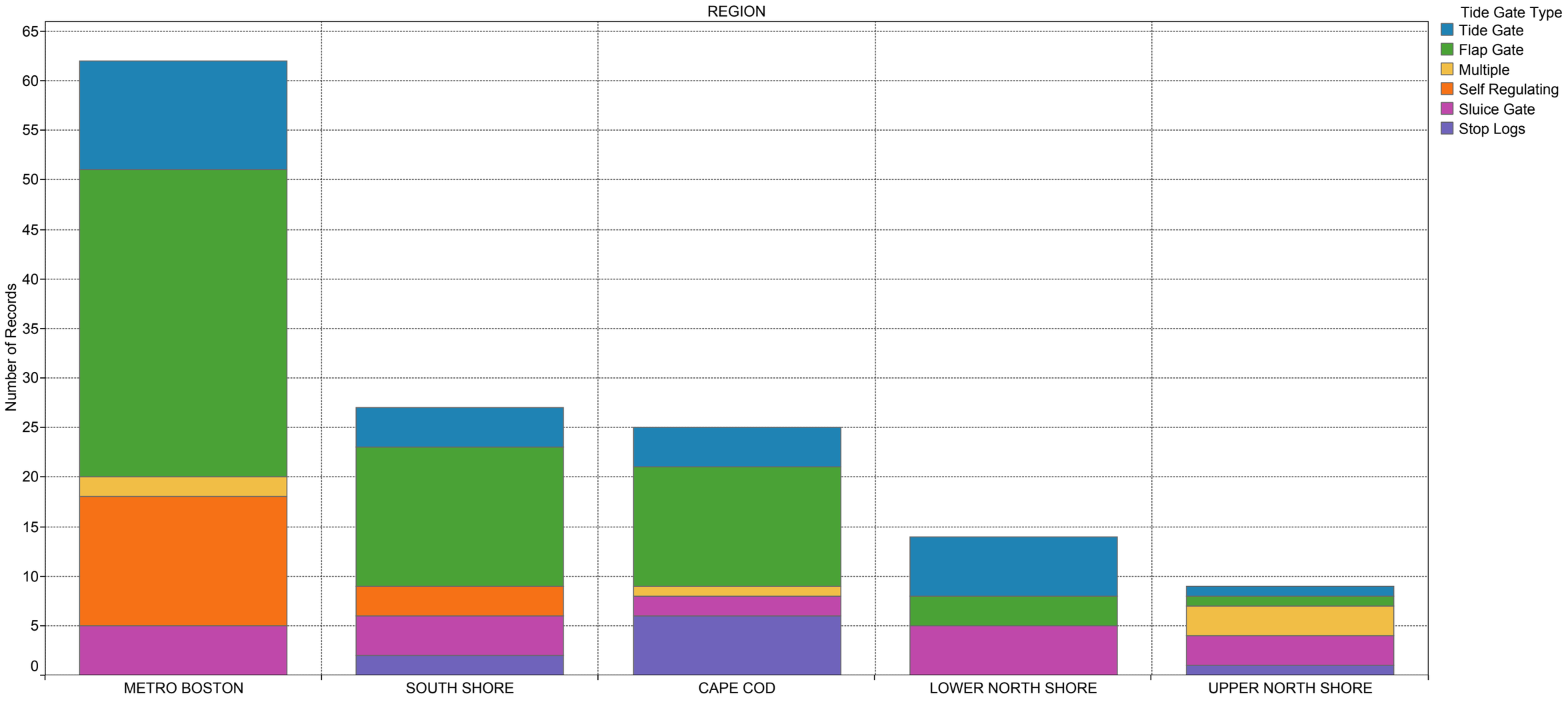
Tide Gate Type
- Tide Gate
- Flap Gate
- Multiple
- Self Regulating
- Sluice Gate
- Stop Logs

Operational Purpose
- Unknown or Null
- Flood Prot. & Rest.
- Flood Protection
- Other

Status
- Unknown or Null
- Active
- Inactive
- Proposed
- Removed

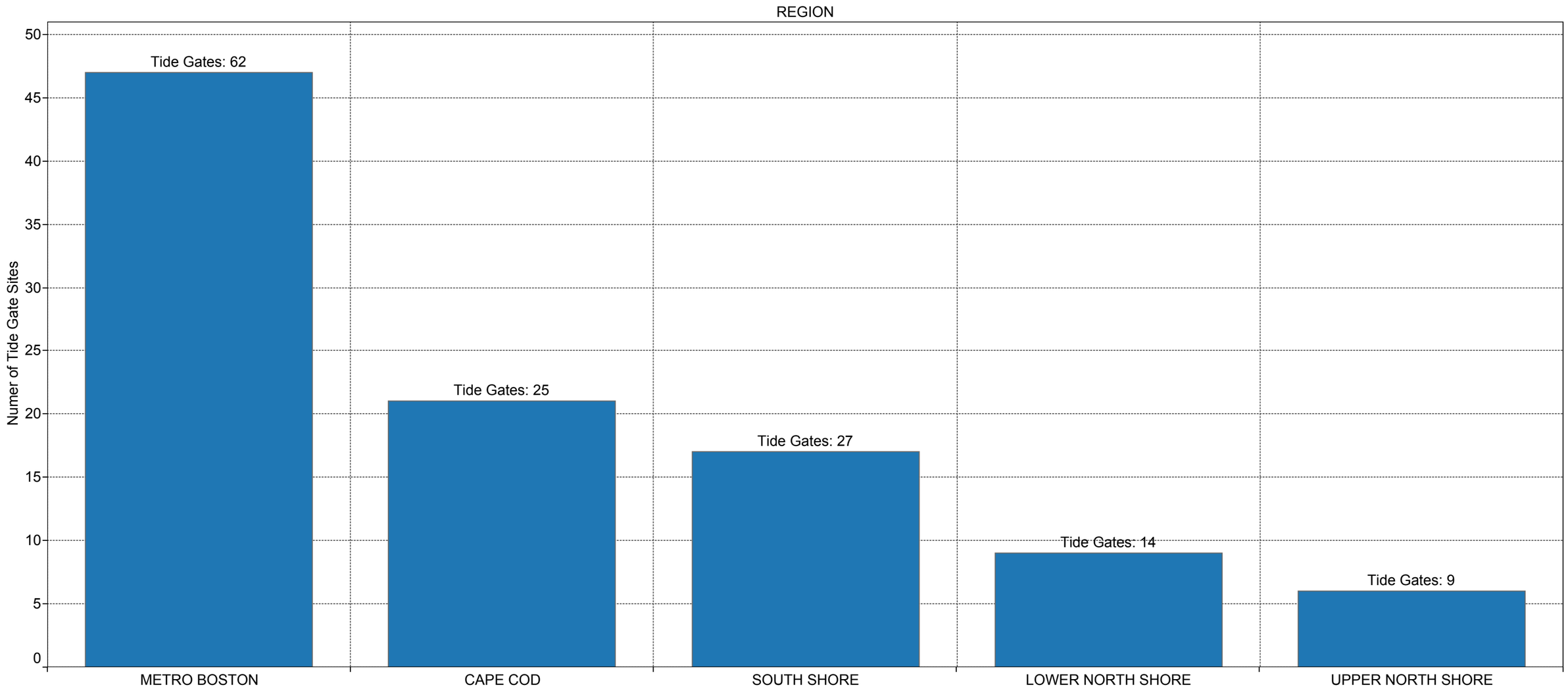
TIDEGateway Exploratory Data Analysis: General Findings

(Draft Final Report – February 2016)



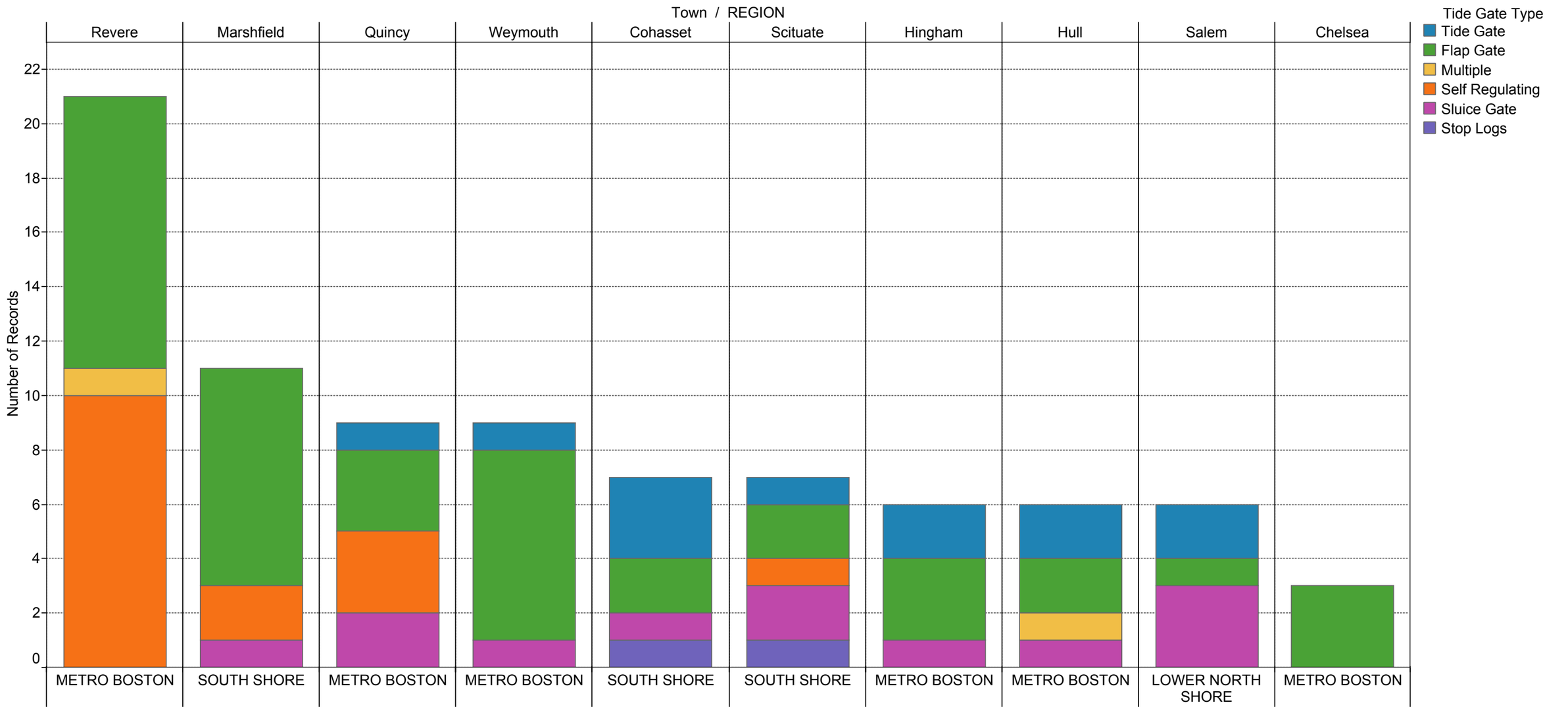
TIDEGateway Exploratory Data Analysis: General Findings

(Draft Final Report – February 2016)



TIDEGateway Exploratory Data Analysis: General Findings

(Draft Final Report – February 2016)



TIDEGateway Exploratory Data Analysis: General Findings

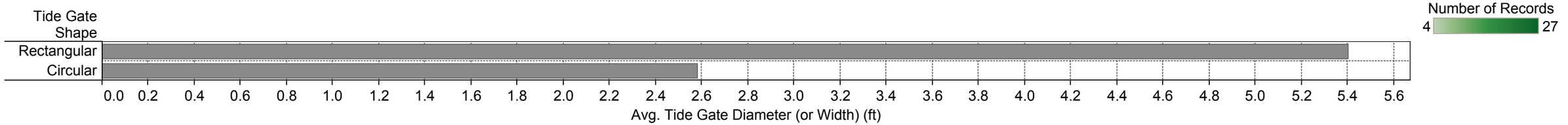
(Draft Final Report – February 2016)

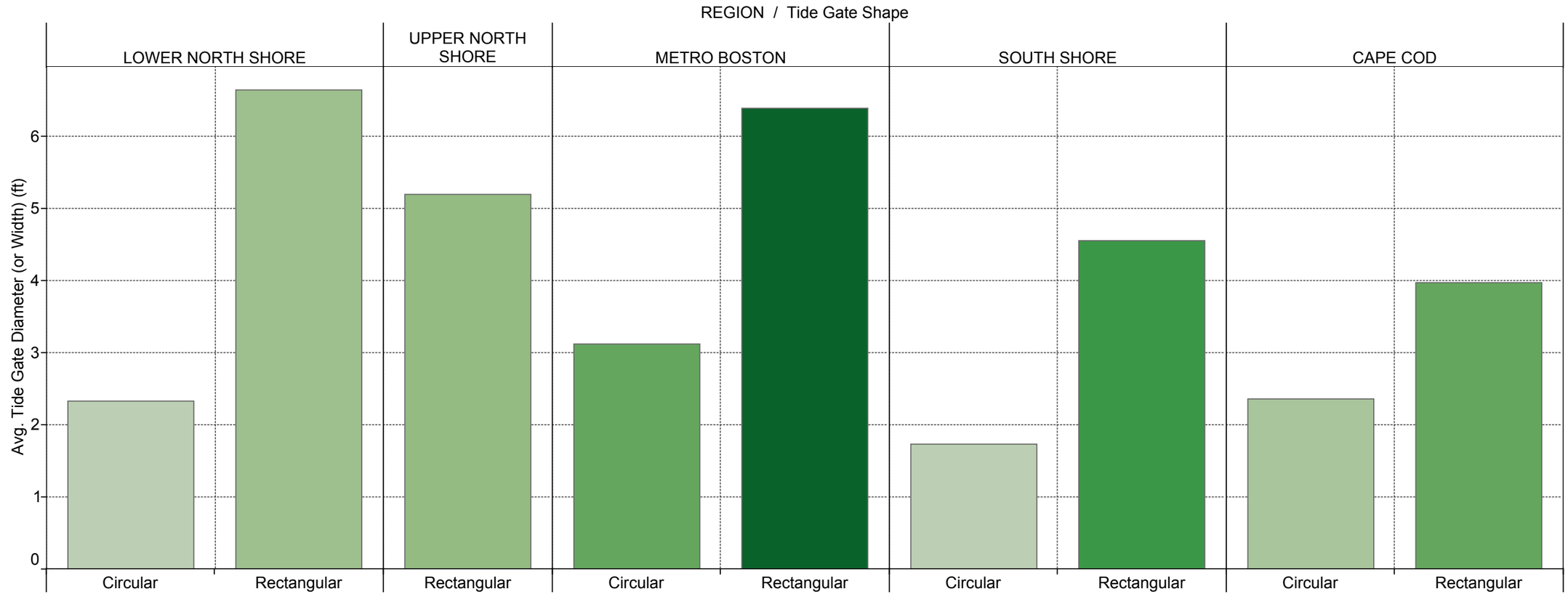
	Tide Gate Material			
Tide Gate Type	Unknown	Metal	Other	Wood
Tide Gate	15	10	1	
Flap Gate	11	32	5	13
Multiple	2	4		
Self Regulating		16		
Sluice Gate	1	16		2
Stop Logs	4	1		4
Grand Total	33	79	6	19

Number of Records
1 79

TIDEGateway Exploratory Data Analysis: General Findings

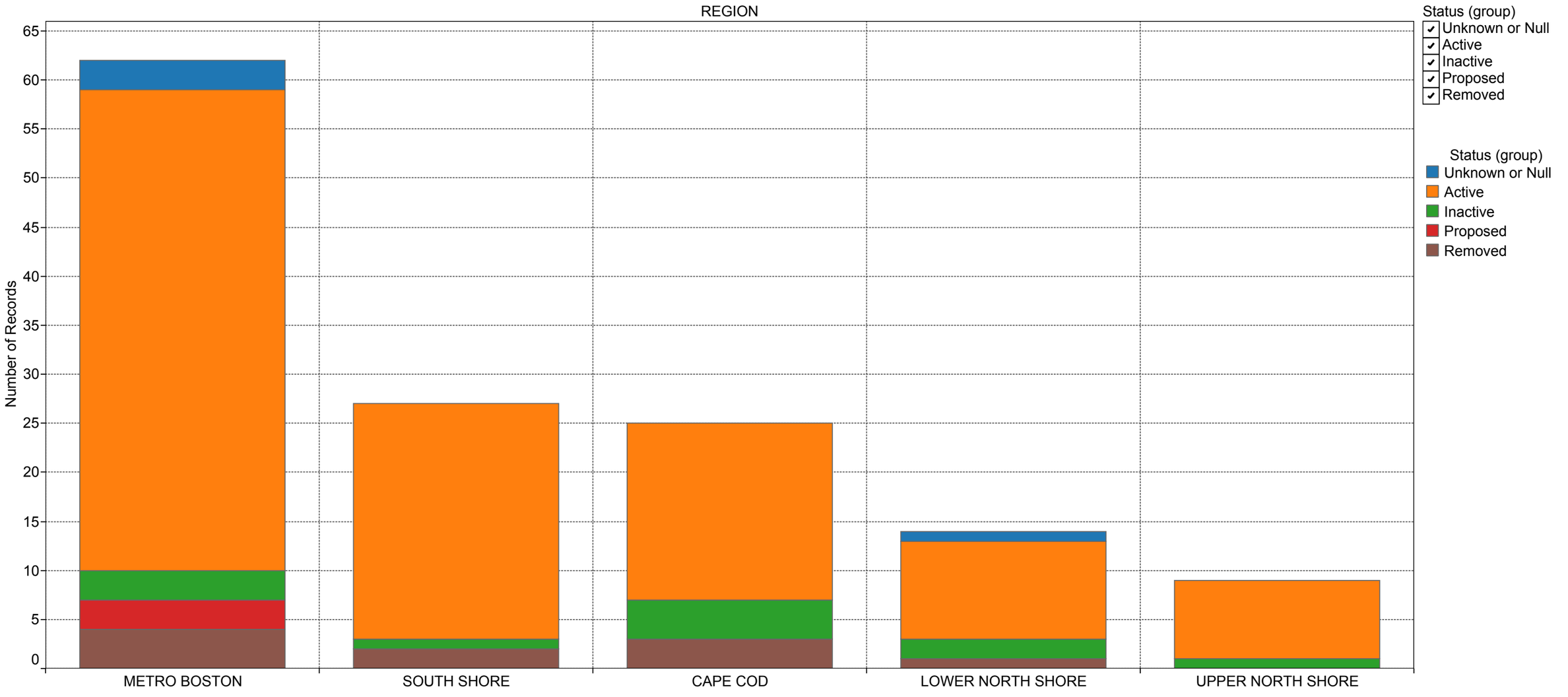
(Draft Final Report – February 2016)





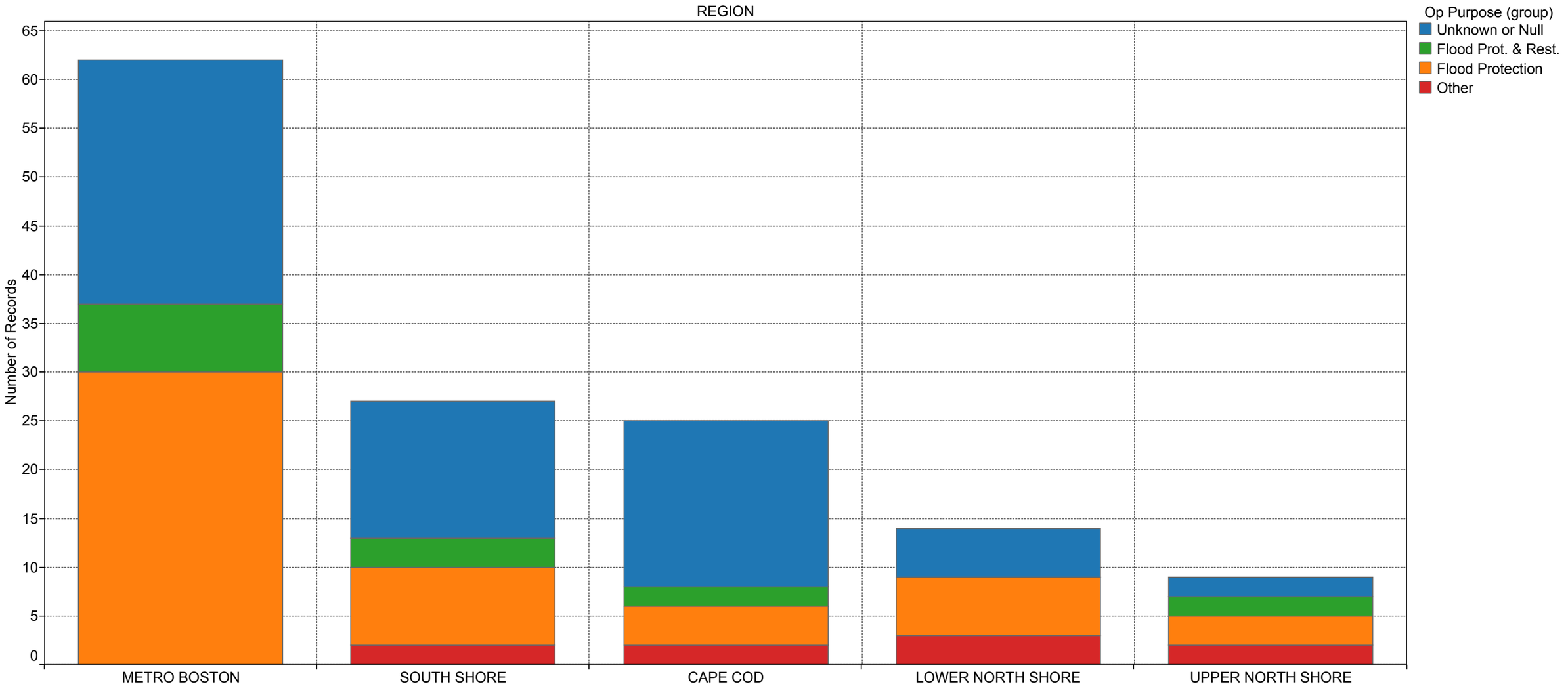
TIDEGateway Exploratory Data Analysis: General Findings

(Draft Final Report – February 2016)



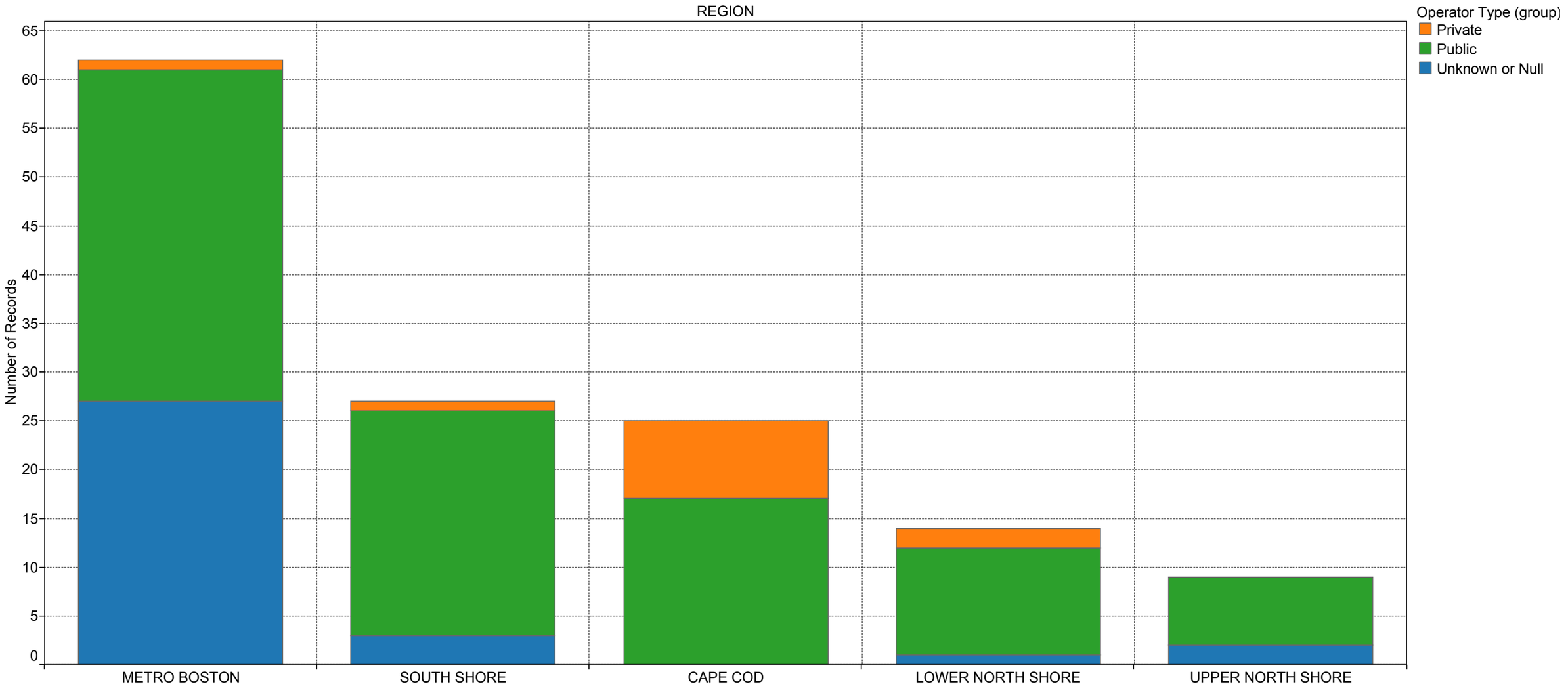
TIDEGateway Exploratory Data Analysis: General Findings

(Draft Final Report – February 2016)



TIDEGateway Exploratory Data Analysis: General Findings

(Draft Final Report – February 2016)



TIDEGateway Exploratory Data Analysis: General Findings

(Draft Final Report – February 2016)

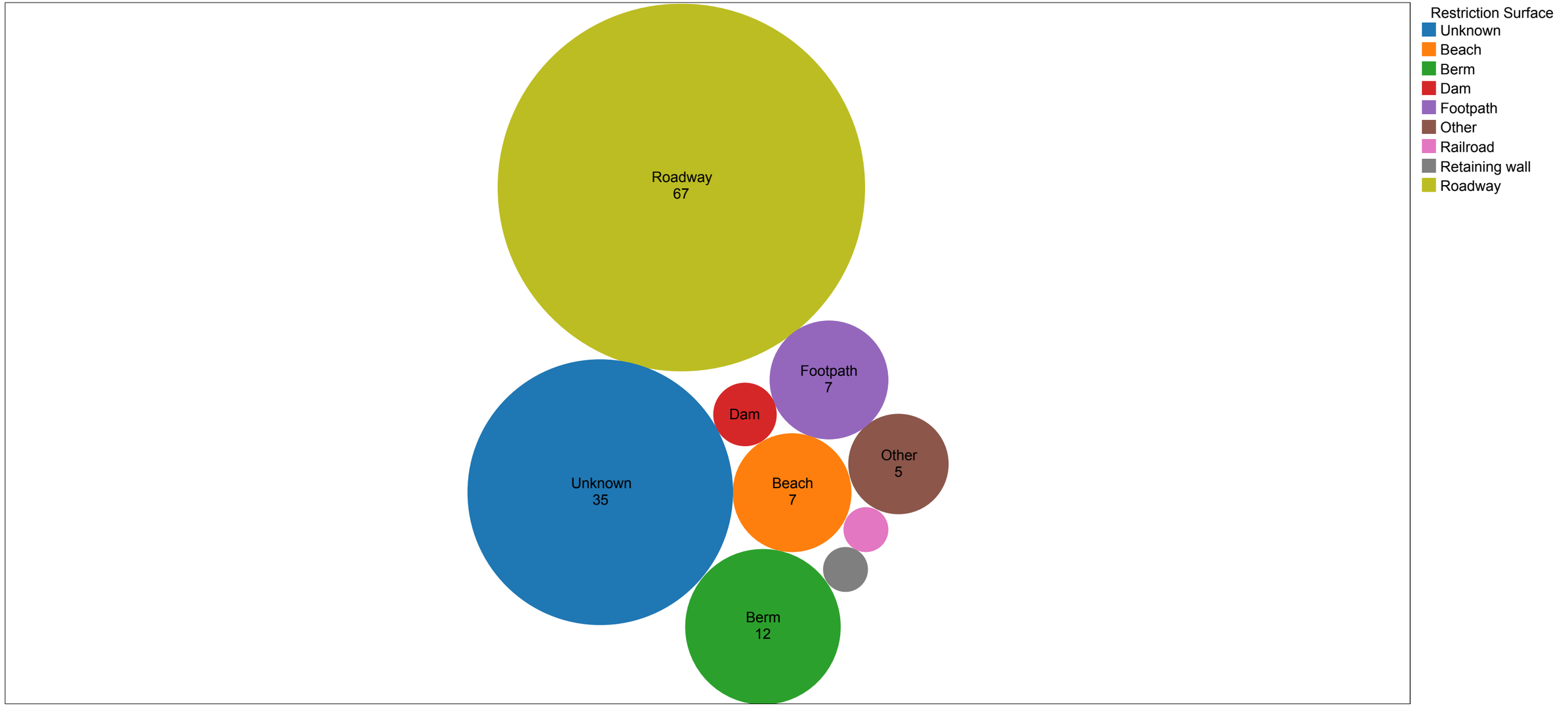
Culvert Material

Tide Gate Type	Unknown	Concrete	Corrugated Metal	Ductile Iron Pipe	Granite Block	Other
Tide Gate	14	8	1		2	1
Flap Gate	15	28	12	1	1	4
Multiple	2	3	1			
Self Regulating	7	9				
Sluice Gate	3	10	1	1	4	
Stop Logs	3	4	2			
Grand Total	44	62	17	2	7	5

Number of Records
1 62

TIDEGateway Exploratory Data Analysis: General Findings

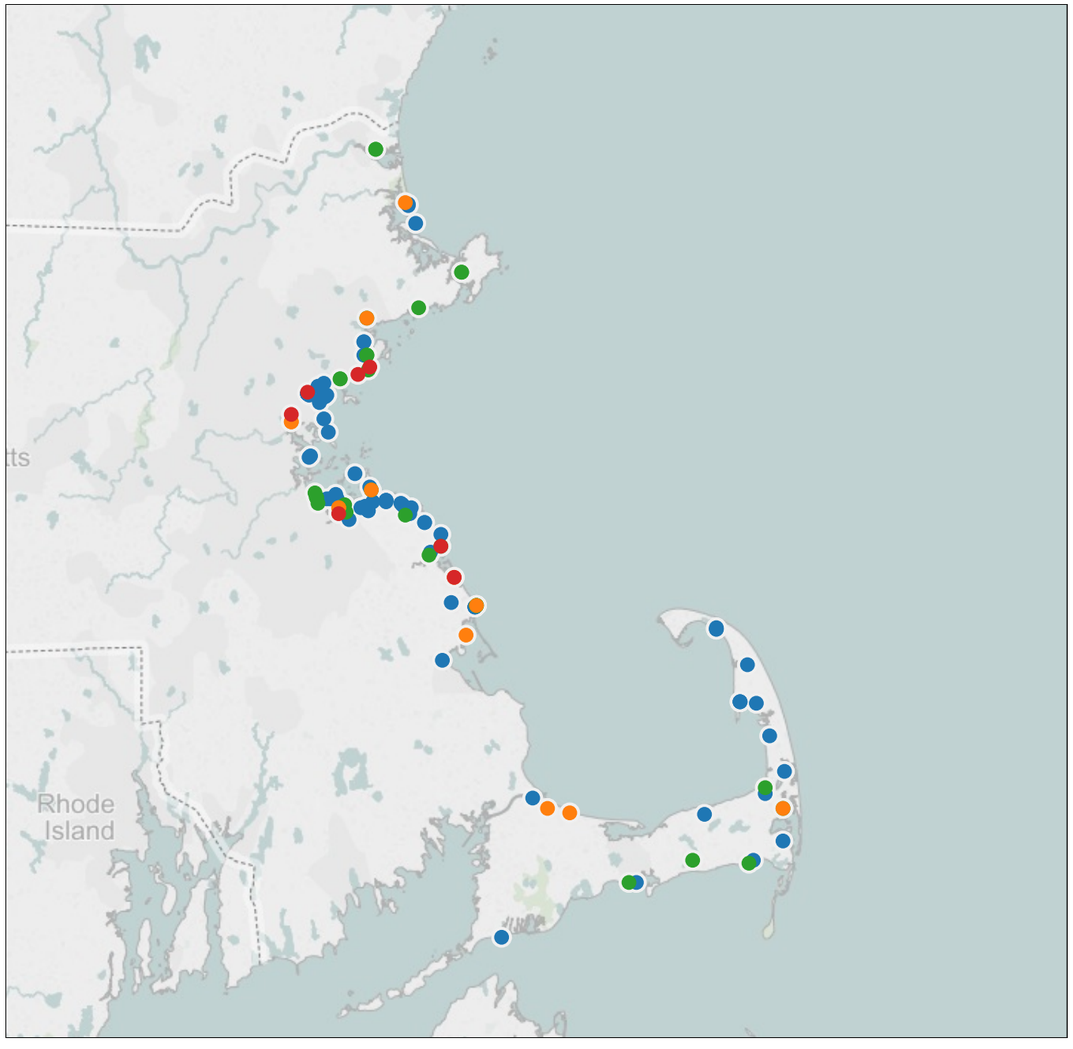
(Draft Final Report – February 2016)



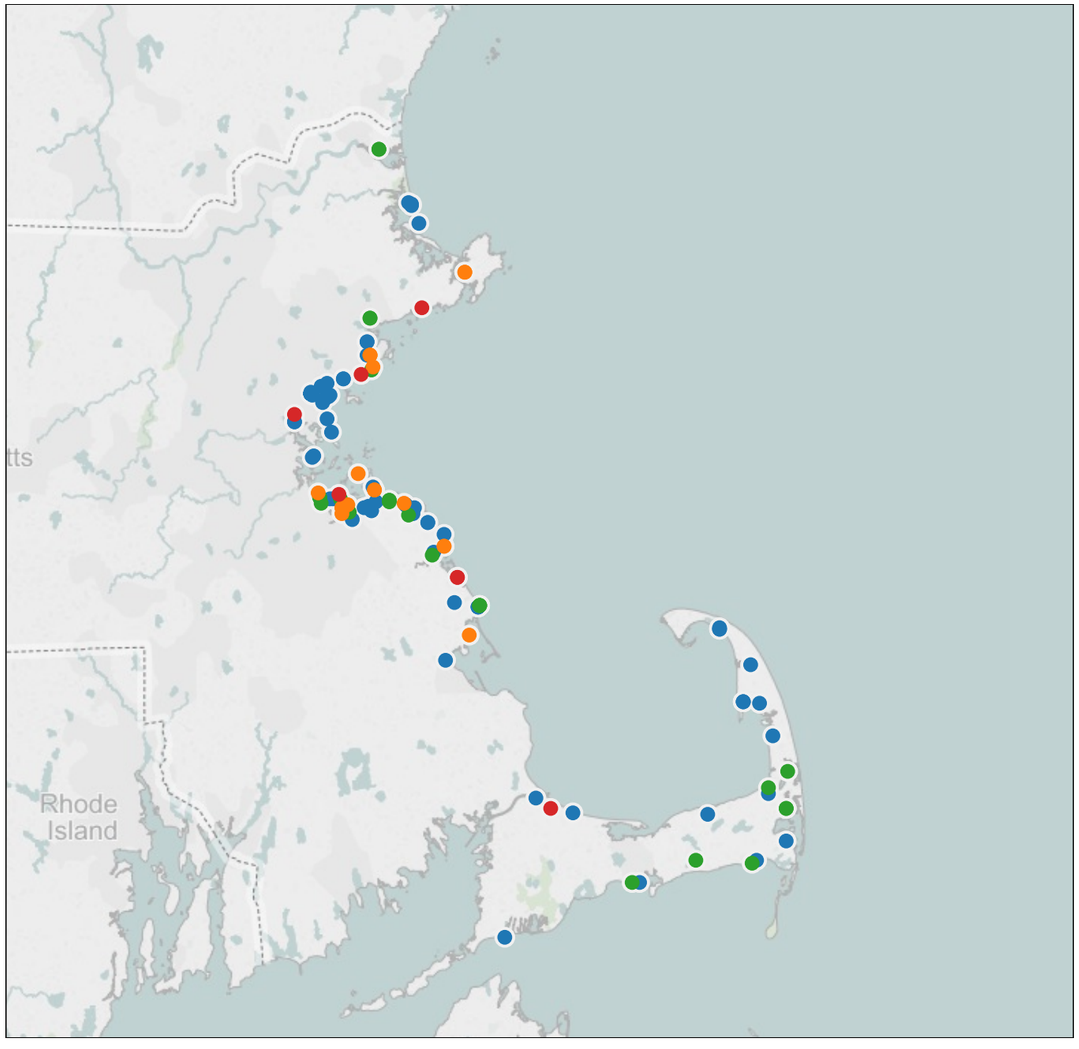
TIDEGateway Exploratory Data Analysis: Condition Findings

(Draft Final Report – February 2016)

Tide Gate Condition



Culvert Condition



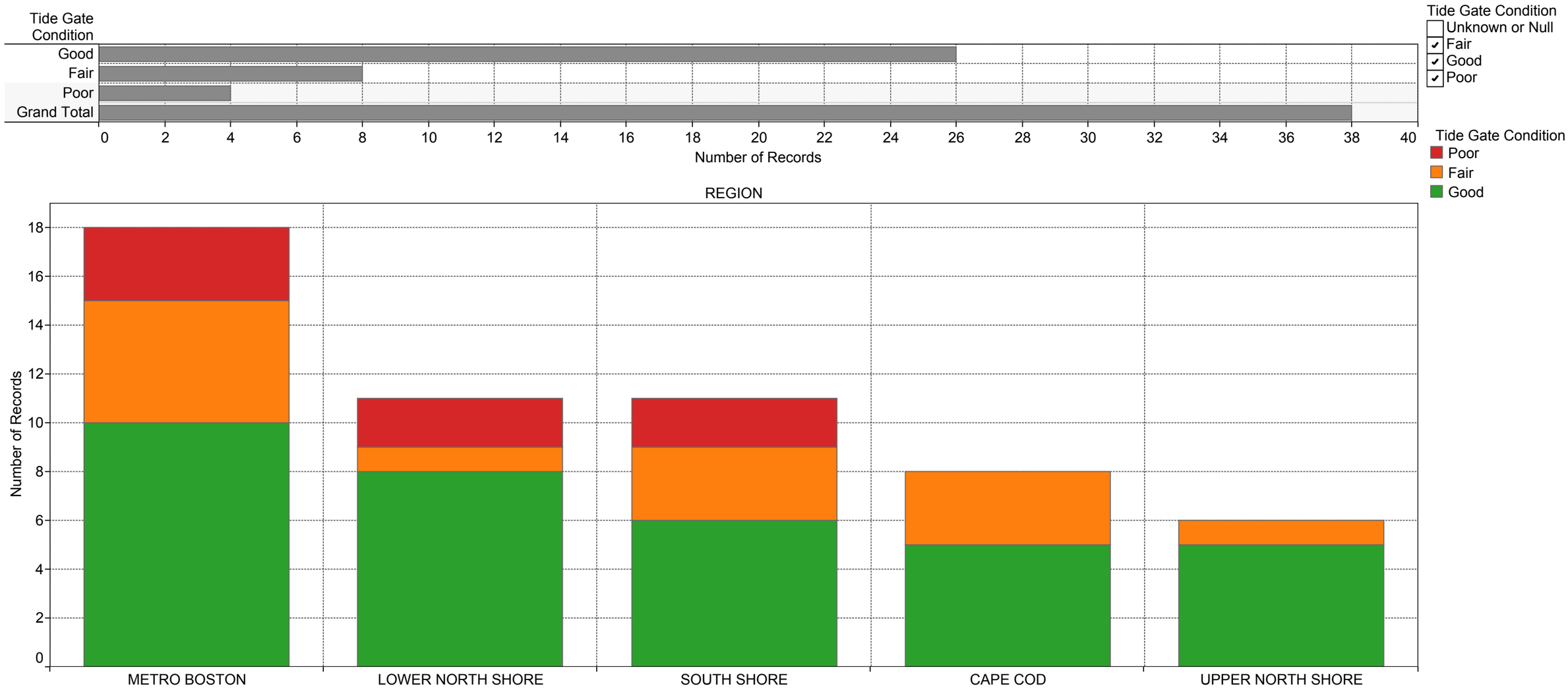
Tide Gate Condition
- Poor
- Fair
- Good
- Unknown or Null

Culvert Condition
- Poor
- Fair
- Good
- Unknown or Null

TIDEGateway Exploratory Data Analysis: Condition Findings

(Draft Final Report – February 2016)

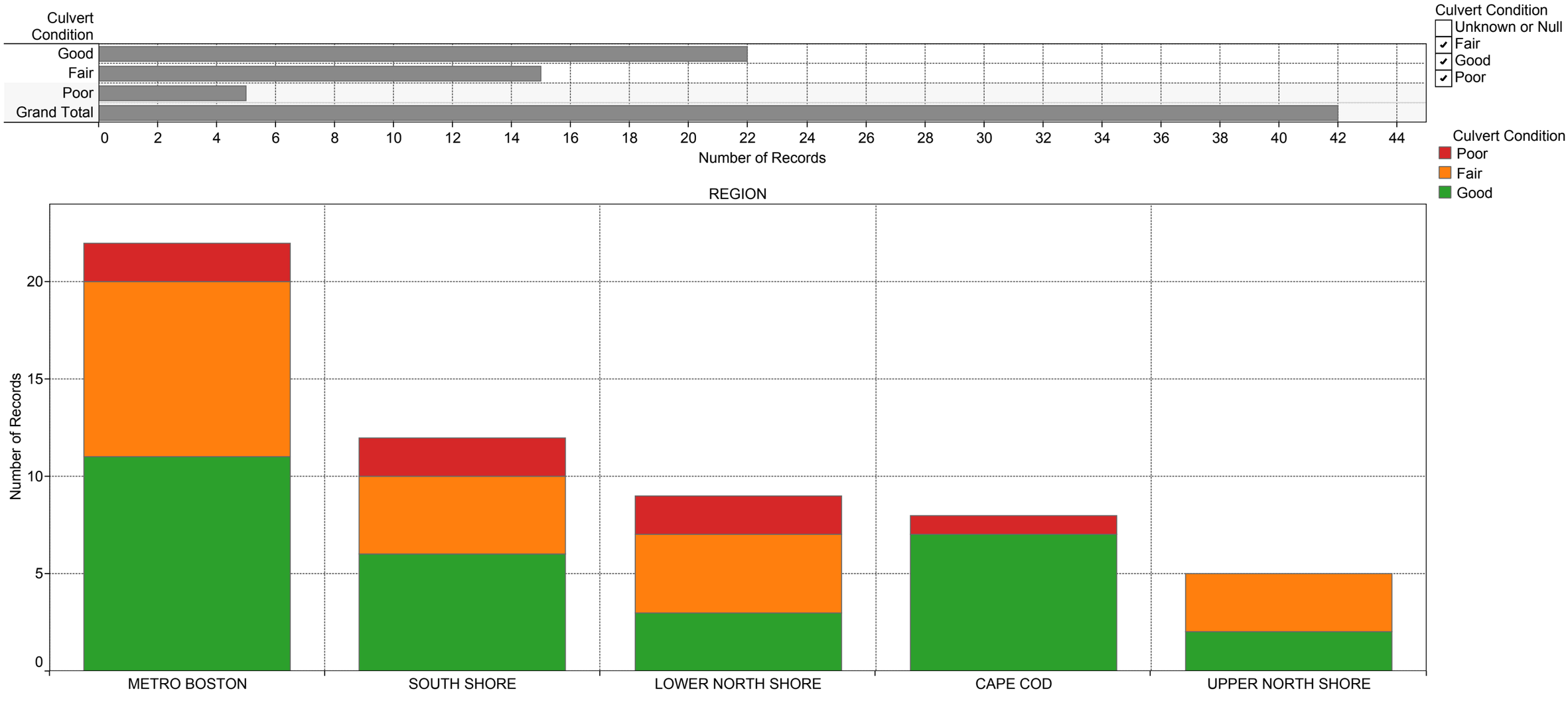
Tide Gate and Culvert Condition | **Tide Gate Condition by Region** | Culvert Condition By Region



TIDEGateway Exploratory Data Analysis: Condition Findings

(Draft Final Report – February 2016)

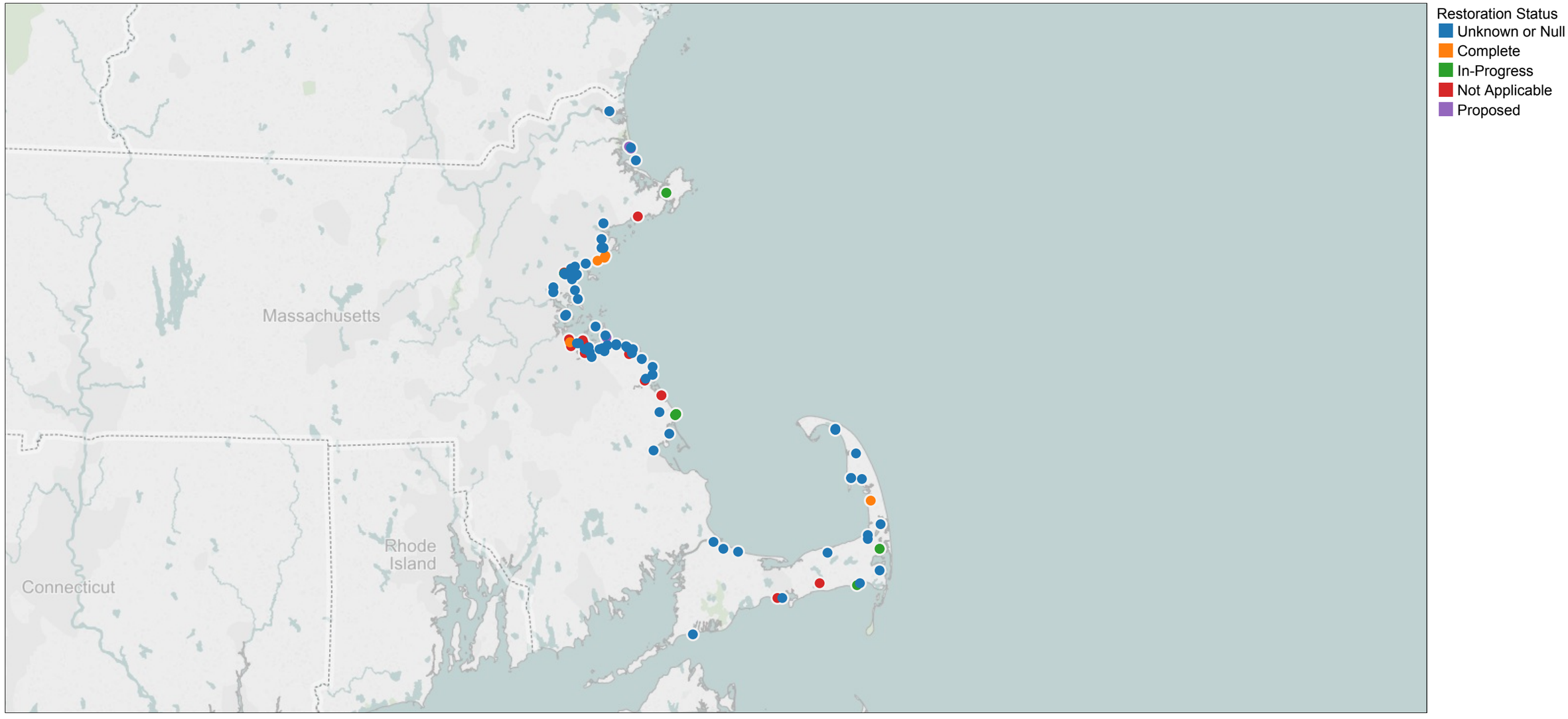
Tide Gate and Culvert Condition | Tide Gate Condition by Region | **Culvert Condition By Region**



TIDEGateway Exploratory Data Analysis: Restoration Findings

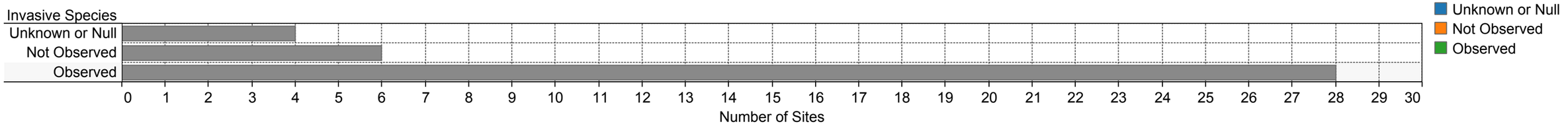
(Draft Final Report – February 2016)

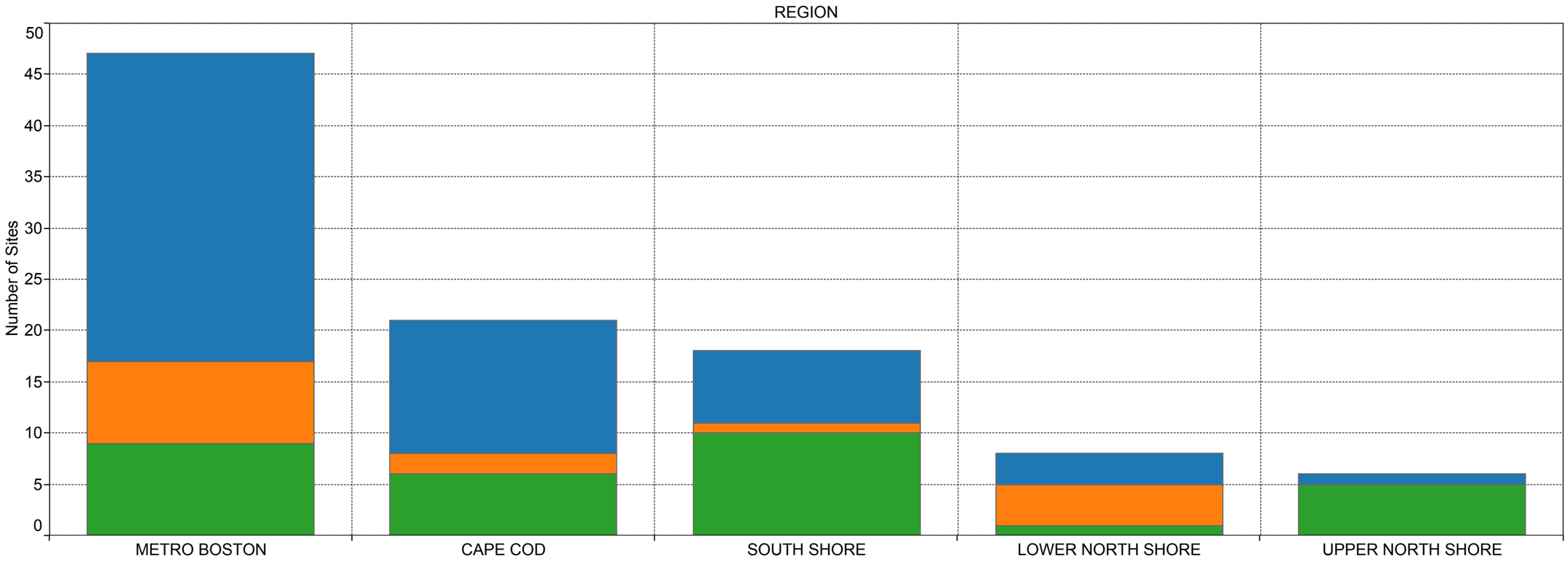
Restoration Status | Invasive Species Observed?



TIDEGateway Exploratory Data Analysis: Restoration Findings

Restoration Status | Invasive Species Observed?





Appendix H:

List of Current Data Gaps

(Updated 1/19/2016)

Raw Attribute Name	Alias	Number of Blank Entries	Complete (%)
UNIQUE_ID	#N/A	0	100%
TIDEGATE_ID	Tide Gate Name	0	100%
TOWN	Town	0	100%
WATER_BODY	Reference Water Body	18	87%
TYPE	Tide Gate Type	3	98%
ORIG_ATLAS_ID	Original Tidal Restriction Atlas ID	77	45%
LAT	Latitude (decimal)	1	99%
LON	Longitude (decimal)	1	99%
OPERATOR_TYPE	Operator Type (Public versus Private)	33	76%
OPERATOR	Owning / Maintaining Agency	61	56%
PERMITS	Existing State or Federal Permits	98	29%
GEN_COMMENTS	General Comments	54	61%
CNTRL_MECH	Tide Gate Control Mechanism	21	85%
GEOMETRY	Tide Gate Geometry	43	69%
TG_DIAMETER	Tide Gate Diameter (ft)	67	52%
TG_HEIGHT	Tide Gate Height (ft)	87	37%
EX_TIDAL_INF_US	Extent of Existing U/S Tidal Influence	120	14%
EX_TIDAL_INF_DS	Extent of Existing D/S Tidal Influence	116	17%
INV_EL	Tidegate Invert Elevation (NAVD88)	115	17%
TG_MATERIAL	Tide Gate Material	34	76%
TG_CONDITION	Condition (Qualitative)	72	48%
INSTALL_DATE	Installation Date	102	27%
STATUS	Operational Status	4	97%
OP_PURPOSE	Operational Purpose	57	59%
OP_PLAN	Operational Plan Present?	80	42%
OP_COMMENTS	Operational Notes	76	45%
TG_COMMENTS	Misc. Tide Gate Comments	29	79%
RESTRIC_SURF	Restriction Type	36	74%
CUL_GEOMETRY	Culvert Geometry	35	75%
CUL_DIAMETER	Culvert Diameter (ft)	66	53%
CUL_HEIGHT	Culvert Height (ft)	100	28%
CUL_MATERIAL	Culvert Material	45	68%
CUL_MAT_BOT	Culvert Bottom Material	87	37%
CUL_CONDITION	Condition (Qualitative)	73	47%
CUL_COMMENTS	Misc. Culvert Comments	62	55%
INVASIVE_SP	Invasive species present upstream?	65	53%
INVASIVE_COMMENTS	Invasive species comments	75	46%
US_TOTAL	Total Upstream Affected Area	100	28%
US_MARSH	Total Upstream Salt Marsh Area	81	42%
REST_STATUS	Restoration Status	73	47%
REST_COMMENTS	Misc. Restoration Comments	84	40%
PHOTOID_1	Photo 1: Tide Gate from Downstream	105	24%
PHOTOID_2	Photo 2: Tide Gate from Upstream	112	19%
PHOTOID_3	Photo 3: Downstream View	110	21%
PHOTOID_4	Photo 4: Upstream View	111	20%

Raw Attribute Name	Alias	Number of Blank Entries	Complete (%)
PHOTOID_5	Photo 5	112	19%
PHOTOID_6	Photo 6	115	17%
PHOTOID_7	Photo 7	119	14%
PHOTOID_8	Photo 8	127	9%
PHOTOID_9	Photo 9	133	4%
PHOTOID_10	Photo 10	134	4%
PHOTOID_11	Photo 11	137	1%
PHOTOID_12	Photo 12	138	1%
PHOTO_ANNOTATION_1	Annotation	108	22%
PHOTO_ANNOTATION_2	Annotation	111	20%
PHOTO_ANNOTATION_3	Annotation	110	21%
PHOTO_ANNOTATION_4	Annotation	111	20%
PHOTO_ANNOTATION_5	Annotation	112	19%
PHOTO_ANNOTATION_6	Annotation	115	17%
PHOTO_ANNOTATION_7	Annotation	119	14%
PHOTO_ANNOTATION_8	Annotation	127	9%
PHOTO_ANNOTATION_9	Annotation	133	4%
PHOTO_ANNOTATION_10	Annotation	134	4%
PHOTO_ANNOTATION_11	Annotation	137	1%
PHOTO_ANNOTATION_12	Annotation	138	1%
PHOTO_COMMENTS	General Photo Comments	110	21%
OTHER_COMMENTS	Other Comments	96	31%

Appendix I:

Selected Field Photograph Findings Log

GEOSYNTEC CONSULTANTS
TIDEGateway Photographic Record

Selected Condition Photographs

Photo ID: 1218151233a_12_1 **Unique ID:** 12 **Site ID:** Orleans-02A **Comments:** At the time of the site visit (12/18/2015), the tide gate was inoperable and was sealed completely shut by fine grained sediment deposited in the channel. Dredging was required to restore proper functionality of the tide gate and to allow passage of upstream flow.	
Photo ID: 1218150907_14_1 **Unique ID:** 14 **Site ID:** Sandwich-01 **Comments:** The metal comprising the flap gate was deformed and did not appear to form a tight seal against the culvert opening. A 3-5" gap was observed from which tidal exchange could occur. In addition, the bottom half of the tide gate was corroded and its operation was impeded by heavy algae growth. It was unclear if the tide gate would be able to fully open in the event of a storm event to pass heavy upstream flows.	

Selected Condition Photographs

Photo ID: 1218150914_14_2

Unique ID: 14

Site ID: Sandwich-01

Comments: The upstream end of the culvert was located at the bottom of a wooden retaining wall in poor condition. The retaining wall was beginning to collapse at multiple locations, excessive wood rot was observed, and upland vegetation was observed growing through the retaining wall - further compromising its structural integrity.

Photo ID: 1202150858g_22_6

Unique ID: 22

Site ID: Beverly-01B

Comments: Beverly-01B was located on the eastern end of the spillway and was a steel sluice gate operated by a handwheel. Grease was observed on the handwheel, so it appeared that the gate was periodically operated. The tide gate was in fair condition; the metal sluice gate was badly corroded and was leaking.

Selected Condition Photographs

Photo ID: 1202150941b_24_8 **Unique ID:** 24 **Site ID:** Manchester-01 **Comments:** The upstream headwall was in poor condition. A chunk of the headwall had fallen into the channel, exposed rebar was observed, and a vertical crack was forming in the top middle of the headwall that extended almost down to the top of the culvert opening.	
Photo ID: 1202150754_25_2 **Unique ID:** 25 **Site ID:** Salem-01 **Comments:** Spalling and general deterioration of the upstream headwall was observed.	

Selected Condition Photographs

Photo ID: 1103151055_36_9 **Unique ID:** 36 **Site ID:** Hull-02 **Comments:** Tide gate was a metal sluice gate operated by a manual jack screw. The tide gate appeared to be in fair condition; however, it appeared that it was inoperable and rusted in place. Significant rusting of the hinges and main structure of the tide gate was observed.	
Photo ID: 1103151108_36_5 **Unique ID:** 36 **Site ID:** Hull-02 **Comments:** There were no apparent structural issues observed at the concrete box culvert; however, the headwalls on both the upstream and downstream end of the culvert were in poor condition. Significant spalling and exposed rebar was observed on both the upstream and downstream headwalls. Further, the access rungs leading from the top of the headwall down to the tide gate were corroded.	

Selected Condition Photographs

Photo ID: 1103151012_38_7 **Unique ID:** 38 **Site ID:** Hull-04 **Comments:** Outfall to culvert was located below high water mark approximately 150' downstream of the tide gate. A metal (rebar) trash grate was installed at the outlet. The culvert was in fair condition - the culvert bell/segments were beginning to decouple and gaps were observed in the joints. It appeared that the cause of the decoupling was lowering of the beach profile (i.e. longshore sediment transport).	
Photo ID: 1102151010a_42_6 **Unique ID:** 42 **Site ID:** Quincy-04 **Comments:** Outfall was located approximately 100' feet north of Bayswater Road on the beach and was partially exposed at low tide. Downstream end of culvert was severely deteriorated: most of the joints had separated and large 1'-2' gaps were observed in the pipe.	

Selected Condition Photographs

Photo ID: IMG_1724_84_2 **Unique ID:** 84 **Site ID:** Quincy-06 **Comments:** Downstream end of culvert was plastic (HDPE) and upstream end of culvert was corrugated metal. Downstream end of culvert appeared to be in good condition; however, upstream end was partially buried, thereby potentially limiting stormwater conveyance capacity.	
Photo ID: 1102151114a_58_1 **Unique ID:** 58 **Site ID:** Weymouth-01 **Comments:** Large wooden flap gate was in poor condition. The bottom half of the tide gate was rotting. The tide gate was installed in such a way that a seal was not created against the headwall thereby allowing some level of tidal exchange at all tidal levels. The tide gate hinges appeared to be operable; however, the tide gate was so waterlogged that it was not possible to fully open.	

Selected Condition Photographs

Photo ID: 1103151227a_63_8 **Unique ID:** 63 **Site ID:** Cohasset-02 **Comments:** Deformation of the corrugated metal culvert was observed on its downstream end indicating that it was potentially beginning to collapse. Significant spalling and cracking was also observed on the downstream concrete headwall.	
Photo ID: 1104151236_28_6 **Unique ID:** 28 **Site ID:** Duxbury-01 **Comments:** The metal circular flap gate was operational; however, the bottom 10% of the flapper was beginning to corrode away.	

Selected Condition Photographs

Photo ID: 1104151131_68_1 **Unique ID:** 68 **Site ID:** Marshfield-01A **Comments:** The self-regulating tide gate was in fair condition and was inoperable; the bottom float which allows the tide gate to open was missing. As a result, it appeared that the gate was currently operating as a flap gate and limiting upstream tidal exchange. A hand operated winch and strap had been installed to operate the SRT and the strap was weathered. Additionally, the SRT's breather was clogged with debris and some leakage was observed around the flange connection to the headwall.	
Photo ID: 1104151019_72_1 **Unique ID:** 72 **Site ID:** Marshfield-05 **Comments:** There were two wooden flap gates at this location. The wood on both tide gates was heavily rotted and waterlogged with rusty wooden hinges. The northern tide gate was inoperable and was stuck shut; it appeared that the hinges were corroded shut. Additionally, the bolts securing the tide gate to the headwall were wearing through the wood. Gaps were observed in the wooden backing behind each tide gate and it appeared that both tide gates did not create a watertight seal at high tide, thus enabling some level of upstream tidal flushing.	

Selected Condition Photographs

Photo ID: 1104151035b_72_2 **Unique ID:** 72 **Site ID:** Marshfield-05 **Comments:** There were two identical oval CMP culverts for each tide gate. Both culverts appeared to be in poor condition. The culverts were separating from the concrete headwall and significant deterioration and rust was observed. The northern culvert (downgradient of the inoperable tide gate) was approximately half full of sediment presumably since the tide gate was rusted shut; presumably not letting sediment from upstream stormwater flows out. Both the upstream and downstream headwalls were also in poor condition and deterioration / spalling was observed in multiple areas.	
Photo ID: 1103151347_74_7 **Unique ID:** 74 **Site ID:** Scituate-01A **Comments:** The downstream metal flap gate was in poor condition. It was rusted open approximately 3 to 4 inches, the bolts affixing it to the concrete headwall were corroded, and it appeared that someone had attempted to remove the tide gate as evidenced by loosened nuts (i.e., the nuts had been backed off the bolts).	

Selected Condition Photographs

Photo ID: 1103151338_74_2 **Unique ID:** 74 **Site ID:** Scituate-01B **Comments:** The reinforced concrete pipe was in fair condition. It appeared that the mouth of the pipe was beginning to separate from the weir wall on the upstream side of the restriction. In addition, erosion was observed around the upstream concrete weir, presumably from stormwater runoff from the adjacent road, tidal influence, or some combination thereof.	
Photo ID: 1202151017a_79_5 **Unique ID:** 79 **Site ID:** Gloucester-01 **Comments:** The upstream portion of the culvert appeared to be in good condition with no apparent deterioration; however, the downstream portion was slightly separating from the headwall in places. Additionally, portions of the downstream culvert were jagged and appeared to pose a potential safety hazard.	

GEOSYNTEC CONSULTANTS
TIDEGateway Photographic Record

Selected Restoration Photographs

Photo ID: 1104151046a_72_7

Unique ID: Marshfield-05

Site ID: 72

Comments: No known restoration efforts or studies had been performed. Low lying properties including a dirt road and house were observed directly adjacent to the upstream impoundment. Abundant phragmites upstream.

Photo ID: IMG_1723_84_4

Unique ID: 84

Site ID: Quincy-06

Comments: Flap gate limited all tidal flow. As a result, freshwater grasses and Phragmites were observed upstream. At the time of the site visit, no known restoration efforts had been undertaken. The upstream area was large and appeared to have significant restoration potential. A number of homes were observed adjacent to the impoundment which might limit restoration options due to potential flooding.

Selected Restoration Photographs

Photo ID: 1218151315f_7_5 **Unique ID:** Eastham-01 **Site ID:** 07 **Comments:** Phragmites dominated the upstream and downstream portions of the restriction. Small patches of high marsh were observed downstream of the restriction. The area appeared to have good restoration potential with minimal to no low-lying infrastructure observed. Note flap gate had been removed or fell off culvert at time of site visit (12/18/2015).	
Photo ID: 1218150917_14_4 **Unique ID:** 14 **Site ID:** Sandwich-01 **Comments:** The downstream portion of the marsh was comprised of a mixture of high marsh and phragmites while the upstream portion of the marsh was predominately phragmites. Upland vegetation was also observed along the railway embankment including wild cherry and sumac. The site appeared to have good restoration potential; however, upgradient infrastructure (i.e. houses) were observed.	

Selected Restoration Photographs

Photo ID: 1103151338b_74_4 **Unique ID:** Scituate-01 **Site ID:** 74 **Comments:** The impoundment was comprised primarily of high marsh and was fringed by phragmites. Houses were observed around the marsh; however, they appeared to be elevated.	
Photo ID: 1218151246_12_6 **Unique ID:** 12 **Site ID:** Orleans-02 **Comments:** The upstream impoundment appeared to be an entirely freshwater system as evidenced by cattails, Atlantic white cedar, and freshwater sedge. The site had good restoration potential with minimal low lying infrastructure observed; however, restoration might be limited by the requirement to preserve Atlantic white cedar.	

Selected Restoration Photographs

Photo ID: 1103151228a_63_4 **Unique ID:** 63 **Site ID:** Cohasset-02 **Comments:** The upstream impoundment was dominated by high marsh and was fringed with Phragmites. Unknown if any restoration efforts had been performed at the site. Future restoration considering upsizing the culvert would need to investigate low lying areas including adjacent farm land directly to the south of the impoundment.	
Photo ID: 1218151246_12_6 **Unique ID:** 6 **Site ID:** Dennis-01 **Comments:** The upstream impoundment was mainly comprised of high marsh and was fringed with phragmites. Upland vegetation was also observed directly to the south of the upstream culvert opening. It appeared that the site would be a candidate for restoration; however, a potentially low lying barn and field was observed to the west of the restriction.	

Selected Restoration Photographs

Photo ID: 1102151018_42_4 **Unique ID:** 42 **Site ID:** Quincy-04 **Comments:** The upstream marsh had a mixture of Spartina Alterniflora and Patens and was bordered by Phragmites. The marsh was previously studied for potential restoration by MADER; however, it was concluded that low lying infrastructure would be a challenge. Future restoration would likely need to consider sizing culvert to accommodate the balance between stormwater outflows and tidal flushing.	
Photo ID: 1102150925a_40_4 **Unique ID:** 40 **Site ID:** Quincy-02 **Comments:** There was a narrow channel on the upstream end of the restriction lined with an approximately 2' wide layer of salt marsh grass. From there, the salt marsh grass transitioned into mowed grass and phragmites. It appeared that no restoration efforts had been made at this location. There was an abundance of low lying infrastructure located at the upstream end of the restriction including houses, deck stairways, and concrete retaining walls.	

Selected Restoration Photographs

Photo ID: 1102151128b_58_4 **Unique ID:** 58 **Site ID:** Weymouth-02 **Comments:** Upstream area varied significantly. Phragmites, upland vegetation, and Spartina Alterniflora islands were observed. Vegetation was indicative of some level of salt water influence, but not enough volume to inundate the marsh top which was mainly comprised of upland vegetation. It appeared that the marsh had potentially subsided over time. Large upstream wetland area with good restoration potential. A marina worker indicated that upstream residents had complained of flooding in the past, but it was unclear if the flooding was a result of tidal inundation, stormwater influence, or a combination.	
Photo ID: 1104151001a_77_5 **Unique ID:** 77 **Site ID:** Scituate-04 **Comments:** Upstream impoundment was predominately comprised of phragmites. Appeared that there was little to no tidal influence. Would potentially be a good restoration candidate - minimal low lying infrastructure was observed; however, upstream area is used by the town as a drinking water well field.	

Selected Restoration Photographs

Photo ID: 1103151113_36_4

Unique ID: 36

Site ID: Hull-02

Comments: Upstream marsh appeared to be relatively healthy with a mixture of low and high marsh species. Phragmites were observed at the fringes. Previous water level logging was performed determine the relative extent of upstream restriction. Low lying properties including a cellular tower and guy wires were observed within and around the impoundment.

GEOSYNTEC CONSULTANTS
TIDEGateway Photographic Record

Selected Miscellaneous Photographs

Photo ID: 1218151138b_06_6

Unique ID: 06

Site ID: Dennis-01

Comments: An abundance of live mussels was observed within the channel at the upstream end of the culvert.

Photo ID: 1202150813_25_8

Unique ID: 25

Site ID: Salem-01

Comments: Multiple invasive striped anemones were observed on the mudflat approximately 100 feet downstream of the downstream bridge opening.

Selected Miscellaneous Photographs

Photo ID: 1102151023_42_5 **Unique ID:** 42 **Site ID:** Quincy-04 **Comments:** A sewer manhole was located adjacent to the upstream end of the culvert in the marsh. Gravel had recently been placed around the manhole and evidence of previous scour was observed suggesting a history of overwash and stormwater inflows.	
Photo ID: 1103151228b_63_5 **Unique ID:** 63 **Site ID:** Cohasset-02 **Comments:** The upstream channel was full of killifish.	

Selected Miscellaneous Photographs

Photo ID: 1103151258_65_3 **Unique ID:** 65 **Site ID:** Cohasset-04 **Comments:** Resident indicated that upstream impoundment used to be a pond; however, indicated that Town of Cohasset drains it for winter ice skating. Mowed cattails were observed throughout the upstream impoundment.	
Photo ID: 1104151149_69_5 **Unique ID:** 69 **Site ID:** Marshfield-02 **Comments:** Many killifish were observed on the downstream side of the tide gate.