

Hazen *Technical Memorandum*

May 13, 2021

To: Walter Weeks, PE
From: Kyle Ballance, PE
Jon Lester, PhD, PE
Alan Davis, PE, ENV SP
Matt Zelin, PE

Re: East Ocean View Neighborhood Drainage Improvements Master Plan Review

East Ocean View Master Plan Review

FINAL

Introduction

The East Ocean View Neighborhood is in the North East portion of the City of Norfolk. The neighborhood is located on a peninsula bordered by the Chesapeake Bay to the North and Little Creek to the South and East. East Ocean View has a long history of stormwater concerns, including frequent nuisance ponding and flooding losses. As a result, the City has selected East Ocean View for major stormwater improvements. To this end a Master Plan study was completed in 2013 by others and the City has selected Hazen and Sawyer (Hazen) for implementation of the recommendations from that master plan. The master plan found multiple deficiencies in the stormwater conveyance system of the neighborhood including insufficient outfalls, undersized pipe, grade issues, and other less frequently occurring concerns. As eight years have elapsed since the analysis was performed an update of the stormwater model and a review of the master plan is necessary to reflect current conditions and City standards. This includes analysis of private development, City maintenance improvements, and projects currently under design within the basin. This review along with the existing master plan will set a foundation for implementation of stormwater improvements within the basin.

This Master Plan Review technical memorandum covers the following topics in detail:

1. Existing conditions
2. Model analysis
3. Recommendation review
4. Conclusion

1. Existing Conditions

The East Ocean View Basin has seen multiple stormwater improvement projects during the eight years since the 2013 Master Plan Study was conducted. These projects have arisen from both City maintenance related work and residential development projects. Despite the continued development in the basin, no major improvements to basin drainage have occurred over the intervening eight years. Data from the City's current and legacy Computerized Maintenance Management System (CMMS) was geolocated to provide an understanding of where issues are occurring in the basin. The CMMS data was listed in broad categories, with no detail of the specifics available for individual cases. In **Figure 1-1** unique symbols were assigned to each broad category. As shown in **Figure 1-1** below there have been numerous reports of flooding stoppages in the basin in the last several years. Flooding stoppages is a generic term used to group multiple different issues in the CMMS, specific causes were not included for each record. Also shown in **Figure 1-1** are Areas of Severe Repetitive Loss and Areas of Repetitive Loss. These terms indicate degrees of loss due to flooding across the basin. The distribution of work orders and areas of loss in **Figure 1-1** serves to highlight the fact that ponding issues are basin wide and are not able to be solved with a single construction phase. Implementation of the Master Plan Study will provide the needed basin wide approach to alleviate the drainage issues experienced in the East Ocean View Basin.

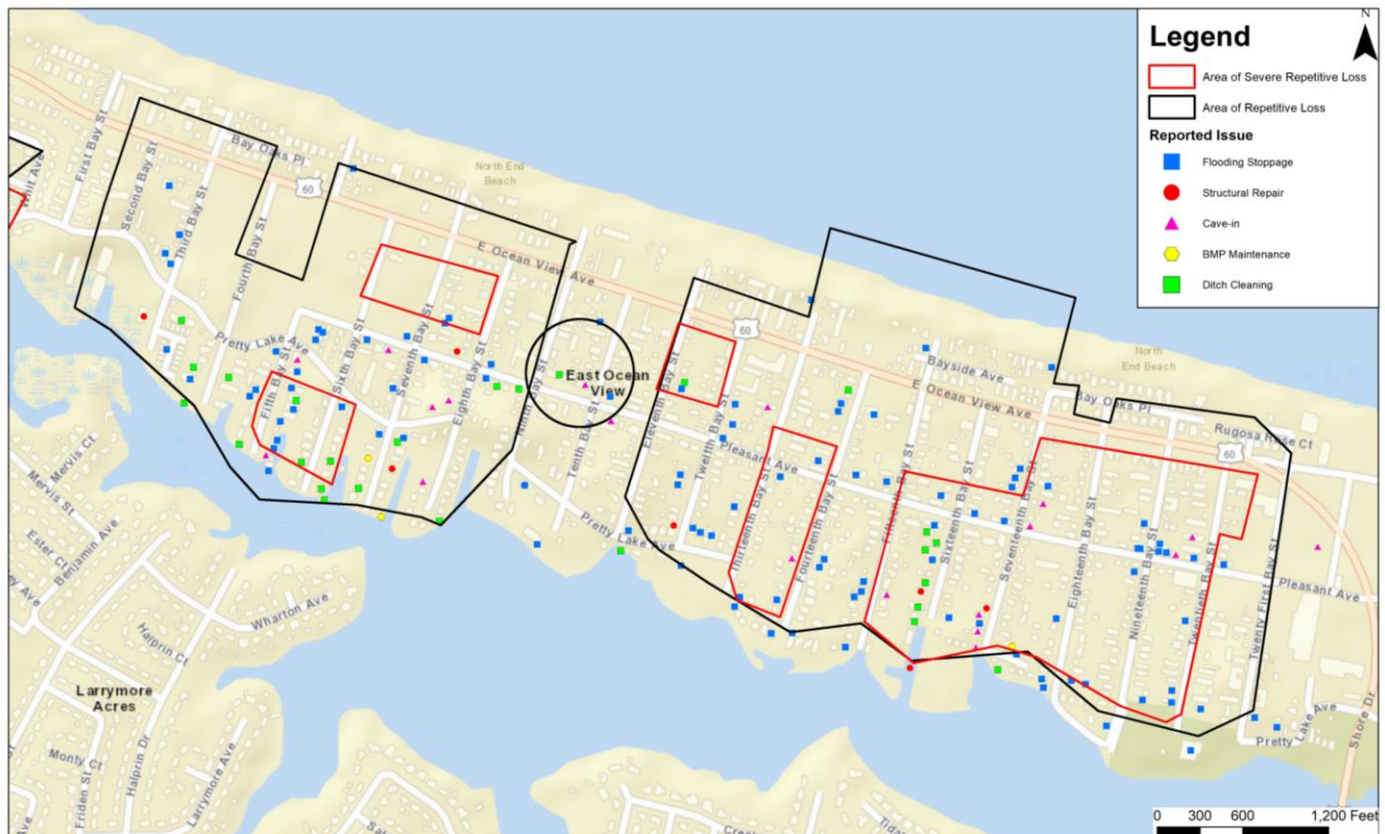


Figure 1-1: Work Order and Flooding Loss Map

2. Model Analysis

2.1 Model Update

The hydraulic model from the 2013 Master Plan Study was migrated to PCSWMM and updated to reflect changes in the land use and collection system. The model drainage areas and parameters (impervious, slope, flow length, etc.) were revised to reflect changes in the watershed since the last study was completed. The boundary conditions were reviewed and found to be appropriate given the location.

The initial effort was to assess the quality of the model's pipe elevation and sizes and compare them to the City's GIS pipe and manhole values. According to the previous master plan, the City's GIS data was used to populate the hydraulic model with pipe dimensions and elevations. However, the findings revealed the model's elevations were not consistent with the City's GIS data which could be a result of changes made by the previous consultant as part of their scope of work. To confirm the model elevations, Hazen obtained supplemental survey elevations and sizes at the locations shown in **Figure 2-1**. Nearly all of the survey elevations were found to not match the model. As the survey is the most accurate source, these elevations were incorporated into the model and non-surveyed elevations were adjusted to achieve consistent slope between the survey locations. As additional survey becomes available during detailed design phases, the model will continue to be updated.

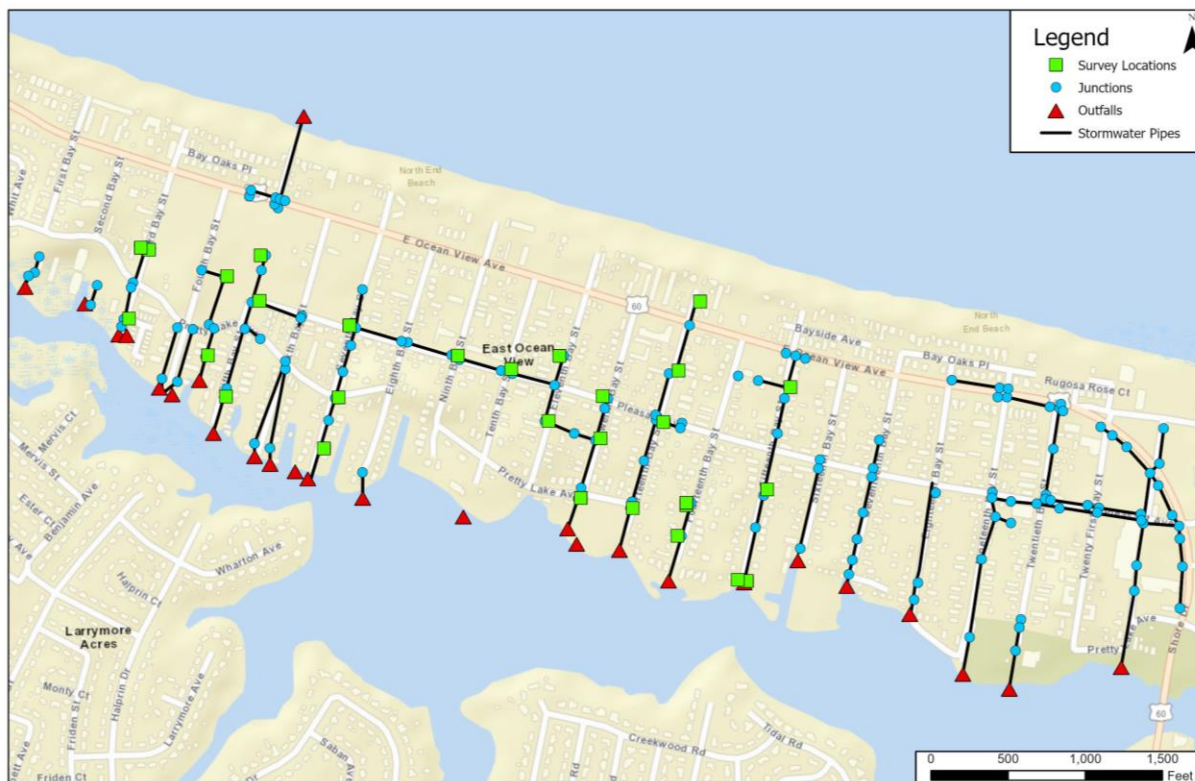


Figure 2-1: Supplemental Survey Locations

There are a number of development and utility related projects that have been designed and constructed in the basin, the largest being The Tern in the eastern portion of the watershed. These projects, shown in **Figure 2-2**, have not yet been fully reflected in the model as the status of construction is unclear. While design plans were available for several of these areas, the elevations shown on the plans did not match the surveyed elevations obtained to validate the model configuration. As such, the projects with conflicting data were assumed to not yet be fully constructed and survey elevations were utilized. **Table 2-1** lists the current and recent projects within the watershed and their status as of this report. Additional model updates will be included as project completion is confirmed with the City.

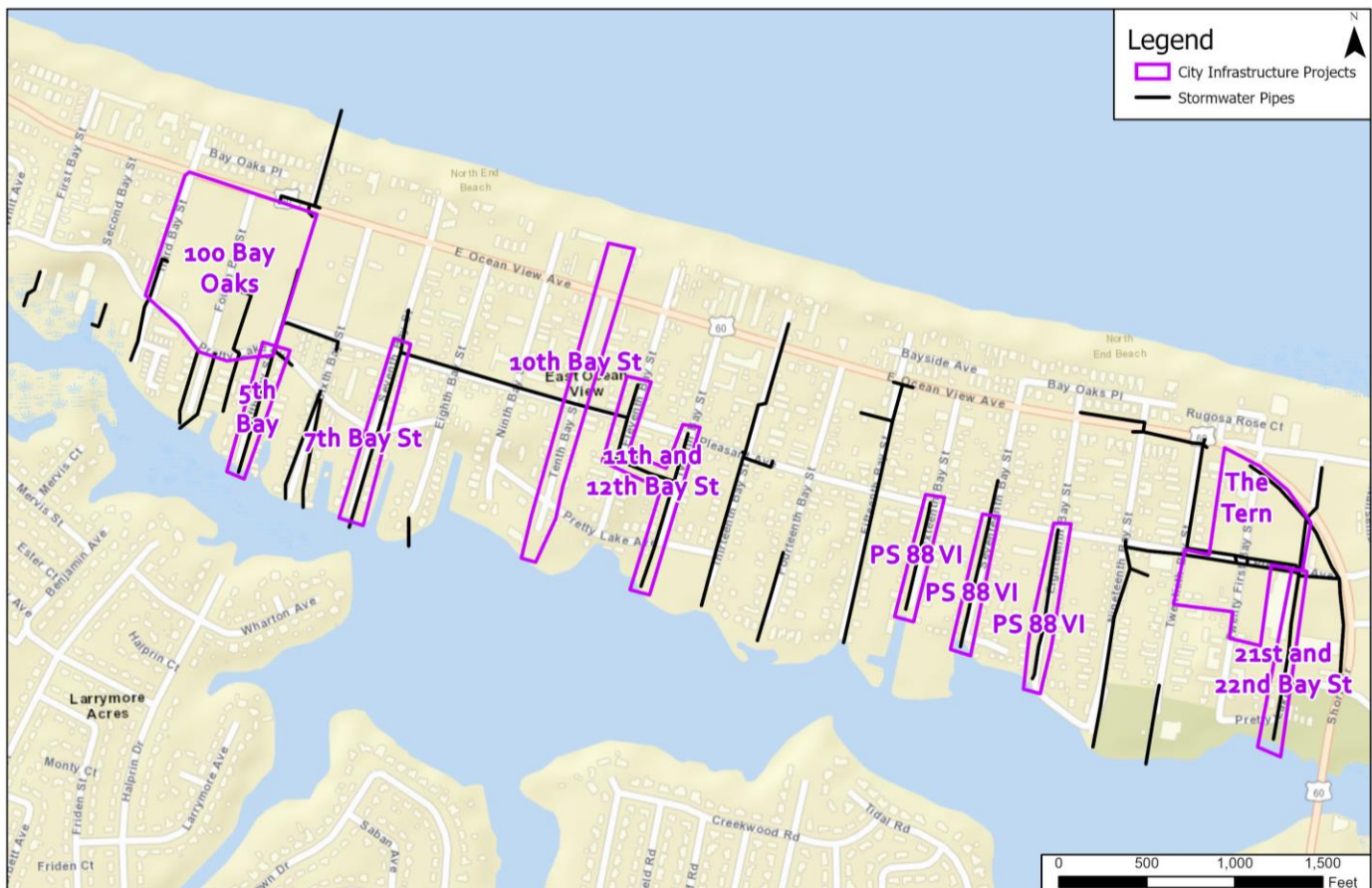


Figure 2-2: Location of development projects within the project area

Table 2-1: Status of Projects in Watershed

Project	2021 Status
Bay Oaks Park Site Improvements	Construction completed
5 th Bay St	Construction completed
7 th Bay St Stormwater and Roadway Improvements	90% design stage
10 th Bay St Stormwater and Roadway Improvements	90% design stage

Project	2021 Status
11 th and 12 th Bay St	CIPP install completed
East Ocean View Pump Station 88 Water and Sanitary Sewer Replacement Phase VI	50% design stage
The Tern Subdivision Plan	Under construction
21 st and 22 nd Bay St Stormwater and Roadway Improvements	Early design stage

2.2 Model Results

Model results for the updated existing conditions model are shown in **Figure 2-3**. Flooding is seen throughout the project area for many of the design storms which is consistent with the 2013 modeling efforts and the flooding witnessed in the field during rain events. Results for the areas surrounding The Tern and other City projects will need to be reevaluated once these projects have been completed.

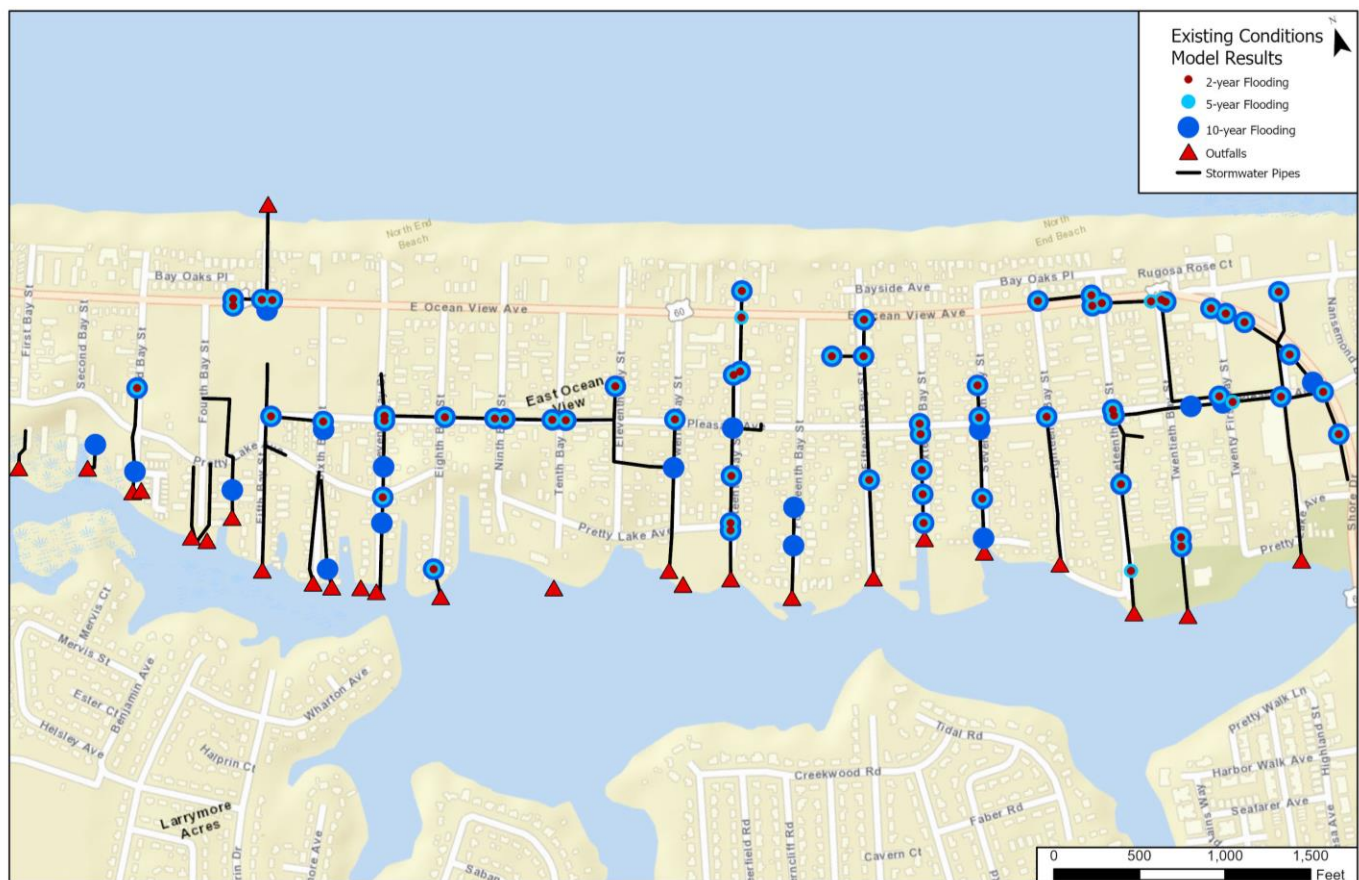


Figure 2-3: Existing conditions model results

The proposed conditions model hydraulic network (which includes the recommended projects) was then connected to the revised delineations as part of this study. The proposed projects continue to greatly reduce the flooding in the project area, even for the 10-year design storm. Additional investigation will be needed to confirm that the recommended projects are feasible given cover limitations and utility conflicts.

Additionally, it may be possible to reduce the amount of pipe upsizing given some of the proposed projects and projects currently under construction. During each of the design phases, additional modeling work will help to fine tune the recommendations of the 2013 report and allow for the most optimized drainage solutions.

3. Recommendation Review

3.1 Additional Impervious Area

The 2013 Master Plan calls for more than 27,000 feet of 5-foot-wide sidewalk. This would add more than 3-acres of additional impervious area. Although this represents only a small percentage of the overall drainage area, this additional impervious area can have significant localized impact. To mitigate this impact consideration should be given to the use of Porous Concrete (PC), Interlocking Pavers (IP), or porous materials for the proposed sidewalks. This will not only negate the increased impervious area but will act as micro-Best Management Practices (BMPs) to decrease the existing runoff by capturing the runoff from adjacent properties before it reaches the street. The runoff reduction rates available for pervious pavements in the Virginia Department of Environmental Quality (DEQ) Handbook are 25 percent for Type 1 and 75 percent for Type 2. Additionally, these BMPs provide the added benefit of 25 percent phosphorous removal. In effect, the Rational Method Runoff Coefficient can be reduced from approximately 0.9 for concrete to 0.65-0.75 for Type 1 and 0.25-0.35 for Type 2.

On-street parking is a frequent point of discussion in Norfolk and East Ocean View is no exception. Residents frequently rely on on-street parking as their primary parking method. Where street parking exists larger vehicles such as emergency services, trash trucks, school busses, and street sweepers are difficult to maneuver on narrow streets. Careful design is required to ensure that 2-way traffic can be safely achieved with designated on-street parking on one or both sides of the street. Coordination between the Civic League and the City's Right of Way Division on the design of on-street parking is imperative to successful implementation. As with the sidewalk consideration should be given to incorporating pervious pavement in the designated on-street parking areas. For the reasons outlined above for sidewalks, pervious pavement could reduce runoff for approximately 6 acres in the East Ocean View drainage basin. In addition to the use of Porous Concrete and Interlocking Pavers, Porous Asphalt (PA) could be utilized for 8-foot wide on-street parking lanes.

3.2 Congested Corridors

The 2013 Master Plan Study recommends several large diameter pipe installations to provide adequate drainage for the East Ocean View Neighborhood Basin. Our review of the basin indicates that several potential conflicts exist. While it is not feasible to identify all conflicts from a desktop analysis our preliminary investigation indicated that 7th Bay Street is particularly congested. The 7th Bay Street Right-of-Way (ROW) contains a water main, gravity sewer, sewer force main, as well as the existing storm pipe. A potential option to be evaluated during design is to reroute the proposed outfall to 8th Bay Street to avoid the congested 7th Bay Street corridor. Additional conflicts may be identified once detailed design is underway. Management of these conflicts and forward planning will be conducted during scoping and design of each phase of the basin improvements. While 95% design plans, by others, exist for 7th Bay

Street, the example of the highly congested corridor illustrates the challenge of designing for the large diameter storm pipe required by the Master Plan. It will be critical in each design phase to work around the existing infrastructure and modify the Master Plan recommendations as necessary to meet the drainage improvement goals.

3.3 Updated Opinion of Probable Construction Cost

The 2013 Master Plan Opinion of Probable Construction Costs (OPCC) excluded costs associated with engineering design, BMPs, construction administration and inspection, and other administrative and operational costs. No additions to the OPCC from the 2013 Master Plan Study have been made. Costs as indicated in the 2013 Master Plan were escalated using a two and a half percent per year increase to account for inflation. This escalation factor resulted in an increase from the 2013 estimate of \$17.5 Million to an escalated estimate of \$21.4 Million for all basin improvements discussed in the Master Plan Study. Since 2013, several projects have been completed either by private developers or as part of the City's Department of Utilities Pump Station 88 water and sewer improvement project. These completed projects, and projects that are currently planned for construction, allowed a few project Area IDs from the 2013 master plan to be eliminated or significantly reduced. With those completed projects taken into consideration, the escalated cost estimate can be reduced to \$12.2 Million. As the current programmed funding for the basin is \$11.8 Million, there will need to be value engineering incorporated into future designs. Opportunities for cost saving identified during the 2013 Master Plan Study review include:

- Use of valley gutters to convey runoff across streets instead of buried infrastructure
- Reduction or elimination of sidewalks
- Reduction or elimination of on-street parking
- Rehabilitation and reuse of existing storm drainage systems were applicable
- Reduction in Level of Service (IE design for less than 10-year, 24-hour design rainfall event)
- Reduction or elimination of high-cost improvements with low overall benefit to basin drainage

3.4 Phasing

A phasing plan is required for the East Ocean View Neighborhood. This need is driven by the scale of improvements required and the large area to be covered by construction. A phasing plan coupled with an understanding of the entire basin improvements is vital to the success of a master plan implementation. Each phase will be designed to provide immediate improvements, while also aligning with the overall basin improvement goals to allow integration with future phases. The use of phases sized to limit contract value to approximately \$2-3 million will result in greater contractor participation than larger phases. Additionally, properly located phases both target the improvements to areas of greatest need and can help limit the resident's construction fatigue. In similar neighborhood construction projects in the City of Norfolk, phasing has followed a targeted approach by completing the most problematic areas first, while being mindful of the construction impacts on residents by rotating construction phases into different

geographical areas of the basin. If possible, this is achieved by alternating from one side of the area to the other to limit constant disruption of an area.

Development of the phasing plan began with a discussion with City staff that did not highlight any specific areas for special priority. As the next step in creating the phasing plan, Hazen performed a review of the available work order data. This data showed a largely even distribution across the basin of Flooding Stoppages, Structural Repairs, Cave-ins, BMP Maintenance, and Ditch Cleanings. Aside from some clustering around 16th Bay Street and 17th Bay Street there are no areas that are clearly higher priority than the average. Public Works is currently addressing the clustering of drainage related issues around 16th Bay St. and 17th Bay St. through cooperation with the Department of Utilities on the Pump Station 88 Phase 6 project. The Department of Utilities Phasing Map for the Pump Station 88 service area is included in **Appendix C**. Therefore, this area along with the area encompassed by the development of ‘The Tern’ will be omitted from the phasing plan. Additionally, the Department of Utilities has designated a large portion of the Phase 5 area in **Figure 3-1** below as Phase 7 of the Pump Station 88 service area. While there is currently no available timeframe for design and construction of this phase of the Pump Station 88 project, the phasing plan below was selected to give the most possible time for coordination between the Master Plan implementation and Department of Utilities work in this area. The remaining phase order was selected to minimize construction fatigue by avoiding repeat construction along phase borders.

Phasing boundaries were selected to generate phases with similar construction costs over the five-year overall project duration. For clarity of the phasing map, the phasing boundaries drawn in **Figure 3-1** include areas of recent development and improvement. These areas of recent development will be avoided as much as possible during design via records research and field visits to avoid repeated disturbance within the right-of-way. The proposed phasing plan is shown in **Figure 3-1** below.

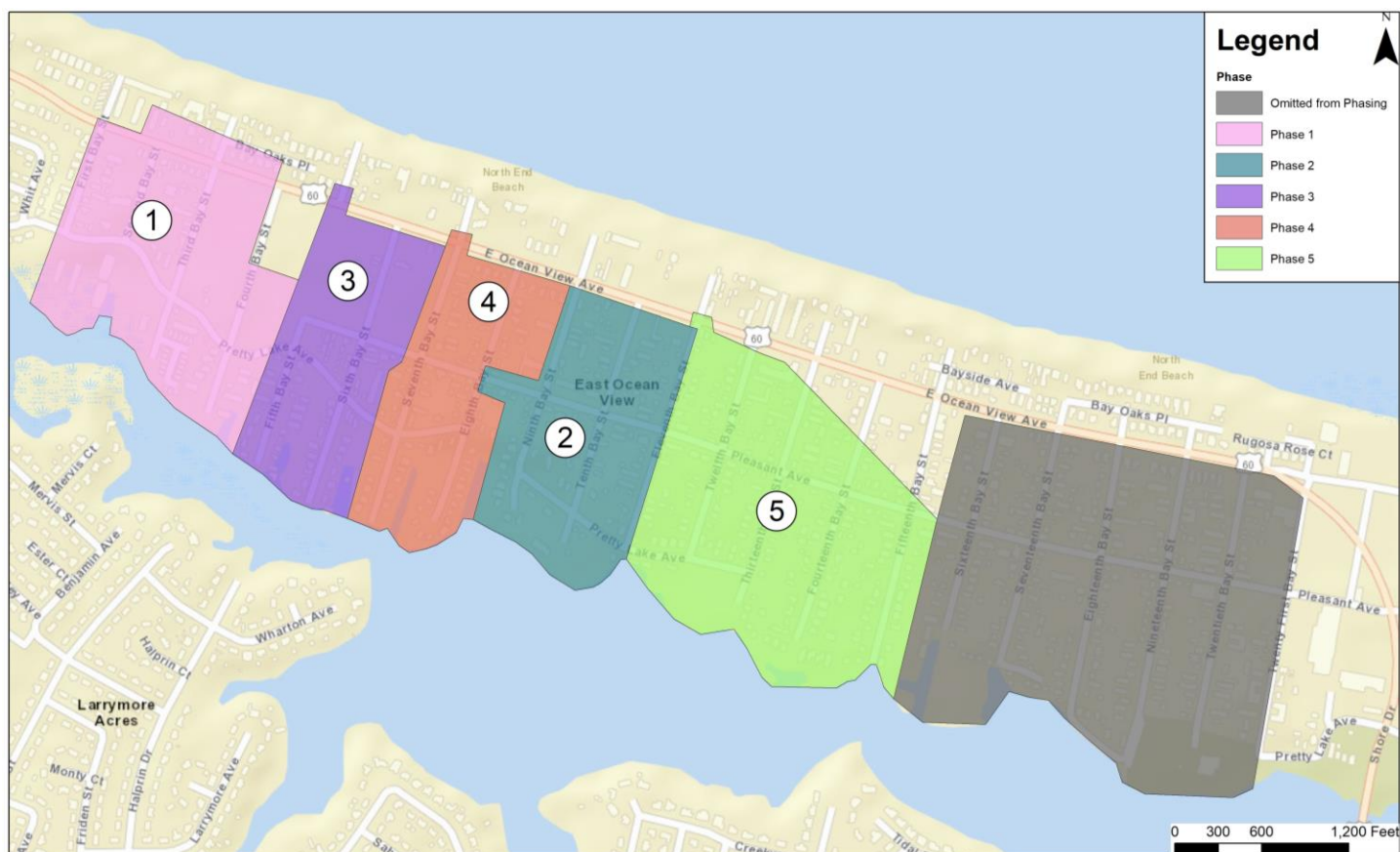


Figure 3-1: Proposed Phasing Plan

Table 3-1 below provides a breakdown of each phase including the previous Master Plan area designation, a brief description of the limits, and the escalated estimate of construction costs.

Table 3-1: Phasing Breakdown

Phase	Master Plan Area ¹	Description ²	Length of Pipe (feet) ³	2021 Costs
1	1-1	South of 1st Bay St	71	\$ 50,000
	3-1	3rd Bay St South of Pretty Lake Ave	378	\$ 256,000
	3-2	Pretty Lake Ave from 1st to 3rd Bay St	353	\$ 244,000
	3-3	3rd Bay St north of Pretty Lake Ave	1,036	\$ 463,000
	4-1	4th Bay St	578	\$ 402,000
	4-2	Between 4th Bay St and 5th Bay St	1,007	\$ 451,000
	Phase 1 Escalated Opinion of Probable Construction Cost:			\$ 1,866,000
2	10-1	10th Bay St. from Pleasant Ave. to Pretty Lake outfall	945	\$ 603,000
	10-2	9th Bay from Pleasant Ave. to Pretty Lake Ave. and Pretty Lake Ave. from 9th Bay to 12th Bay	1,500	\$ 821,000
	10-3	10th Bay St. from Ocean View Ave. to Pleasant Ave. and Pleasant Ave. from 9th Bay St. to 11th Bay St.	660	\$ 497,000
	10-4	Pleasant Ave. from 7th Bay St. to 9th Bay St.	860	\$ 563,000
	10-5	9th Bay St north of Pleasant Ave	0	\$ 29,000
	Phase 2 Escalated Opinion of Probable Construction Cost:			\$ 2,513,000
3	5-1	5th Bay St. from Pleasant Ave. to Pretty Lake outfall	1,054	\$ 736,000
	5-2	East Ocean View Ave at 5th Bay St	237	\$ 146,000
	6-1	6th Bay south of Pleasant Ave. and Pretty Lake Ave. from 5th Bay to 7th Bay	1,200	\$ 871,000
	6-2	Pleasant Ave. from 5th Bay St. to 7th Bay St.	685	\$ 424,000
	6-3	6th Bay St. from Ocean View Ave. to Pleasant Ave.	325	\$ 322,000
	Phase 3 Escalated Opinion of Probable Construction Cost:			\$ 2,499,000
4	7-1	7th Bay St. from Ocean View Ave. to Pretty Lake outfall	1,740	\$ 1,153,000
	7-2	8th Bay St. from Ocean View Ave. to Pretty Lake outfall	325	\$ 290,000
	8-1	8th Bay south of Pleasant Ave. and Pretty Lake Ave. from 7th Bay to 8th Bay	700	\$ 744,000
	Phase 4 Escalated Opinion of Probable Construction Cost:			\$ 2,187,000
5	12-1	12th Bay St. from Pleasant Ave. to Pretty Lake Outfall	955	\$ 454,000
	12-2	11th Bay St. from Ocean View Ave. to Pretty Lake Ave. and Pleasant Ave. from 11th Bay St. to 12th Bay St.	860	\$ 582,000
	13-1	13th Bay St	1,581	\$ 1,060,000
	14-2	Pleasant Ave from 12th Bay St to 15th Bay St	0	\$ 74,000
	15-1	15th Bay St	1,739	\$ 963,000
	Phase 5 Escalated Opinion of Probable Construction Cost:			\$ 3,133,000
TOTAL ESCALATED OPINION OF PROBABLE CONSTRUCTION COST				\$ 12,198,000

1: See Appendix A for 2013 Master Plan Area locations

2: See Appendix B : 2013 Master Plan Table ES-1 for details of improvements included in Master Plan Area.

3: Values are summed from 2013 Master Plan Table ES-1 columns "Length of Replacement Pipe (feet)"², "Length of Additional Pipe (feet)"³, and "Length of Extension Pipe (feet)"⁴

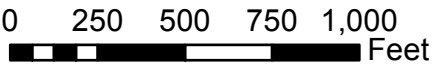
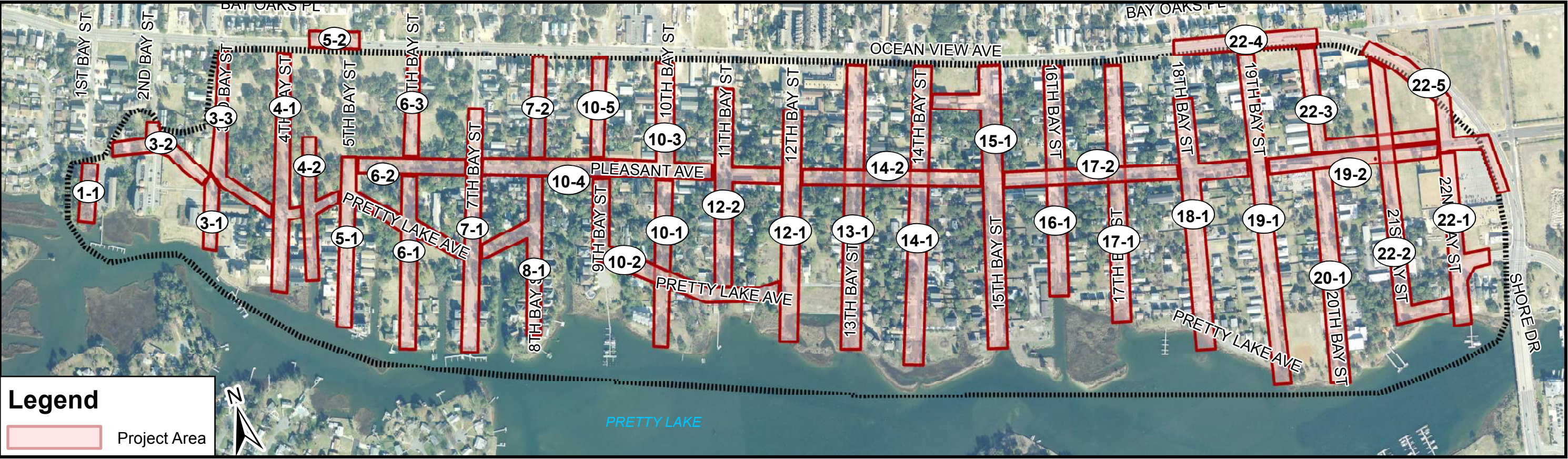
4. Conclusion

As shown in **Figure 1-1** the East Ocean View basin has widespread drainage issues. These issues have resulted in regular maintenance work and occasional improvement projects. However, there has been no basin wide implementation of the Master Plan study from 2013. As discussed in **Section 2**, the updated model largely agrees with the issues discussed in the 2013 report. The basin wide modeling results validate the need for systemic improvements. The model results also agree closely enough with the 2013 results that the project areas discussed in the 2013 report may be used as the basis for phasing and the construction cost estimates.

Implementation of the phases discussed in **Section 3.4** will require additional model runs to fine tune the recommended improvements during each design phase. It will also be imperative to explore value engineering opportunities as discussed in **Section 3.3** to reduce the overall construction cost to complete the project within the current \$11.8 Million program budget and schedule.

Careful implementation of the recommendations from the 2013 master plan, with revisions from the updated model, will serve to improve the stormwater system in the East Ocean View basin.

Appendix A: 2013 Master Plan Project Area Map



East Ocean View Stormwater Master Plan
Figure ES-5 Proposed Improvement Projects

Appendix B: 2013 Master Plan Table ES-1

Table ES-1 Improvements

Project Area ID ¹	Length of Replacement Pipe (feet) ²	Length of Additional Pipe (feet) ³	Length of Extension Pipe (feet) ⁴	Pavement Resurface (sq ft)	Length of Curb and Gutter (feet)	Length of 5' Wide Concrete Sidewalk (feet)	Opinion of Probable Construction Cost ⁵
1-1	71			190			\$41,000
3-1	305	73		1,010	824		\$210,000
3-2			353	940	1,454	580	\$200,000
3-3		764	272	2,760	667	1,094	\$380,000
4-1			578	1,540	2,773	1,219	\$330,000
4-2	692		315	2,700	410		\$370,000
5-1	1,054			2,175	1,810	865	\$604,000
5-2	237			630			\$120,000
6-1	1,200			4,135	3,400	1,690	\$715,000
6-2	685			1,690	1,380	690	\$348,000
6-3	325			1,400	1,150	575	\$264,000
7-1	1,740			4,300	540	560	\$946,000
7-2	325			1,400	1,150	575	\$238,000
8-1	700			5,100	1,400	1,115	\$611,000
10-1	945			2,070	1,960	810	\$495,000
10-2	1,500			3,700	2,600	1,500	\$674,000
10-3	660			1,600	1,200	900	\$408,000
10-4	860			1,930	1,100	350	\$462,000
10-5						344	\$24,000
12-1	955			1,900			\$373,000
12-2	860			3,200	2,000	1,300	\$478,000
13-1	1,581			4,360	1,830	1,716	\$870,000
14-1	728	879		4,300	1,408	1,289	\$760,000
14-2					1,345		\$61,000
15-1	1,739			4,640	1,475	604	\$790,000
16-1		604	346	2,530	2,619	1,459	\$600,000
17-1	967		155	3,000	2,827	1,553	\$630,000
17-2					1,288		\$59,000
18-1			381	1,020	2,589	1,486	\$290,000

Project Area ID ¹	Length of Replacement Pipe (feet) ²	Length of Additional Pipe (feet) ³	Length of Extension Pipe (feet) ⁴	Pavement Resurface (sq ft)	Length of Curb and Gutter (feet)	Length of 5' Wide Concrete Sidewalk (feet)	Opinion of Probable Construction Cost ⁵
19-1	1,376	1,314	362	5,920	3,212	830	\$1,500,000
19-2	298		240	1,430	454		\$250,000
20-1	413		372	2,090	1,720	631	\$410,000
22-1	1,557	672		5,950	1,036	1,503	\$1,200,000
22-2					3,143		\$130,000
22-3	1,223		422	4,400	1,973	1,589	\$880,000
22-4	864			2,300	4	5	\$390,000
22-5	1,072			2,860	599	208	\$440,000
Total	24,932	4,306	3,796	89,170	53,340	27,040	\$17,551,000

Notes:

¹ Project Area ID includes the Bay Street of the drainage outfall, followed by the suggested order of project area implementation from downstream to upstream within each drainage subsystem. For example, Project 10-5 indicates the project is part of the drainage system which outfalls on 10th Bay Street and is the fifth project recommended for implementation because it is upstream of 4 other projects.

² Length of Replacement Pipe indicates the replacement of existing stormwater pipe with new pipe of a larger size.

³ Length of Additional Pipe indicates the addition of new stormwater pipe to supplement capacity of existing system.

⁴ Length of Extension Pipe indicates the addition of new peripheral stormwater pipe to improve street drainage beyond the modeled network of pipes.

⁵ Cost estimates do not include proposed BMPs.

Appendix C: Pump Station 88 Phasing Plan

Appendix C : Pump Station 88 Phasing Plan
Provided by City of Norfolk on 5/11/2021

