



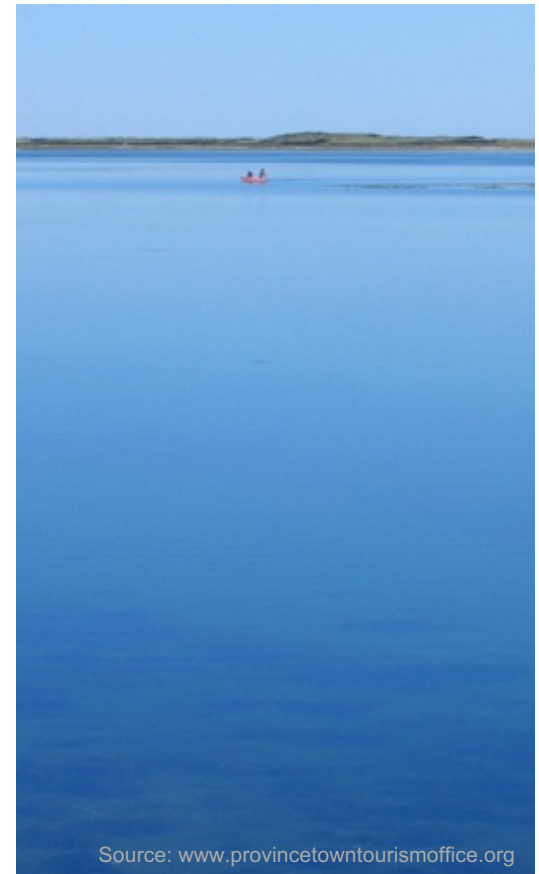
Use of Porous Pavement Improves Water Quality and Reduces Beach Closures in Provincetown Harbor

Sandra L Tripp PE BCEE | Senior Project Manager



Outline

- Background
- Provincetown Harbor and 2003 stormwater assessment
- Commercial Street projects
 - Phases 1, 2 and 3
- Project successes
 - Water quantity
 - Water quality
 - Public acceptance
- Next steps



Source: www.provincetowntourismoffice.org

Background

- Provincetown is located on the outer tip of Cape Cod



Background

- Commercial Street in Provincetown is the downtown “Main Street” of Provincetown



Background

- Provides primary access to Provincetown Harbor



Background

- Year-round population of around 3,000
- Significant growth during the summer
 - Seasonal population increases to approximately 30,000
 - Summer tourism can bring in half a million visitors to Commercial Street



Source: www.townchamber.com

Provincetown Harbor

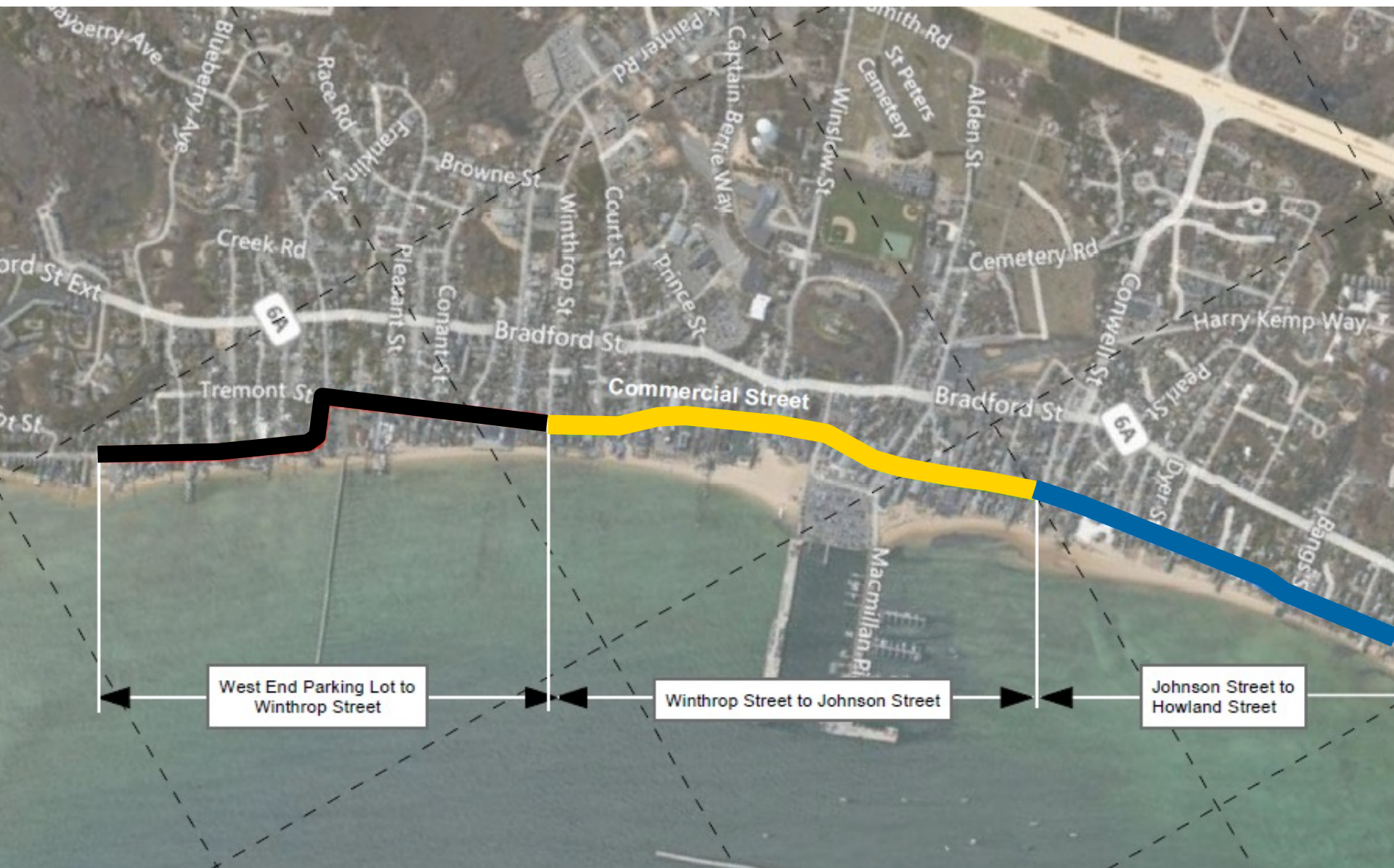
- Listed on the Massachusetts 2012 Integrated List of Waters as a “Category 4a” water body – TMDL for pathogens
- Heavy recreational and commercial use
- Economic driver for the Town
- Beach closures affect economy and public perception
- Dense development and impervious areas contribute runoff to the Harbor



2003 stormwater assessment

- Stormwater Assessment funded by Massachusetts Office of Coastal Zone Management (CZM) in FY2003
- Assessment included
 - Sampling of 25 identified discharges (P-1 to P-25)
 - Mapping of contributory areas
 - Classification of surrounding land use, drainage area and runoff volumes
 - Prioritization of mitigation measures





West End Parking Lot to Winthrop Street

Winthrop Street to Johnson Street

Johnson Street to Howland Street

Commercial Street projects

- Vacuum sewer installed in Commercial Street
- Other utility improvements
- Trench paving, pavement patches, rutting
- Roadway condition of Commercial Street was deteriorated
- Limited curb reveal
- Sidewalks needed improvements



Commercial Street condition



- Deteriorated and/or failed pavement

Commercial Street condition



**Historic Photo of
Flooding at #439
Commercial**

- Localized flooding which impacted commercial properties

Commercial Street condition



- Commercially vital yet narrow corridor

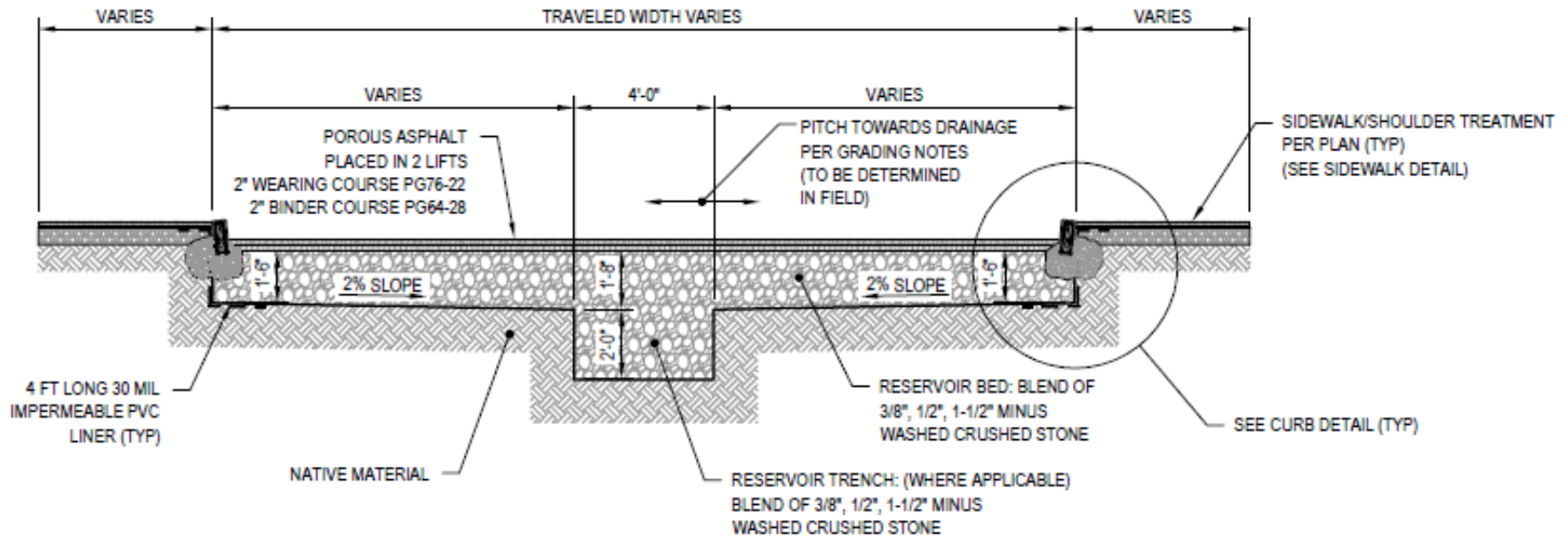
Commercial Street projects

Stormwater project morphed into road reconstruction project

- Project provides two benefits
 - Address stormwater issues **and**
 - Provide a means for road reconstruction along Commercial Street



Commercial Street projects



Commercial Street projects



Source: www.ptownchamber.com

Commercial Street Phase 1, 2 and 3

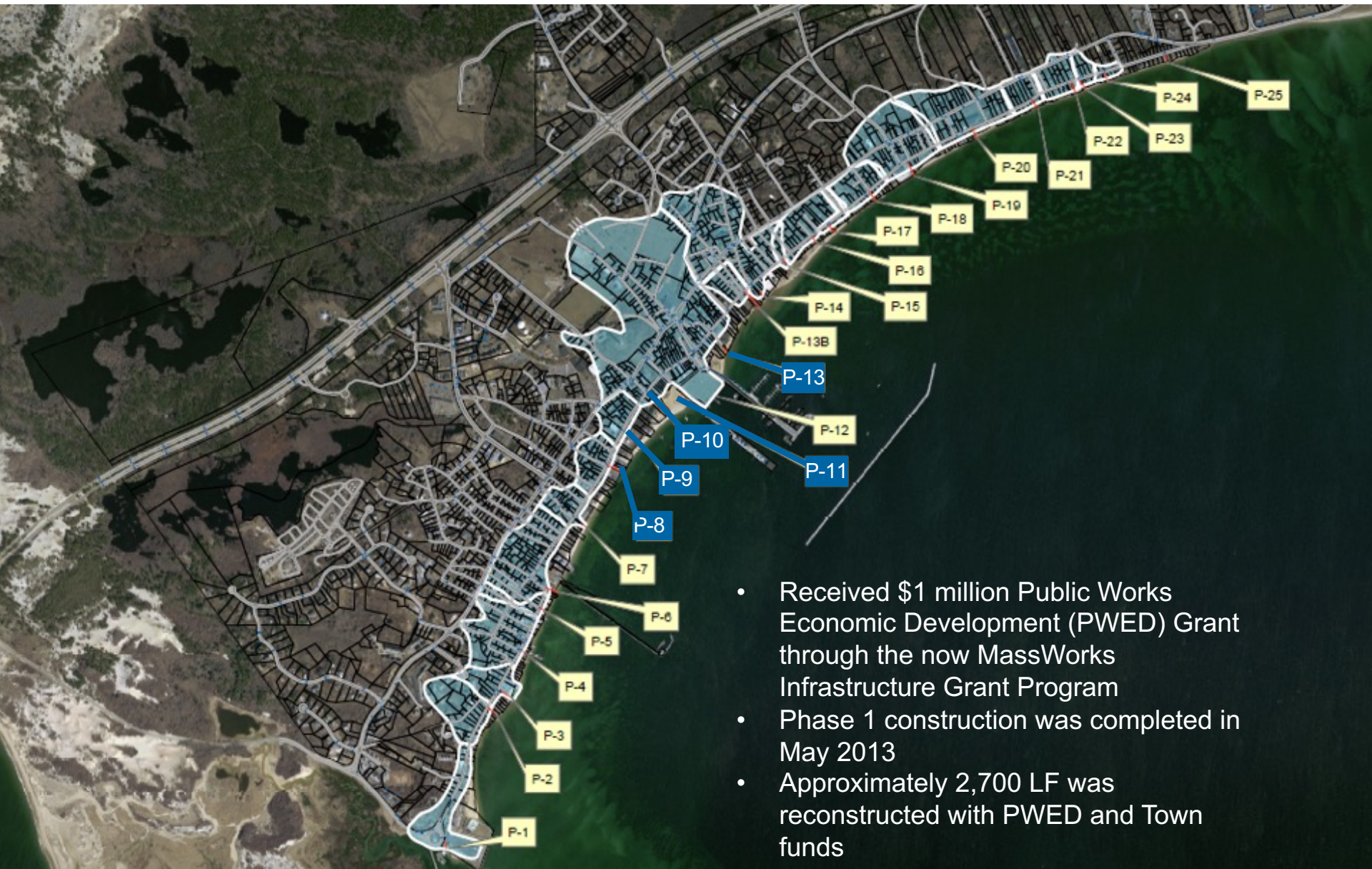
- Projects include
 - Stone bed and trench
 - Drainage replacement
 - 2 courses of porous pavement
 - New granite curbing, brick sidewalks and miscellaneous detail work



Commercial Street Phase 1

- 5 outfalls within project limits
 - P-8 Court Street
 - P-9 Post Office
 - P-10 Gosnold
 - P-11 Ryder Street
 - P-13 Lands End





- Received \$1 million Public Works Economic Development (PWED) Grant through the now MassWorks Infrastructure Grant Program
- Phase 1 construction was completed in May 2013
- Approximately 2,700 LF was reconstructed with PWED and Town funds



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May 19 3:00 pm
Orleans' Naugatuck Middle School

Free Admission
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Presented in partnership with the Provincetown Chamber Music Society

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Commercial Street Phase 2

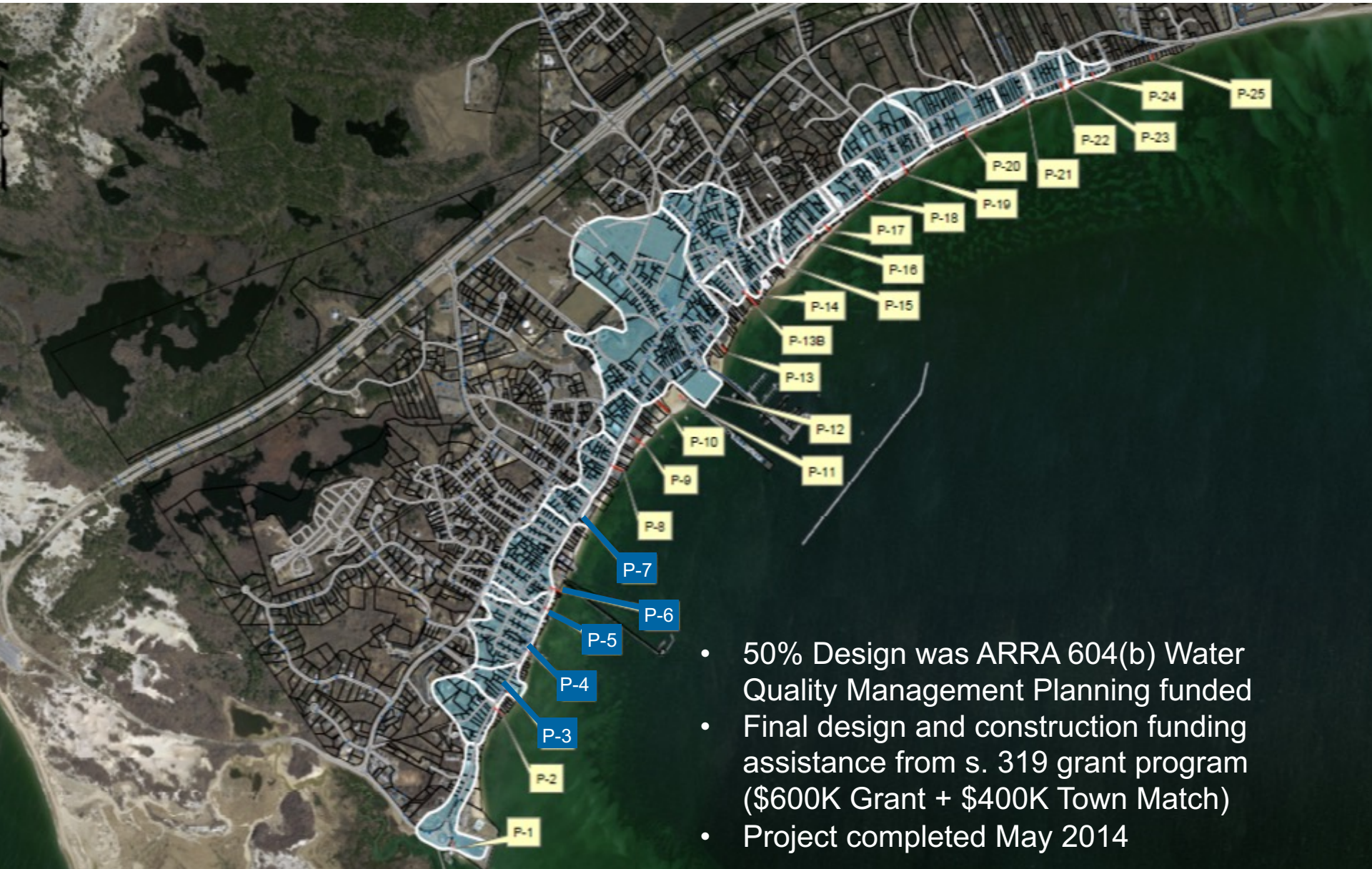
- Commercial Street – Phase 2
 - Original project limits – Atlantic Avenue to West End Parking Lot (2,300 LF)
 - Expand back to pick up where Phase 1 left off (Winthrop St to Atlantic Avenue 420 LF)



Commercial Street Phase 2

- 5 active outfalls within project limits
 - P-7 Atlantic Avenue
 - P-6 Coast Guard Town Landing
 - P-5 Mechanic Street
 - P-4 West Vine Street (Captain Jack's)
 - P-3 West End Lot





- 50% Design was ARRA 604(b) Water Quality Management Planning funded
- Final design and construction funding assistance from s. 319 grant program (\$600K Grant + \$400K Town Match)
- Project completed May 2014



Commercial Street Phase 3

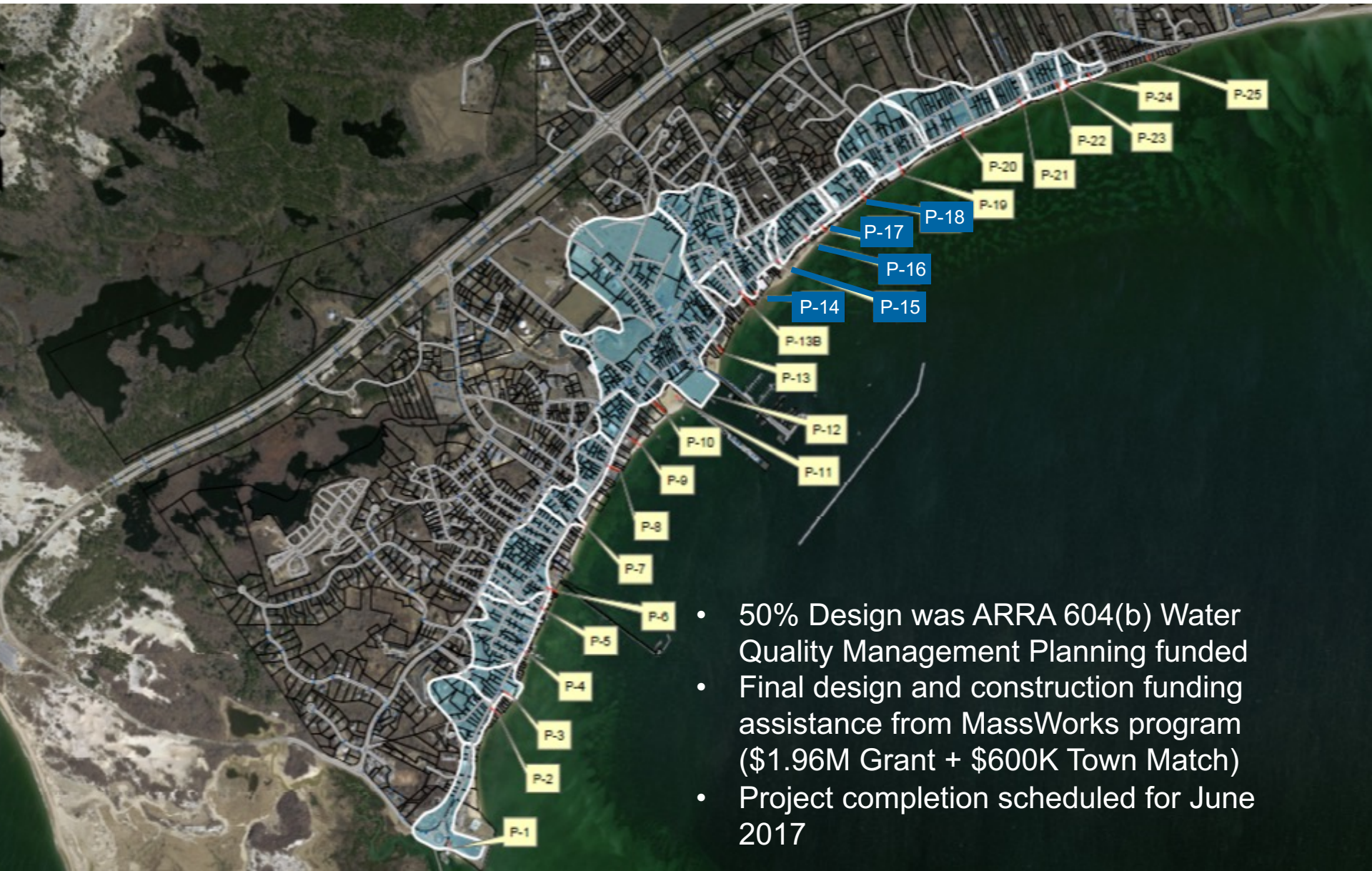
- Commercial Street – Phase 3
 - Johnson Street to Holland Street (2,400 LF)



Commercial Street Phase 2

- 5 active outfalls within project limits
 - P-14 Pearl Street
 - P-15 Dyer Street
 - P-16 Jack's
 - P-17 Young Court
 - P-18 Cooks Street





- 50% Design was ARRA 604(b) Water Quality Management Planning funded
- Final design and construction funding assistance from MassWorks program (\$1.96M Grant + \$600K Town Match)
- Project completion scheduled for June 2017





Commercial Street projects

Local challenges

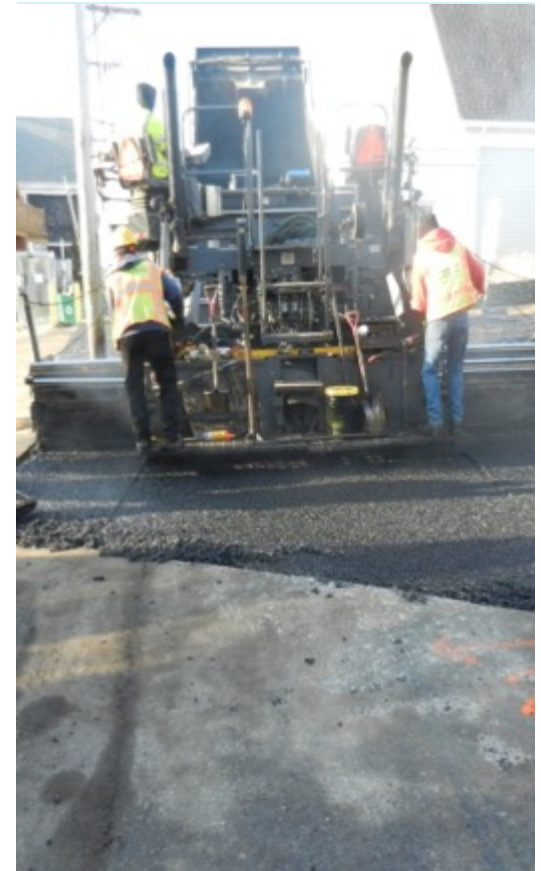
- Limited construction schedule
 - Work could not begin until October 15th
 - Work must be complete by May 15th
- Progress is weather dependent
- Small roadway layout – one-way traffic
- Location (Tip of Cape Cod)
- Bid costs reflected the above issues



Commercial Street projects

Technical challenges

- Roadway closures and detours
- Once porous pavement is placed, the surface is not drivable for 2-3 days
- Road defined by existing structures and sidewalks
- Sidewalk replacement and site restoration



Commercial Street projects

Asphalt

- Phase 1
 - Loose, porous binder somewhat unstable
 - Binder spalled at intersections
 - Top course had areas of clogging
- Phases 2 and 3 improved asphalt mix
 - 3-1/2" ATPB
 - Thicker lift
 - More porous (20% voids)



Water quantity management



Water quantity management

Testing Porous Asphalt - Video

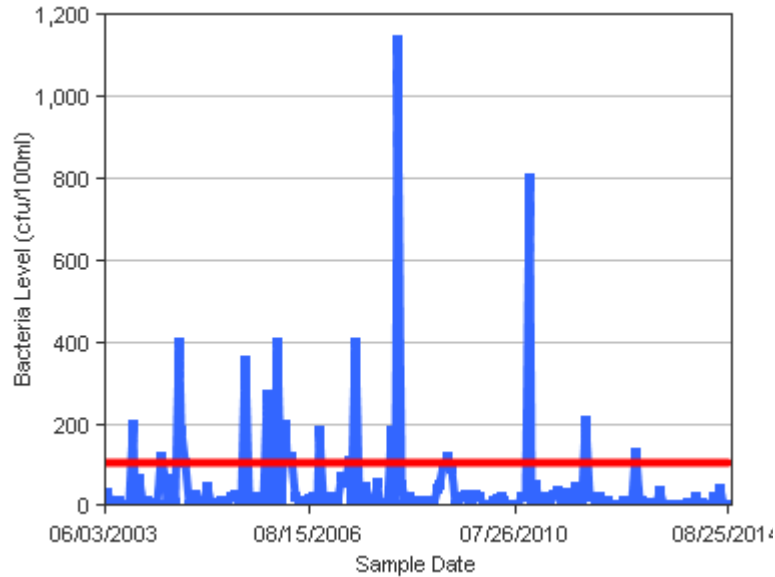
Water quality improvements

Phase	Beach Sampling Point	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	Johnson St	1	0	1	3	1	1	0	1	0	1
1	333 Commercial St	2	1	3	2	1	1	0	0	0	0
1	Ryder Beach (Middle)	0	1	1	2	2	3	0	0	0	0
1	Court St	1	3	0	3	1	1	0	0	0	0
2	Atlantic Avenue	1	3	5	2	0	1	1	0	0	0
2	Town Landing (West of CG Station)	3	2	1	1	0	1	1	0	0	0
2	West End Lot	2	3	1	3	2	1	1	2	0	0

Water quality improvements

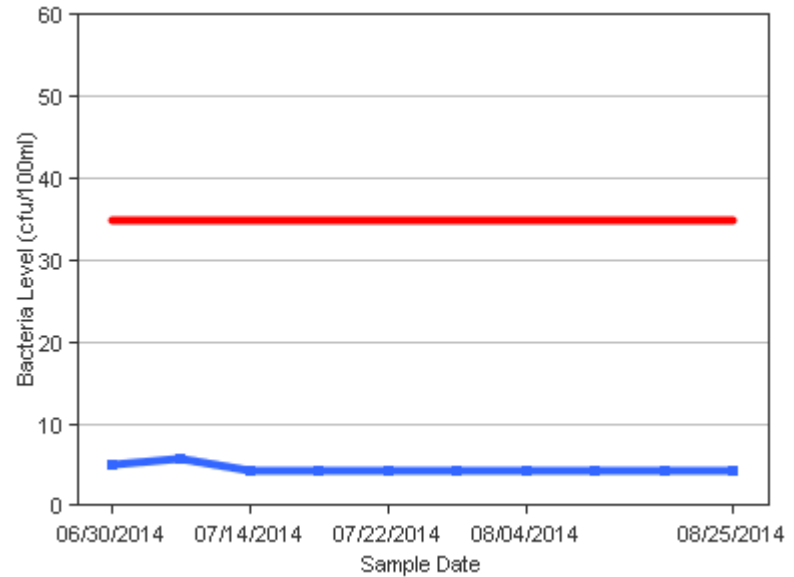
Town Landing West of Coast Guard (P-6)

Historical Sampling Results



Summers 2003 - 2014

Geometric Mean Trend



Summer 2014 (Post-Construction)

Public approval of projects

- Project planning
 - Town meetings
 - Public forums
 - Weekly drop-in hours
- During construction
 - Public meetings
 - Weekly e-blasts
 - On-site personnel accessibility
- Results
 - Town acceptance of next phases
 - Demonstrated appreciation of DPW's efforts



Next steps

- Commercial Street – Phases 3 and 4
 - Final pavement for Phase 3 this spring
 - Remainder of Commercial Street planned for Phase 4



Acknowledgements

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www.ghd.com