



Subject	Meeting Minutes - Citizen Advisory Group (CAG) Meeting #7
Meeting Date	January 31, 2017
Scheduled Time	6:00 pm – 7:15 pm ET
Location	Learning Center Room, 4th Floor, One Bergen County Plaza, Hackensack, NJ 07601
Attendees	Attendee list available, <i>for internal use only</i>

- The PowerPoint slide presentation utilized at the meeting is attached to the meeting minutes (see **Attachment 1**).
- A CAG meeting packet was provided to all attendees and is also attached to the meeting minutes (see **Attachment 2**).
- Linda Fisher, NJDEP Rebuild by Design Meadowlands (RBDM) Project Team Manager, welcomed everyone and provided a brief introduction of the team for new meeting attendees.
- Chris Benosky, AECOM's Rebuild by Design (RBD) Program Manager, provided a brief project status update and an overview of the meeting's agenda. The Draft Concept Screening Criteria Matrix, originally presented at the CAG #3 meeting, has been refined further; it is a living document that will continue to be modified, as appropriate, during the alternative development process. The Meeting Summary for CAG Meeting #6 and the December 2016 Newsletter are available on the Project website at www.rbd-meadowlands.nj.gov. The RBDM Project Team is in the process of developing stormwater drainage options. The primary focus of this meeting is to walk the CAG Members through the progress made to date on the development of Alternative 2 (Stormwater Drainage Improvements Alternative).
- During the concept development process for Alternative 2, the RBDM Project Team has been utilizing the CAG's input related to: areas prone to flooding within the Project Area (CAG Meeting #2A/2B); the concept screening criteria (CAG Meeting #3); concept development and ranking (CAG Meeting #4); and drainage basin opportunity areas (CAG Meeting #5). In addition to the CAG's input and discussions, the RBDM Project Team has used input from the mayors, existing data, new field investigation data, hydrologic modeling, and screening criteria to develop seven buildable concepts that would reduce flooding in the Project Area, while minimizing impacts to the human, built, and natural environments.
- The RBDM Project Team is conducting modeling to better understand the potential for each of the Alternative 2 concepts to increase the conveyance and collection of stormwater in the Project Area. The Team is also continuing to collect additional field data to support the more detailed drainage modeling effort that will be used to assess each concept's ability to control and move stormwater, as well as the benefits of each concept relative to its anticipated cost. To



date, the Team has developed and applied simplified models for East and West Riser, Main Street, Carol Place, East Carlstadt, Losen Slote, DePeyster Creek, and Peach Island Creek.

- The hydrologic modeling is based on the 20 stormwater sub-basins in the Project Area that ultimately flow into either the Hackensack River or Berry's Creek. As the Team developed stormwater drainage concepts, an emphasis was placed on frequently flooded areas in the Project Area that were identified through CAG input and feedback (CAG Meeting #2A/2B). To further validate these models, the Team used data from several past flood events. A few of these events were illustrated during the presentation, including the Brand Street in Little Ferry, Asia Place in Moonachie, Carol Place in Moonachie, and Kero Road in Carlstadt.
 - Garrett Avery, AECOM's RBDM Project Manager, and Lulu Loquidis, AECOM Landscape Designer, provided a detailed description of each of the seven concepts. Ms. Loquidis presented information on the stormwater collection aspects of each of the concepts, while Mr. Avery focused on the stormwater conveyance aspects. Stormwater collection and conveyance components need to work in tandem. To minimize costs, the Team is looking for ways to improve or enhance the capacity of existing stormwater conveyance systems to the extent feasible.
1. **Main Street Concept** – This concept would connect features along Main Street, Bergen Turnpike, Sylvan Avenue, Willow Lake Park, and Indian Lake with new open space features on the Hackensack River. The Team is looking for opportunities to use the “kit of parts” to help improve water quality and collect water, such as permeable pavement, bump outs, bioswales, and new open spaces that also provide opportunities for the community to enjoy the Hackensack River. The “kit of parts” was first introduced during CAG Meeting #4. To improve stormwater conveyance, this concept considers improvements to three pump stations (i.e., Little Ferry Circle, Main Street, and Willow Lake); the potential to allow Willow Lake to become a timed reservoir; a berm to increase capacity at Indian Lake; and an increase in culvert sizes along Main Street.
 2. **DePeyster Creek Concept** – This concept would connect features along DePeyster Creek, Mehrhof Road, Monroe Street, and the Hackensack River. To improve stormwater collection, this concept considers new open space and improvements to existing open space along DePeyster Creek, which would in turn provide co-benefits to the community (e.g., water access, ecological uplift). To improve stormwater conveyance, this concept considers improvements to DePeyster Creek, including channel berming to increase capacity and pump station improvements. The RBDM Team is looking at opportunities to strategically integrate these systems into public space to make it more pleasing for the community.
 3. **Moonachie Concept** – This concept would connect features along Empire Boulevard and Moonachie Road. To improve stormwater collection, this concept considers bioswales, median planting, and open space improvements for the community. The Team is looking



into ways to improve the drainage within and from the ball fields along Redneck Avenue. To improve stormwater conveyance, this concept considers off-channel storage, increasing channel conveyance, riparian buffer enhancements, and back-flow protection for outfalls on the Losen Slote. The Team presented an example of how curb cuts, permeable pavers, bioswales, and an improved subsurface pipe network could work in tandem to both collect and convey water along Empire Boulevard in Moonachie.

4. **Losen Slote Concept** – This concept would connect features at the Moonachie Police Department; Robert Craig, Washington, and Little Ferry Elementary Schools; the municipal building; the public library; and local parks. To improve stormwater collection, this concept considers ways to convert the larger areas of existing lawn space to rain gardens, native plantings, and bioswales. Losen Slote is important ecologically and for stormwater management. Over the years, this waterway has become constrained by nearby development. Therefore, instead of increasing channel conveyance and capacity opportunities in the upper portion of this drainage, improvements would include new pump stations, a force main, and booster pumps. In the lower portion of Losen Slote, potential improvements include habitat restoration, supplemental dredging, back-flow protection for residential outfalls, and channel improvements. The Team presented an example of how the proposed collection and conveyance improvements, such as permeable pavers, native plantings, subsurface conveyance, and rain gardens, could be incorporated within civic properties to provide educational opportunities.
5. **All West Riser Concept** – To improve stormwater collection, this concept considers median plantings, bioswales, rain gardens, and street improvements along Moonachie Avenue. This concept considers several conveyance improvements, including two new pump stations, a force main, improvements to the Vincent Place pump station, and channel improvements and channel berming in conjunction with habitat restoration. The Team presented two examples to illustrate the proposed improvements. The first example illustrated how a new pump station could be incorporated into the community in a more aesthetically pleasing way. The second example illustrated how channel and habitat improvements could be implemented in a manner to improve stormwater management and ecological uplift.
6. **All East Riser Concept** – To improve stormwater collection, this concept considers improvements along the East Riser and new open space at Caesar Place Park. The proposed collection improvements are very similar to the All West Riser Concept #5. Moving from north to south, this concept considers several conveyance improvements, including a new pump station at Green Street with force main, channel improvements with habitat restoration near Teterboro woods, and a new pump station at East Riser. Moonachie currently lacks active space; thus, the Team is considering new open space opportunities at Caesar Place Park. An example was provided to illustrate how stormwater collection and conveyance features could be incorporated into active space (e.g., soccer field, jogging path) for the community.



7. **All East Riser and Main Street with Diversion Collection Concept** – This concept is a combination of Concepts #1 and #6. This concept considers similar improvement strategies for stormwater collection. The main difference in this concept pertains to increased stormwater conveyance. This concept involves the addition of another pump station with a force main that would move water east, out of the Project Area and into the Hackensack River more directly.
- Mr. Benosky provided an overview of the next steps. The next CAG meeting will be in **March 2017**. CAG members were encouraged to continue to build interest in the Proposed Project and to visit the Proposed Project website at www.rbd.meadowlands.nj.gov or email questions to rbd-meadowlands@dep.nj.gov for more information. Before opening the meeting up for questions, Mr. Benosky informed the CAG Members that the RBDM Project Team is in the process of modeling these seven concepts and the Team is interested in feedback from the CAG Members as they continue to move forward. Please provide all comments and input to NJDEP by **February 7, 2017**.
 - Following the completion of the presentation, the CAG Members posed the following questions and comments:
 1. Water levels within the Losen Slote are rising and falling, independent of rain events. A breach in the pump station's drain was located and filled, but now there may be another breach. A path may need to be cut on the dike to determine what is going on as it is heavily overgrown with *Phragmites*. Are you in a position to help with this? I wanted to at least make you aware of the situation.
Response: We would not be able to address this issue for this specific project. However, we will have a survey team in the area this week that can look into the issue and potentially obtain more information on the cause.
 2. Part of the reason we are dealing with these flooding issues is because they were ignored for so many years. It is wonderful that habitat restoration and rain gardens are under consideration; however, we need to consider operations and maintenance (O&M) over the long-term because *Phragmites* will begin to take over. O&M will need to be done by someone with knowledge of maintaining native species. Hopefully, a training program can be established as part of these great improvement opportunities. Local community groups would be willing to help develop and deliver the proper training.
Response: While the Proposed Project cannot fund O&M, the NJDEP Project Team is required to develop an O&M Plan for the Proposed Project; this O&M Plan will address long-term maintenance requirements and responsibilities, including any required training.



3. My concern is related to pump stations. Once they are built, diesel or gasoline must be brought in to fuel and maintain them. As great designers, please try to minimize the number of pump stations due to their long-term maintenance.

Response: This is something the NJDEP Project Team is definitely trying to do. The primary reason pump stations are under consideration is because the terrain is very flat and in some locations mechanical assistance (i.e., pumps) may be necessary to ensure proper stormwater conveyance.

4. What happens to downstream properties at the end of a stormwater conveyance? If sea level rises and tide gates are down, who is looking at getting water down and out?

Response: The Hybrid Alternative (i.e., Alternative 3) would be the most appropriate alternative to address this concern because this alternative includes both stormwater drainage improvements and storm surge protection measures, working together. Alternative 2 does not include a line of protection that protects against storm surge. However, one solution to this potential concern is for water to be pumped out over the tide gate when it is closed. This is something that is being taken into consideration as we develop these concepts and alternatives.

5. Since the 1990s, sea level has been rising and flood events have increased in frequency over the last 20 years. Before we used to get an occasional flood every 15 years; now we are inundated by flood events every 2 years. Is the entire system so encroached upon by development, sedimentation build up, etc. that it no longer works, or is sea level rise (SLR) playing a role? In other words, is this something we did to ourselves or is this something we have no control over? The ongoing flooding has reduced our real estate values. We need to get water out, but need to understand if it's due to SLR or simply a bad system. If we can resolve 60-70 percent of the drainage issues in the Project Area, this would be a great achievement.

Response: The NJDEP Project Team is considering the effects of climate change, including both SLR and increased precipitation within the next 50 years. These particular topics will be addressed in more detail at the next CAG meeting when the Team presents the progress on Alternative 1 concept development.

6. There are fewer wetlands in the Project Area now than in the past. The more extensive wetlands of the past used to maintain stormwater in the 1920s (i.e., as freshwater wetlands behind a diked system), but now they are tidal wetlands. Approximately 40 percent of flood waters flow into Sawmill Creek and the remainder flow into the Hackensack River. Since more areas are tidal, this creates less resistance by the dikes and increased water over time within the overall system.



Response: The NJDEP Project Team is performing watershed modeling as a part of this study to incorporate these considerations into the overall analysis and concept/alternative development.

7. I am concerned that this project is very expensive and that no one will be around to maintain and take care of it. There has to be a plan to consider post-construction maintenance. There will have to be a program and training that is maintained and improved upon over the years. In the 1950s, the dikes and tide gates protected what were once freshwater wetlands. Now, wetlands are brackish and dikes and tide gates are in need of maintenance.

Response: An O&M Plan will be developed for the Proposed Project.

8. It would be helpful to know the cost for O&M so the town, county, or state can identify funding. The O&M Plan needs to include these costs.

Response: The cost of O&M is being assessed for Alternatives 1, 2, and 3. The cost of O&M is not only being considered during the initial concept screening process, but will be assessed in detail as part of the Feasibility Study.

9. As discussed in an earlier question, once you have a pump station, you have to supply it with fuel (diesel or gasoline) to maintain it. In addition to diesel or gasoline pump stations, are natural gas or electrically powered pump stations also being considered?

Response: This will be considered during the design process. Cost will be the main issue. The NJDEP Project Team is trying to eliminate pump stations to the extent possible because they are expensive; whenever possible, the design team is trying to naturally convey water to keep costs down. The Team will take this input into consideration. As part of this analysis, we will examine both short-term and long-term costs. For example, while a natural gas pump station may have a higher initial cost, it may be a better option long-term from an O&M cost than a diesel pump station.

10. What about the properties east of Mehrhof Road and the Hackensack River? Are you looking at buy-outs? Are there plans to buy-out flood prone areas?

Response: The intent is to keep buy-outs limited because buy-outs take time to obtain and are costly; this is one of the factors being considered during the concept screening process. The NJDEP Project Team is making every effort to locate improvements on state or municipally owned parcels, and is only considering buy-outs that are necessary to reduce flooding and implement the collective system. This project is not a buy-out program. However, there are programs that do this, such as the NJDEP's Green Acres Program.

11. Costs should be shared if multiple towns are benefited. For example, Little Ferry should not have to disproportionately shoulder costs if the benefits are shared.



Response: This is something that will be worked out with the towns; all towns benefiting from the stormwater improvements would have to share O&M costs.

The meeting adjourned at 7:15 pm ET.

Attachment 1.

Power Point Slide Presentation (as delivered)

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CITIZEN ADVISORY GROUP (CAG) MEETING #7 STORMWATER DRAINAGE IMPROVEMENTS

WELCOMING

Linda Fisher, NJDEP



Welcome & Opening Remarks



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AGENDA

Chris Benosky, AECOM

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- Project Status Update and Schedule
- Alternative 2: Stormwater Drainage Improvements
 - Alternative 2 Development
 - Modeling Update
 - Frequently Flooded Areas
 - Stormwater Drainage Improvement Options
 - Collection and Conveyance



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PROJECT STATUS UPDATE

Chris Benosky, AECOM

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- Developed working draft Concept Screening Criteria
- Completed and published to Project Website:
 - Meeting Minutes from CAG Meeting #6
 - December 2016 Newsletter
- Developing Stormwater Drainage Options



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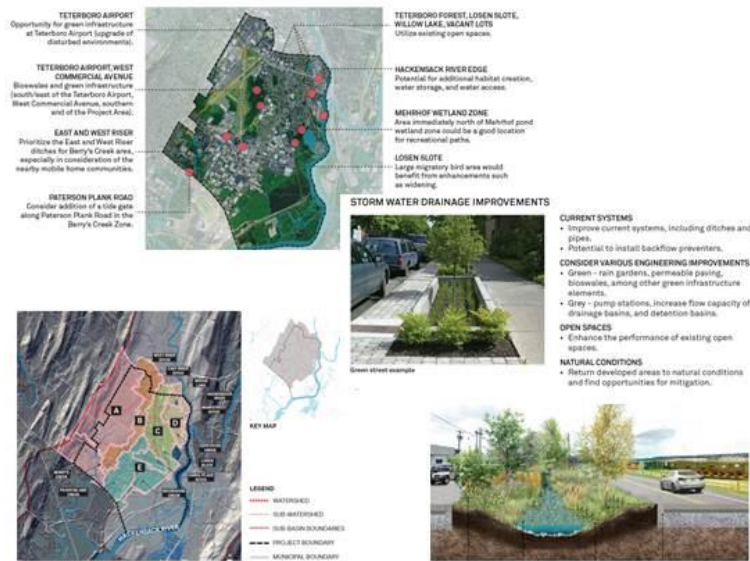
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ALTERNATIVE 2

PREVIOUS CAG INPUT AND DISCUSSION

Chris Benosky, AECOM

5



- **CAG Meeting #2A/B**
Areas Prone to Flooding within the Project Area
- **CAG Meeting #3**
Concept Screening Criteria Review
- **CAG Meeting #4**
Concept Development and Ranking for Alternative 2
- **CAG Meeting #5**
Review of Drainage Basin Opportunity Areas



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ALTERNATIVE 2: PROCESS

DEVELOPMENT OF ALTERNATIVE 2 CONCEPTS

Chris Benosky, AECOM

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- Concept development process utilized the following to arrive at the 7 concepts:



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ALTERNATIVE 2:

STORMWATER DRAINAGE IMPROVEMENTS

CHRISTOPHER BENOSKY, AECOM



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MODELING UPDATE

SIMPLIFIED MODEL PROGRESS

8

Conducting modeling to better understand how each of the initial Alternative 2 concepts will function:

- a. Quantity of stormwater
- b. Movement of stormwater
- c. Control of stormwater



Currently, continuing to conduct stormwater system surveys to support more detailed drainage models of each of the concepts



Future use of modeling results:

- a. Assess each concept's hydraulic feasibility (to control and move stormwater volumes)
- b. Preliminarily determine the benefits each concept would provide relative to cost



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MODELING UPDATE SIMPLIFIED MODEL PROGRESS

9

- Completed development and application of simplified models for:
 - East and West Riser
 - Main Street
 - Carol Place
 - East Carlstadt
 - Losen Slote
 - DePeyster Creek
 - Peach Island Creek



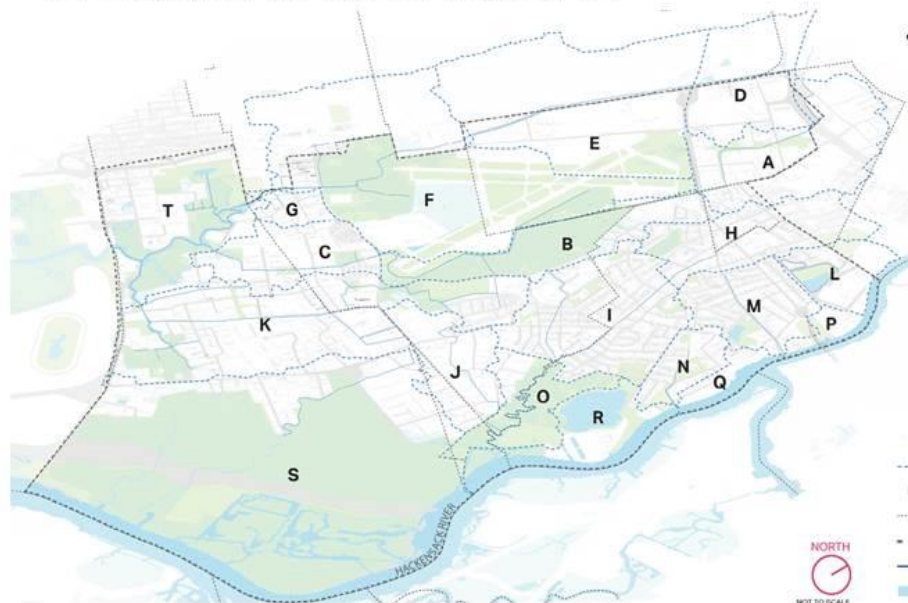
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STORMWATER SUBBASINS

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- THERE ARE 20 SUBBASIN AREAS WITHIN THE PROJECT AREA

A: UPPER EAST RISER
 B: MIDDLE EAST RISER
 C: LOWER EAST RISER
 D: UPPER WEST RISER 1
 E: UPPER WEST RISER 2
 F: MIDDLE WEST RISER
 G: LOWER WEST RISER
 H: UPPER LOSEN SLOTE 1
 I: UPPER LOSEN SLOTE 2
 J: MOONACHIE
 K: CARLSTADT
 L: INDIAN LAKE
 M: MAIN STREET
 N: DEPEYSTER CREEK
 O: LOWER LOSEN SLOTE
 P: UPPER HACKENSACK
 Q: MIDDLE HACKENSACK 1
 R: MIDDLE HACKENSACK 2
 S: LOWER HACKENSACK
 T: BERRY'S CREEK



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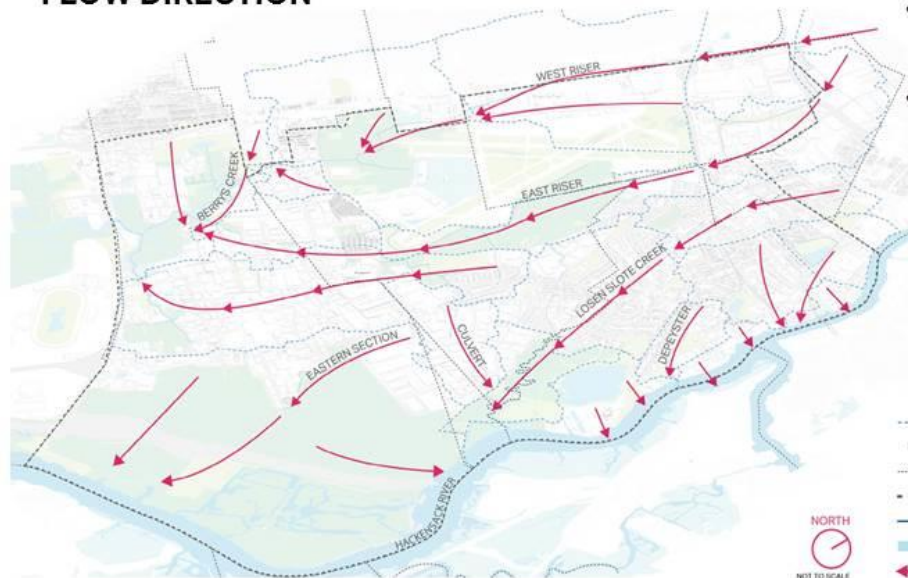
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STORMWATER SUBBASINS

FLOW DIRECTION

11



- SUBBASINS BOUNDARIES IDENTIFY HOW WATER IS FLOWING ON SITE TOWARDS A COMMON POINT
- THE HYDROLOGIC MODELING IS BASED ON THESE SUBBASIN AREAS

--- SUBBASIN BOUNDARY
 M SUBBASIN NAME
 --- MUNICIPAL BOUNDARY
 - - - PROJECT AREA
 --- EXISTING DITCH/CREEK
 --- WATER
 --- PRIMARY CONVEYANCE DIRECTION



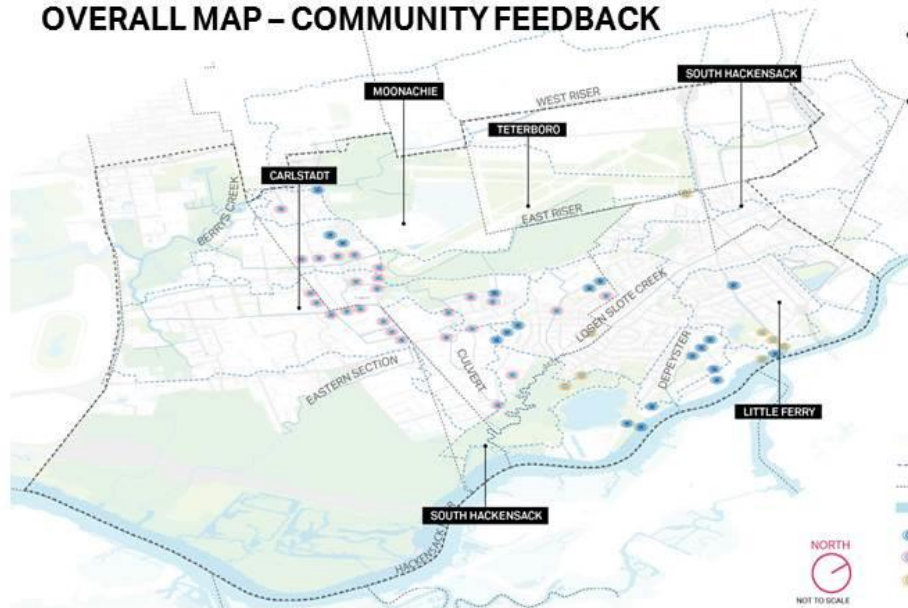
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FREQUENTLY FLOODED AREAS

OVERALL MAP - COMMUNITY FEEDBACK

12



- INTEGRATING COMMUNITY FEEDBACK INTO MODELING
- FOCUSING OUR ATTENTION ON FREQUENTLY FLOODED AREAS DURING THE DEVELOPMENT OF STORMWATER DRAINAGE IMPROVEMENT CONCEPTS

--- SUBBASIN BOUNDARY
 --- MUNICIPAL BOUNDARY
 --- WATER
 ● FLOODS IN REGULAR RAINFALL
 ● FLOODS IN HEAVY RAINFALL
 ● FLOODS IN MAJOR STORM EVENT
 *DATA COLLECTED FROM CAG #2



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FREQUENTLY FLOODED AREAS

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LITTLE FERRY



Image Source: Hackensack Meadowlands Floodplain Management Plan (Oct 24, 2005)

BRANDT STREET

Flood Event Date:
OCTOBER 14, 2005

Estimated Flood Elevation:
4.5 NAVD88



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FREQUENTLY FLOODED AREAS

14

MOONACHIE

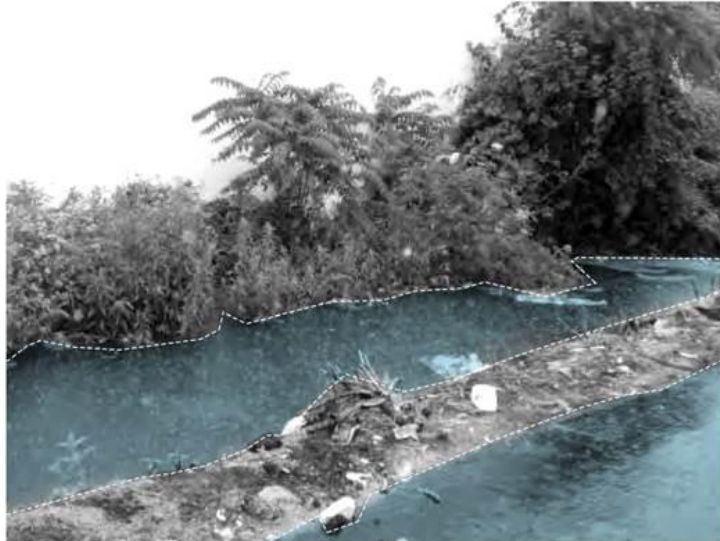


Image Source: Hackensack Meadowlands Floodplain Management Plan (Oct 24, 2005)

110 ASIA PLACE

Flood Event Date:
JUNE 10, 2005

Estimated Flood Elevation:
3.75 NAVD88



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FREQUENTLY FLOODED AREAS

MOONACHIE

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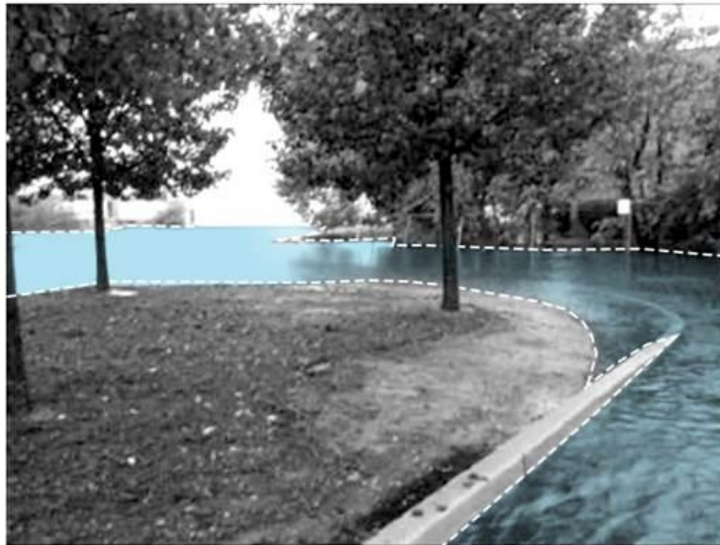


Image Source: Hackensack Meadowlands Floodplain Management Plan (Oct 24, 2005)

1 CAROL PLACE

Flood Event Date:
OCTOBER 12, 2005

Estimated Flood Elevation:
4.8 NAVD88



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FREQUENTLY FLOODED AREAS

CARLSTADT

16



Image Source: Hackensack Meadowlands Floodplain Management Plan (Oct 24, 2005)

140 KERO ROAD

Flood Event Date:
JULY 8, 2005

Estimated Flood Elevation:
4.5 NAVD88



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PRELIMINARY

STORMWATER DRAINAGE IMPROVEMENT AREAS

CHRISTOPHER BENOSKY, AECOM

&

LULU LOQUIDIS, AECOM



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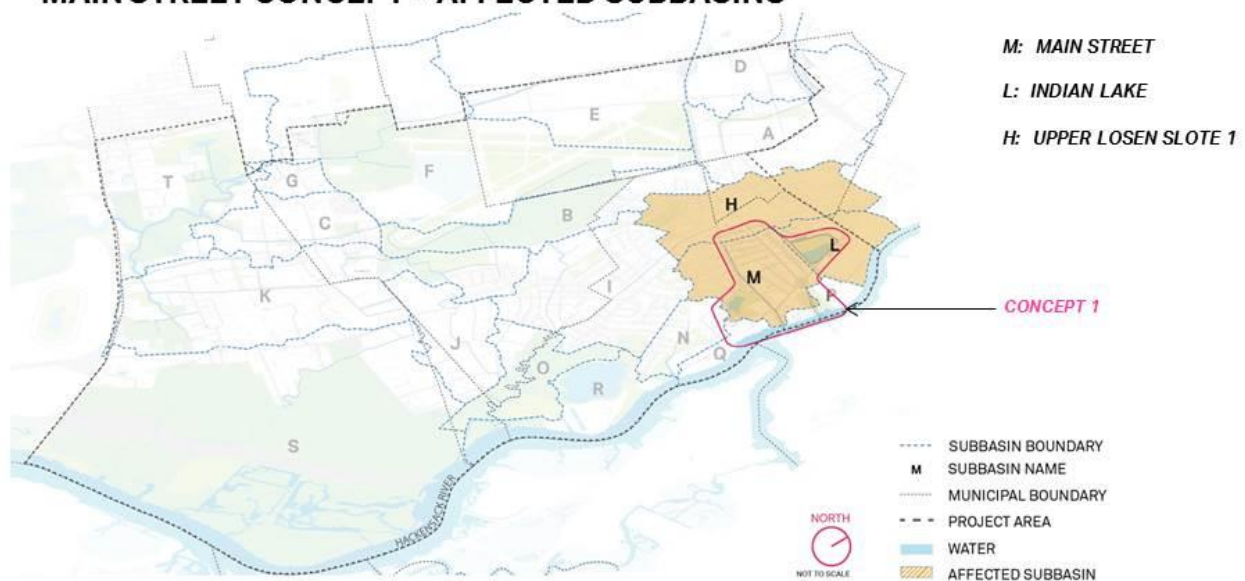
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DRAINAGE IMPROVEMENT CONCEPT 1

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MAIN STREET CONCEPT + AFFECTED SUBBASINS



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DRAINAGE IMPROVEMENT CONCEPT 1

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MAIN STREET COLLECTION

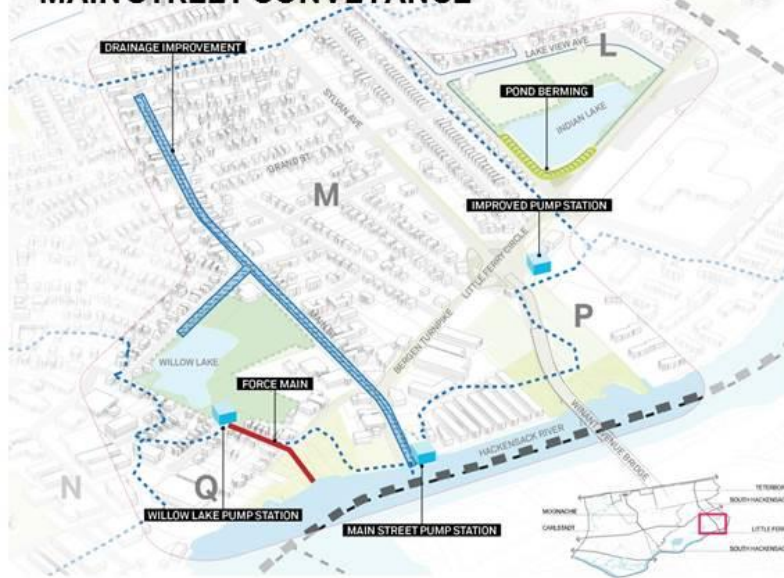


- **CONNECTING FEATURES ALONG MAIN STREET, BERGEN TURNPIKE, SYLVAN AVE, WILLOW LAKE PARK, INDIAN LAKE, AND NEW OPEN SPACE FEATURES ON THE HACKENSACK RIVER**
- **IMPROVEMENTS INCLUDE BIOSWALES, RAIN GARDENS, BUMP OUTS, MEDIAN PLANTING, NEW OPEN SPACE, AND OPEN SPACE IMPROVEMENTS**

DRAINAGE IMPROVEMENT CONCEPT 1

20

MAIN STREET CONVEYANCE



- **IMPROVED PUMP STATIONS AT LITTLE FERRY CIRCLE, MAIN STREET, AND WILLOW LAKE. BERM TO INCREASE STORAGE CAPACITY AT INDIAN LAKE**
- **IMPROVE CONVEYANCE BY INCREASING CULVERT SIZES ALONG MAIN STREET**



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NEW OPEN SPACE

21



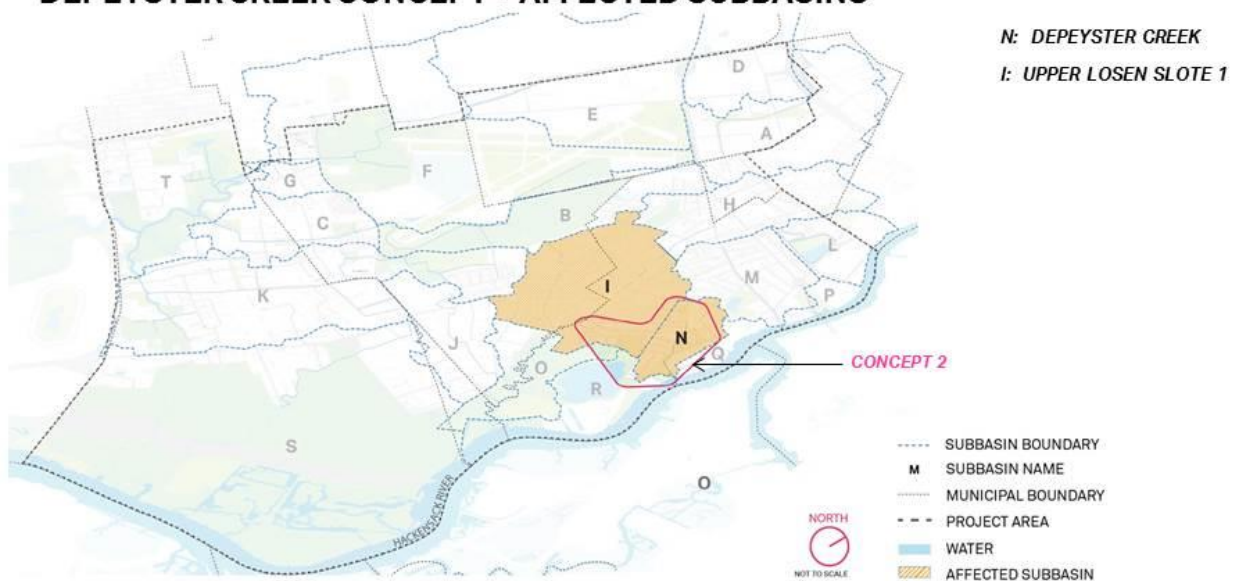
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DRAINAGE IMPROVEMENT CONCEPT 2 DEPEYSTER CREEK CONCEPT + AFFECTED SUBBASINS

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DRAINAGE IMPROVEMENT CONCEPT 2

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DEPYSTER CREEK COLLECTION



- **CONNECTING FEATURES ALONG DEPYSTER CREEK, MEHRHOF RD, MONROE ST, AND THE HACKENSACK RIVER**
- **IMPROVEMENTS INCLUDE NEW OPEN SPACE, OPEN SPACE IMPROVEMENTS, RECREATION, BIOSWALES, PERMEABLE PAVING, BIORETENTION, AND RAIN GARDENS**

DRAINAGE IMPROVEMENT CONCEPT 2

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DEPYSTER CREEK CONVEYANCE



- **INCREASE CHANNEL CONVEYANCE AND IMPROVE PUMP STATION AT DEPYSTER CREEK**
- **CHANNEL BERMING TO INCREASE CAPACITY AT DEPYSTER CREEK**



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IMPROVED PUMP STATION + NEW OPEN SPACE

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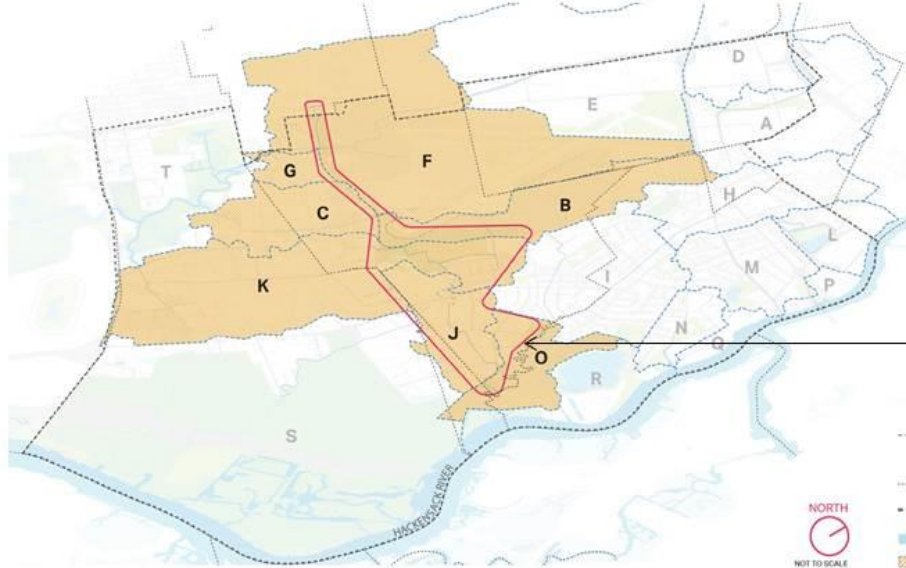
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DRAINAGE IMPROVEMENT CONCEPT 3

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MOONACHIE CONCEPT + AFFECTED SUBBASINS



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DRAINAGE IMPROVEMENT CONCEPT 3

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MOONACHIE COLLECTION



- CONNECTING FEATURES ALONG EMPIRE BLVD, AND MOONACHIE ROAD
- IMPROVEMENTS INCLUDE BIOSWALES, MEDIAN PLANTING, NEW OPEN SPACE, AND RECREATION



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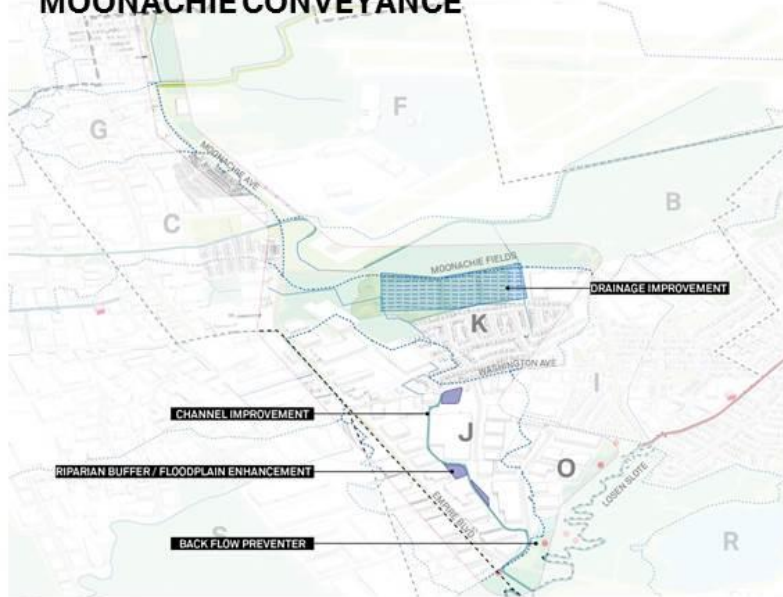
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DRAINAGE IMPROVEMENT CONCEPT 3

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MOONACHIE CONVEYANCE



- OFF CHANNEL STORAGE, INCREASED CONVEYANCE, AND LOCAL DRAINAGE IMPROVEMENTS
- BACK FLOW PROTECTION FOR OUTFALLS TO LOSEN SLOTE



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BIOSWALES + STREET IMPROVEMENTS

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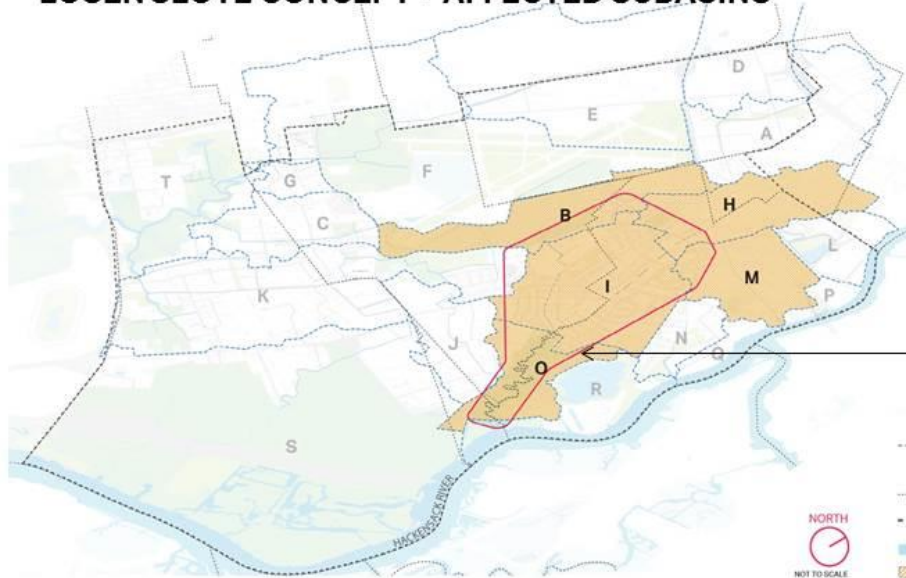
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DRAINAGE IMPROVEMENT CONCEPT 4

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LOSEN SLOTE CONCEPT + AFFECTED SUBBASINS



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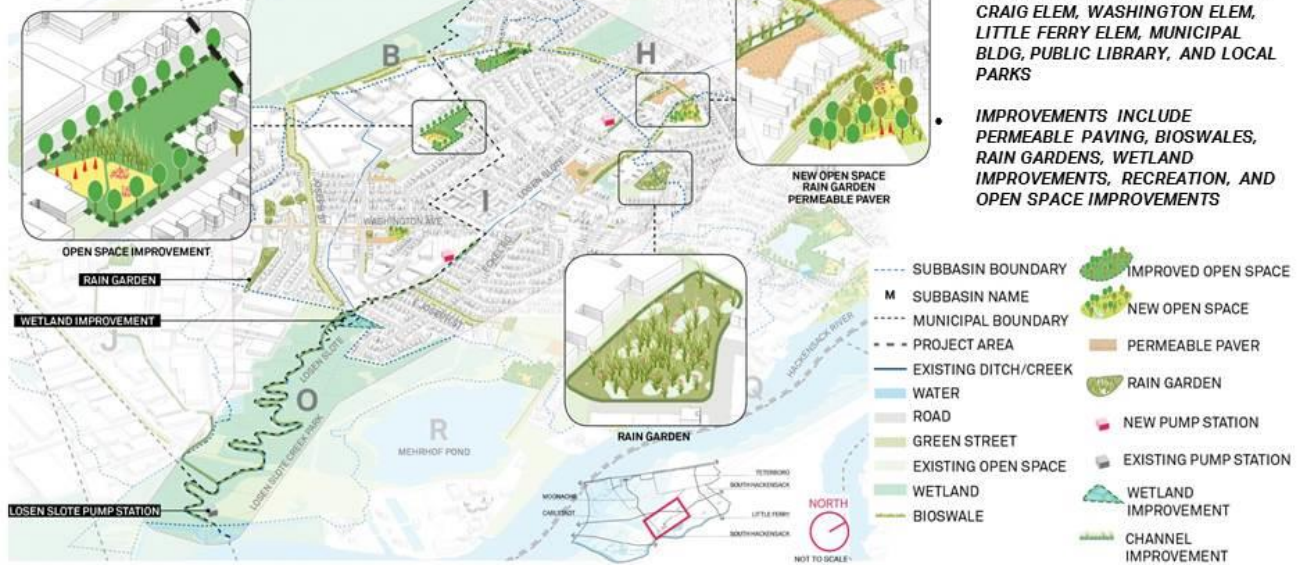
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DRAINAGE IMPROVEMENT CONCEPT 4

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LOSEN SLOTE COLLECTION



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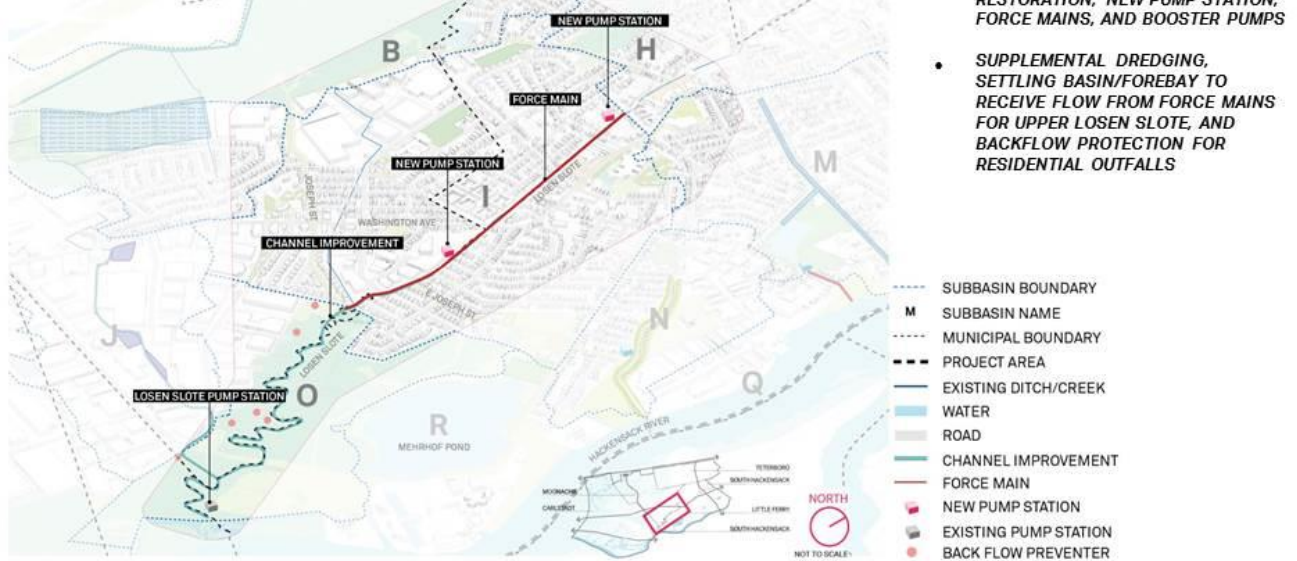
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DRAINAGE IMPROVEMENT CONCEPT 4

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LOSEN SLOTE CONVEYANCE



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IMPROVEMENTS TO CIVIC AMENITY PROPERTY

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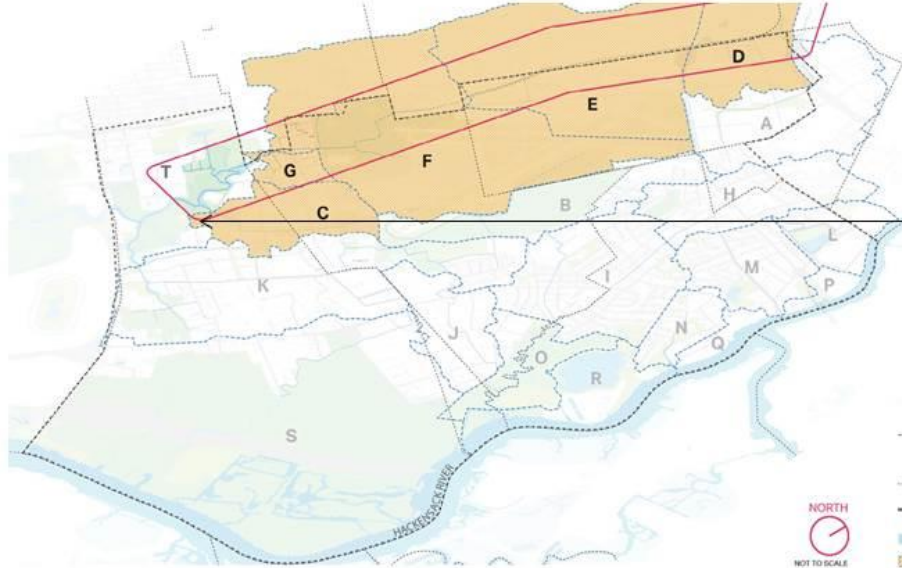
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DRAINAGE IMPROVEMENT CONCEPT 5

34

ALL WEST RISER CONCEPT + AFFECTED SUBBASINS



D: UPPER WEST RISER 1
E: UPPER WEST RISER 2
F: MIDDLE WEST RISER
G: LOWER WEST RISER
C: LOWER EAST RISER



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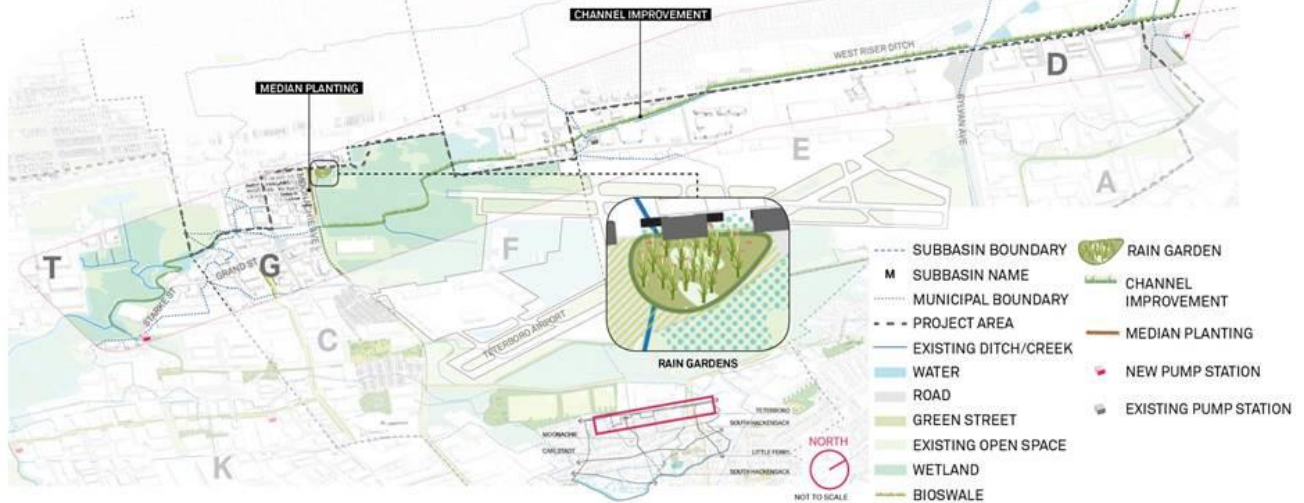
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DRAINAGE IMPROVEMENT CONCEPT 5

35

ALL WEST RISER COLLECTION

- MEDIAN PLANTING, BIOSWALES, STREET IMPROVEMENTS, AND RAIN GARDENS ON MOONACHIE AVE



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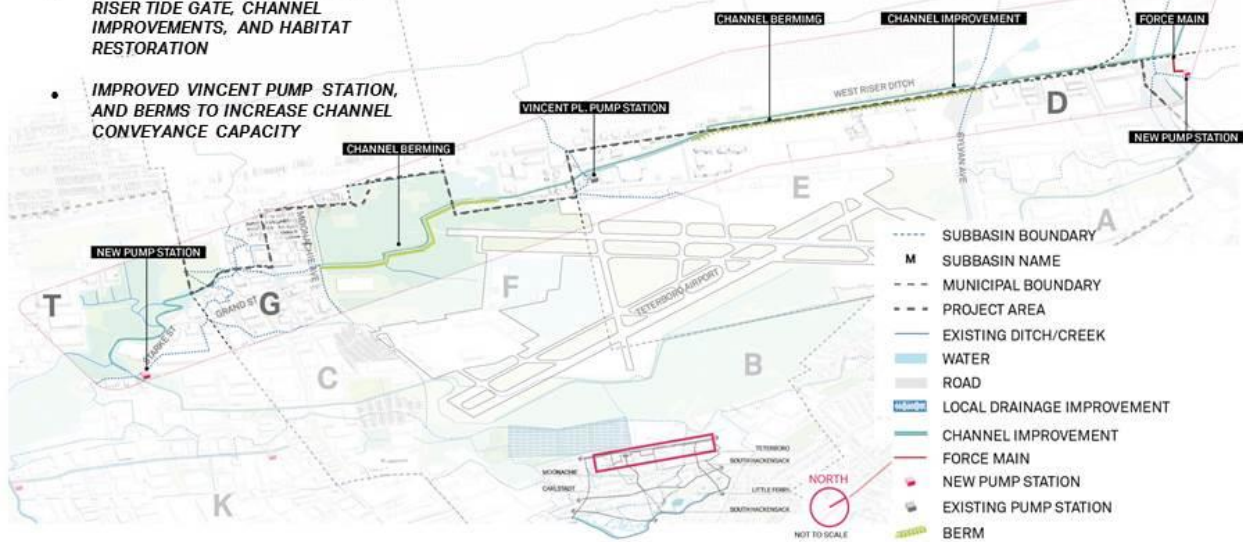
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DRAINAGE IMPROVEMENT CONCEPT 5

36

ALL WEST RISER CONVEYANCE

- NEW PUMP STATION NEAR WEST RISER TIDE GATE, CHANNEL IMPROVEMENTS, AND HABITAT RESTORATION
- IMPROVED VINCENT PUMP STATION, AND BERMS TO INCREASE CHANNEL CONVEYANCE CAPACITY



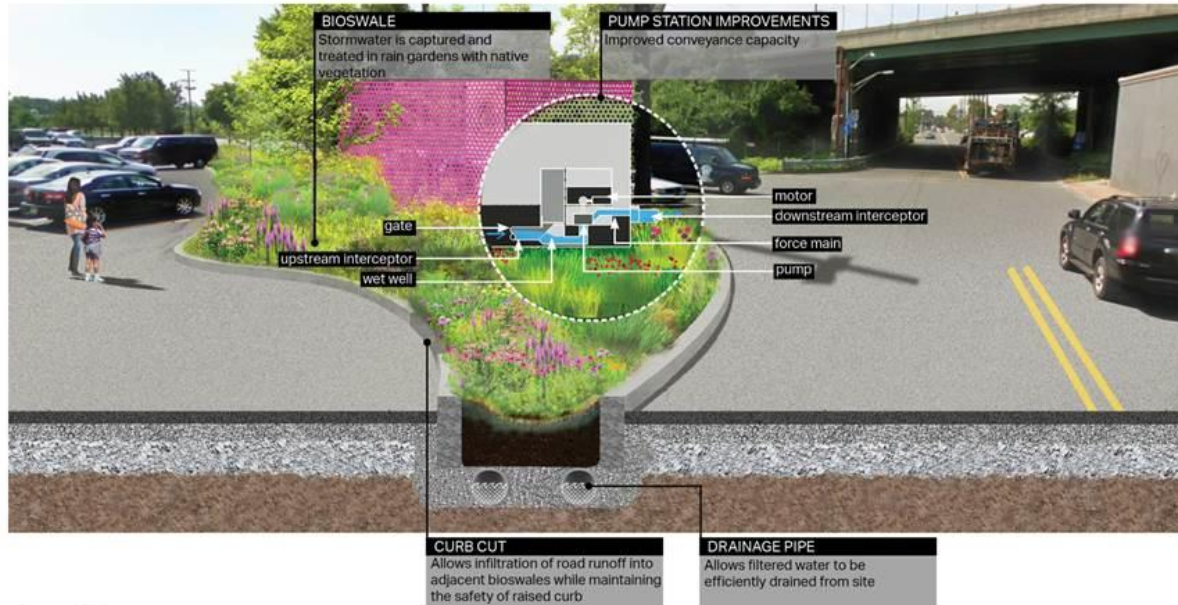
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NEW PUMP STATION

37



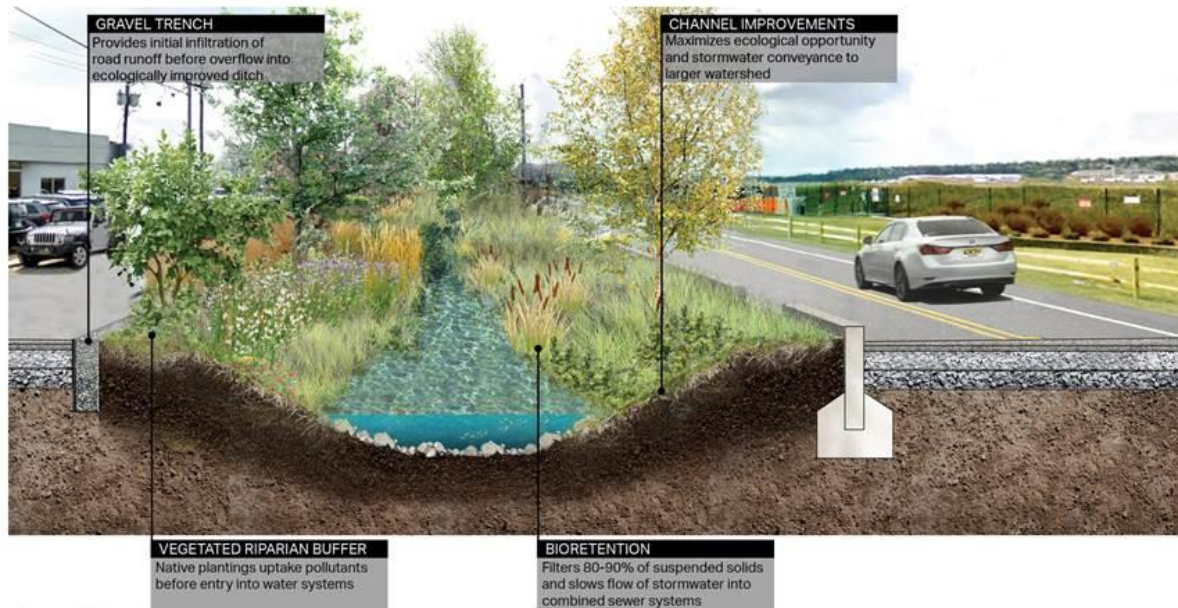
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CHANNEL + HABITAT IMPROVEMENTS

38



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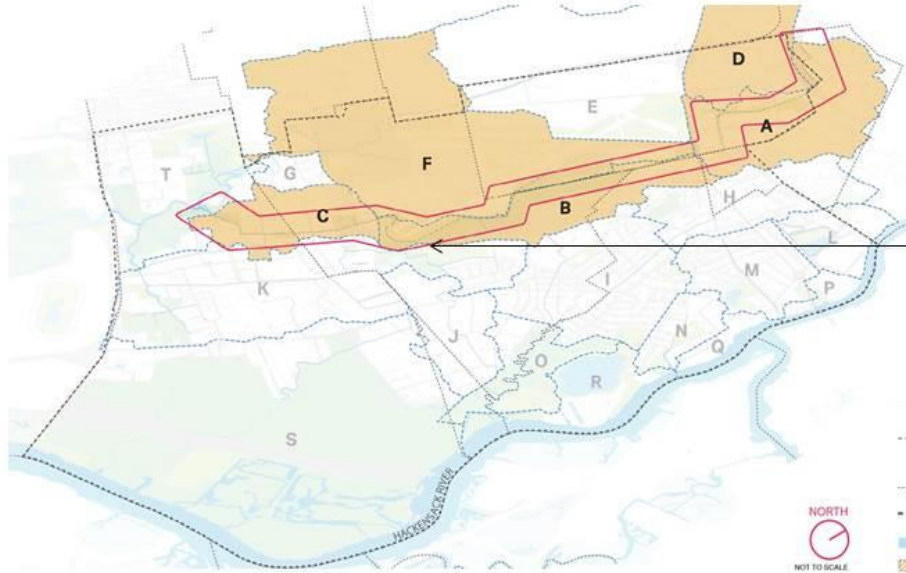
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DRAINAGE IMPROVEMENT CONCEPT 6

39

ALL EAST RISER CONCEPT + AFFECTED SUBBASINS



- A: UPPER EAST RISER
- D: UPPER WEST RISER 1
- E: UPPER WEST RISER 2
- F: MIDDLE WEST RISER
- B: MIDDLE EAST RISER
- C: LOWER EAST RISER
- CONCEPT 6



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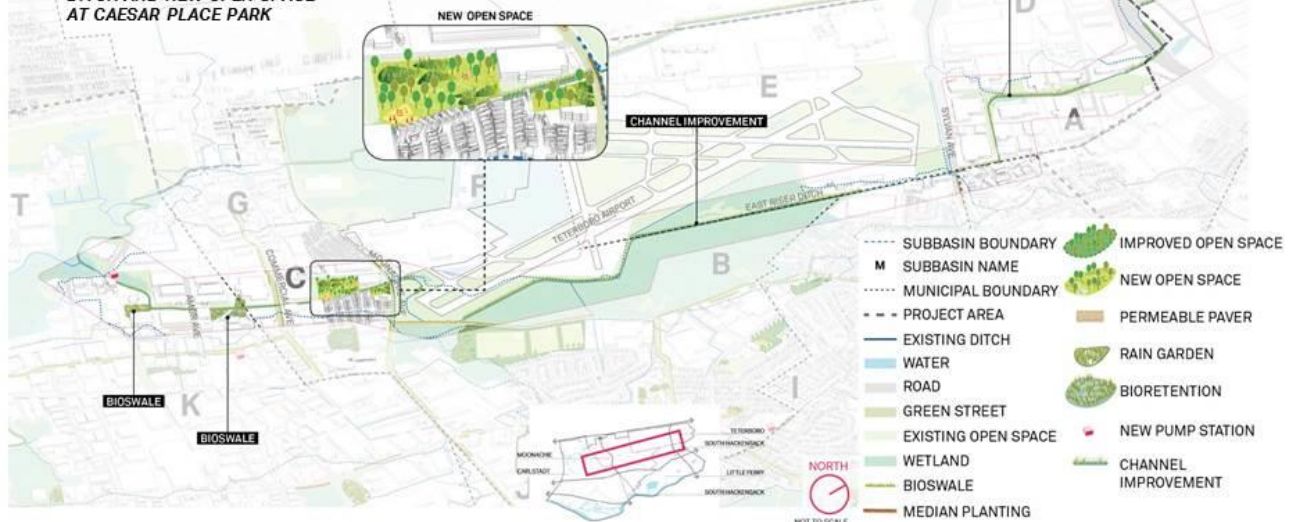
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DRAINAGE IMPROVEMENT CONCEPT 6

40

ALL EAST RISER COLLECTION

- IMPROVEMENTS TO EAST RISER DITCH AND NEW OPEN SPACE AT CAESAR PLACE PARK



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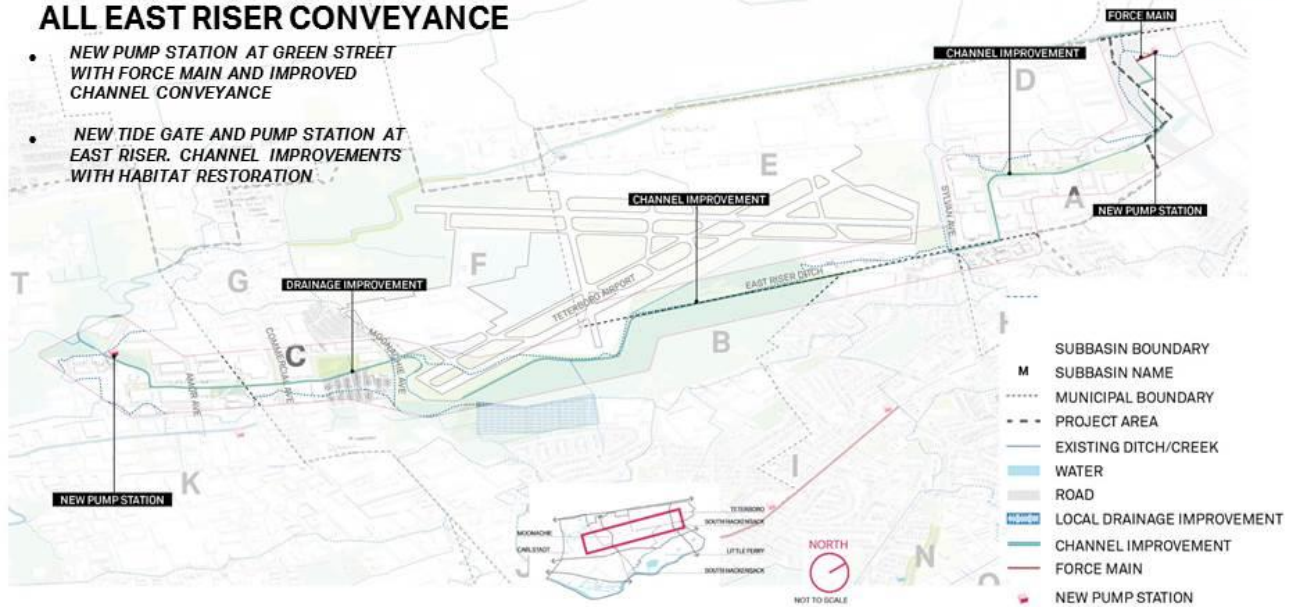
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DRAINAGE IMPROVEMENT CONCEPT 6

41

ALL EAST RISER CONVEYANCE

- NEW PUMP STATION AT GREEN STREET WITH FORCE MAIN AND IMPROVED CHANNEL CONVEYANCE
- NEW TIDE GATE AND PUMP STATION AT EAST RISER. CHANNEL IMPROVEMENTS WITH HABITAT RESTORATION



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OPEN SPACE IMPROVEMENTS

42



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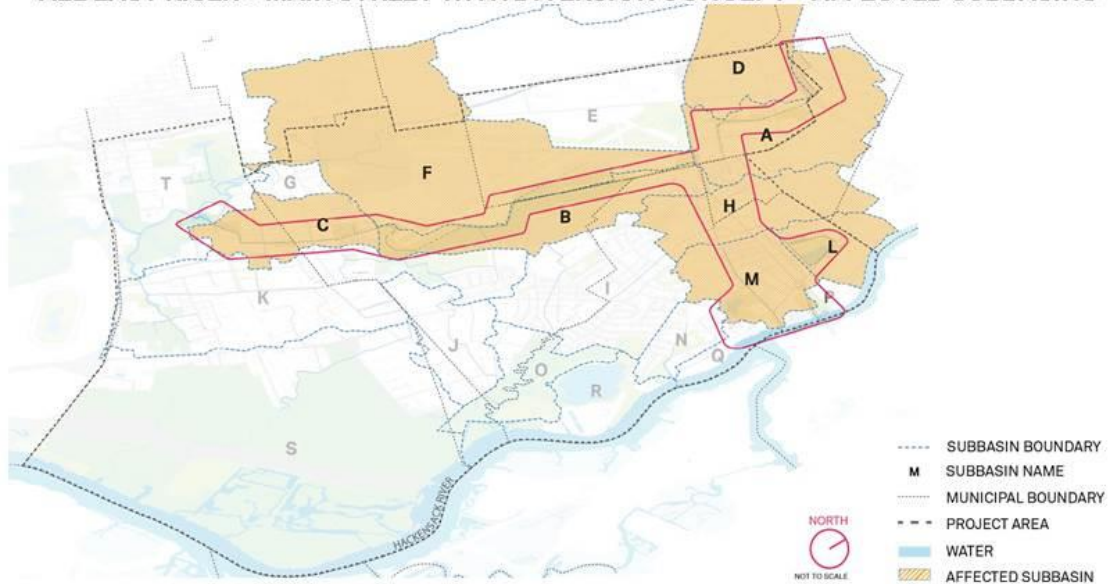
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DRAINAGE IMPROVEMENT CONCEPT 7

43

ALL EAST RISER + MAIN STREET WITH DIVERSION CONCEPT + AFFECTED SUBBASINS



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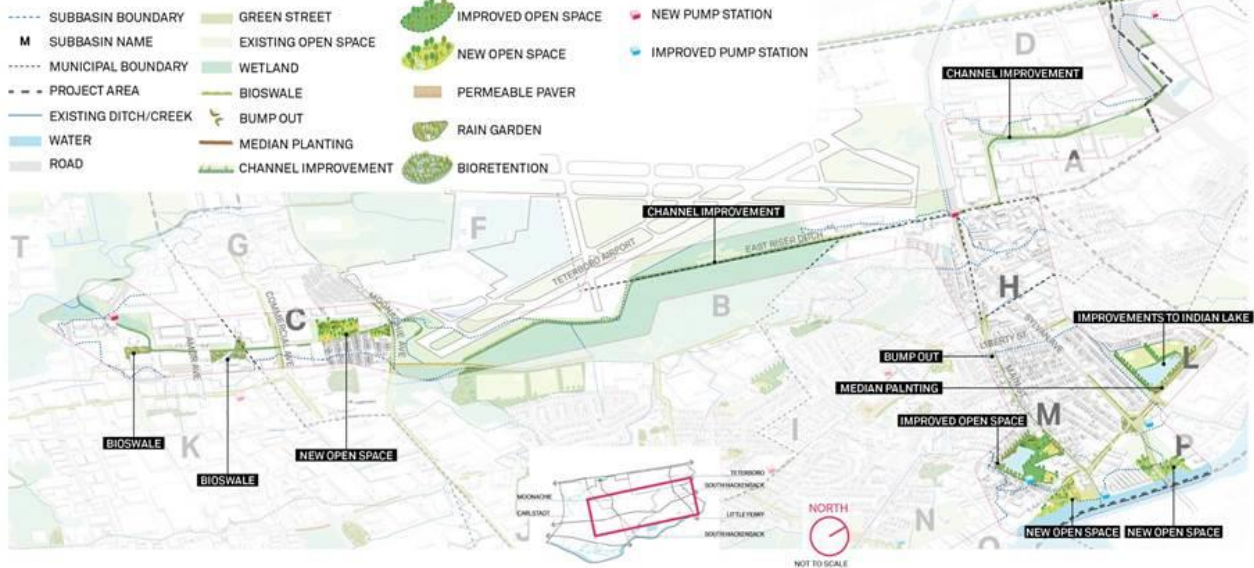
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DRAINAGE IMPROVEMENT CONCEPT 7

44

ALL EAST RISER + MAIN STREET WITH DIVERSION COLLECTION



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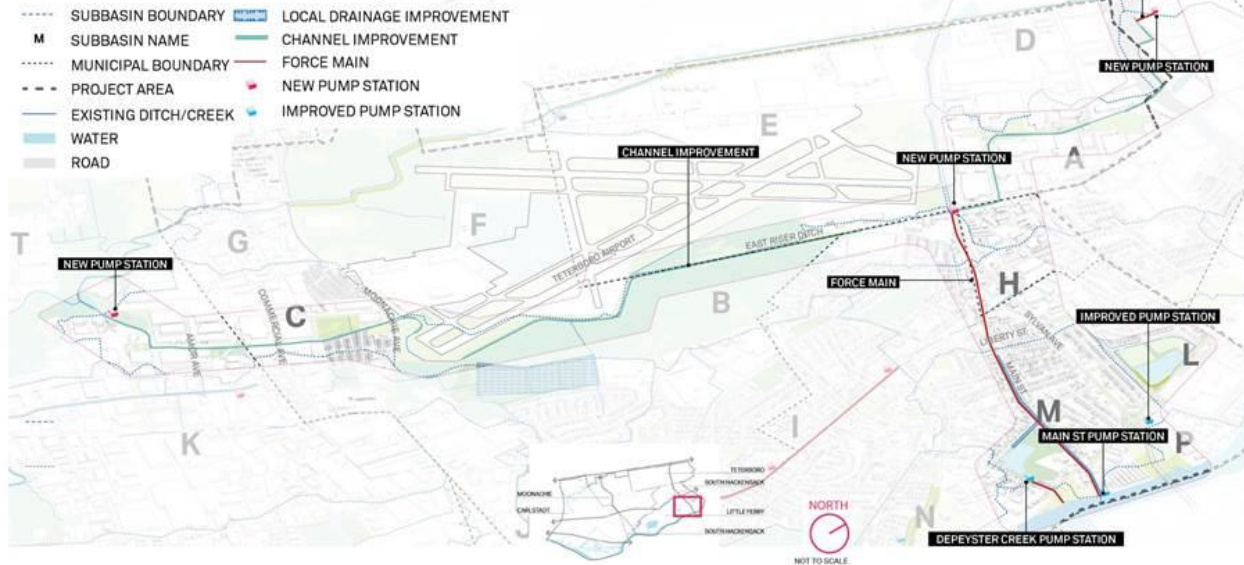
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DRAINAGE IMPROVEMENT CONCEPT 7

45

ALL EAST RISER + MAIN STREET WITH DIVERSION CONVEYANCE



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BUMP OUTS + STREET IMPROVEMENTS

46



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NEXT STEPS

CHRISTOPHER BENOSKY, AECOM



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NEXT STEPS

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NJDEP / AECOM UPCOMING ACTIVITIES

- Prepare Meeting Summary for CAG #7
- Continue developing:
 - Concepts and Alternatives
- CAG #8 in March
 - Alternative 1 – Structural Flood Reduction



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NEXT STEPS

49

CAG: CALL TO ACTION

- Submit comments from CAG #7 meeting by **February 7, 2017**
- Share information from this meeting with friends and neighbors
- Continue to build interest in the Project
- Ensure the public knows about upcoming information (to be posted on Project website)



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NEXT STEPS

50

Critical Information

March, 2017 - TBD

CAG Meeting #8: Alternative 1: Structural Flood Reduction

Project Website

www.rbd-meadowlands.nj.gov

Project Email

rbd-meadowlands@dep.nj.gov

Question & Answer



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THANK YOU!



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Attachment 2.

CAG Meeting Packet #7 (provided as handout at meeting)

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CITIZEN ADVISORY GROUP (CAG) MEETING #7

**ALTERNATIVE 2: STORMWATER DRAINAGE
IMPROVEMENTS**

January 31, 2017



PREPARED BY **AECOM**

Español 中文:繁體版 Việt-ngữ 한국어 Tagalog
Português العربية Kreyòl ગુજરાતી Italiano Polski
www.renewjerseystronger.org

Table of Contents

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1.0 List of Acronyms

List of Acronyms

BCR	Benefit/Cost Ratio
CAG	Citizen Advisory Group
CDBG-DR	Community Development Block Grant – Disaster Recovery
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
HUD	Department of Housing and Urban Development
NEPA	National Environmental Policy Act
NJDEP	New Jersey Department of Environmental Protection
RBD	Rebuild by Design
RBDM	Rebuild by Design Meadowlands

2.0 Agenda

Alternative 2: Stormwater Drainage Improvements

6-8 PM

January 31, 2017

**Learning Center Room , 4th Floor
One Bergen County Plaza
Hackensack, NJ 07601**

Project Website

www.rbd-meadowlands.nj.gov

Project email

rbd-meadowlands@dep.nj.gov

Welcome

Presentation

Opening Remarks (10 Minutes)

Welcoming (Linda Fisher, NJDEP)

Project Status Update and Alternative 2 Development (Chris Benosky, AECOM)

Alternative 2: Stormwater Drainage Improvements (10 Minutes)

Simplified Modeling Update (Chris Benosky, AECOM)

Frequently Flooded Areas (Chris Benosky, AECOM)

Stormwater Drainage Improvement Areas (40 Minutes)

Drainage Improvement concepts (Chris Benosky & Lulu Loquidis, AECOM)

Next Steps & Q&A/Closure (20 Minutes)

Next Steps (Chris Benosky, AECOM)

Question and Answers

3.0 Power Point Presentation

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CITIZEN ADVISORY GROUP (CAG) MEETING #7 STORMWATER DRAINAGE IMPROVEMENTS

WELCOMING

Linda Fisher, NJDEP



Welcome & Opening Remarks



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AGENDA

Chris Benosky, AECOM

3

- Project Status Update and Schedule
- Alternative 2: Stormwater Drainage Improvements
 - Alternative 2 Development
 - Modeling Update
 - Frequently Flooded Areas
 - Stormwater Drainage Improvement Options
 - Collection and Conveyance



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PROJECT STATUS UPDATE

Chris Benosky, AECOM

4

- Developed working draft Concept Screening Criteria
- Completed and published to Project Website:
 - Meeting Minutes from CAG Meeting #6
 - December 2016 Newsletter
- Developing Stormwater Drainage Options



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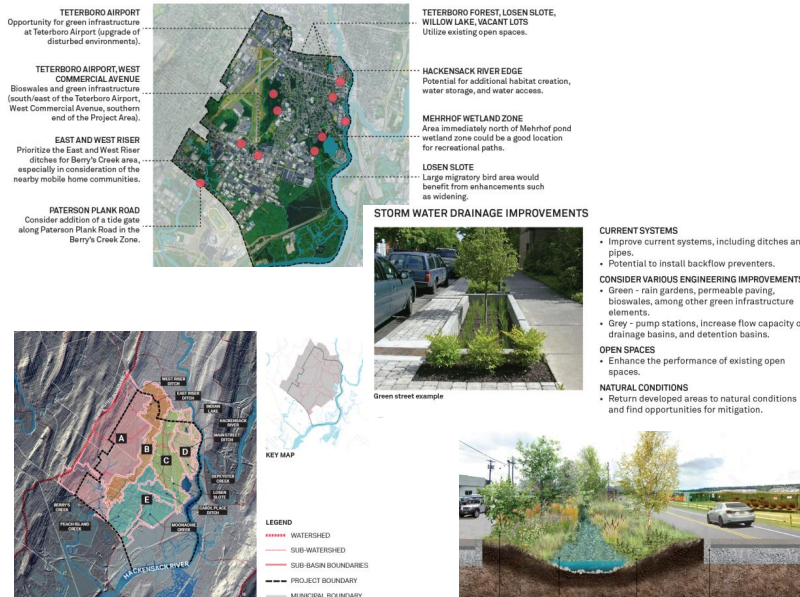
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ALTERNATIVE 2

PREVIOUS CAG INPUT AND DISCUSSION

Chris Benosky, AECOM

5



- CAG Meeting #2A/B**
Areas Prone to Flooding within the Project Area
- CAG Meeting #3**
Concept Screening Criteria Review
- CAG Meeting #4**
Concept Development and Ranking for Alternative 2
- CAG Meeting #5**
Review of Drainage Basin Opportunity Areas



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ALTERNATIVE 2: PROCESS

DEVELOPMENT OF ALTERNATIVE 2 CONCEPTS

Chris Benosky, AECOM

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- Concept development process utilized the following to arrive at the 7 concepts:



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ALTERNATIVE 2:

STORMWATER DRAINAGE IMPROVEMENTS

CHRISTOPHER BENOSKY, AECOM



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MODELING UPDATE

SIMPLIFIED MODEL PROGRESS

8

Conducting modeling to better understand how each of the initial Alternative 2 concepts will function:

- a. Quantity of stormwater
- b. Movement of stormwater
- c. Control of stormwater



Currently, continuing to conduct stormwater system surveys to support more detailed drainage models of each of the concepts



Future use of modeling results:

- a. Assess each concept's hydraulic feasibility (to control and move stormwater volumes)
- b. Preliminarily determine the benefits each concept would provide relative to cost



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MODELING UPDATE SIMPLIFIED MODEL PROGRESS

9

- Completed development and application of simplified models for:
 - East and West Riser
 - Main Street
 - Carol Place
 - East Carlstadt
 - Losen Slote
 - DePeyster Creek
 - Peach Island Creek



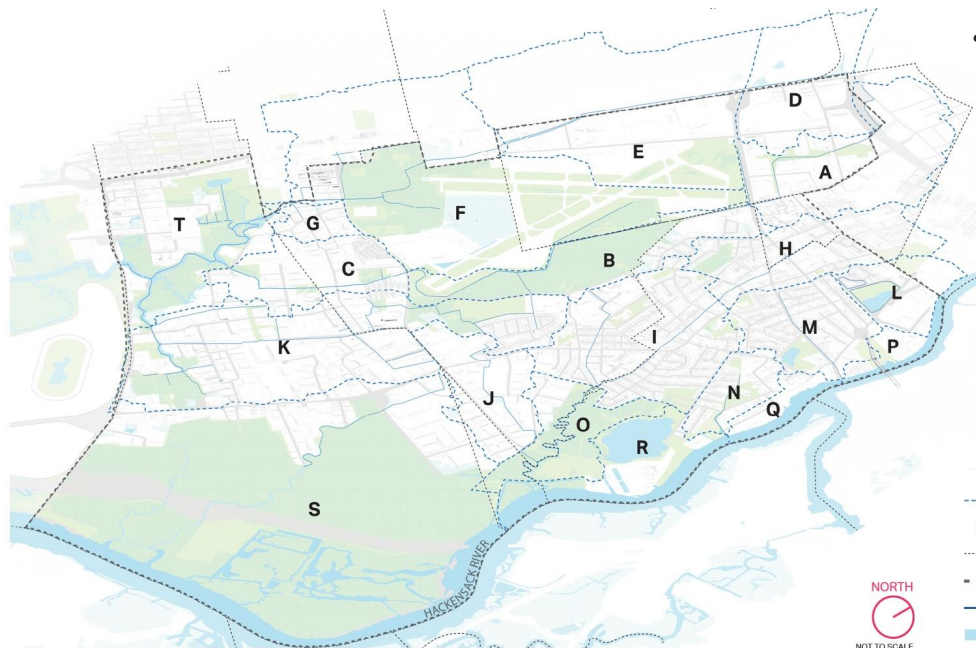
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STORMWATER SUBBASINS

10



- THERE ARE 20 SUBBASIN AREAS WITHIN THE PROJECT AREA

A: UPPER EAST RISER
B: MIDDLE EAST RISER
C: LOWER EAST RISER
D: UPPER WEST RISER 1
E: UPPER WEST RISER 2
F: MIDDLE WEST RISER
G: LOWER WEST RISER
H: UPPER LOSEN SLOTE 1
I: UPPER LOSEN SLOTE 2
J: MOONACHIE
K: CARLSTADT
L: INDIAN LAKE
M: MAIN STREET
N: DEPEYSTER CREEK
O: LOWER LOSEN SLOTE
P: UPPER HACKENSACK
Q: MIDDLE HACKENSACK 1
R: MIDDLE HACKENSACK 2
S: LOWER HACKENSACK
T: BERRY'S CREEK

--- SUBBASIN BOUNDARY
M SUBBASIN NAME
--- MUNICIPAL BOUNDARY
--- PROJECT AREA
--- EXISTING DITCH
--- WATER



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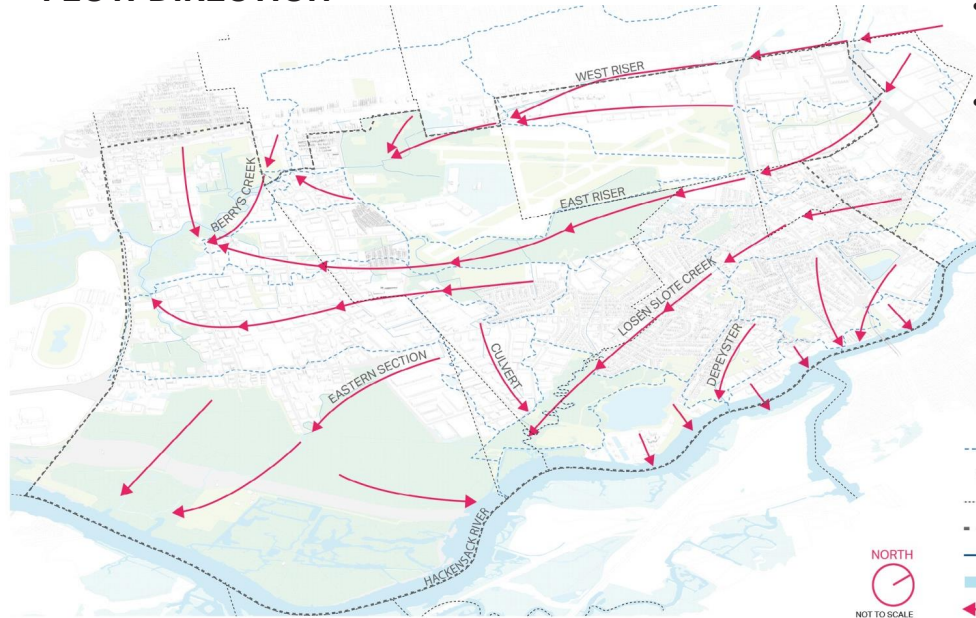
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STORMWATER SUBBASINS

FLOW DIRECTION

11



- SUBBASINS BOUNDARIES IDENTIFY HOW WATER IS FLOWING ON SITE TOWARDS A COMMON POINT
- THE HYDROLOGIC MODELING IS BASED ON THESE SUBBASIN AREAS

- SUBBASIN BOUNDARY
- M SUBBASIN NAME
- MUNICIPAL BOUNDARY
- - - PROJECT AREA
- EXISTING DITCH/CREEK
- WATER
- PRIMARY CONVEYANCE DIRECTION



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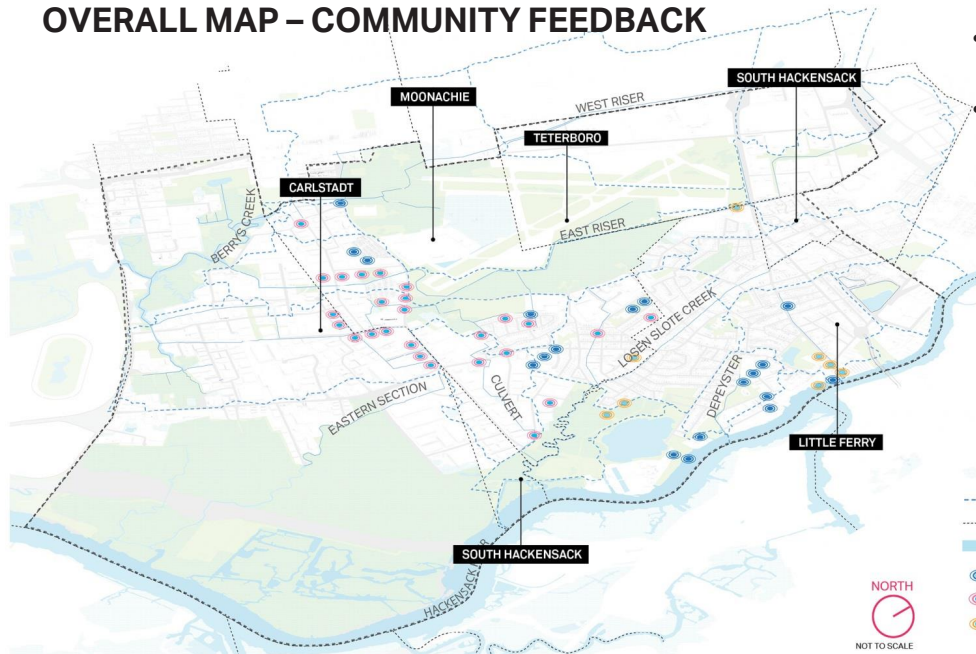
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FREQUENTLY FLOODED AREAS

OVERALL MAP – COMMUNITY FEEDBACK

12



- INTEGRATING COMMUNITY FEEDBACK INTO MODELING
- FOCUSING OUR ATTENTION ON FREQUENTLY FLOODED AREAS DURING THE DEVELOPMENT OF STORMWATER DRAINAGE IMPROVEMENT CONCEPTS

- SUBBASIN BOUNDARY
- MUNICIPAL BOUNDARY
- WATER
- FLOODS IN REGULAR RAINFALL
- FLOODS IN HEAVY RAINFALL
- FLOODS IN MAJOR STORM EVENT



*DATA COLLECTED FROM CAG #2



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FREQUENTLY FLOODED AREAS

13

LITTLE FERRY

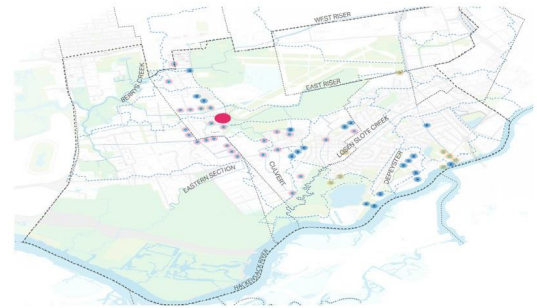


Image Source: Hackensack Meadowlands Floodplain Management Plan (Oct 24, 2005)

BRANDT STREET

Flood Event Date:
OCTOBER 14, 2005

Estimated Flood Elevation:
4.5 NAVD88



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FREQUENTLY FLOODED AREAS

14

MOONACHIE

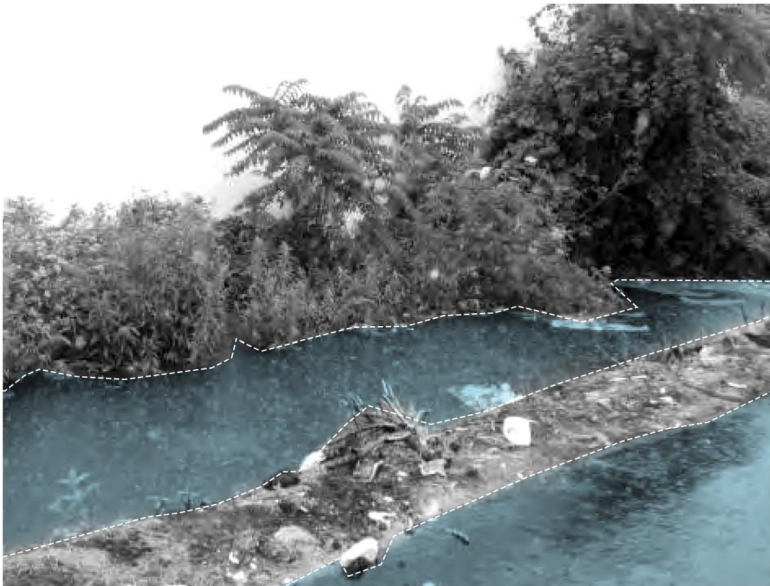
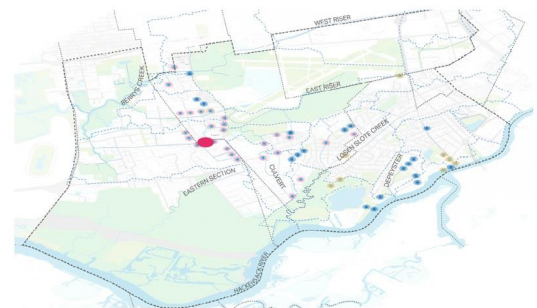


Image Source: Hackensack Meadowlands Floodplain Management Plan (Oct 24, 2005)

110 ASIA PLACE

Flood Event Date:
JUNE 10, 2005

Estimated Flood Elevation:
3.75 NAVD88



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FREQUENTLY FLOODED AREAS

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MOONACHIE

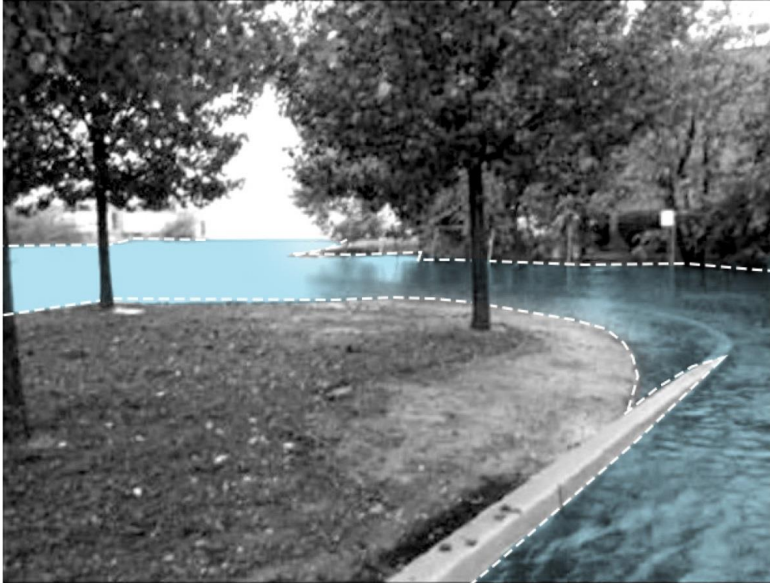
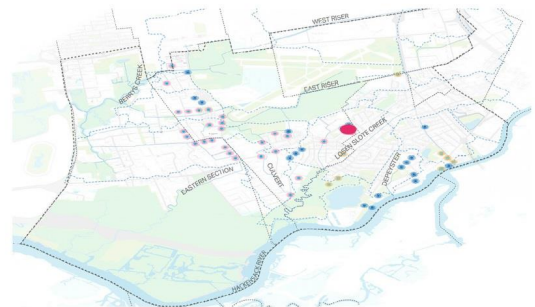


Image Source: Hackensack Meadowlands Floodplain Management Plan (Oct 24, 2005)

1 CAROL PLACE

Flood Event Date:
OCTOBER 12, 2005

Estimated Flood Elevation:
4.8 NAVD88



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FREQUENTLY FLOODED AREAS

16

CARLSTADT

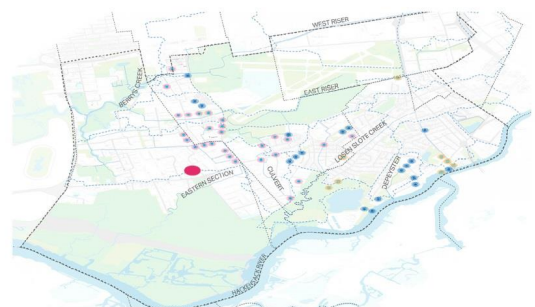


Image Source: Hackensack Meadowlands Floodplain Management Plan (Oct 24, 2005)

140 KERO ROAD

Flood Event Date:
JULY 8, 2005

Estimated Flood Elevation:
4.5 NAVD88



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PRELIMINARY

STORMWATER DRAINAGE IMPROVEMENT AREAS

CHRISTOPHER BENOSKY, AECOM

&

LULU LOQUIDIS, AECOM



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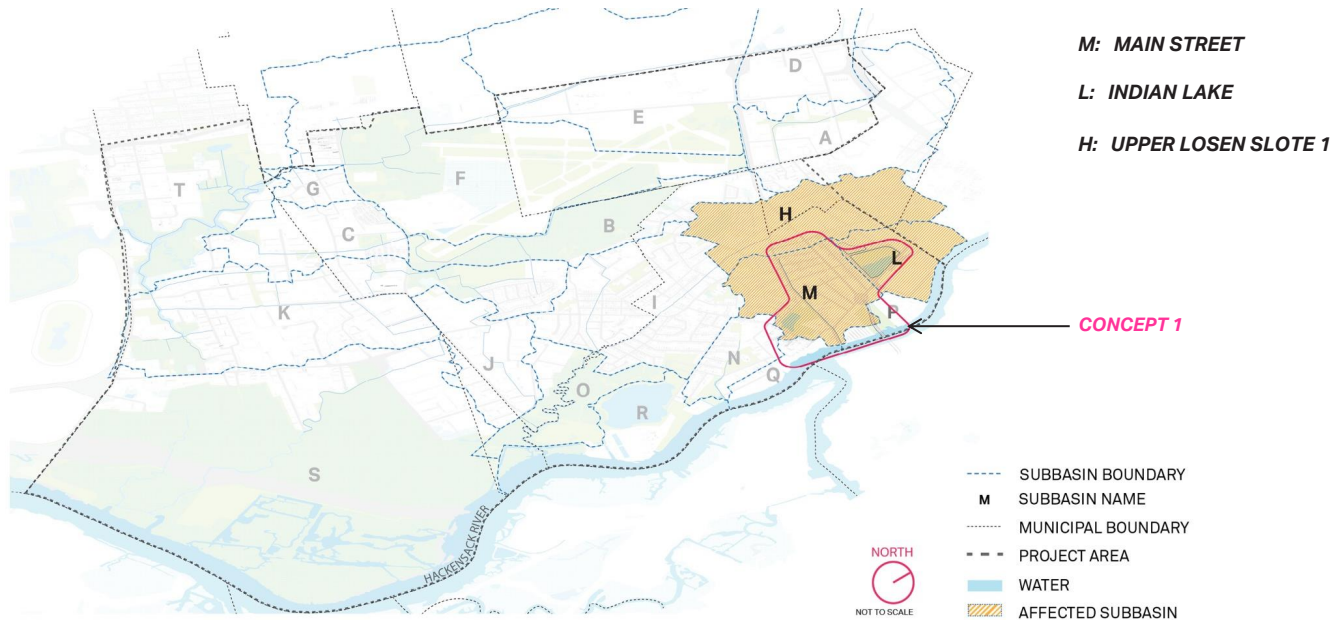
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DRAINAGE IMPROVEMENT CONCEPT 1

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MAIN STREET CONCEPT + AFFECTED SUBBASINS



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DRAINAGE IMPROVEMENT CONCEPT 1

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MAIN STREET COLLECTION



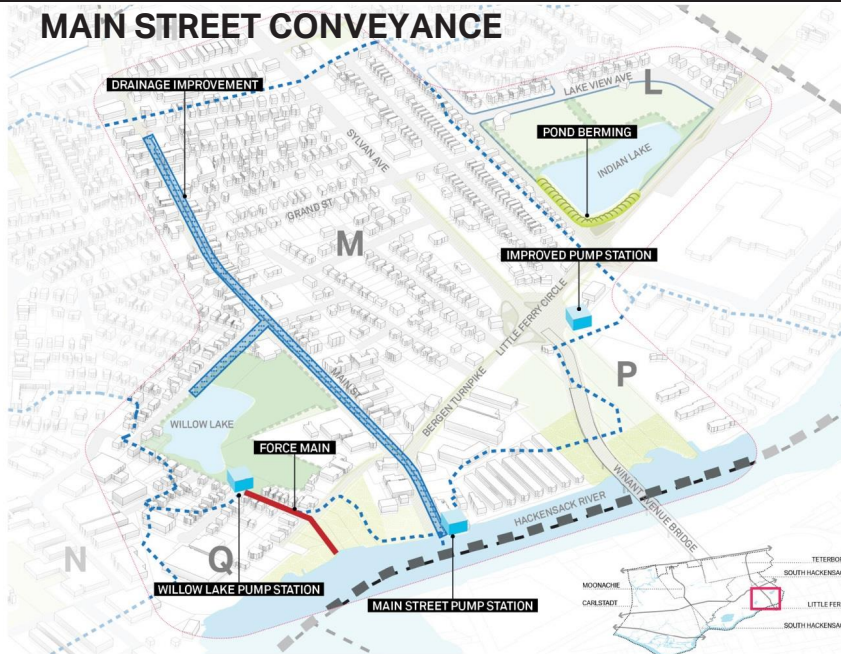
- **CONNECTING FEATURES ALONG MAIN STREET, BERGEN TURNPIKE, SYLVAN AVE, WILLOW LAKE PARK, INDIAN LAKE, AND NEW OPEN SPACE FEATURES ON THE HACKENSACK RIVER**
- **IMPROVEMENTS INCLUDE BIOSWALES, RAIN GARDENS, BUMP OUTS, MEDIAN PLANTING, NEW OPEN SPACE, AND OPEN SPACE IMPROVEMENTS**



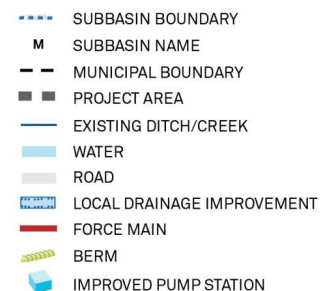
DRAINAGE IMPROVEMENT CONCEPT 1

20

MAIN STREET CONVEYANCE



- **IMPROVED PUMP STATIONS AT LITTLE FERRY CIRCLE, MAIN STREET, AND WILLOW LAKE. BERM TO INCREASE STORAGE CAPACITY AT INDIAN LAKE**
- **IMPROVE CONVEYANCE BY INCREASING CULVERT SIZES ALONG MAIN STREET**



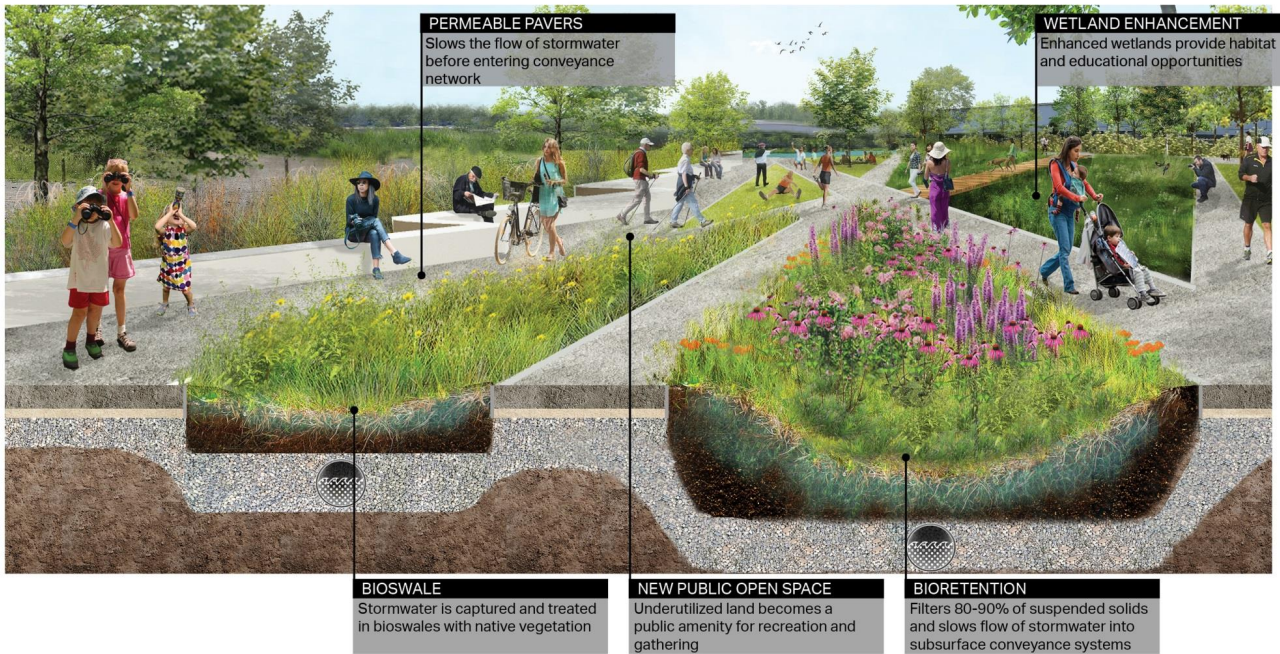
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NEW OPEN SPACE

21



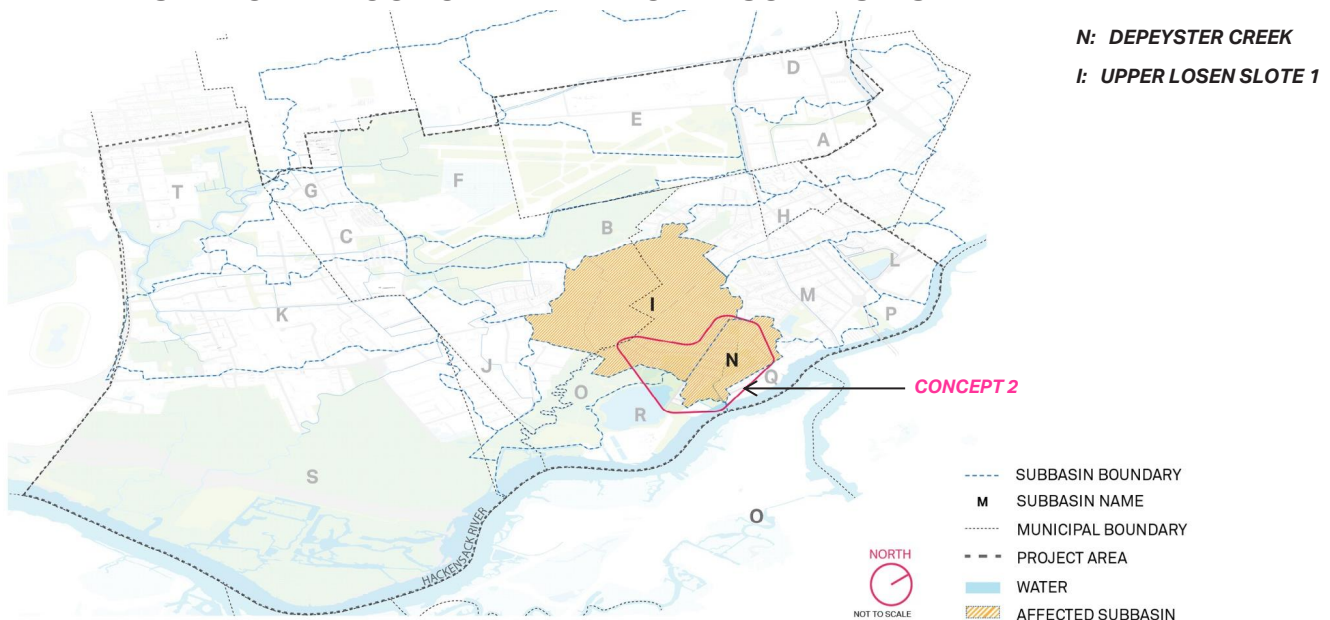
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DRAINAGE IMPROVEMENT CONCEPT 2 DEPEYSTER CREEK CONCEPT + AFFECTED SUBBASINS

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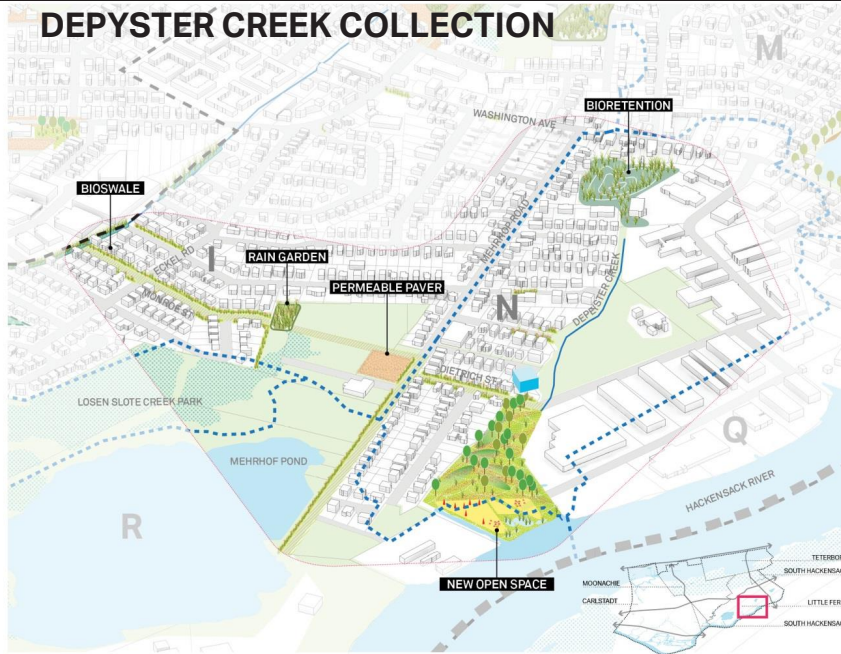
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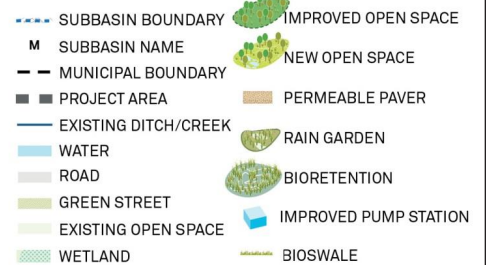
DRAINAGE IMPROVEMENT CONCEPT 2

23

DEPYSTER CREEK COLLECTION



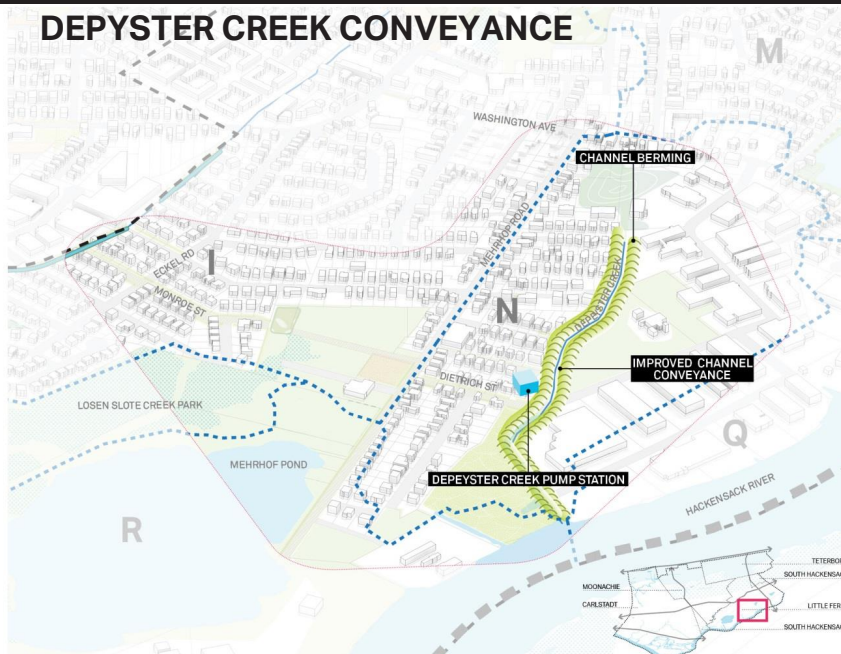
- **CONNECTING FEATURES ALONG DEPYSTER CREEK, MEHRHOF RD, MONROE ST, AND THE HACKENSACK RIVER**
- **IMPROVEMENTS INCLUDE NEW OPEN SPACE, OPEN SPACE IMPROVEMENTS, RECREATION, BIOSWALES, PERMEABLE PAVING, BIORETENTION, AND RAIN GARDENS**



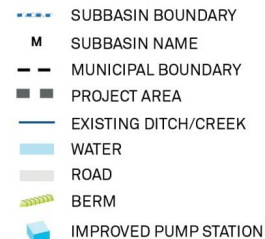
DRAINAGE IMPROVEMENT CONCEPT 2

24

DEPYSTER CREEK CONVEYANCE



- **INCREASE CHANNEL CONVEYANCE AND IMPROVE PUMP STATION AT DEPYSTER CREEK**
- **CHANNEL BERMING TO INCREASE CAPACITY AT DEPYSTER CREEK**



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IMPROVED PUMP STATION + NEW OPEN SPACE

25



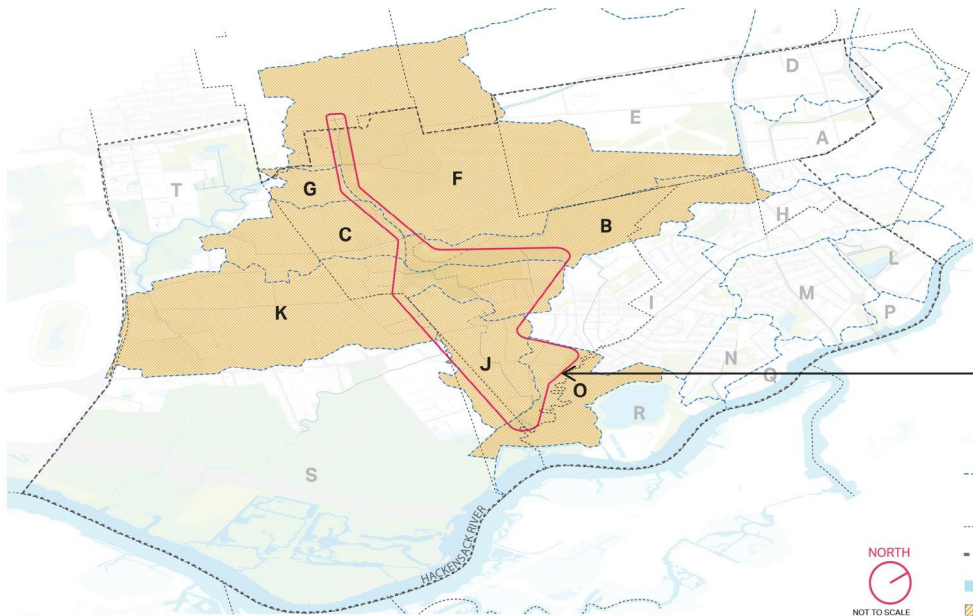
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DRAINAGE IMPROVEMENT CONCEPT 3 MOONACHIE CONCEPT + AFFECTED SUBBASINS

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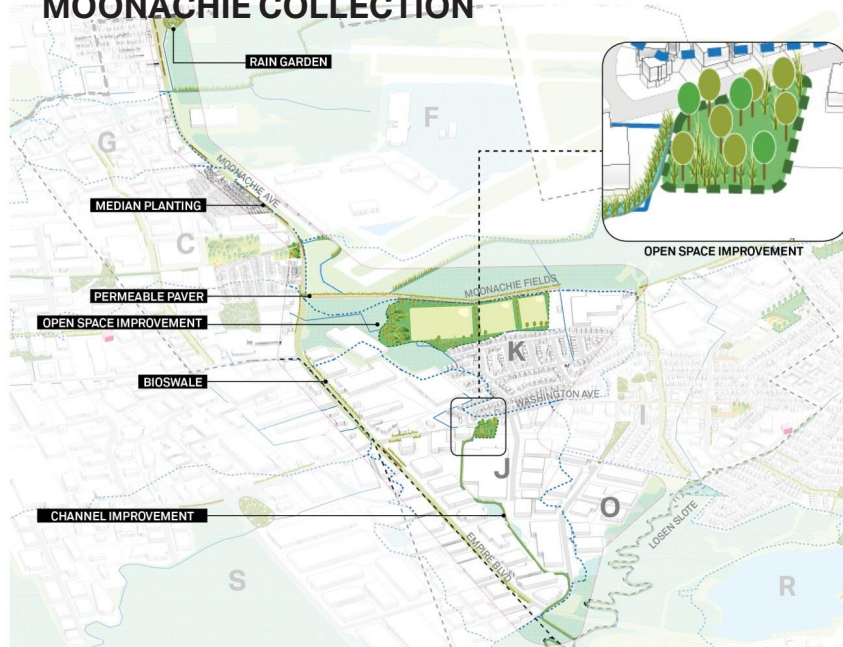
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DRAINAGE IMPROVEMENT CONCEPT 3

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MOONACHIE COLLECTION



- CONNECTING FEATURES ALONG EMPIRE BLVD, AND MOONACHIE ROAD
- IMPROVEMENTS INCLUDE BIOSWALES, MEDIAN PLANTING, NEW OPEN SPACE, AND RECREATION



- SUBBASIN BOUNDARY
- M SUBBASIN NAME
- MUNICIPAL BOUNDARY
- - - PROJECT AREA
- EXISTING DITCH/CREEK
- WATER
- ROAD
- GREEN STREET
- EXISTING OPEN SPACE
- WETLAND
- IMPROVED OPEN SPACE
- PERMEABLE PAVEMENT
- RAIN GARDEN
- CHANNEL IMPROVEMENT
- MEDIAN PLANTING
- BIOSWALE



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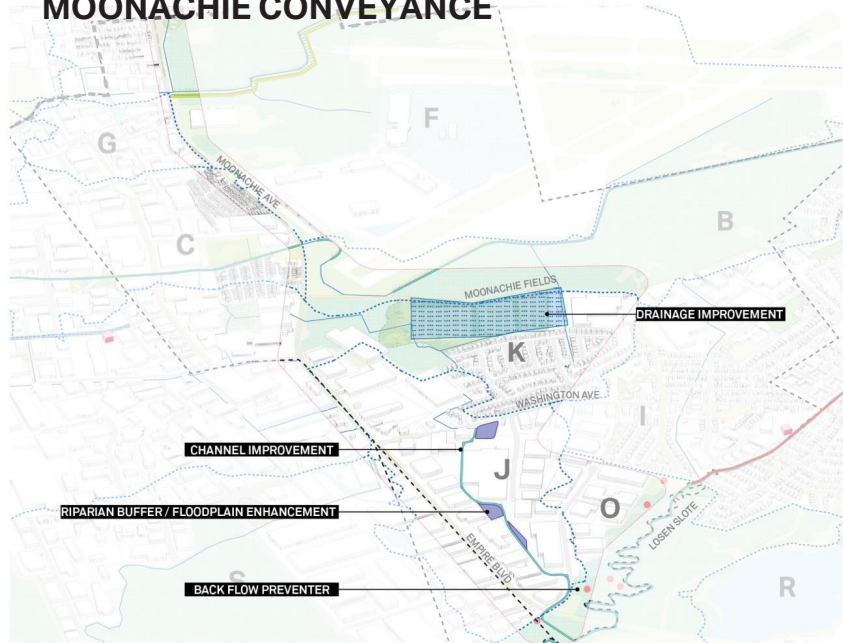
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DRAINAGE IMPROVEMENT CONCEPT 3

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MOONACHIE CONVEYANCE



- OFF CHANNEL STORAGE, INCREASED CONVEYANCE, AND LOCAL DRAINAGE IMPROVEMENTS
- BACK FLOW PROTECTION FOR OUTFALLS TO LOSEN SLOTE



- SUBBASIN BOUNDARY
- M SUBBASIN NAME
- MUNICIPAL BOUNDARY
- - - PROJECT AREA
- EXISTING DITCH/CREEK
- WATER
- ROAD
- LOCAL DRAINAGE IMPROVEMENT
- RIPARIAN BUFFER / FLOODPLAIN ENHANCEMENT
- CHANNEL IMPROVEMENT
- BACK FLOW PREVENTER



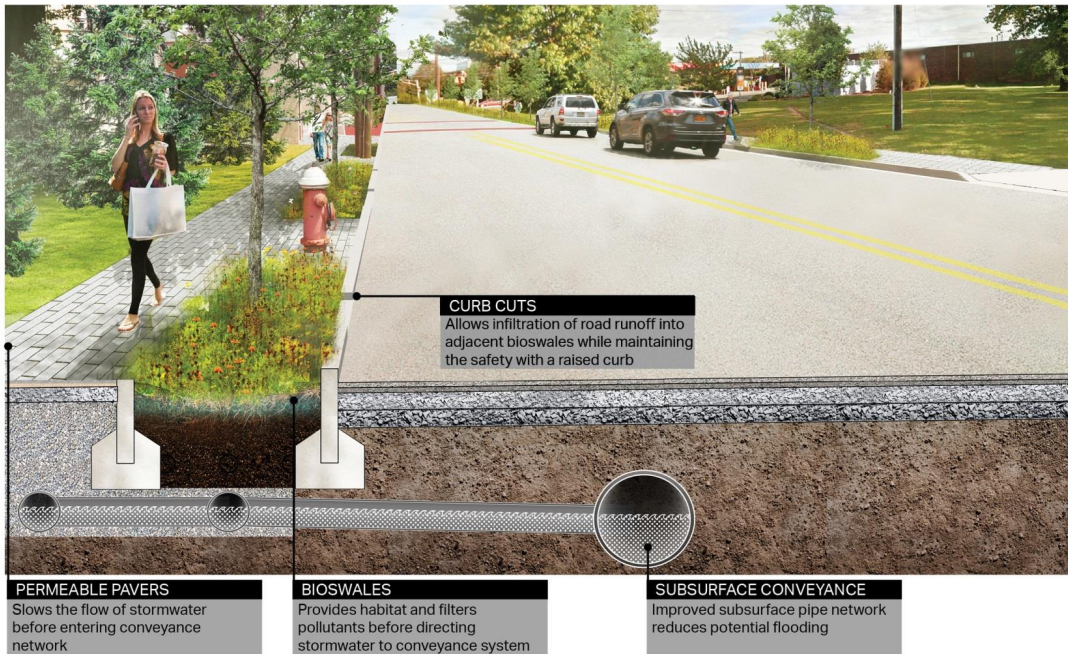
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BIOSWALES + STREET IMPROVEMENTS



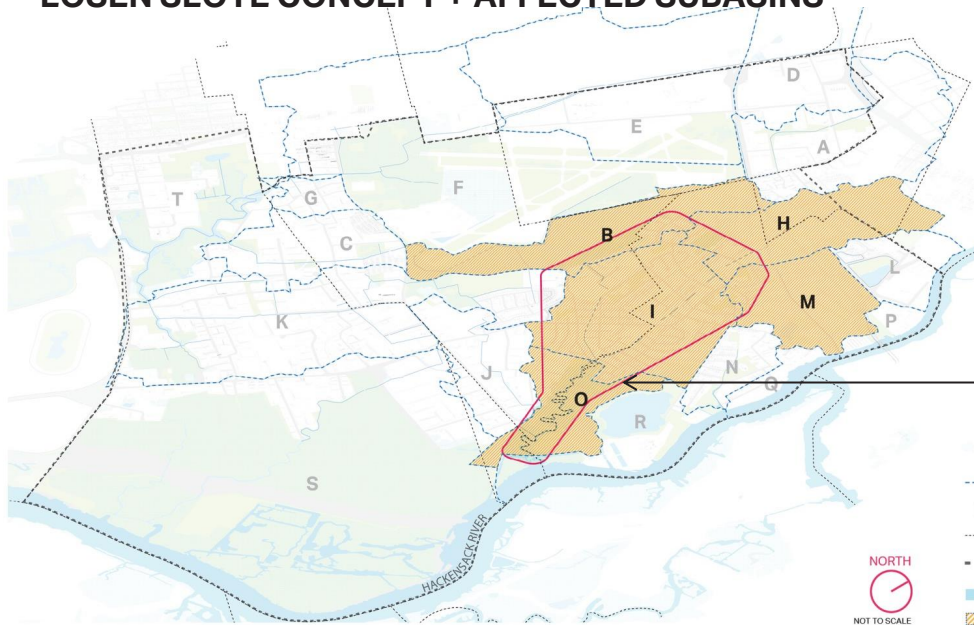
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DRAINAGE IMPROVEMENT CONCEPT 4 LOSEN SLOTE CONCEPT + AFFECTED SUBBASINS



O: LOWER LOSEN SLOTE
I: UPPER LOSEN SLOTE 2
M: MAIN STREET
H: UPPER LOSEN SLOTE 1
B: MIDDLE EAST RISER

CONCEPT 4

--- SUBBASIN BOUNDARY
M SUBBASIN NAME
--- MUNICIPAL BOUNDARY
--- PROJECT AREA
--- WATER
--- AFFECTED SUBBASIN



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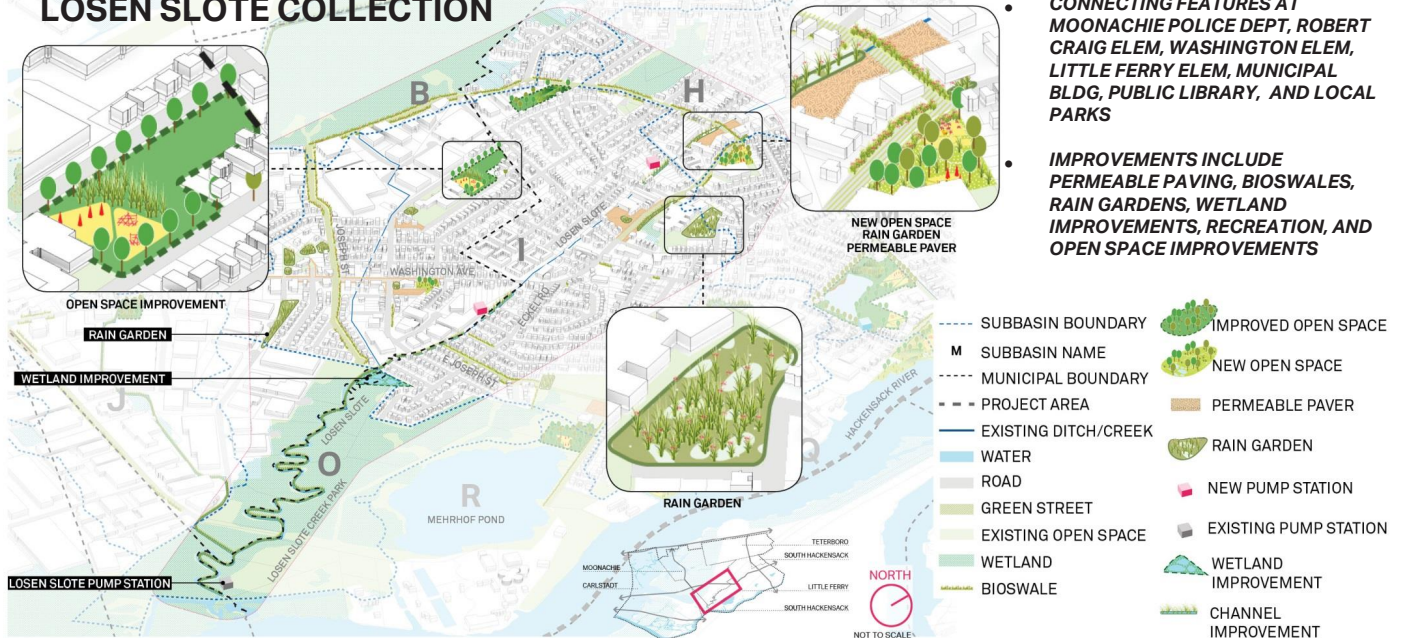
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DRAINAGE IMPROVEMENT CONCEPT 4

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LOSEN SLOTE COLLECTION



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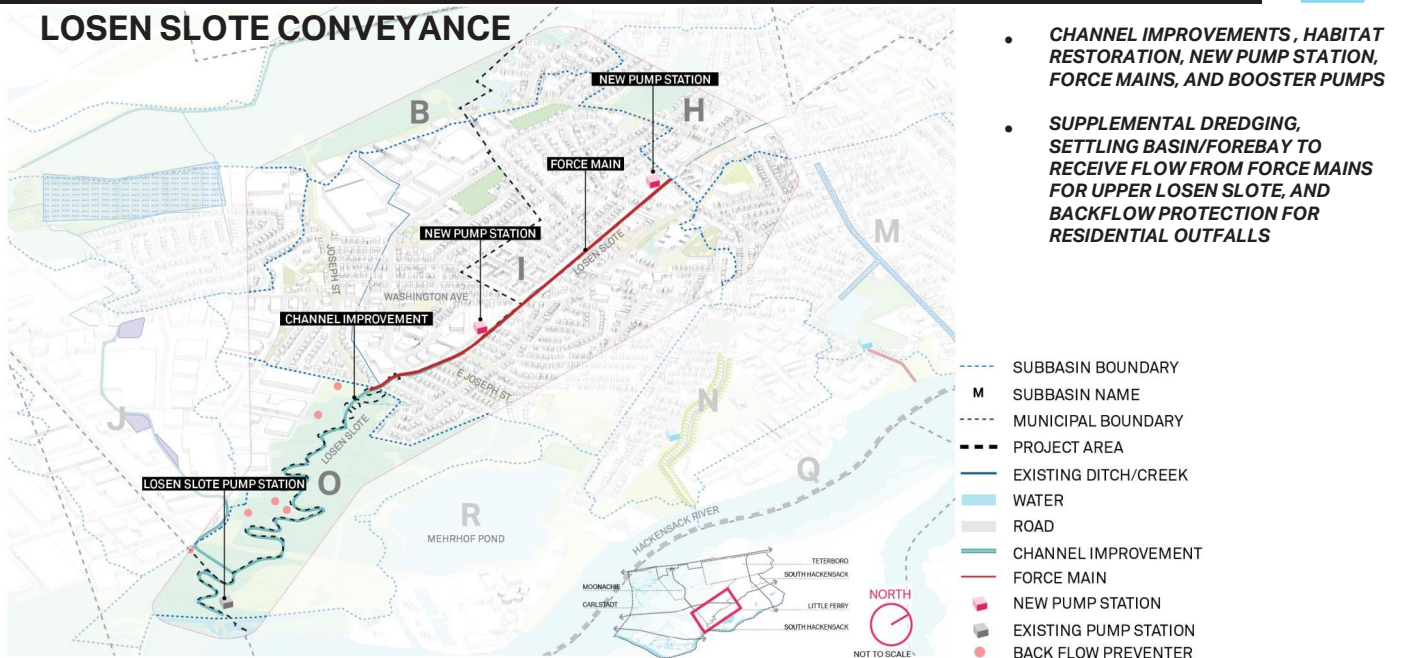
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DRAINAGE IMPROVEMENT CONCEPT 4

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LOSEN SLOTE CONVEYANCE



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IMPROVEMENTS TO CIVIC AMENITY PROPERTY

33



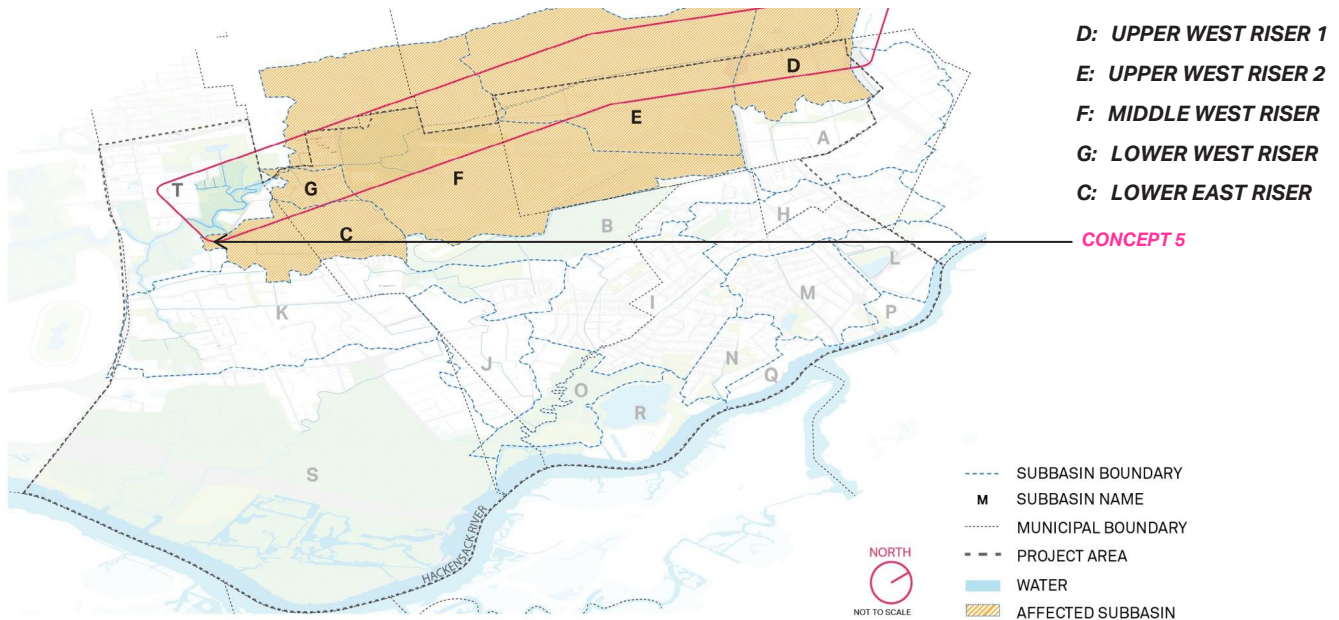
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DRAINAGE IMPROVEMENT CONCEPT 5 ALL WEST RISER CONCEPT + AFFECTED SUBBASINS

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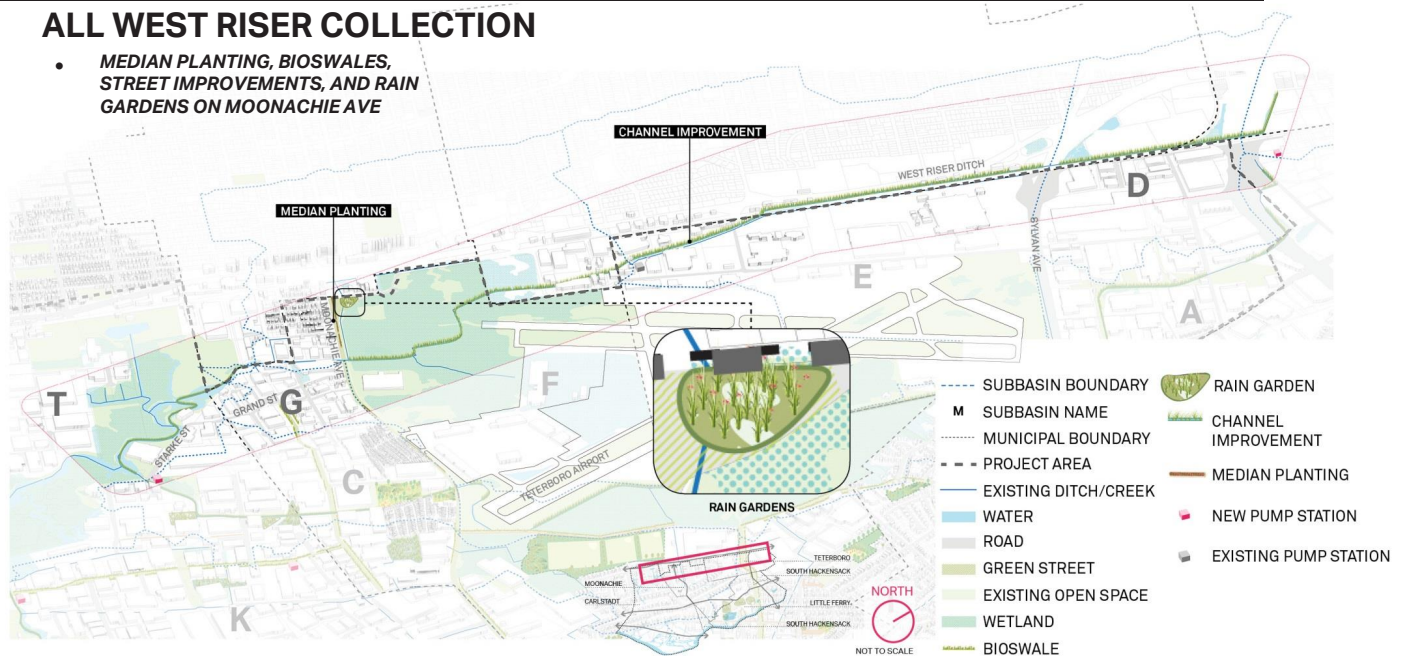
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DRAINAGE IMPROVEMENT CONCEPT 5

35

ALL WEST RISER COLLECTION

- MEDIAN PLANTING, BIOSWALES, STREET IMPROVEMENTS, AND RAIN GARDENS ON MOONACHIE AVE



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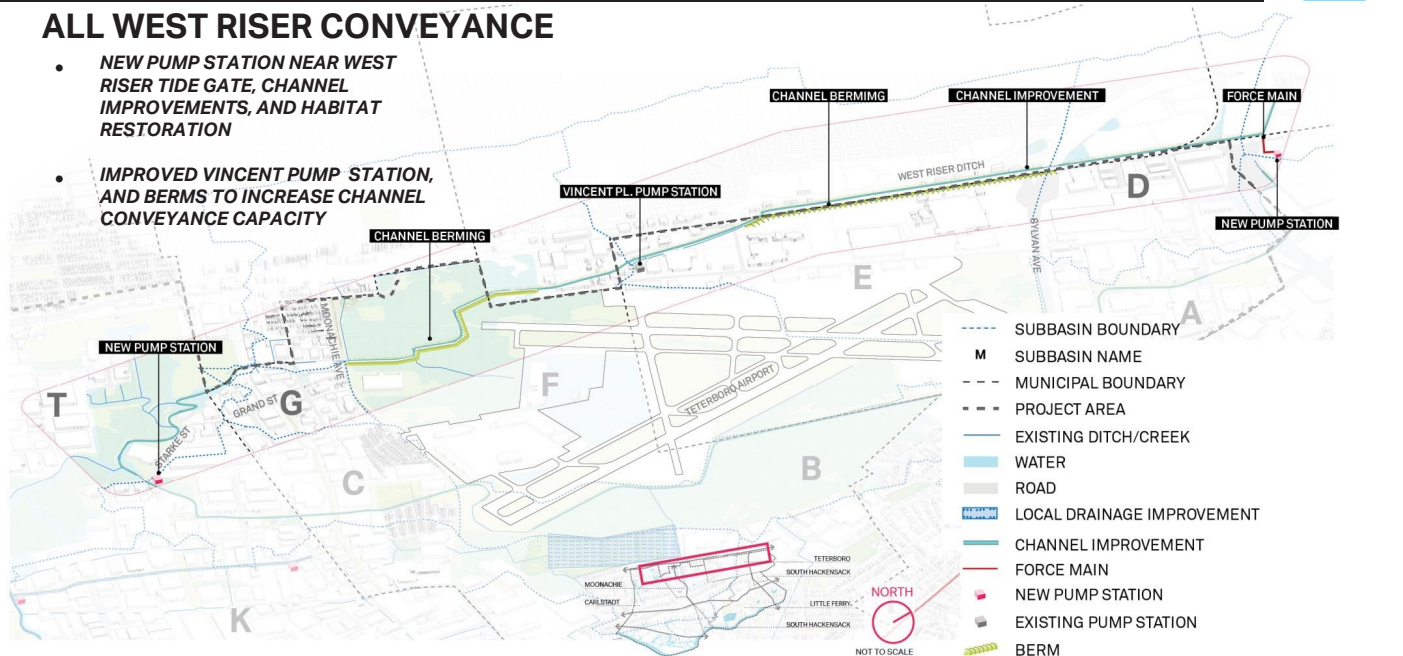
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DRAINAGE IMPROVEMENT CONCEPT 5

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ALL WEST RISER CONVEYANCE

- NEW PUMP STATION NEAR WEST RISER TIDE GATE, CHANNEL IMPROVEMENTS, AND HABITAT RESTORATION
- IMPROVED VINCENT PUMP STATION, AND BERMS TO INCREASE CHANNEL CONVEYANCE CAPACITY



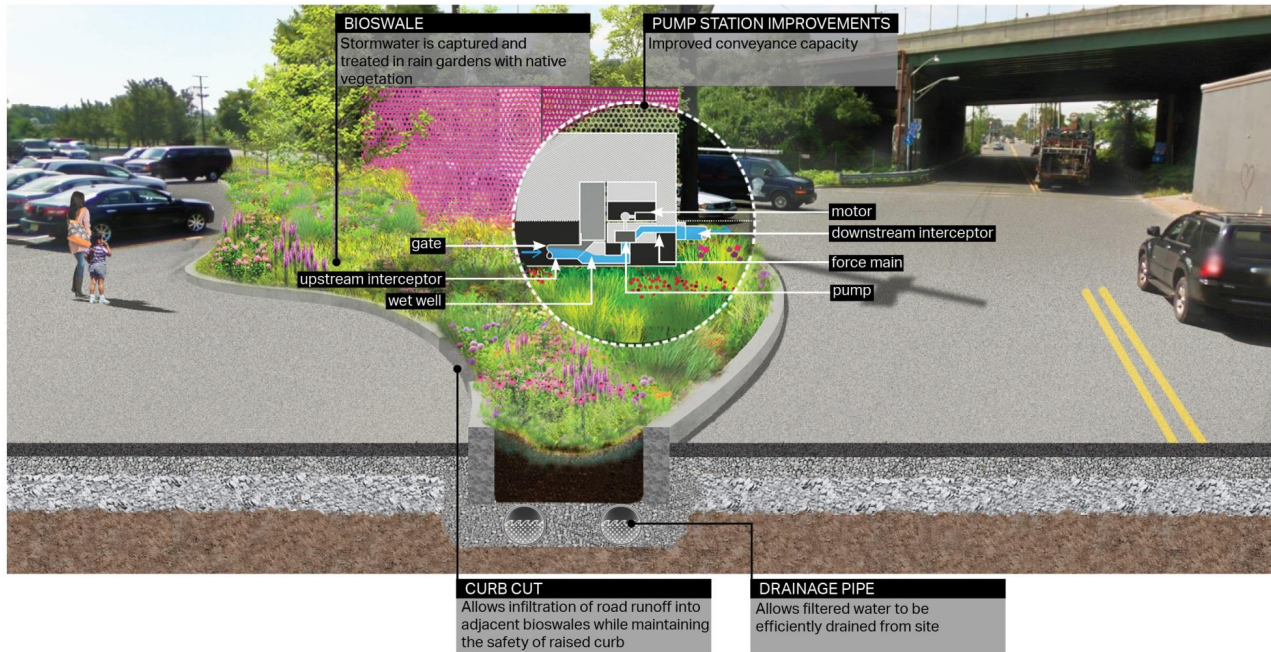
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NEW PUMP STATION

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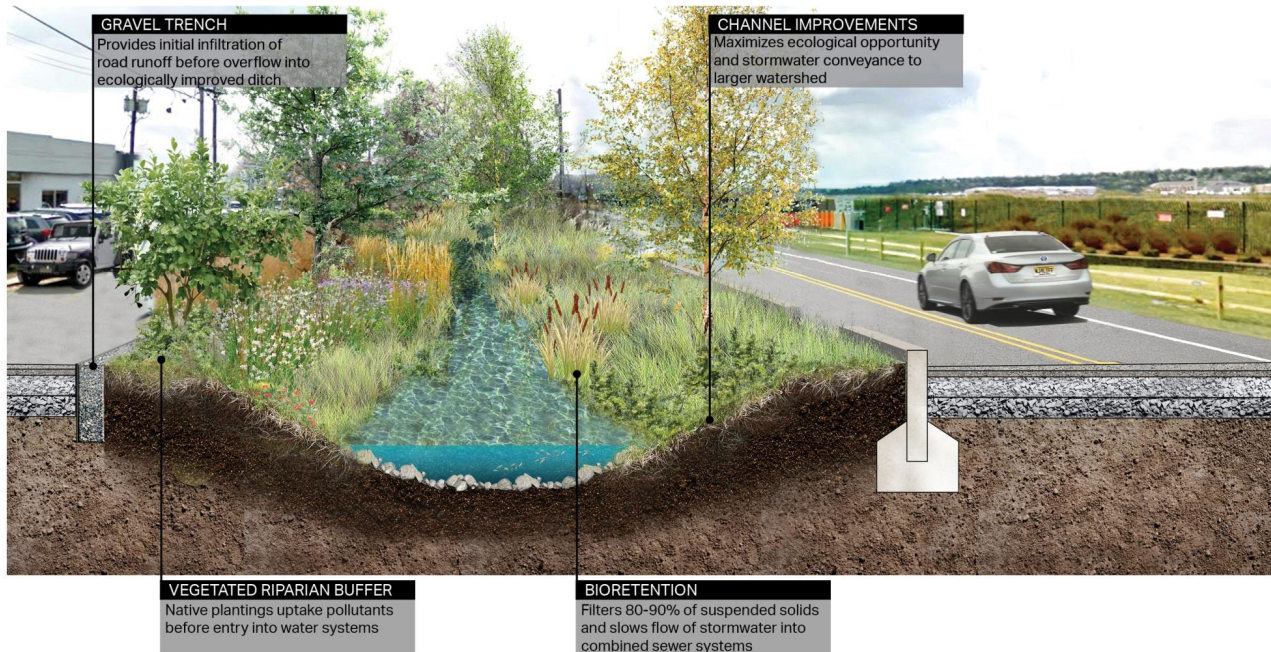
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CHANNEL + HABITAT IMPROVEMENTS

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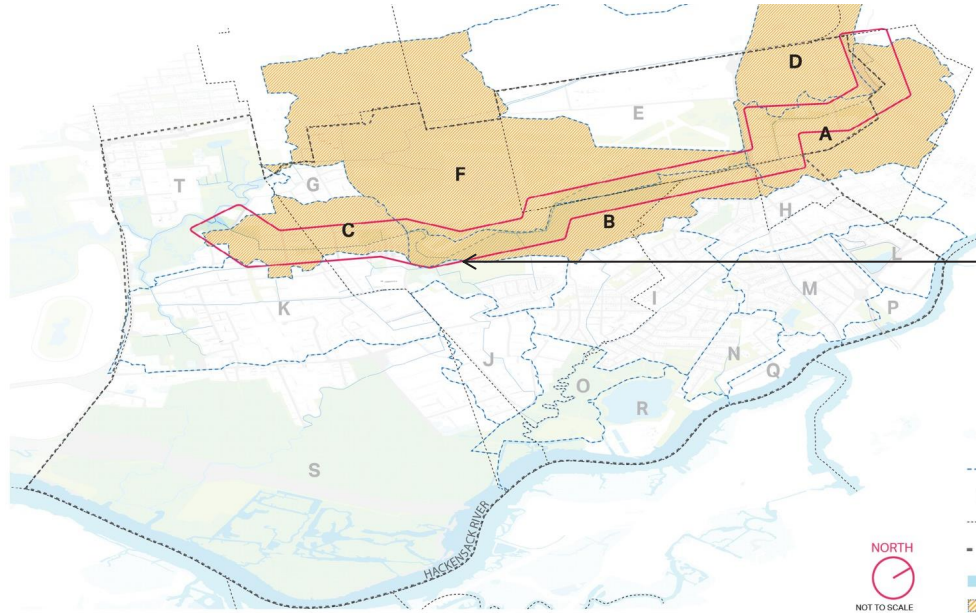
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DRAINAGE IMPROVEMENT CONCEPT 6

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ALL EAST RISER CONCEPT + AFFECTED SUBBASINS



A: UPPER EAST RISER
D: UPPER WEST RISER 1
E: UPPER WEST RISER 2
F: MIDDLE WEST RISER
B: MIDDLE EAST RISER
C: LOWER EAST RISER

CONCEPT 6

- SUBBASIN BOUNDARY
- M** SUBBASIN NAME
- MUNICIPAL BOUNDARY
- - - PROJECT AREA
- WATER
- AFFECTED SUBBASIN



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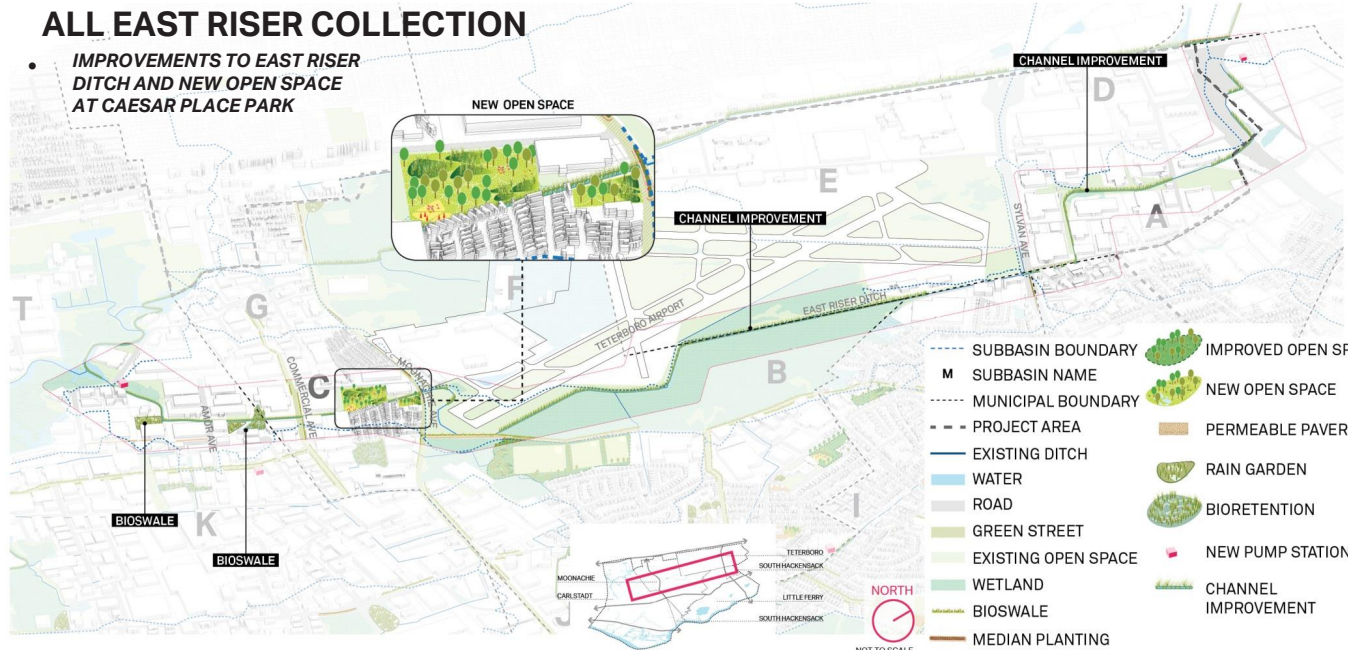
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DRAINAGE IMPROVEMENT CONCEPT 6

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ALL EAST RISER COLLECTION

- IMPROVEMENTS TO EAST RISER DITCH AND NEW OPEN SPACE AT CAESAR PLACE PARK



- SUBBASIN BOUNDARY
- M** SUBBASIN NAME
- MUNICIPAL BOUNDARY
- - - PROJECT AREA
- EXISTING DITCH
- WATER
- ROAD
- GREEN STREET
- EXISTING OPEN SPACE
- WETLAND
- BIOSWALE
- MEDIAN PLANTING
- IMPROVED OPEN SPACE
- NEW OPEN SPACE
- PERMEABLE PAVER
- RAIN GARDEN
- BIORETENTION
- NEW PUMP STATION
- CHANNEL IMPROVEMENT



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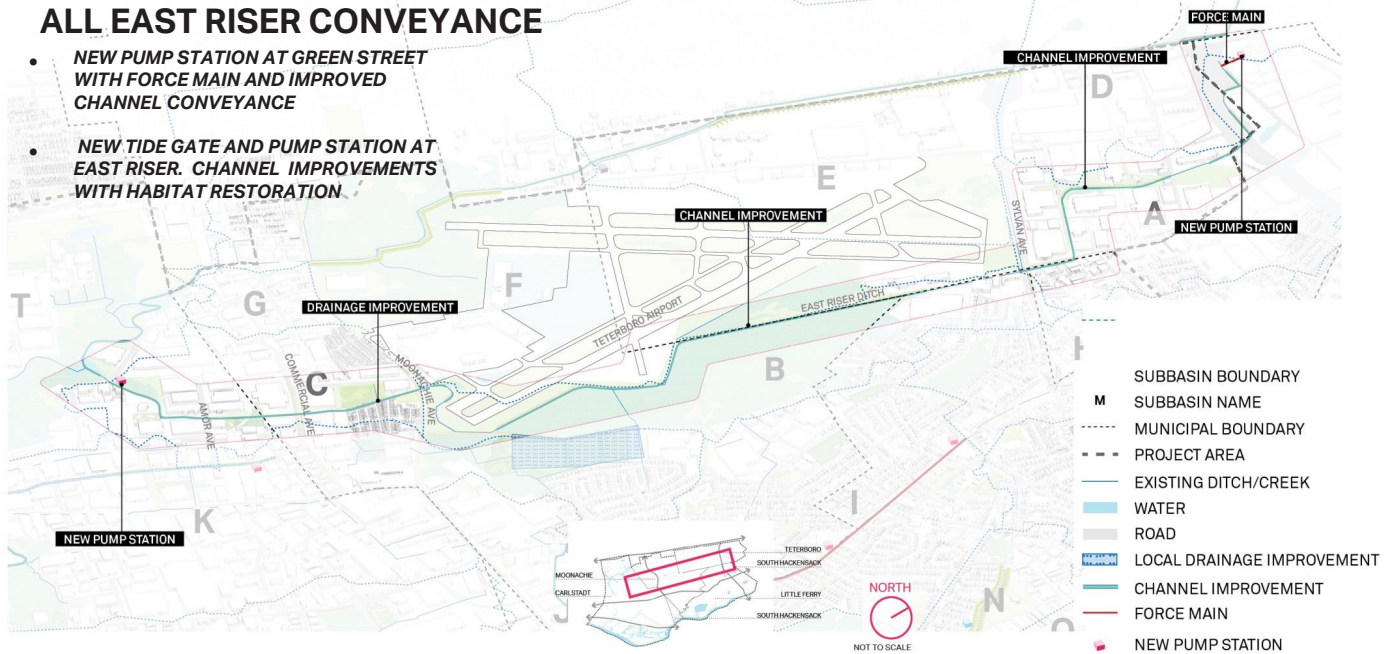
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DRAINAGE IMPROVEMENT CONCEPT 6

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ALL EAST RISER CONVEYANCE

- NEW PUMP STATION AT GREEN STREET WITH FORCE MAIN AND IMPROVED CHANNEL CONVEYANCE
- NEW TIDE GATE AND PUMP STATION AT EAST RISER. CHANNEL IMPROVEMENTS WITH HABITAT RESTORATION



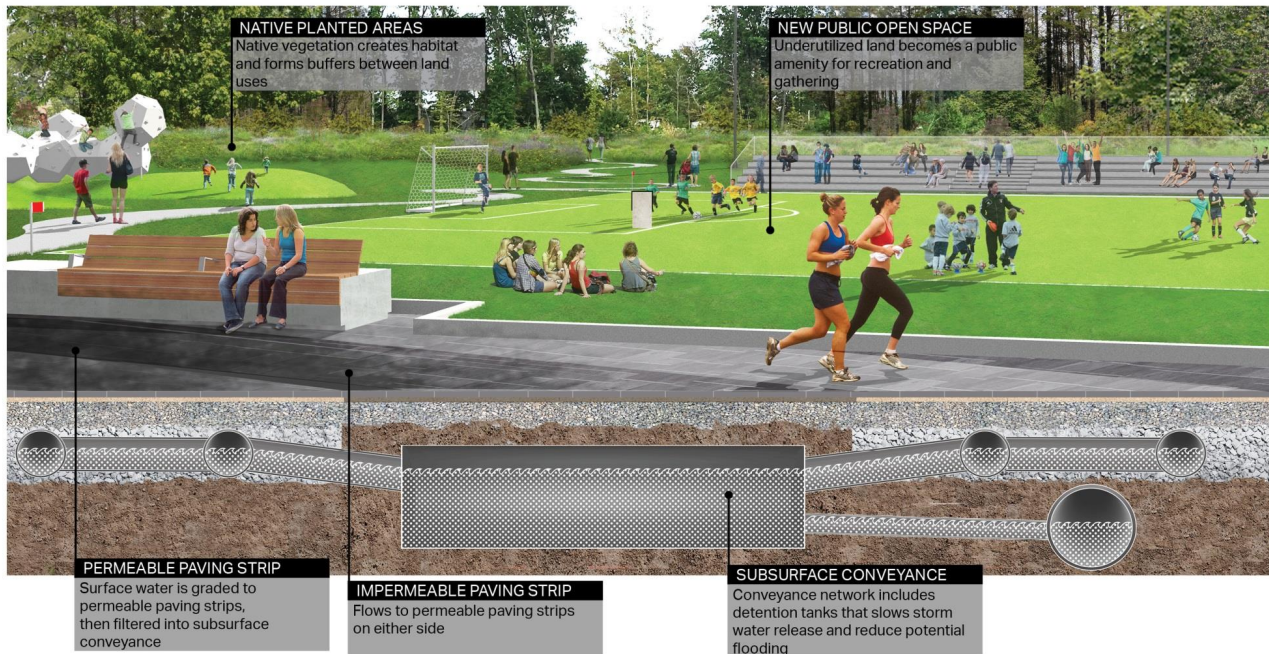
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OPEN SPACE IMPROVEMENTS

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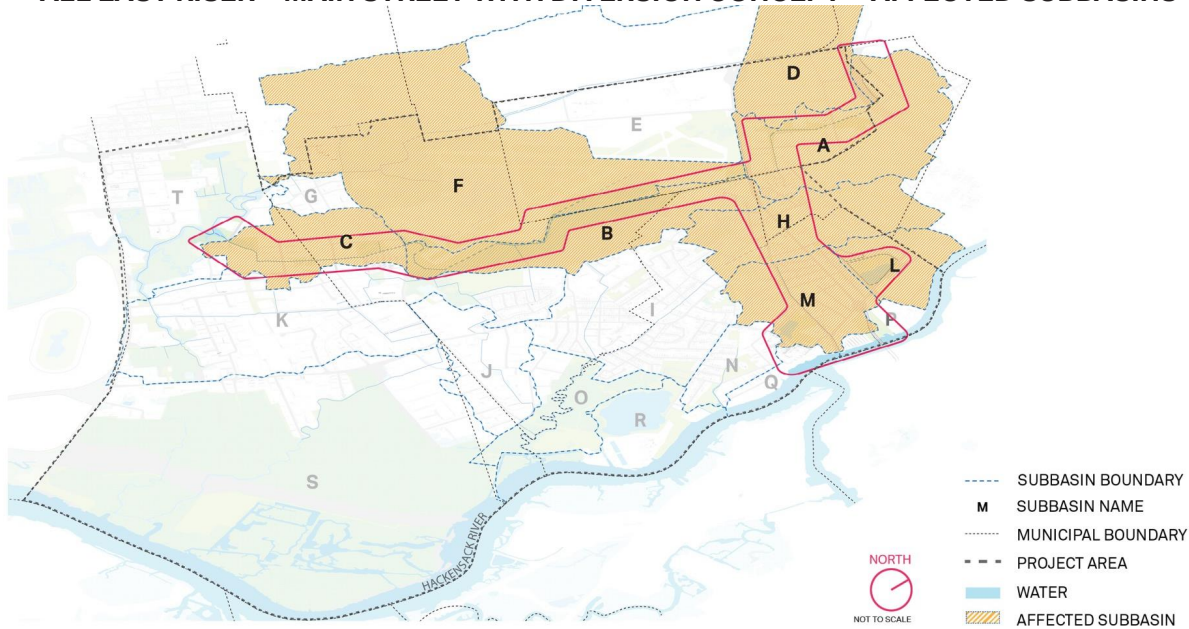
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DRAINAGE IMPROVEMENT CONCEPT 7

43

ALL EAST RISER + MAIN STREET WITH DIVERSION CONCEPT + AFFECTED SUBBASINS



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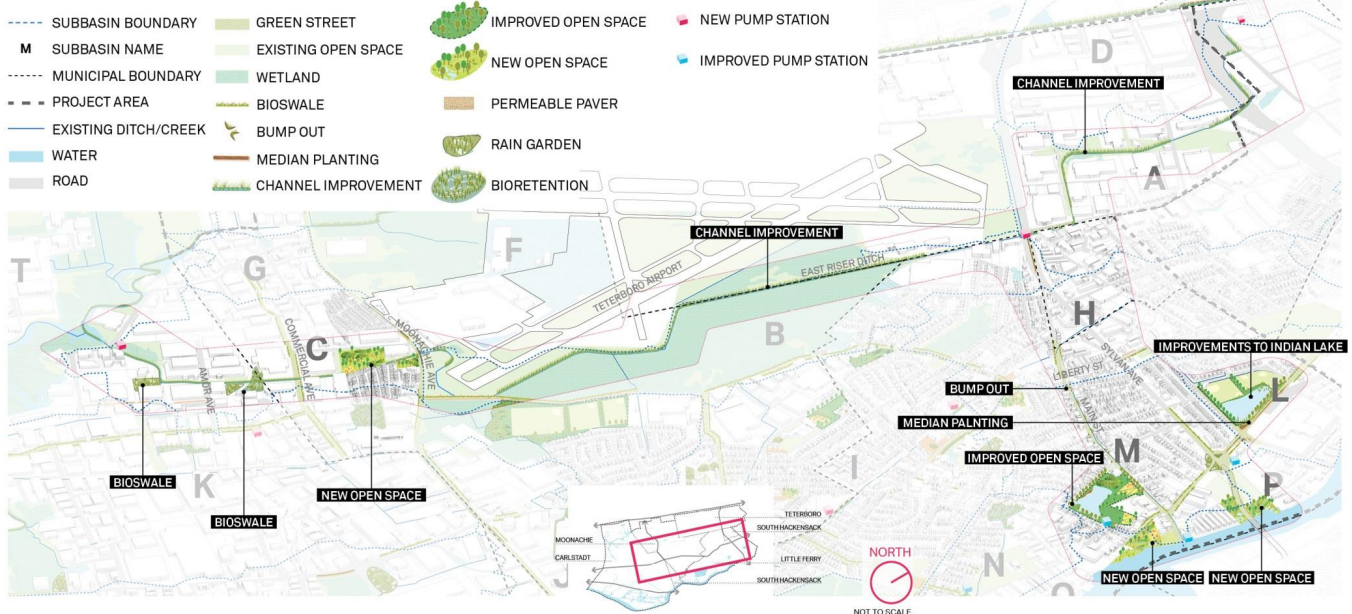
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DRAINAGE IMPROVEMENT CONCEPT 7

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ALL EAST RISER + MAIN STREET WITH DIVERSION COLLECTION



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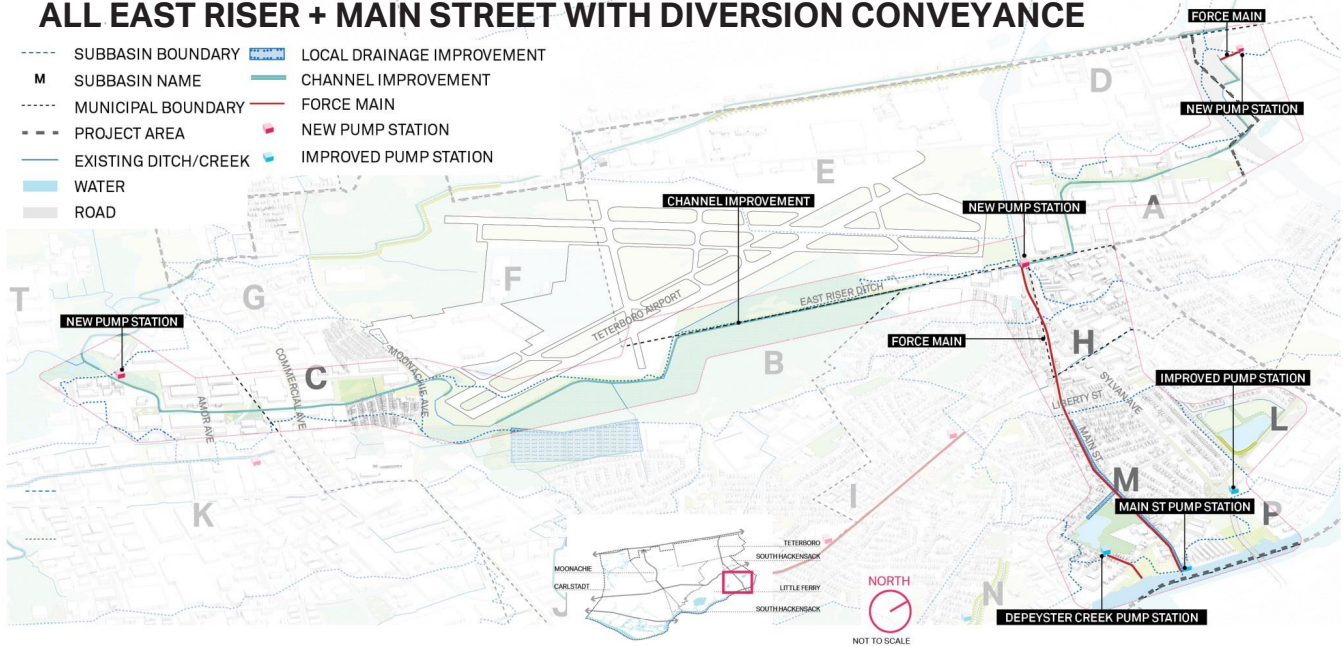
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DRAINAGE IMPROVEMENT CONCEPT 7

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ALL EAST RISER + MAIN STREET WITH DIVERSION CONVEYANCE

- SUBBASIN BOUNDARY
- M SUBBASIN NAME
- MUNICIPAL BOUNDARY
- - - PROJECT AREA
- EXISTING DITCH/CREEK
- WATER
- ROAD
- LOCAL DRAINAGE IMPROVEMENT
- CHANNEL IMPROVEMENT
- FORCE MAIN
- NEW PUMP STATION
- IMPROVED PUMP STATION



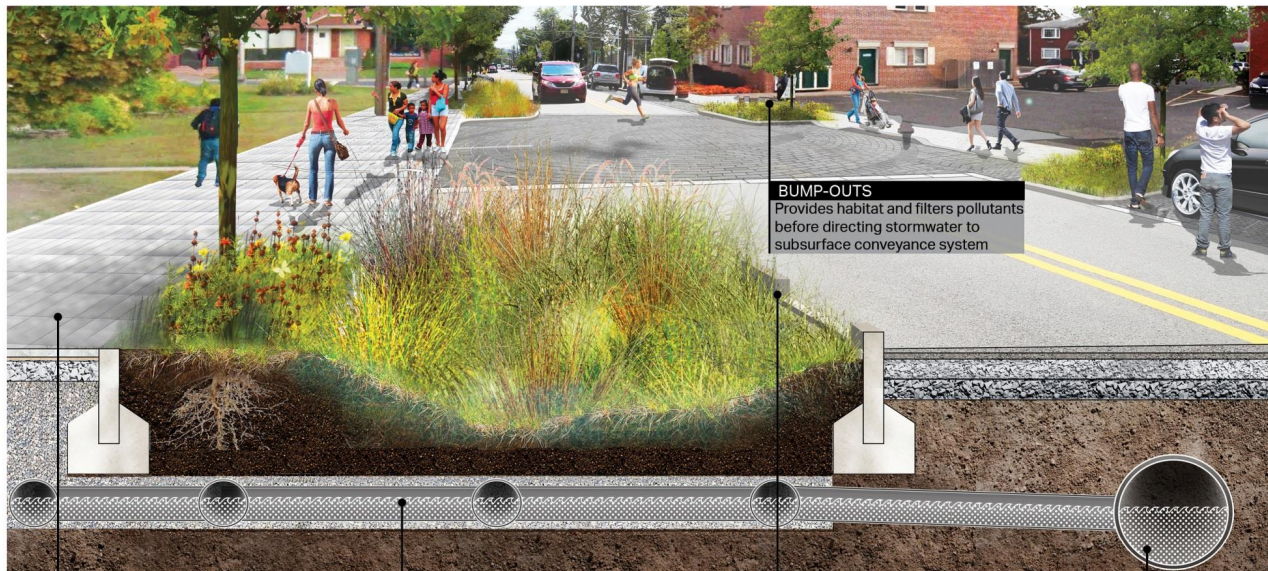
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BUMP OUTS + STREET IMPROVEMENTS

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BUMP-OUTS
Provides habitat and filters pollutants before directing stormwater to subsurface conveyance system

PERMEABLE PAVERS
Slows the flow of stormwater and filters water before entering conveyance system

SUBSURFACE CONVEYANCE
Improved subsurface pipe network reduces potential flooding

CURB CUT
Allows infiltration of road runoff into adjacent bioswales while maintaining the safety of raised curb

FORCE MAIN
Pumped stormwater conveyance to ensure grey infrastructure flood mitigation



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NEXT STEPS

CHRISTOPHER BENOSKY, AECOM



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NEXT STEPS

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NJDEP / AECOM UPCOMING ACTIVITIES

- Prepare Meeting Summary for CAG #7
- Continue developing:
 - Concepts and Alternatives
- CAG #8 in March
 - Alternative 1 – Structural Flood Reduction



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NEXT STEPS

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CAG: CALL TO ACTION

- Submit comments from CAG #7 meeting by **February 7, 2017**
- Share information from this meeting with friends and neighbors
- Continue to build interest in the Project
- Ensure the public knows about upcoming information (to be posted on Project website)



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NEXT STEPS

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Critical Information

March, 2017 - TBD

CAG Meeting #8: Alternative 1: Structural Flood Reduction

Project Website

www.rbd-meadowlands.nj.gov

Project Email

rbd-meadowlands@dep.nj.gov

Question & Answer



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4.0 Personal Notes

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100																																																																																																																																																																																
Population (millions)	532.2	537.7	543.2	548.7	554.2	559.7	565.2	570.7	576.2	581.7	587.2	592.7	598.2	603.7	609.2	614.7	620.2	625.7	631.2	636.7	642.2	647.7	653.2	658.7	664.2	669.7	675.2	680.7	686.2	691.7	697.2	702.7	708.2	713.7	719.2	724.7	730.2	735.7	741.2	746.7	752.2	757.7	763.2	768.7	774.2	779.7	785.2	790.7	796.2	801.7	807.2	812.7	818.2	823.7	829.2	834.7	840.2	845.7	851.2	856.7	862.2	867.7	873.2	878.7	884.2	889.7	895.2	900.7	906.2	911.7	917.2	922.7	928.2	933.7	939.2	944.7	950.2	955.7	961.2	966.7	972.2	977.7	983.2	988.7	994.2	999.7	1005.2	1010.7	1016.2	1021.7	1027.2	1032.7	1038.2	1043.7	1049.2	1054.7	1060.2	1065.7	1071.2	1076.7	1082.2	1087.7	1093.2	1098.7	1104.2	1109.7	1115.2	1120.7	1126.2	1131.7	1137.2	1142.7	1148.2	1153.7	1159.2	1164.7	1170.2	1175.7	1181.2	1186.7	1192.2	1197.7	1203.2	1208.7	1214.2	1219.7	1225.2	1230.7	1236.2	1241.7	1247.2	1252.7	1258.2	1263.7	1269.2	1274.7	1280.2	1285.7	1291.2	1296.7	1302.2	1307.7	1313.2	1318.7	1324.2	1329.7	1335.2	1340.7	1346.2	1351.7	1357.2	1362.7	1368.2	1373.7	1379.2	1384.7	1390.2	1395.7	1401.2	1406.7	1412.2	1417.7	1423.2	1428.7	1434.2	1439.7	1445.2	1450.7	1456.2	1461.7	1467.2	1472.7	1478.2	1483.7	1489.2	1494.7	1500.2	1505.7	1511.2	1516.7	1522.2	1527.7	1533.2	1538.7	1544.2	1549.7	1555.2	1560.7	1566.2	1571.7	1577.2	1582.7	1588.2	1593.7	1599.2	1604.7	1610.2	1615.7	1621.2	1626.7	1632.2	1637.7	1643.2	1648.7	1654.2	1659.7	1665.2	1670.7	1676.2	1681.7	1687.2	1692.7	1698.2	1703.7	1709.2	1714.7	1720.2	1725.7	1731.2	1736.7	1742.2	1747.7	1753.2	1758.7	1764.2	1769.7	1775.2	1780.7	1786.2	1791.7	1797.2	1802.7	1808.2	1813.7	1819.2	1824.7	1830.2	1835.7	1841.2	1846.7	1852.2	1857.7	1863.2	1868.7	1874.2	1879.7	1885.2	1890.7	1896.2	1901.7	1907.2	1912.7	1918.2	1923.7	1929.2	1934.7	1940.2	1945.7	1951.2	1956.7	1962.2	1967.7	1973.2	1978.7	1984.2	1989.7	1995.2	2000.7	2006.2	2011.7	2017.2	2022.7	2028.2	2033.7	2039.2	2044.7	2050.2	2055.7	2061.2	2066.7	2072.2	2077.7	2083.2	2088.7	2094.2	2099.7	210