

# Bangor Airport Stormwater Services Design Report Presentation



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## BANGOR INTERNATIONAL AIRPORT AND THE BIRCH STREAM CATCHMENT

- BIA is the largest single entity in the catchment area
- Other areas of impervious cover contribute to pollutant loads
- Some other entities contribute stormwater to the BIA system
- Birch Stream is Urban Impaired



## STORMWATER DESIGN PROJECT OVERVIEW

- Background Study
- Identification of Stressors
- Selection of BMPs
- Concept Design Development
- Stakeholder Meetings
- Refinement of Solutions
- Prioritization
- Implementation



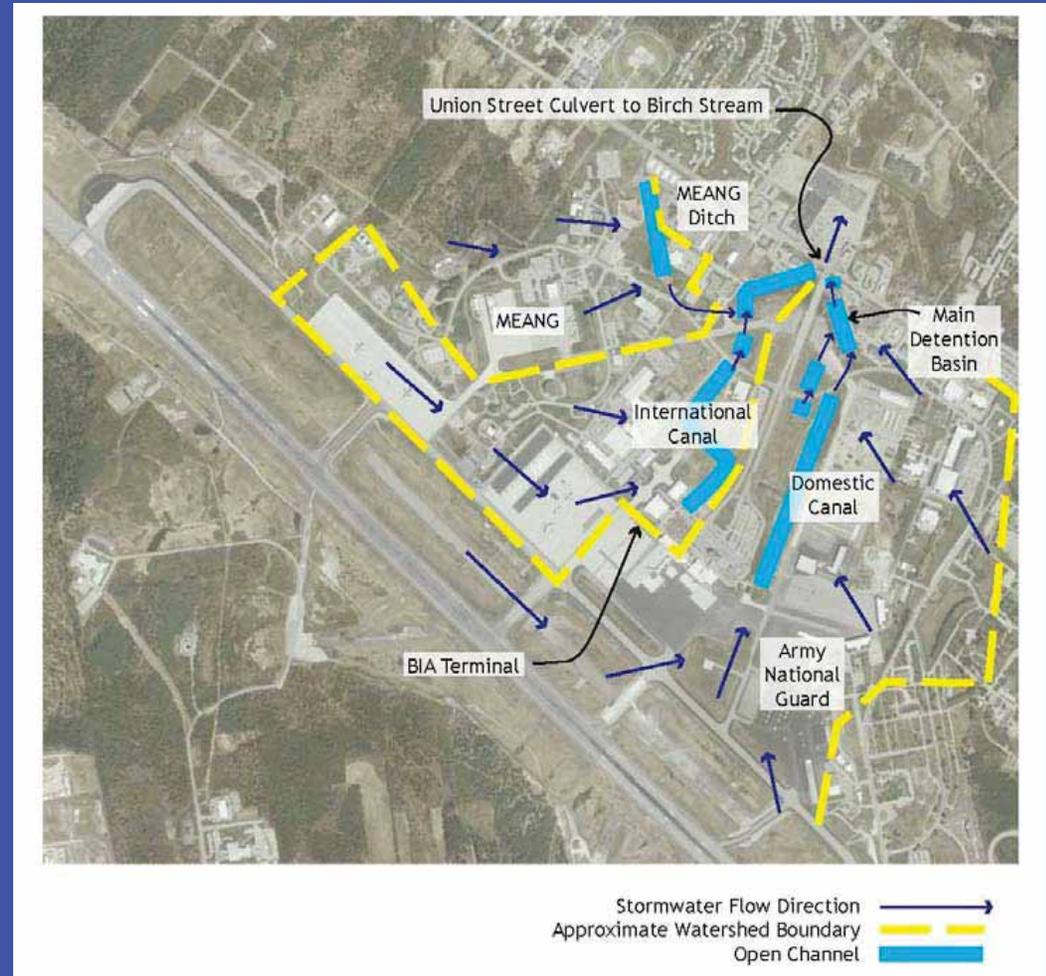
## KEY STUDY FINDINGS

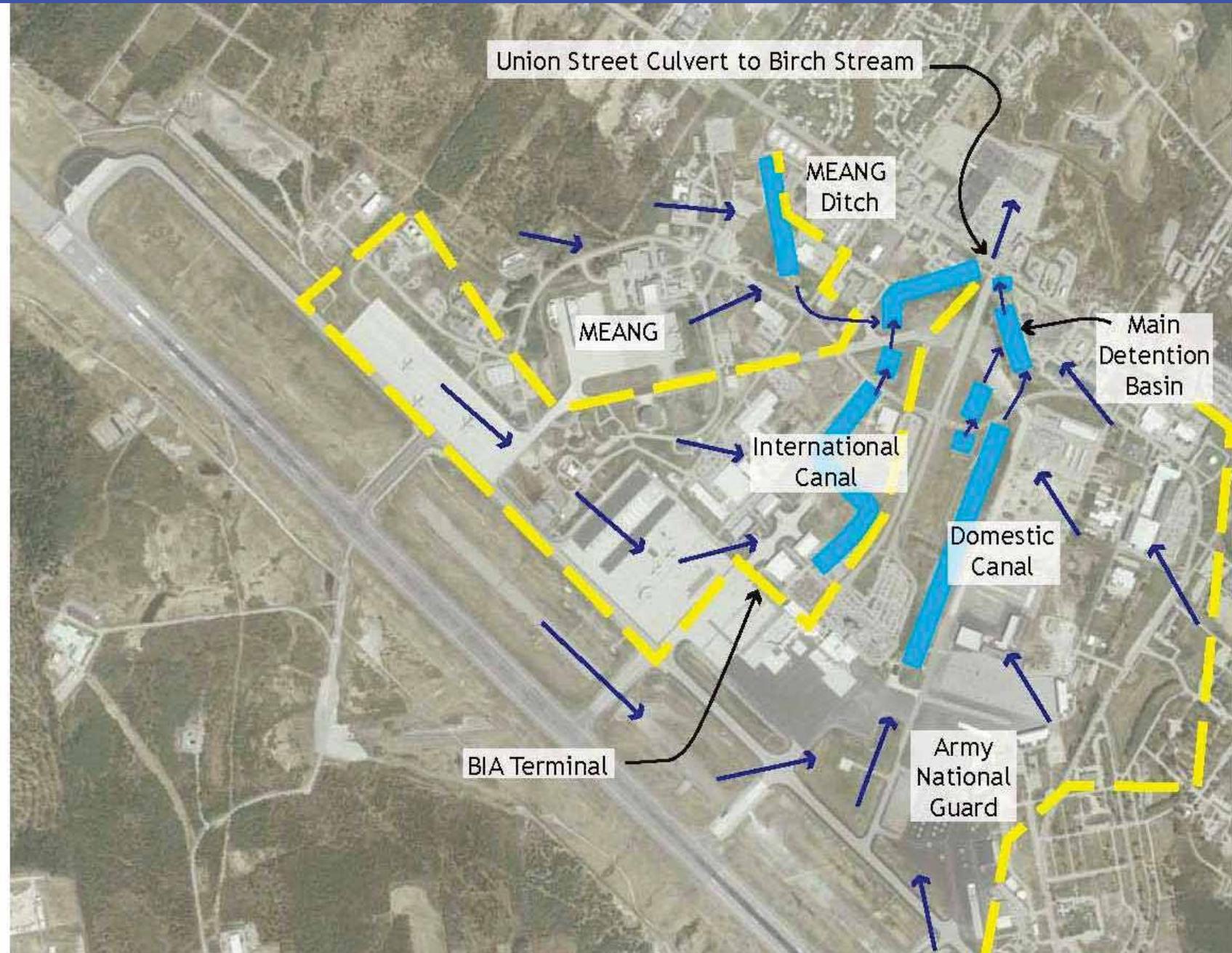
- Key stressors include :  
De-icing fluid,  
toxicants, thermal  
impacts, nutrients
- High peak flows and  
seasonal high temps
- Low O<sub>2</sub> levels in  
runoff
- Wildlife habitat issues
- Some minor sediment  
contamination found
- Efficiency gains  
possible
- Space available within  
system for retrofits
- New technologies  
offer viable treatment  
options
- Source control  
possible

# Bangor Airport Stormwater Services Design Report

## DESIGN APPROACH

- Isolate key stressors and flow paths
- BMP Selection
- Locate areas of work
- Cost : Benefit Analysis
- Development of Solution Options

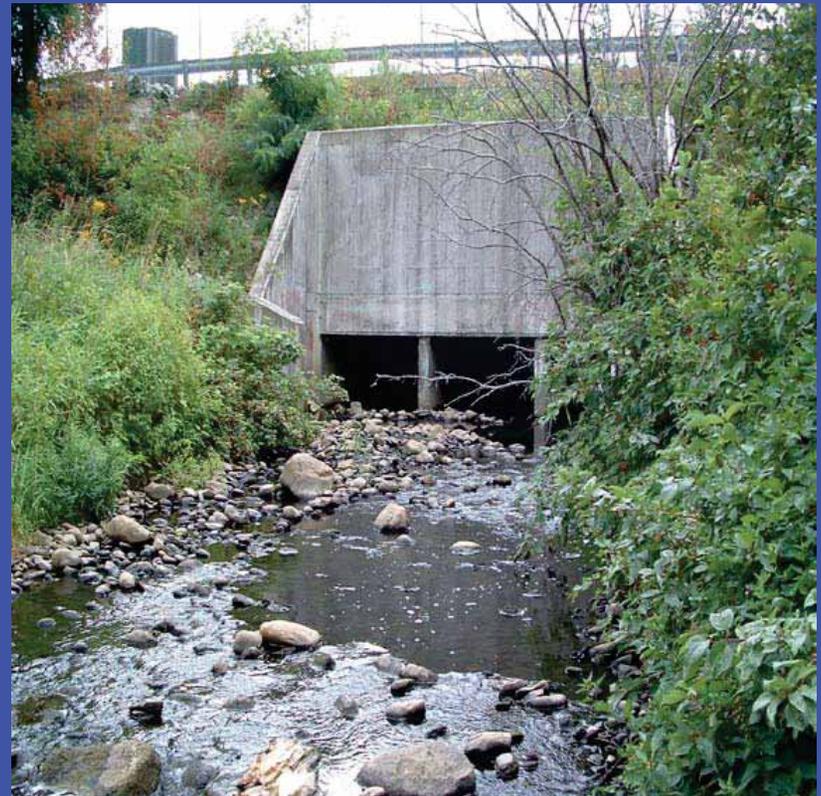




## DESIGN SOLUTIONS

### GENERAL NPS POLLUTANTS & THERMAL IMPACTS

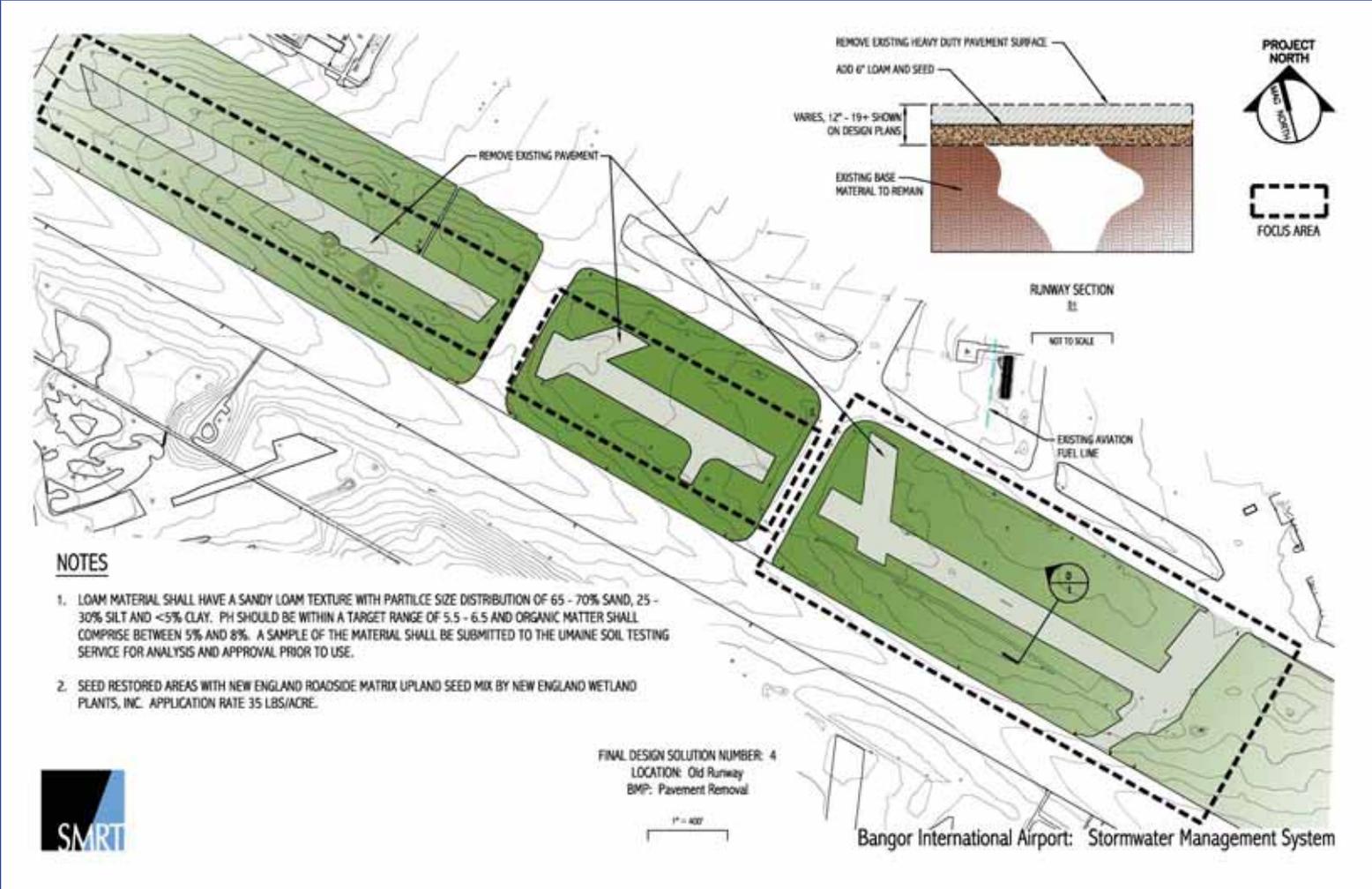
- Source Control
- Bioretention
- Filtration
- Water level control
- Wetland treatment



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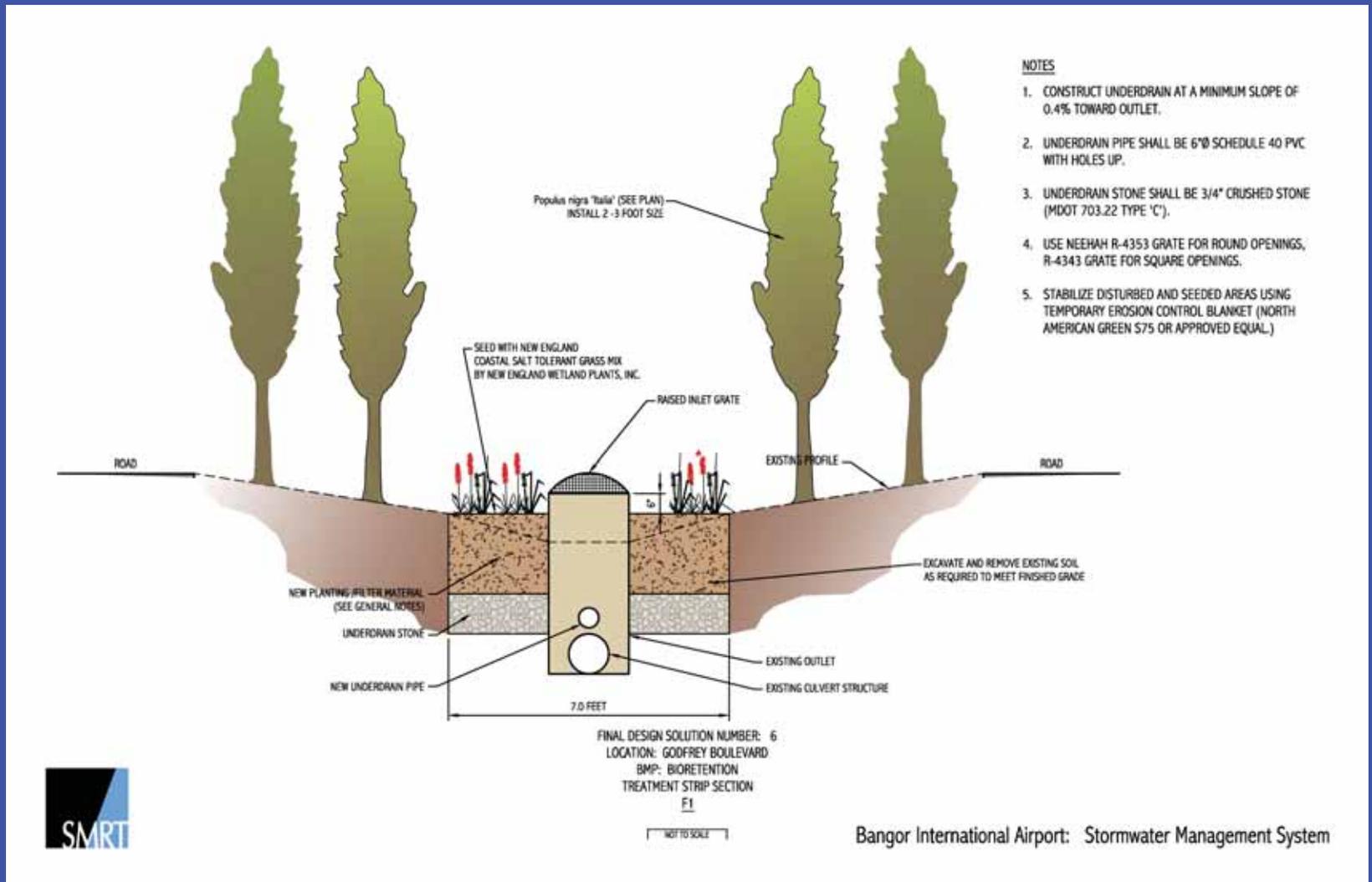
## Source Control

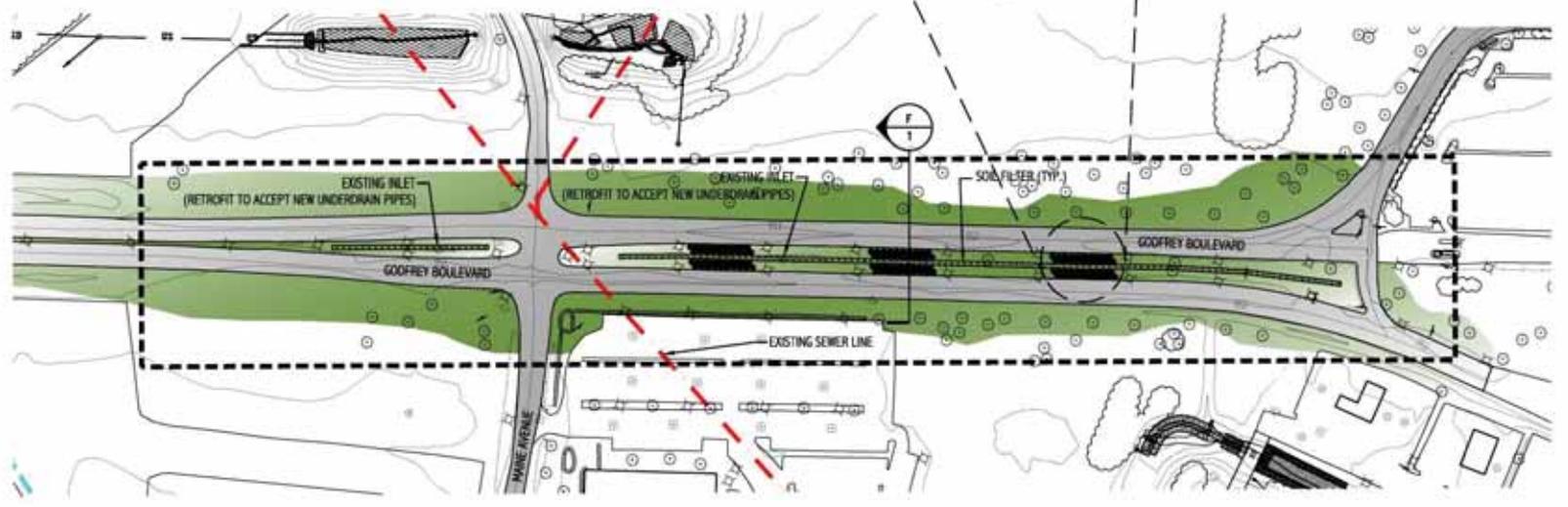
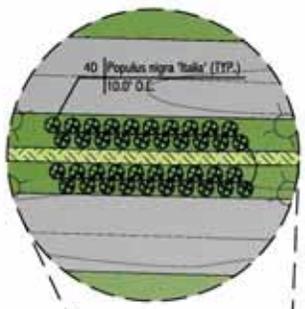


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## Bioretention





FINAL DESIGN SOLUTION NUMBER: 6  
LOCATION: Godfrey Boulevard  
BMP: Bioretention



Bangor International Airport: Stormwater Management System



**NOTE:**

MANHOLE #2 SHALL HAVE A DITCH GRATE INLET SET AT ELEVATION 167.0. DITCH GRATE SHALL BE NEENAH R4349C OR APPROVED EQUAL. SET MANHOLE ON EXISTING STORMDRAIN LINE.

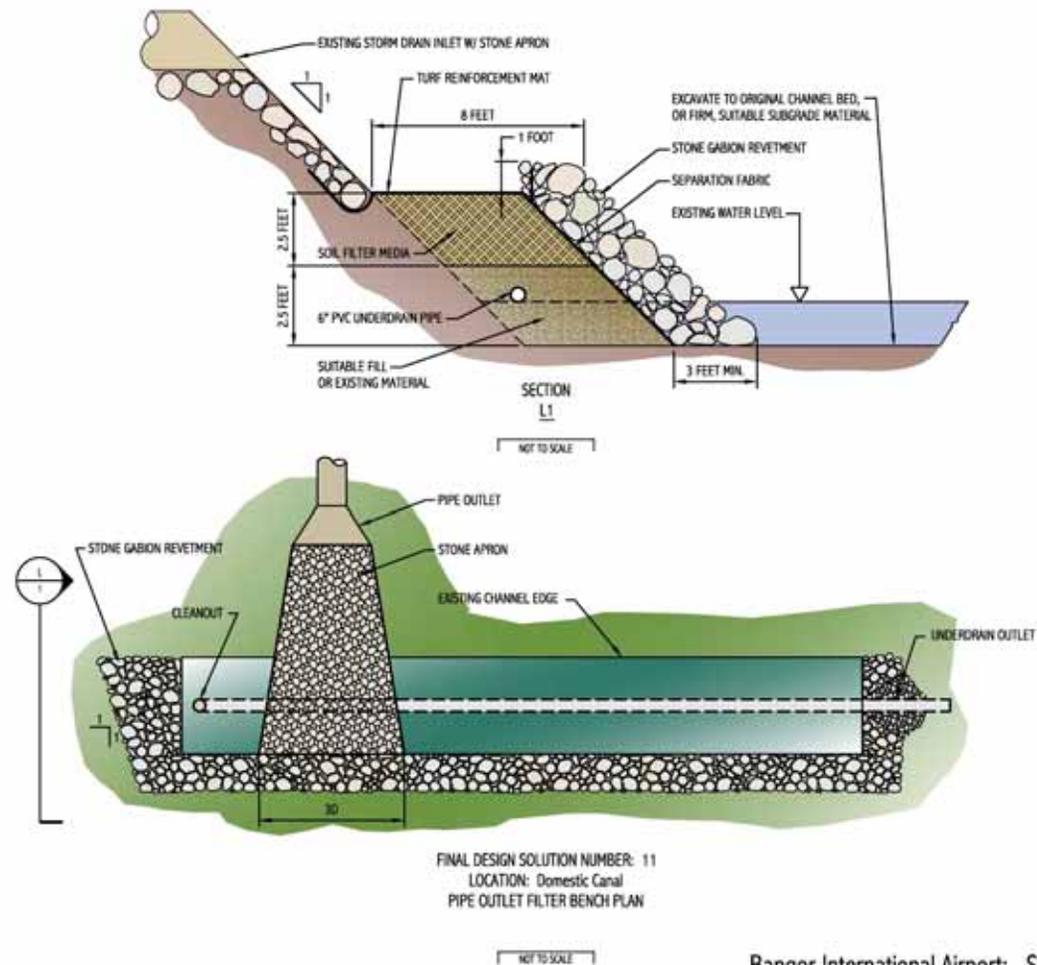
FINAL DESIGN SOLUTION NUMBER: 10  
 LOCATION: Maine Avenue & Talt Street  
 BMP: Bioretention Swale



Bangor International Airport: Stormwater Management System

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## Filtration





## Thermal Impacts

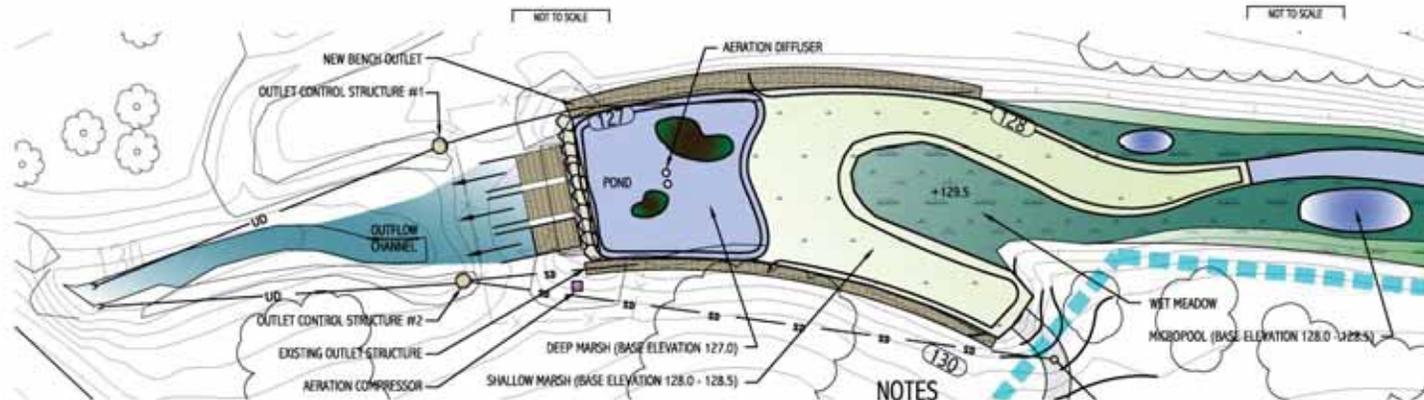
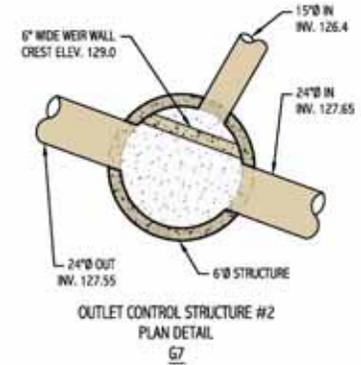
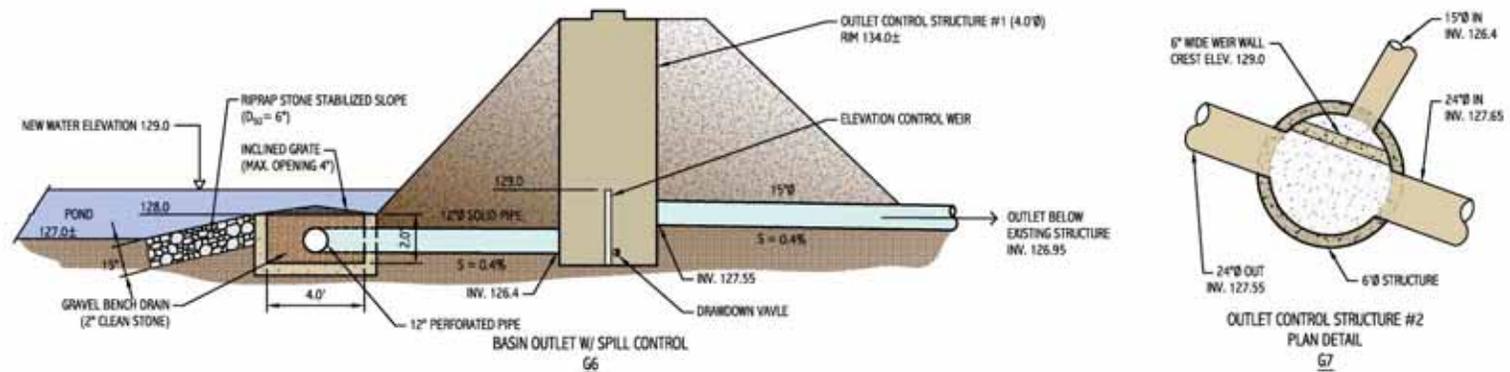
- Large, shallow open water areas attract heat
- Raised water temps reduce dissolved oxygen levels
- Reduce open water and increase flow to mitigate impacts



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## Water level control



### NOTES

1. AERATION SHALL BE PROVIDED BY A 1/4 HP ROTARY VANE COMPRESSOR KIT WITH WEIGHTED TUBING FROM POND AND LANDSCAPE SOLUTIONS, INC. OF TROY, MI.
2. LOCATION AND DESIGN OF ELECTRICAL SUPPLY TO BE UNDERTAKEN BY A LICENSED ELECTRICAL CONTRACTOR.
3. AERATION COMPRESSOR SHALL BE HOUSED IN A WEATHERTIGHT LOCKABLE STEEL CABINET.

FINAL DESIGN SOLUTION NUMBER: 7  
LOCATION: Existing Detention Basin  
BASIN OUTLET DETAIL PLAN  
G5

1" = 40'



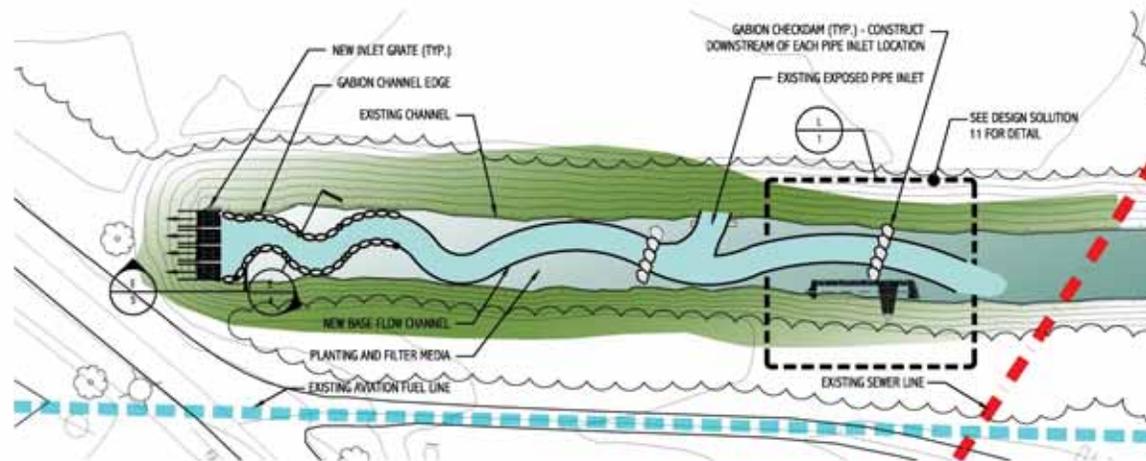
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## Water level control

### NOTES

1. EXISTING SEDIMENT SHALL BE REMOVED FROM THE CHANNEL AND DISPOSED OF OFF-SITE.
2. SOIL PLANTING MEDIA SHALL BE A MIXTURE OF 35% CLEAN SCREENED LOAM AND 65% FINE SAND. LOAM MATERIAL SHALL BE FREE OF STUMPS, ROOTS, STONES, OBJECTS GREATER THAN 2" IN SIZE AND OTHER DELETERIOUS MATTER. SIEVE ANALYSIS FOR SAND MATERIAL SHALL BE SUBMITTED PRIOR TO USE. LOAM MATERIAL SHALL BE SUBMITTED TO UMAINE SOIL TESTING LAB FOR ANALYSIS.
3. PLANTINGS MAY BE ENHANCED WITH *Typha latifolia* (EITHER TRANSPLANTED OR IMPORTED).
4. TURF REINFORCEMENT MAT SHALL BE NORTH AMERICAN GREEN P300 OR APPROVED EQUAL.
5. GABION CHECKDAMS SHALL BE PROVIDED DOWNSTREAM OF EACH PIPE INLET TO THE CANAL.



FINAL DESIGN SOLUTION NUMBER: 5a  
LOCATION: Domestic Canal  
PHASE I  
NEW BASE FLOW CHANNEL PLAN DETAIL  
E1

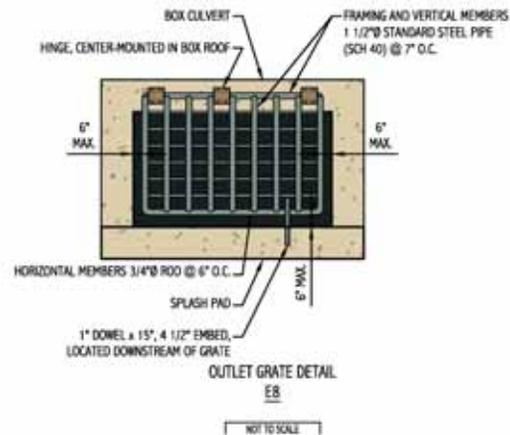
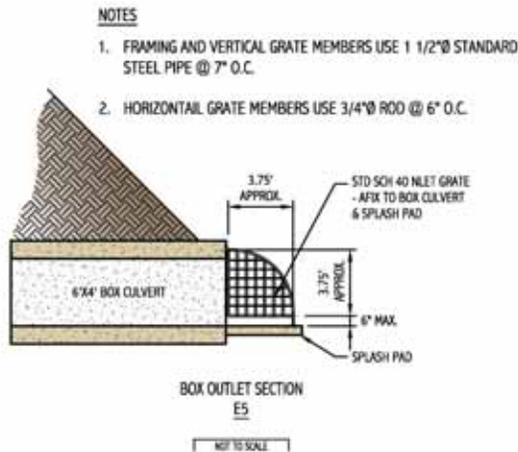
1" = 50'



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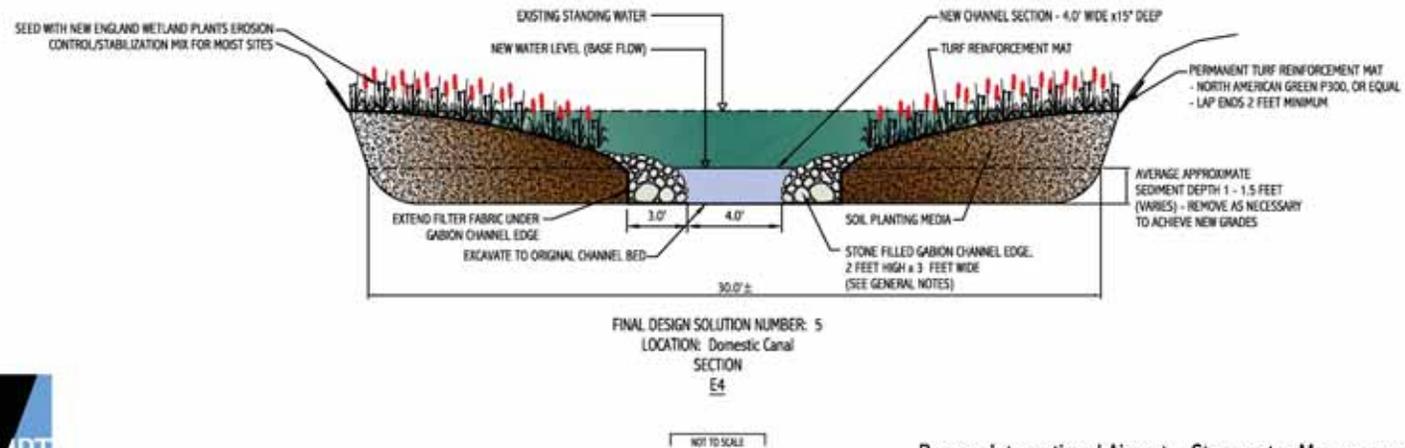
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## Water level control



**NOTES**

1. UNDERDRAIN PIPE SHALL BE CONSTRUCTED IN A MINIMUM 12" BED AND SURROUND OF 3/4" CRUSHED STONE (MDOT 703.22 TYPE 'C').
2. TURF REINFORCEMENT MAT SHALL BE NORTH AMERICAN GREEN P300 OR APPROVED EQUAL.
3. SEPARATION FABRIC SHALL BE MIRAFI 140N OR APPROVED EQUAL.
4. STONE APRON SHALL BE CONSTRUCTED OF RIPRAP STONE D<sub>50</sub> ≥ 12" (SEE GENERAL NOTES).

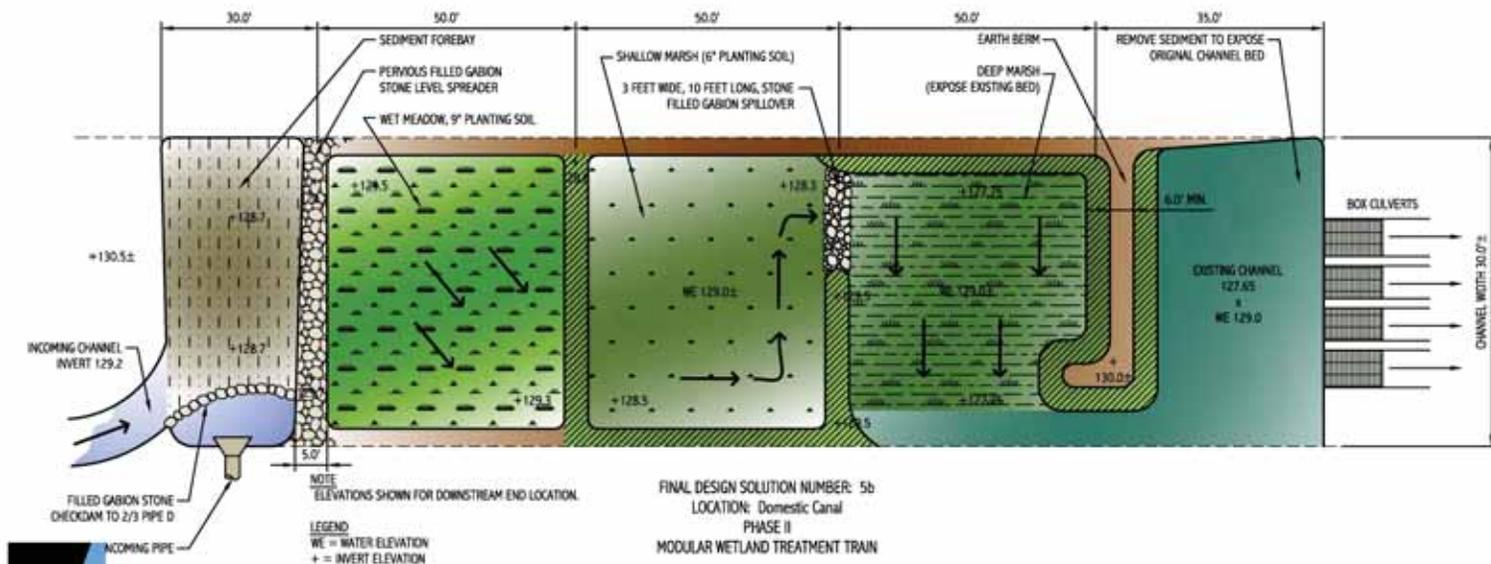


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## Wetland treatment

### NOTES

- EXCAVATE SEDIMENT FOREBAY TO ORIGINAL CHANNEL BED.
- ENTIRE WET MEADOW AREA SHALL BE GRADED, SEEDED WITH NEW ENGLAND EROSION CONTROL/RESTORATION MIX FOR DETENTION BASINS AND MOIST SITES, AND COVERED WITH PERMANENT TURF REINFORCEMENT MAT (NORTH AMERICAN GREEN P300 OR APPROVED EQUAL).
- SHALLOW MARSH AND DEEP MARSH AREAS SHALL BE CONSTRUCTED USING A MINIMUM OF 9" DEPTH OF WETLAND PLANTING SOIL AND COVERED WITH TURF REINFORCEMENT MAT, AS SPECIFIED IN NOTE 2 ABOVE.
- EARTH BERMS SHALL BE CONSTRUCTED OF SUITABLE IMPERVIOUS MATERIAL SUITABLE OR EMBANKMENT CONSTRUCTION, COMPACTED TO 90% MAXIMUM DRY DENSITY, SEEDED AND COVERED WITH TRM AS IN NOTE 2 ABOVE.
- PLANT MARSH AREAS WITH *Typha latifolia*, *Typha angustifolia*, *Phalaris arundinacea*, *Scirpus cyperinus*, and *Impatiens capensis*.
- PERVIOUS STONE LEVEL SPREADER SHALL BE CONSTRUCTED OF RIPRAP STONE ( $D_{50} = 1.2"$ ). STONE LAYER SHALL BE CONSTRUCTED TO A DEPTH OF 2.2' WITH A MIRAF 140N FILTER FABRIC UNDERLAY.



E6

NOT TO SCALE

## DESIGN SOLUTIONS

### SPECIALIZED BMPS

- Aeration
- Flow Management
- SSF Wetlands
- Wildlife Management



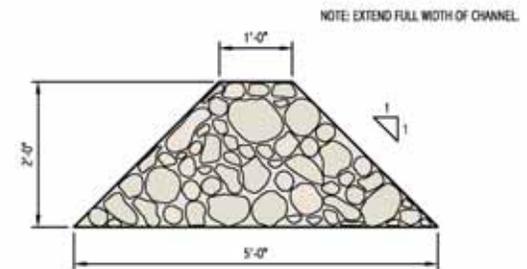
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## Aeration

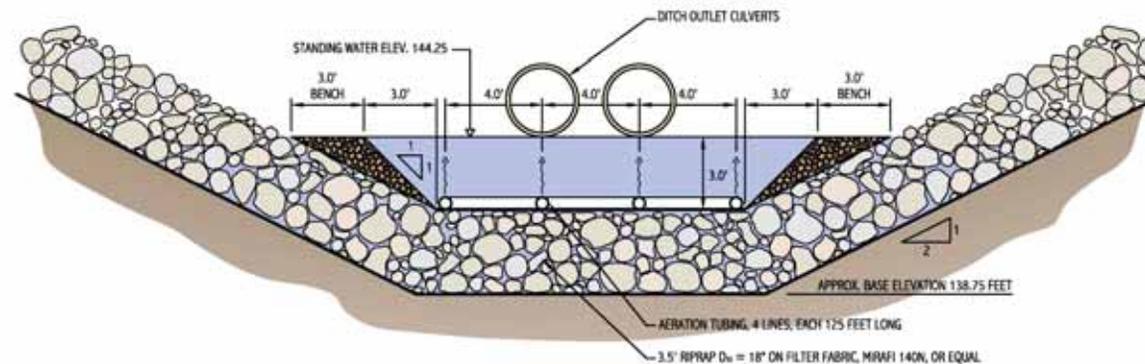
### AERATION NOTES

1. FOR OPTION A: AERATION SHALL BE PROVIDED BY FOUR LINES OF 3/4" BUBBLE TUBING™ FROM CANADIAN POND PRODUCTS LIMITED, KNOWLTON, QUEBEC. EACH SHALL BE 125 FEET LONG, ANCHORED INTO THE RIPRAP BASE USING A MINIMUM 3 FEET LONG 1"Ø STEEL PINS.
2. THE SYSTEM COMPRESSOR AND ELECTRICAL SUPPLY SHALL BE SIZED TO DELIVER A MINIMUM 35 CFM OF AIR THROUGH THE TUBING.
3. COMPRESSOR(S) SHALL BE HOUSED IN A WEATHER RESISTANT ENCLOSURE AT THE APPROXIMATE LOCATION SHOWN ON THE PLAN.
4. FOR OPTION B: AERATION SHALL BE PROVIDED BY TWO ASI BUBBLE DIFFUSION/MIXING STATIONARY AERATION GRIDS, BY AERATION SOLUTIONS, INC. EACH GRID MEASURES 4'x5' AND CONTAINS 42.5' OF 0.5IN ID x 1.0IN OD PATENTED MEMBRANE. GRIDS SHALL BE LOCATED AT THE CENTER OF THE CHANNEL 40 FEET FROM EACH END AND 50 FEET APART. AIR FLOW SHALL BE PROVIDED BY TWO (2) 1.5HP SINGLE PHASE HIGH EFFICIENCY REGENERATIVE ELECTRIC MOTOR BLOWERS.
5. ELECTRIC SUPPLY LOCATION AND DESIGN TO BE UNDERTAKEN BY A QUALIFIED ELECTRICAL CONTRACTOR.



STONE GABION CHECKDAM DETAIL  
A2

NOT TO SCALE



FINAL DESIGN SOLUTION NUMBER: 1  
LOCATION: International Canal  
AERATION POND SECTION - OPTION 1  
A1

NOT TO SCALE

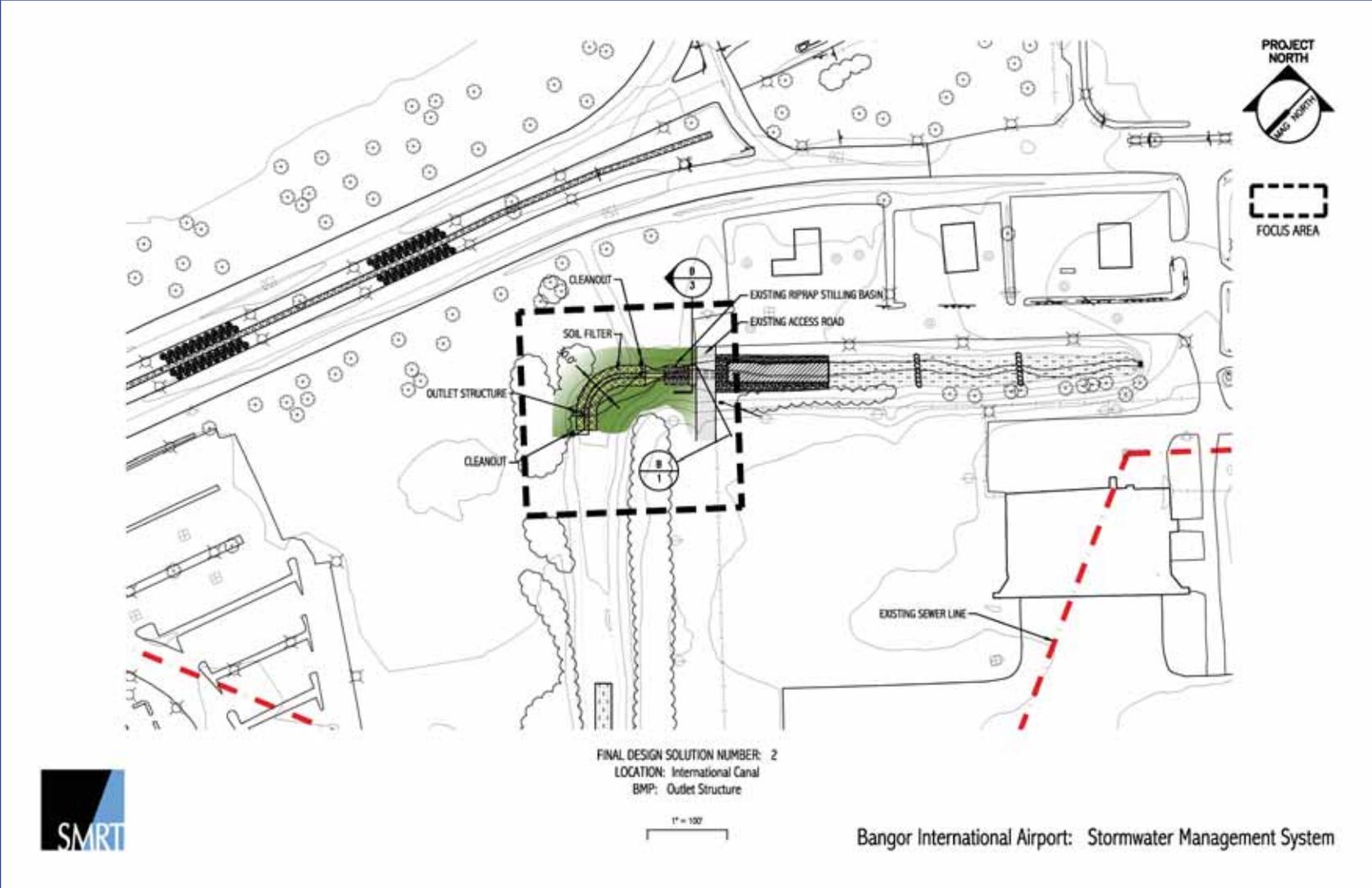




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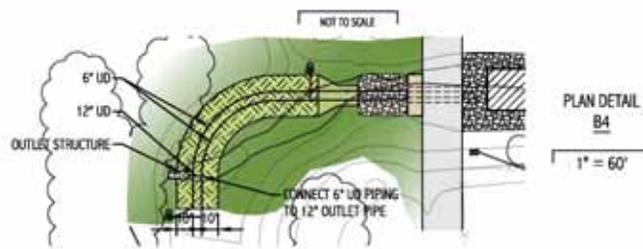
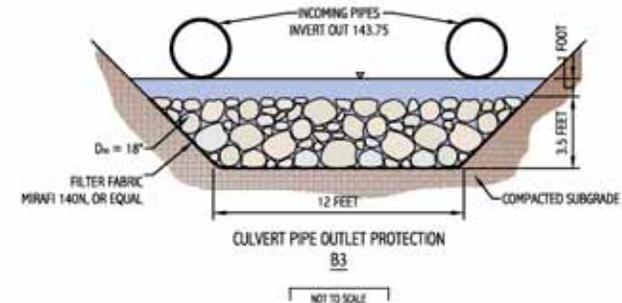
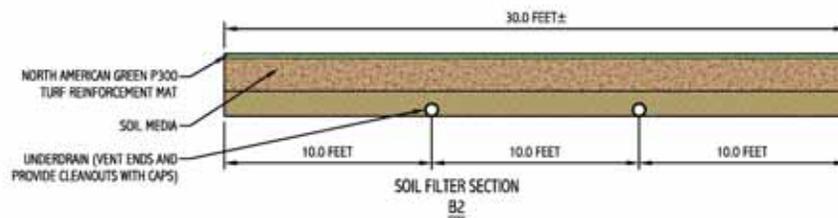


## Flow Management



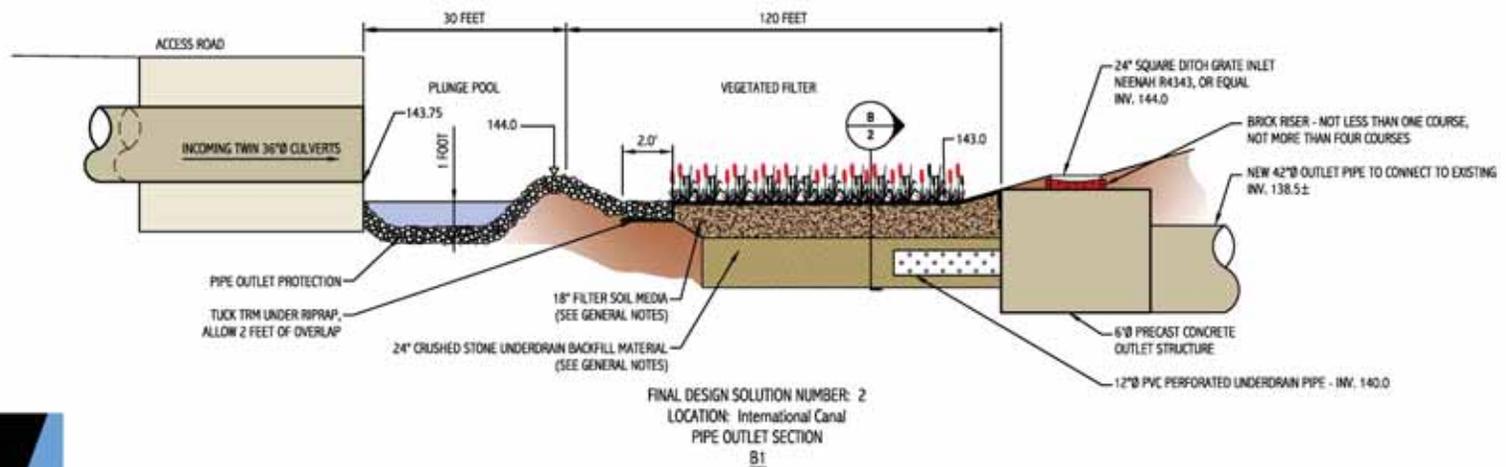
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## Flow Management



### NOTES

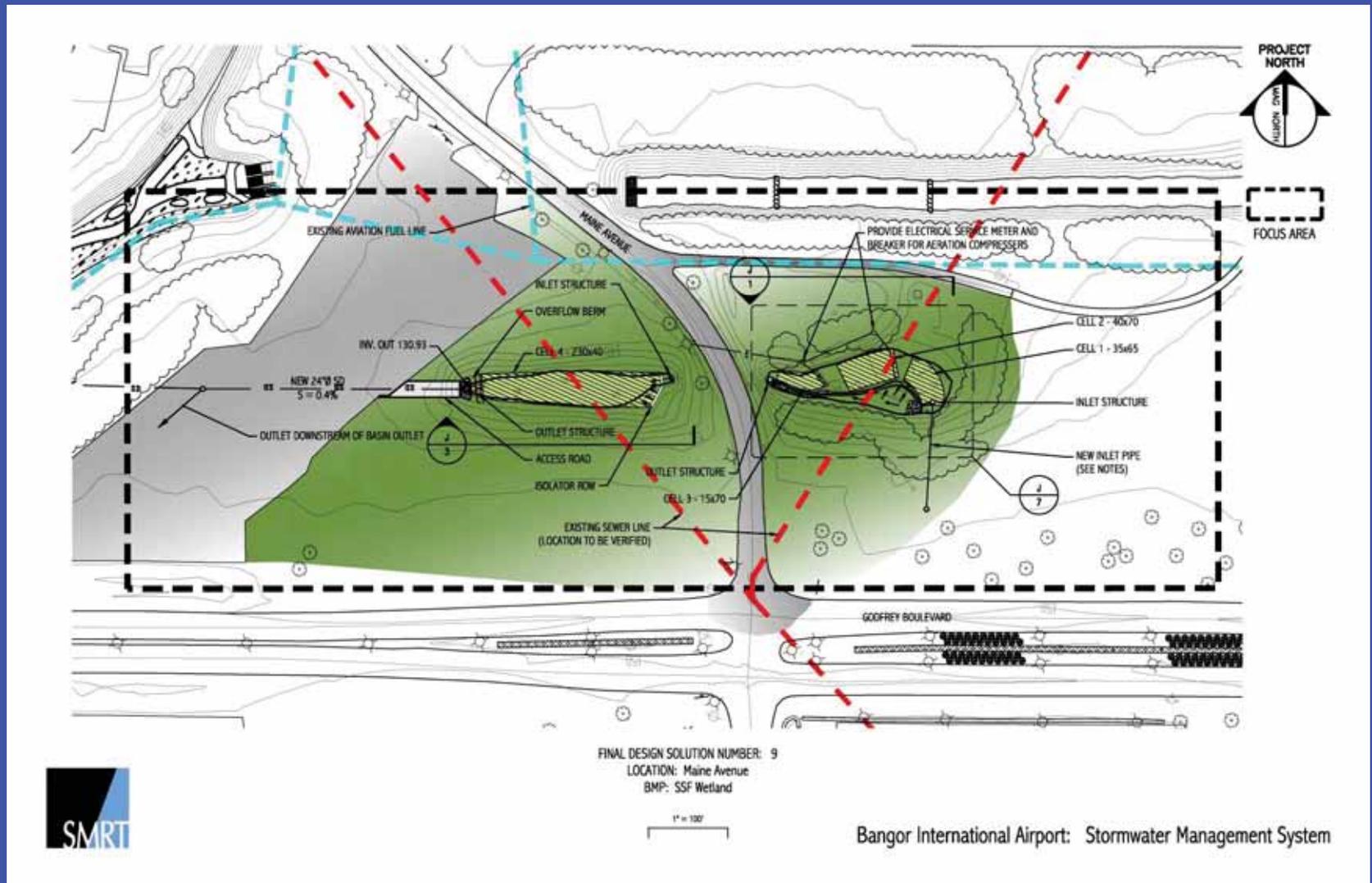
1. SEED VEGETATED FILTER WITH NEW ENGLAND RESTORATION/EROSION CONTROL MIX FOR MOIST SITES, BY NEW ENGLAND WETLAND PLANTS, INC. APPLICATION RATE 35 LBS/ACRE.
2. CONTRACTOR SHALL PROVIDE SOIL EROSION AND SEDIMENT CONTROL MEASURES TO PROTECT DOWNSTREAM WATER QUALITY DURING CONSTRUCTION.



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## SSF Wetlands



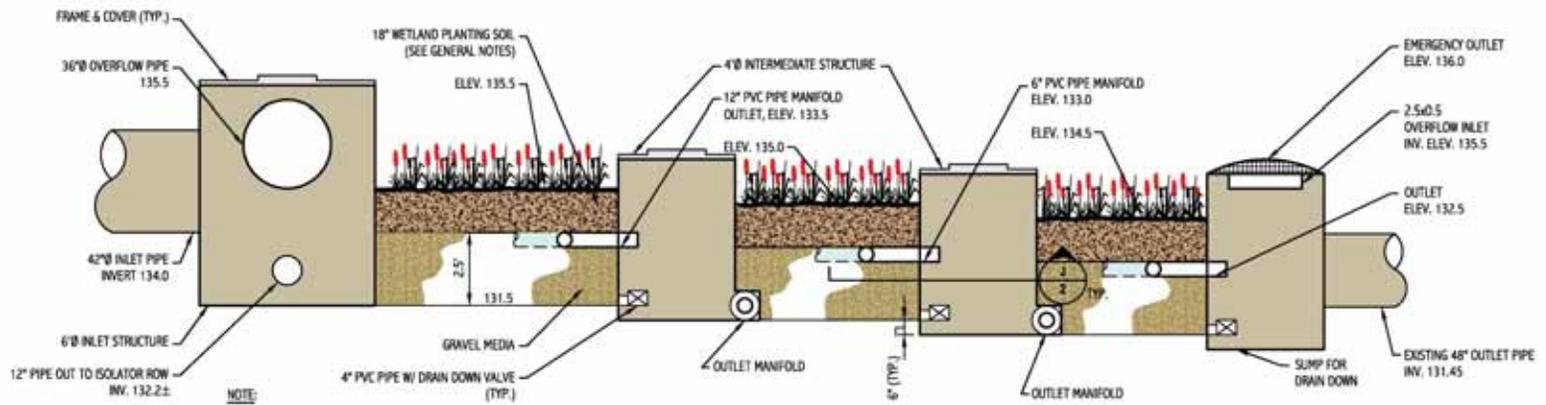
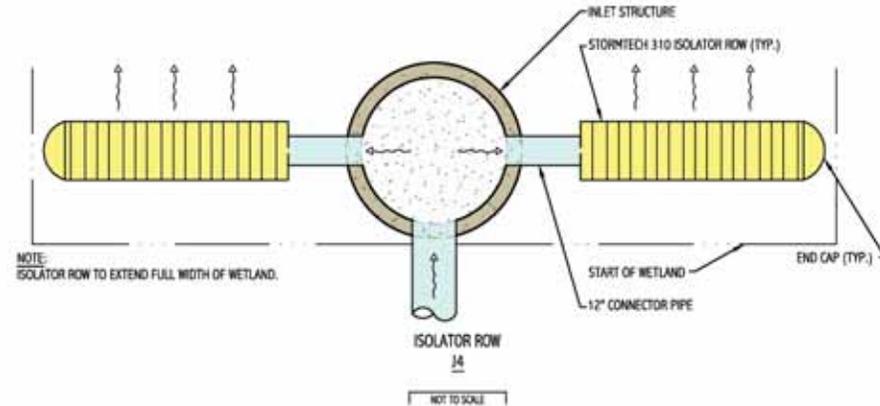
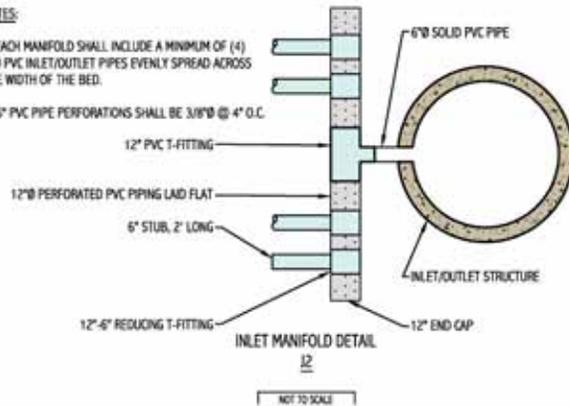
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## SSF Wetland

**NOTES:**

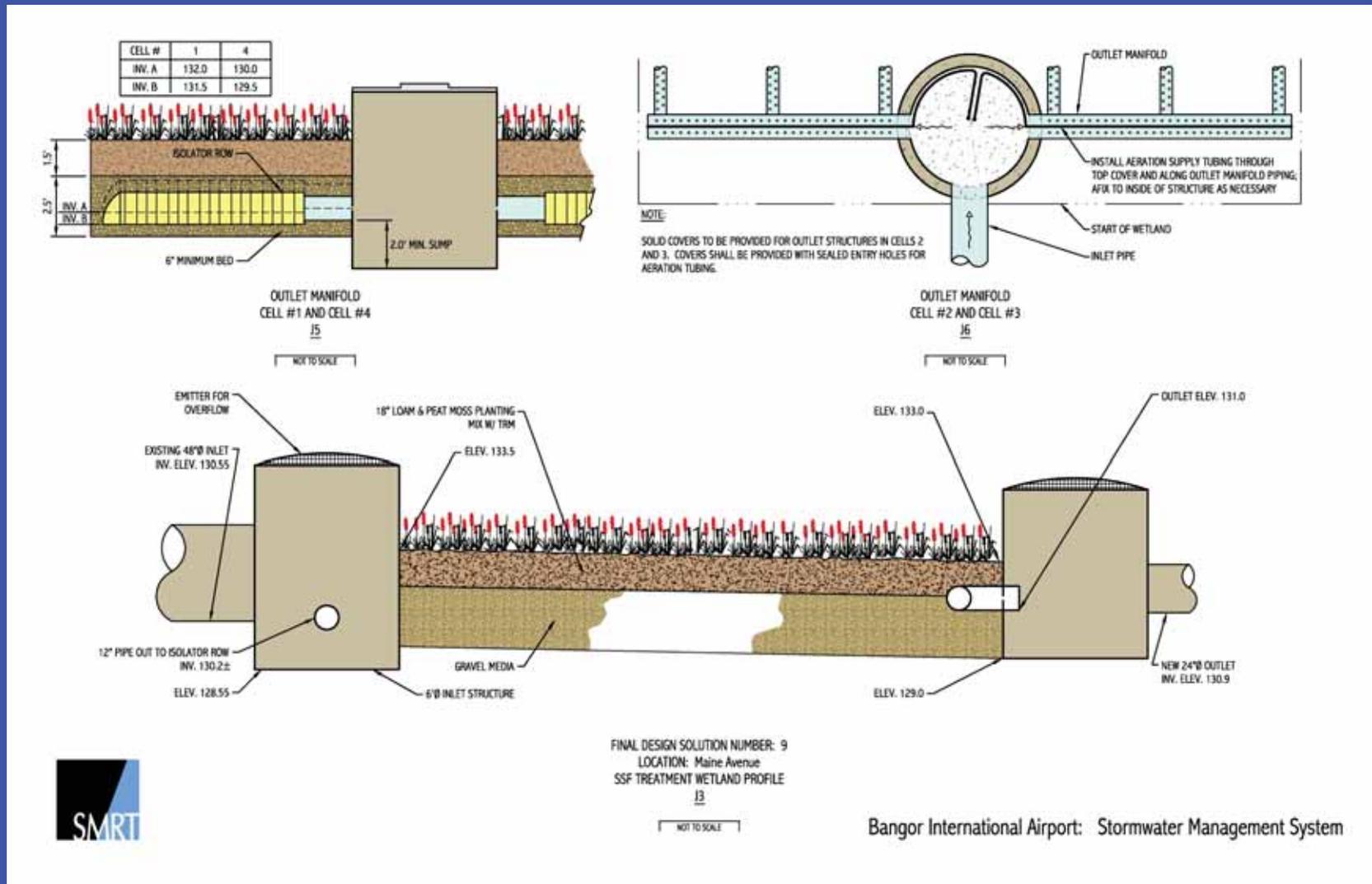
1. EACH MANIFOLD SHALL INCLUDE A MINIMUM OF (4) 6"Ø PVC INLET/OUTLET PIPES EVENLY SPREAD ACROSS THE WIDTH OF THE BED.

2. 6" PVC PIPE PERFORATIONS SHALL BE 3/8"Ø @ 4" O.C.



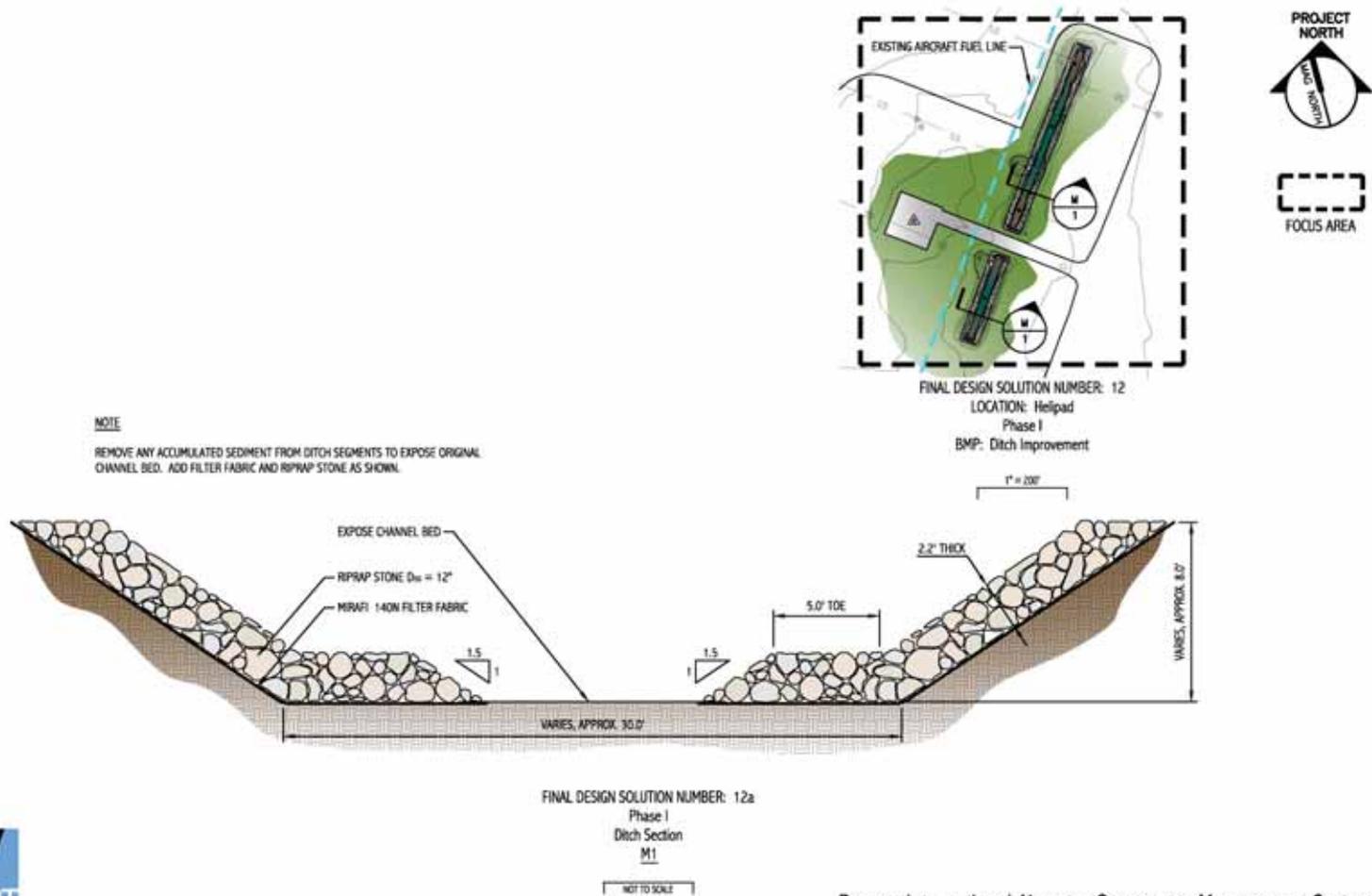
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## SSF Wetland



# Bangor Airport Stormwater Services Design Report

## Wildlife Management



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## PRIORITIZATION

1. Availability of financial resources will dictate implementation schedule.
2. High priority should be given to BMPs that tackle stressors of highest importance - Propylene glycol and NPS toxicants.
3. High peak flows, thermal impacts and nutrient loading are considered moderately important.
4. Implementation of some BMPs will need to proceed in sequence.



## MAINTENANCE AND TRAINING

1. Some new BMPs will require greater maintenance efforts
2. Training in BMP upkeep and performance monitoring
3. Time and resource commitments



## IMPLEMENTATION

### Non- sequential

1. Pipe Outlet BMPs
2. Pavement Removal
3. Bioretention
4. MEANG Ditch Improvements

### Sequential

1. Central Canal Re-grade
2. Central Canal Outlet
3. Central Canal Aeration
4. SFF Wetland Cells
5. Detention Basin Outlets/Level
6. Southern Canal Improvements

## SUMMARY

- BIA complex is a key component of the Birch Stream watershed
- Comprehensive plans have been developed to improve water quality in the airport stormwater system, and will be implemented by the City, with the assistance of MEANG, ANG, MEDEP.
- Water quality will continue to be assessed as implementation occurs to measure performance.
- Other measures will be required throughout the catchment area to allow Birch Stream to attain Class B status.

# Bangor Airport Stormwater Services Design Report

## DISCUSSION

- QUESTIONS.....
- COMMENTS.....
- INPUT.....
- SUGGESTIONS.....

