



Stormwater Designs

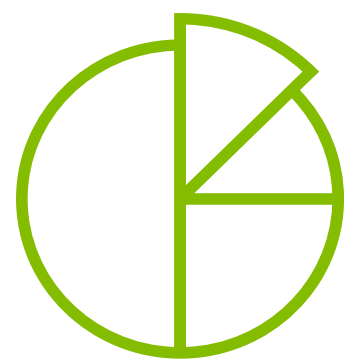
Assessment and Evaluation

During Phase 2 of the MCEA process, alternative solutions including the “Do Nothing” alternative were assessed. The preferred alternative solution was a combination of:

- Managing stormwater (SWM) demand to reduce the volume of runoff generated during rainfall events (such as limiting growth/land development and allowing only Low Impact Development measures) and
- New SWM infrastructure to handle the anticipated remaining flow of runoff.

The “Do Nothing” alternative was considered, but it does not address the problem and therefore is not considered a reasonable option. It will not be included as a design alternative.

Evaluation Criteria – Stormwater



Criteria Group	Indicator	Evaluation Criteria	
Natural Environment	Aquatic	0 Number of watercourse crossings 0 Wetland areas directly impacted 0 Effect on wildlife corridors 0 Disruption to areas with potential wildlife habitat	0 Opportunities to enhance habitat 0 Area and type of currently natural land that will be affected 0 Area of removal of tree canopy 0 Potential disruption to Species at Risk habitat
	Wildlife		
	Vegetation		
	Species at Risk		
Cultural Environment	Archaeological Resources	0 Effect on areas identified archeological potential	
	Indigenous Resources	0 Effect on areas of potential indigenous cultural significance	
Physical Environment	Groundwater	0 Potential effect on groundwater infiltration	
	Potential to Encounter or Move Contaminated Soils	0 Number of residential wells potentially impacted 0 Proximity to areas of known potential contamination	
Socio-Economic Environment	Compatibility with Current Planning Goals	0 Degree of conformance to previous studies or planning documents	
	Effect on Existing Residences	0 Disruption during construction	
	Planned Development	0 Perceived enjoyment	
	Recreational Features	0 Number of changes to major utility corridors and existing structures	
	Major Infrastructure Changes	0 Amount of property required (existing and future development)	
	Property Taking	0 Estimated and relative cost	
Technical	Regulatory Requirements	0 Water quality and quantity control provided	
		0 Proximity to Intake Protection Zone (Water Works Intake) 0 Incorporation of Low Impact Development	

Stormwater Approach

Terminology

End-of-Pipe Stormwater Facility (SWM Pond)	Ponds that treat runoff collected using catchbasins and storm sewer pipes in larger areas. The pipes outlet into the ponds, which are generally sized to provide water quantity and quality control for urban runoff. Quantity control helps to prevent flooding and quality control helps to remove contaminants from reaching watercourses.
Water Quality Treatment	Requirements for contaminant removal effectiveness are based on Ministry of Environment, Conservation and Parks guidelines.
Water Quantity Control	Requirements for flood control are based on the City of Peterborough and Otonabee Region Conservation guidelines. Usually the runoff that occurs after development must be controlled to match pre-development levels.
Low Impact Development (LID)	These SWM measures treat runoff closer to its source than the “end-of-pipe” facility and are designed to mimic existing runoff conditions. LID measures, such as bioretention, enhanced grass swales and dry swales, are small scale and designed to encourage infiltration, filtration and detention of stormwater.
Permeable Pipes	Modified storm pipe system that includes perforated pipes to encourage infiltration and reduce the volume of runoff reaching the pipe outlet.
Oil Grit Separators (OGS)	Specially designed manhole structures that allow for separation of oils and road grit from runoff. The waste is held in the manhole for regular clean out.
Dry Pond	Pond that retains water during a storm event, but allows water to infiltrate the soil or discharge so the pond is dry when there is no rainfall.
Treatment Train	Consists of a combination of LID and SWM Pond(s) that provide runoff treatment measures from the runoff source to the outlet point. The treatment train adds appropriate measures throughout the system. It provides flexibility in stormwater design to accommodate site-specific conditions.

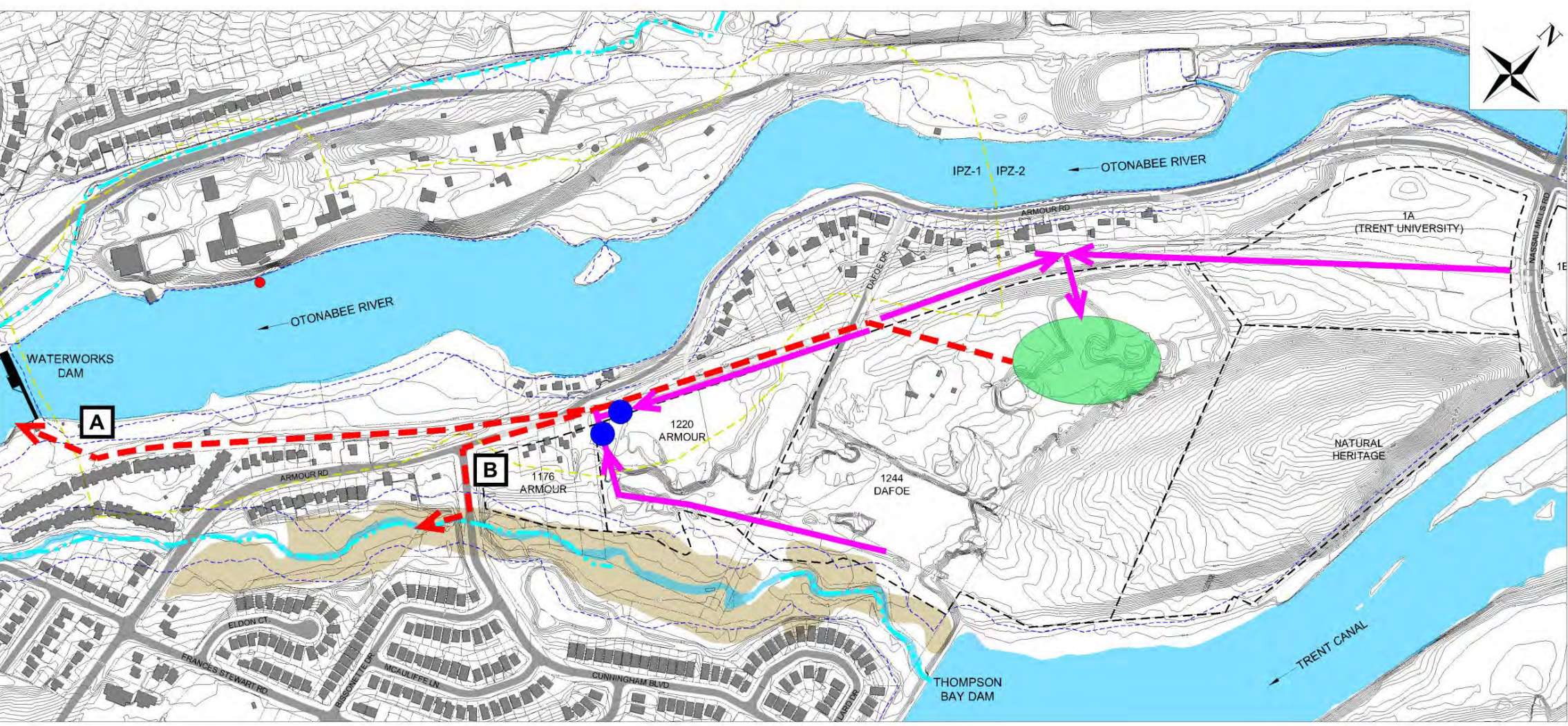
SWM Options for effectively treating runoff from transportation corridors and/or development lands were considered with reference to the locations where transportation infrastructure and/or development is planned.

- Armour Road/Auburn North Area
- Nassau Mills/West Campus Area
- Nassau Mills/ Armour/ University/ Pioneer/ East Campus Area
- Water Street/Woodland Drive Area
- Water Street – South of Nassau Mills Road

The suitability of each type of SWM measure was examined for these locations and the preferred SWM option identified.



Stormwater Options – Armour Rd/Auburn North

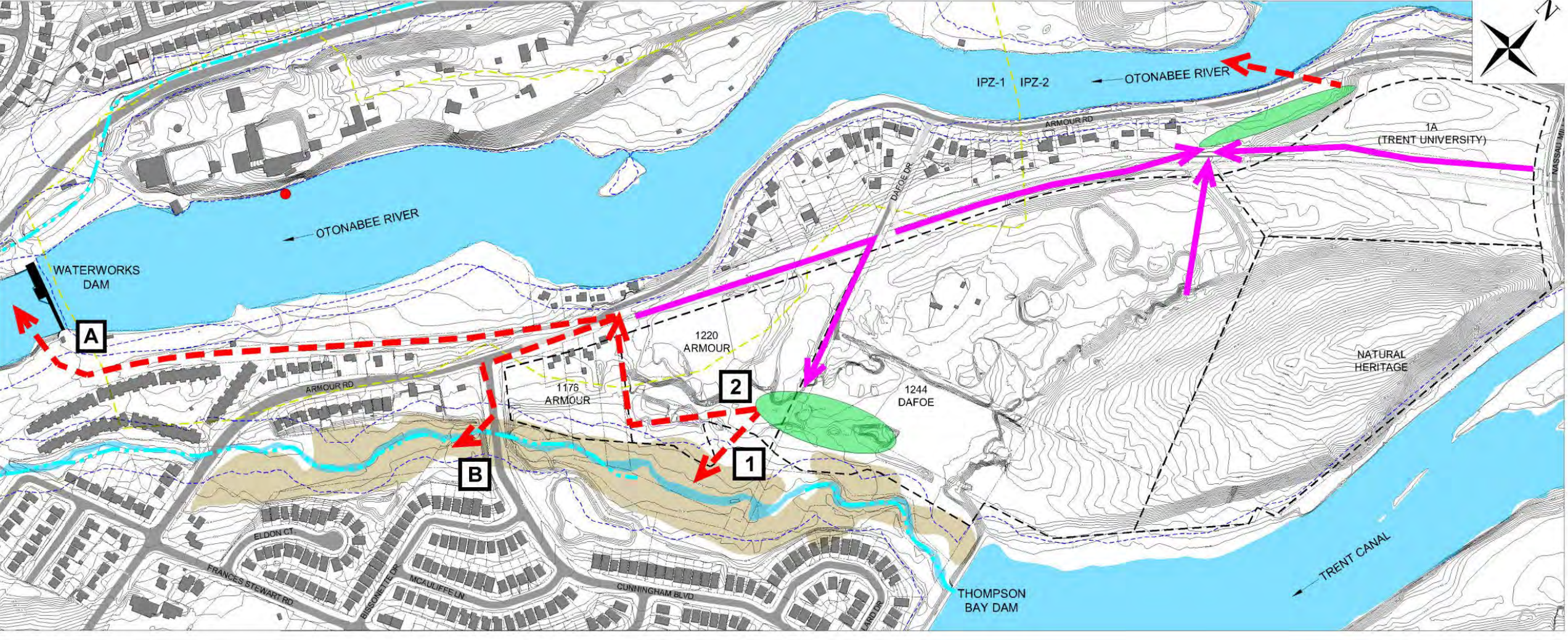
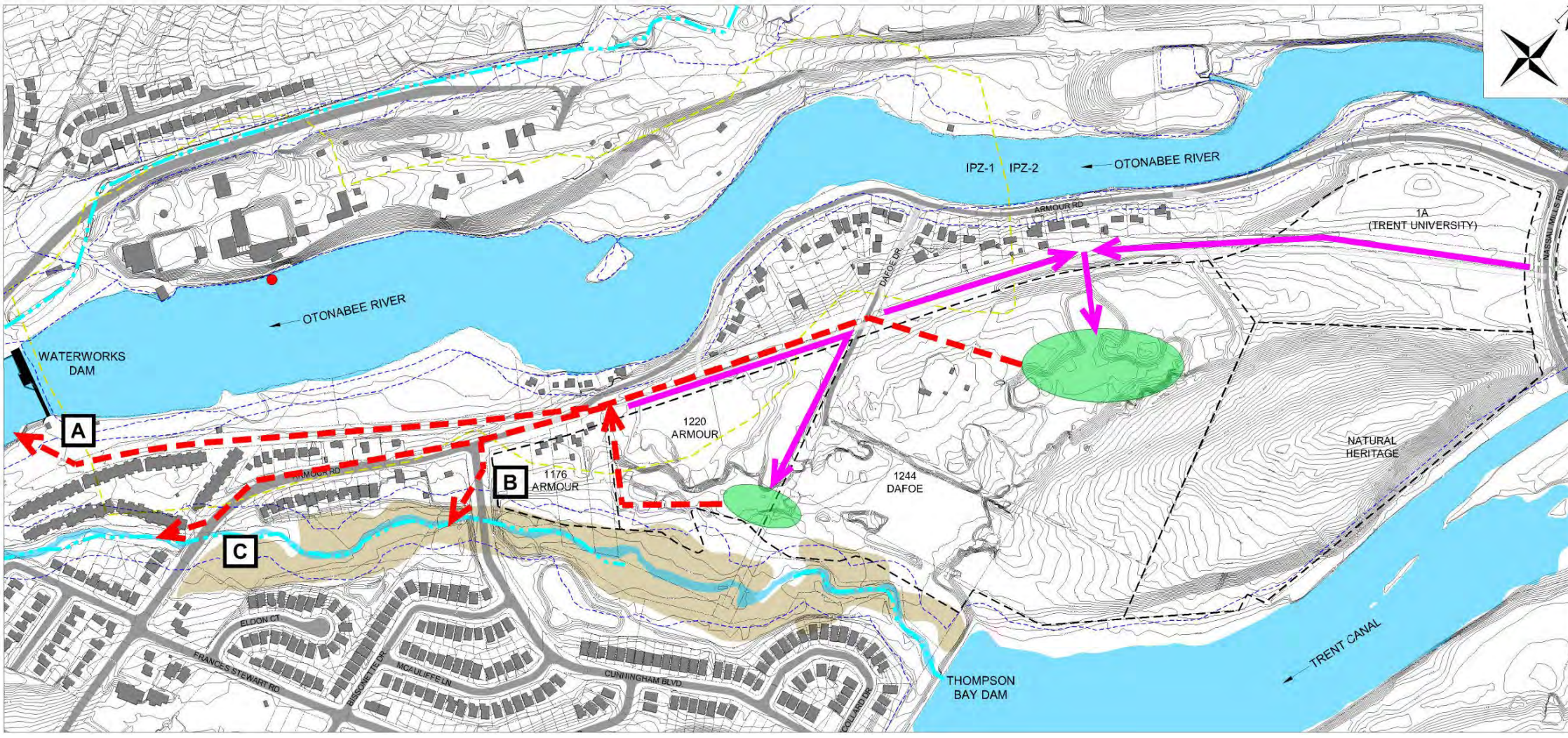


OPTION 1
Use Quarry Depression as SWM Pond to service North Area and Oil Grit Separators to service South Area

- A** - Storm Sewer or Combination of Storm Sewer and Ditch to Otonabee River Downstream of Waterworks Dam
B - Outlet Downstream of Thompson Creek Crossing

OPTION 2
Use Quarry Depression as SWM Pond to service North Area and Small SWM Pond to service South Area

- A** - Storm Sewer or Combination of Storm Sewer and Ditch to Otonabee River Downstream of Waterworks Dam
B - Outlet Downstream of Thompson Creek Crossing
C - Outlet Downstream of Thompson Creek Crossing

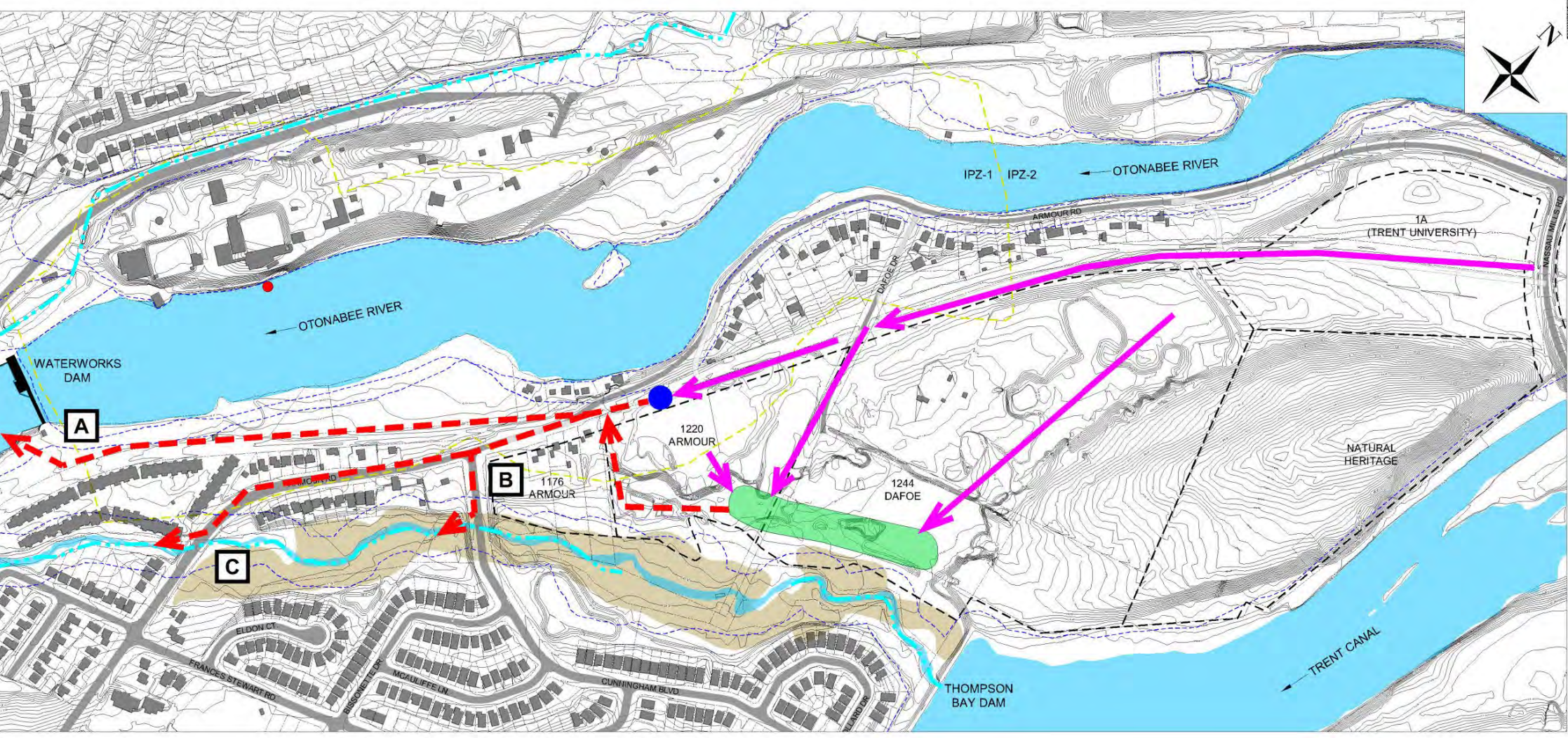
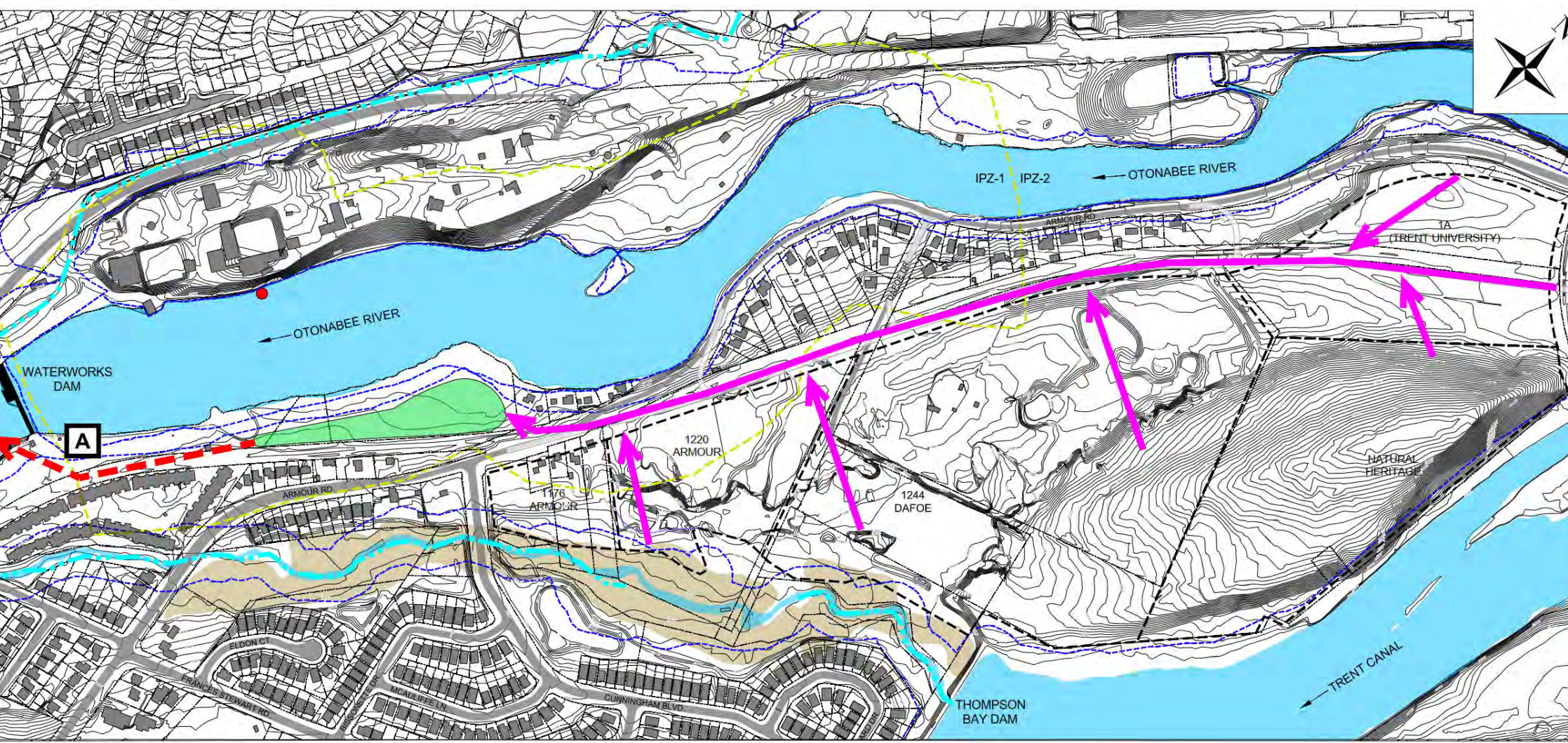


OPTION 3
Two Independent SWM Ponds

- 1** - Water Quality Outflow to Thompson Creek and balance of flow to A or B
2 - Total Outflow to A or B
A - Storm Sewer or Combination of Storm Sewer and Ditch to Otonabee River Downstream of Waterworks Dam
B - Outlet Downstream of Thompson Creek Crossing

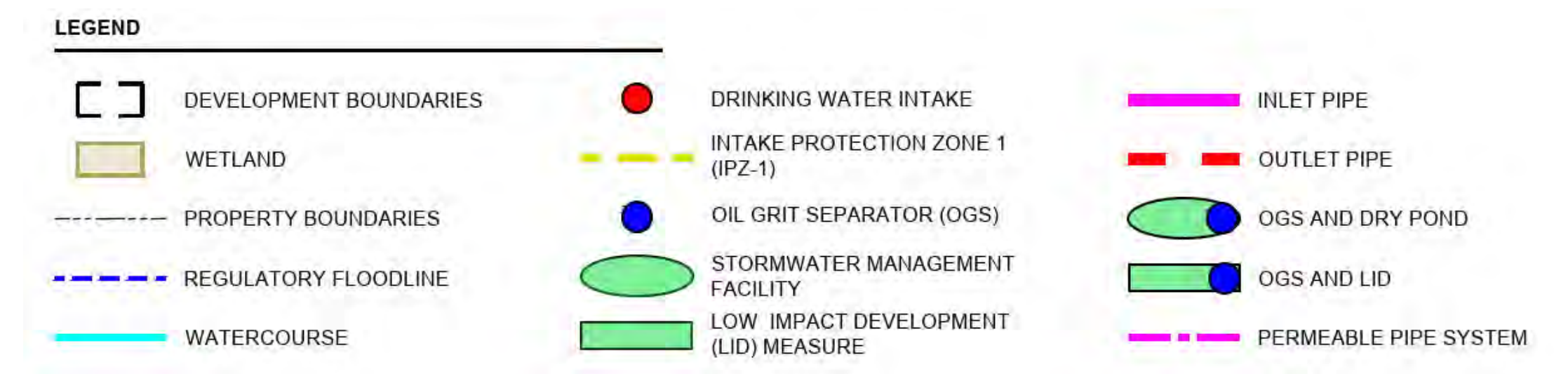
OPTION 4
One SWM Pond at the Otonabee River Consistent with Master Drainage Plan and Secondary Plan

- A** - Total Pond Outflow To Storm Sewer Or Ditch To Otonabee River Downstream Of Waterworks Dam



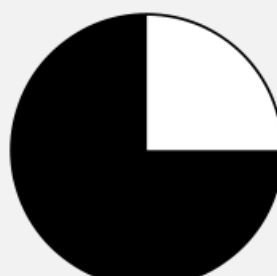
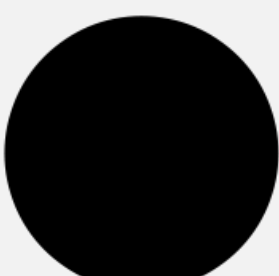
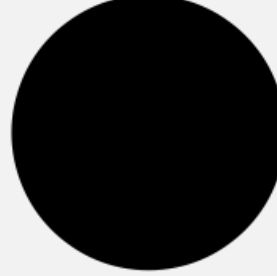
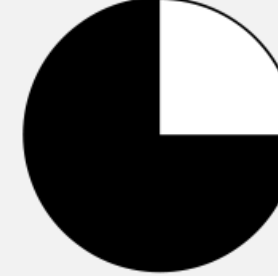
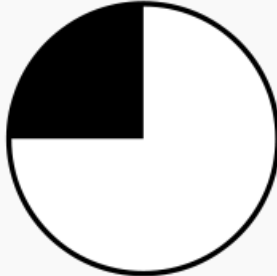
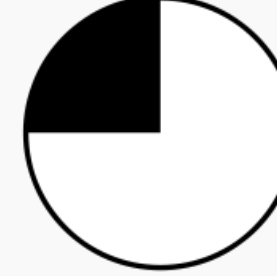
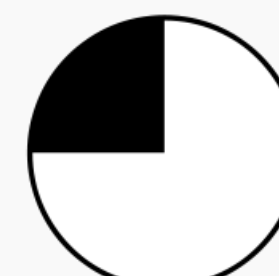
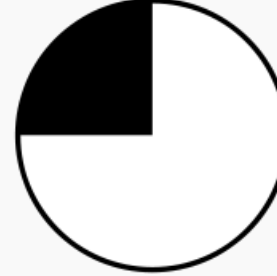
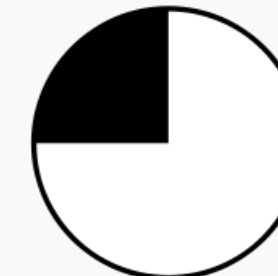
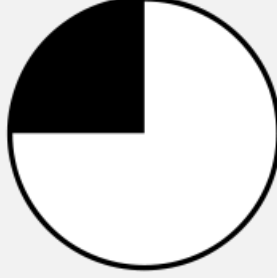
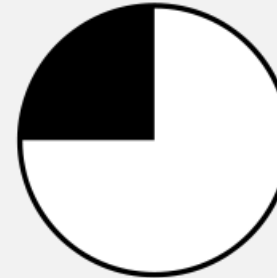
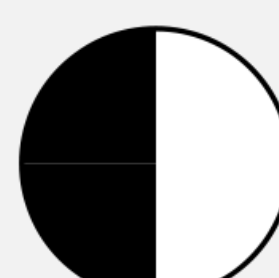
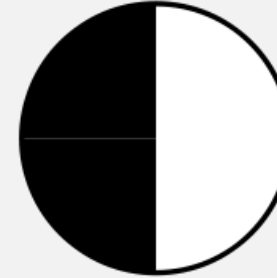
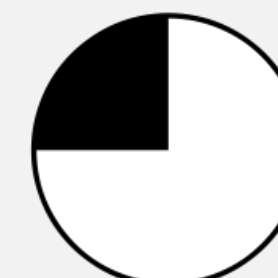
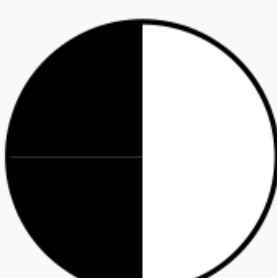
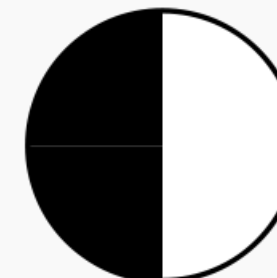
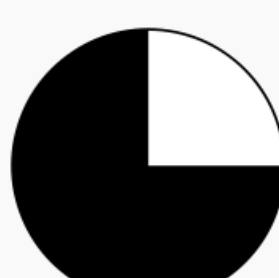
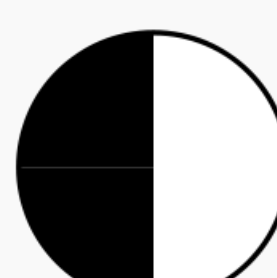
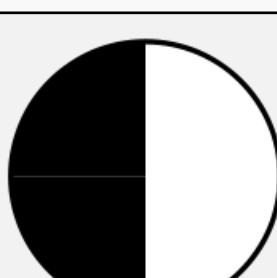
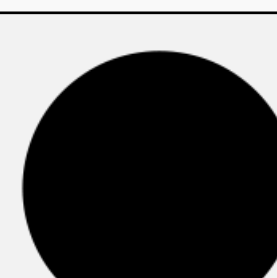
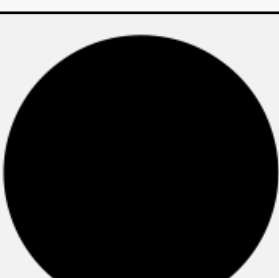
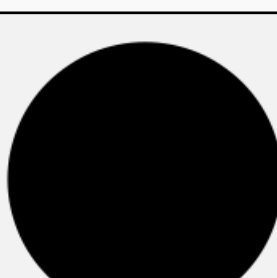
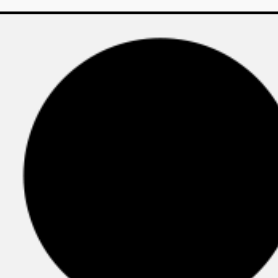
OPTION 5
One SWM Pond at Thompson Creek with a portion of Armour Road serviced by an Oil Grit Separator

- A** - Storm Sewer or Combination of Storm Sewers and Ditch to Otonabee River Downstream of Waterworks Dam
B - Outlet Downstream of Thompson Creek Crossing
C - Outlet Downstream of Thompson Creek Crossing



Evaluation of Stormwater Options – Armour Road/Auburn North

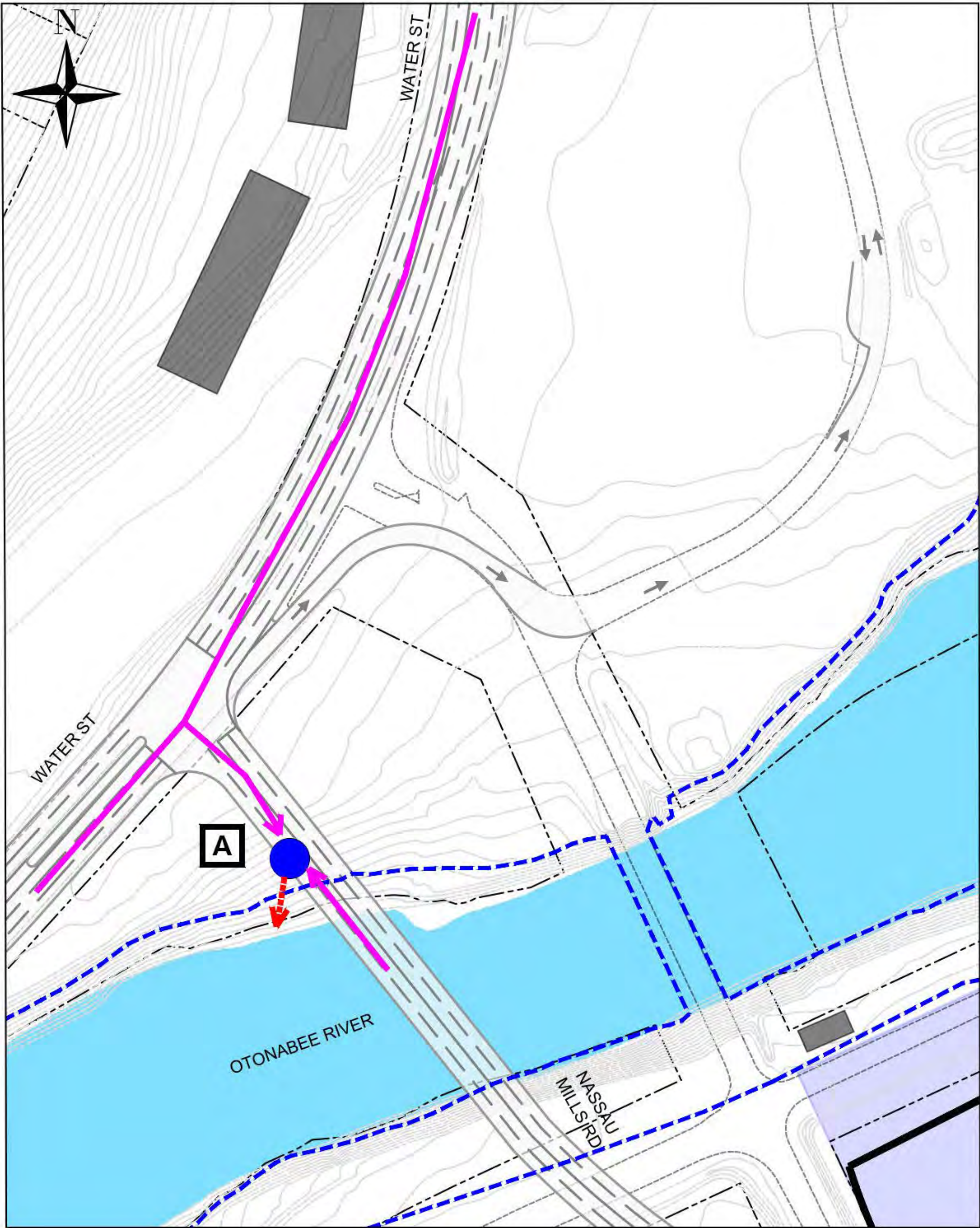
Most Preferred     Least Preferred

Criteria Group	Option 1 Quarry Pond servicing North Area and Oil Grit Separators servicing South Area	Option 2 Quarry Pond servicing North Area and Small SWM Pond servicing South Area	Option 3 Two Independent SWM Ponds	Option 4 One SWM Pond Consistent with Master Drainage Plan	Option 5 One SWM Pond at Thompson Creek
Natural Environment					
Cultural Environment					
Physical Environment					
Socio-Economic Environment					
Technical					

Option 3 is Preferred because:

- o Addresses water quality and quantity treatment
- o Allows road to be serviced at two locations keeping infrastructure costs lower
- o Serves planned development by maximizing developable area
- o Allows road and development to be implemented in stages or separately
- o Allows for potential integration with adjacent natural and recreation areas
- o Minimizes potential disruption to existing residences

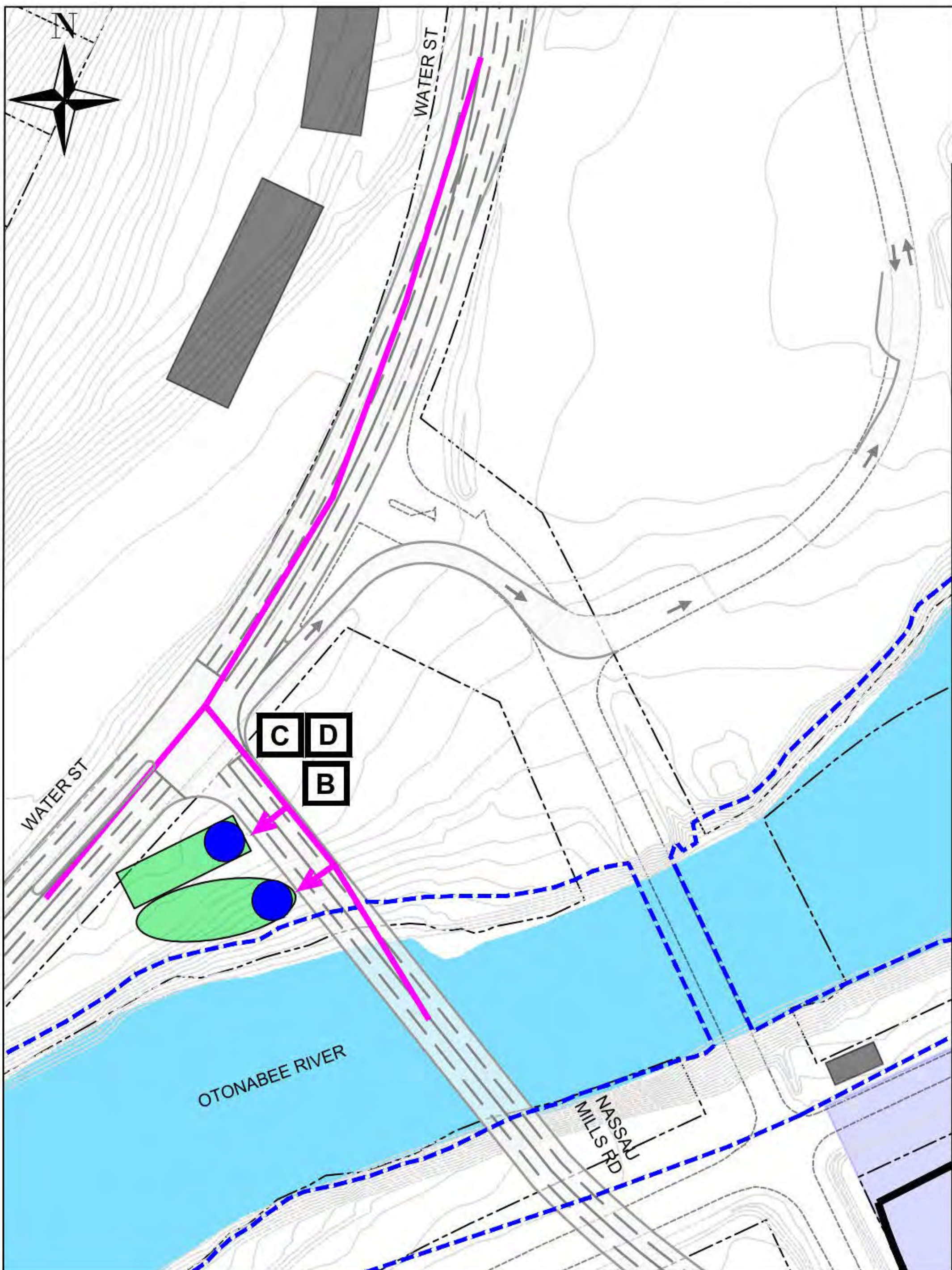
Stormwater Options – West Campus / Nassau Mills Road - Water Street - West Bank Drive



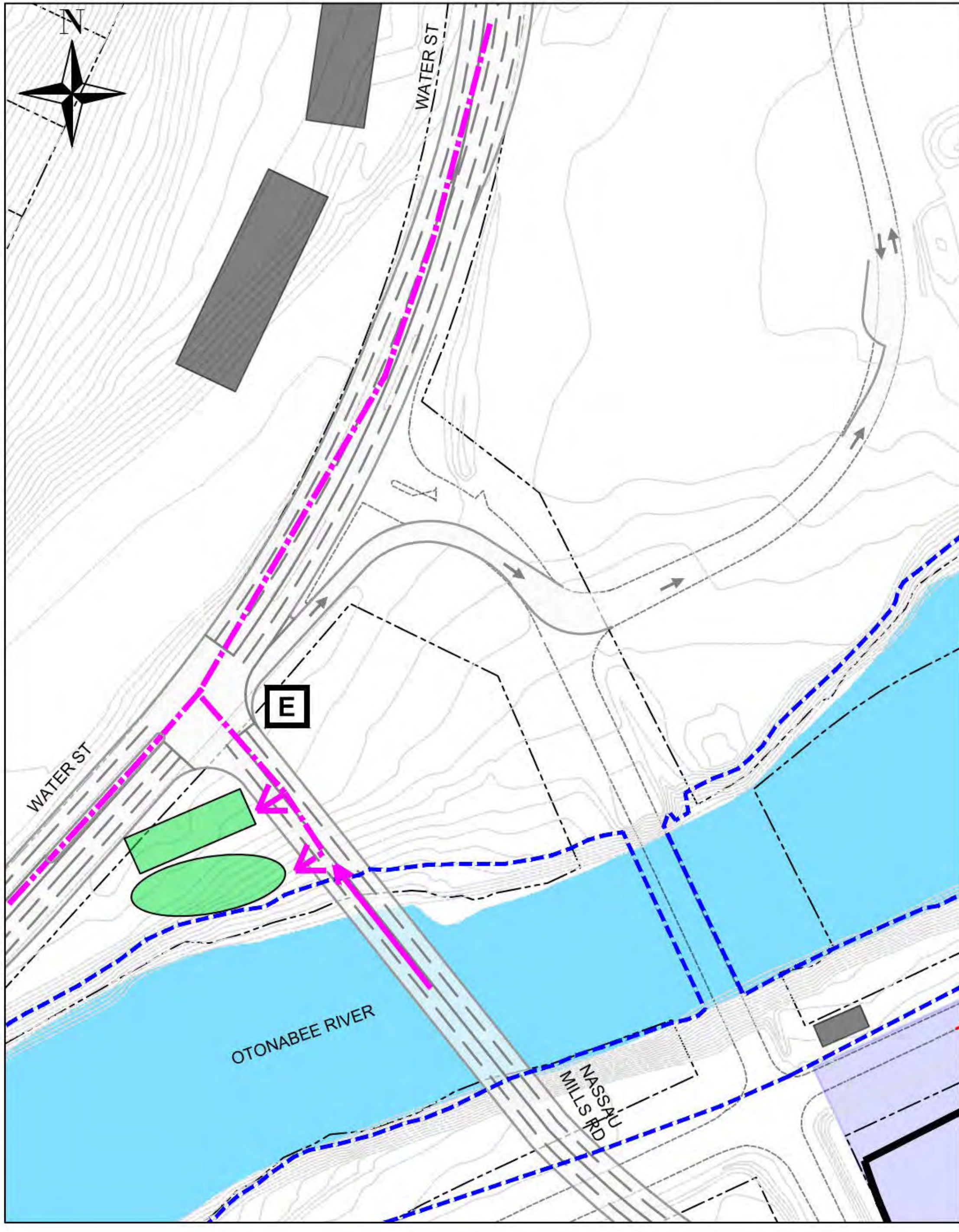
OPTION A
Oversized Storm Sewer Pipe Storage with Oil Grit Separator

LEGEND

DEVELOPMENT BOUNDARIES	DRINKING WATER INTAKE	INLET PIPE
WETLAND	INTAKE PROTECTION ZONE 1 (IPZ-1)	OUTLET PIPE
PROPERTY BOUNDARIES	OIL GRIT SEPARATOR (OGS)	OGS AND DRY POND / UNDERGROUND STORAGE
REGULATORY FLOODLINE	STORMWATER MANAGEMENT FACILITY	OGS AND LID
WATERCOURSE	LOW IMPACT DEVELOPMENT (LID) MEASURE	PERMEABLE PIPE SYSTEM



OPTION B, C and D
B – Storm Sewers with Oil Grit Separator with Balance of Flow to Dry Pond / Underground Storage
C – Storm Sewers with Oil Grit Separator with Balance of Flow to Low Impact Development Measures
D - Storm Sewers with Low Impact Development Measures Only



OPTION E
Perforated Pipe System Integrated with Storm Sewers with Balance of flow to Dry Pond or Low Impact Development Measures

Evaluation of Stormwater Options – West Campus / Nassau Mills Road - Water Street - West Bank Drive

Most Preferred

Least Preferred

Criteria Group	Option A Oversized Storm Pipe with Oil Grit Separator	Option B Oil Grit Separator and Dry Pond / Underground Storage	Option C Oil Grit Separator and Low Impact Development Measure	Option D Low Impact Development Measure Only	Option E Perforated Pipe System to Dry Pond or Low Impact Development Measure
Natural Environment					
Cultural Environment					
Physical Environment					
Socio-Economic Environment					
Technical					

- Option C is preferred subject to further assessment because:

 - o Addresses water quality and quantity treatment
 - o Treats runoff from entire road and not just widening or improvements
 - o Allows integration of solution with recreation and natural environment
 - o Can be implemented in stages
 - o Allows for integration with transportation design
 - o Incorporates Low Impact Design (LID)

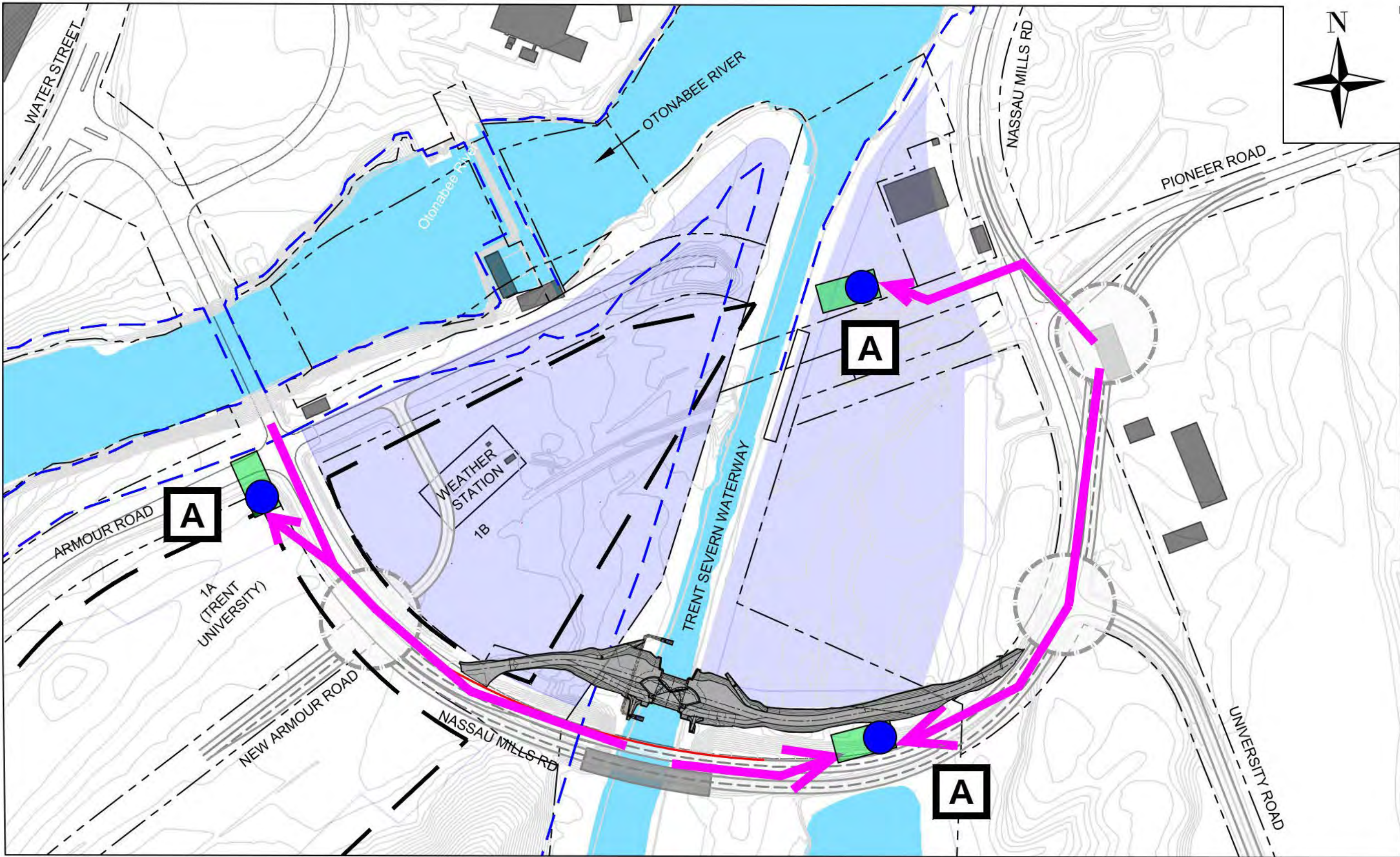
- If further assessment indicates Option C cannot be implemented, the preferred is Option B

Water Street – South of Nassau Mills Road:

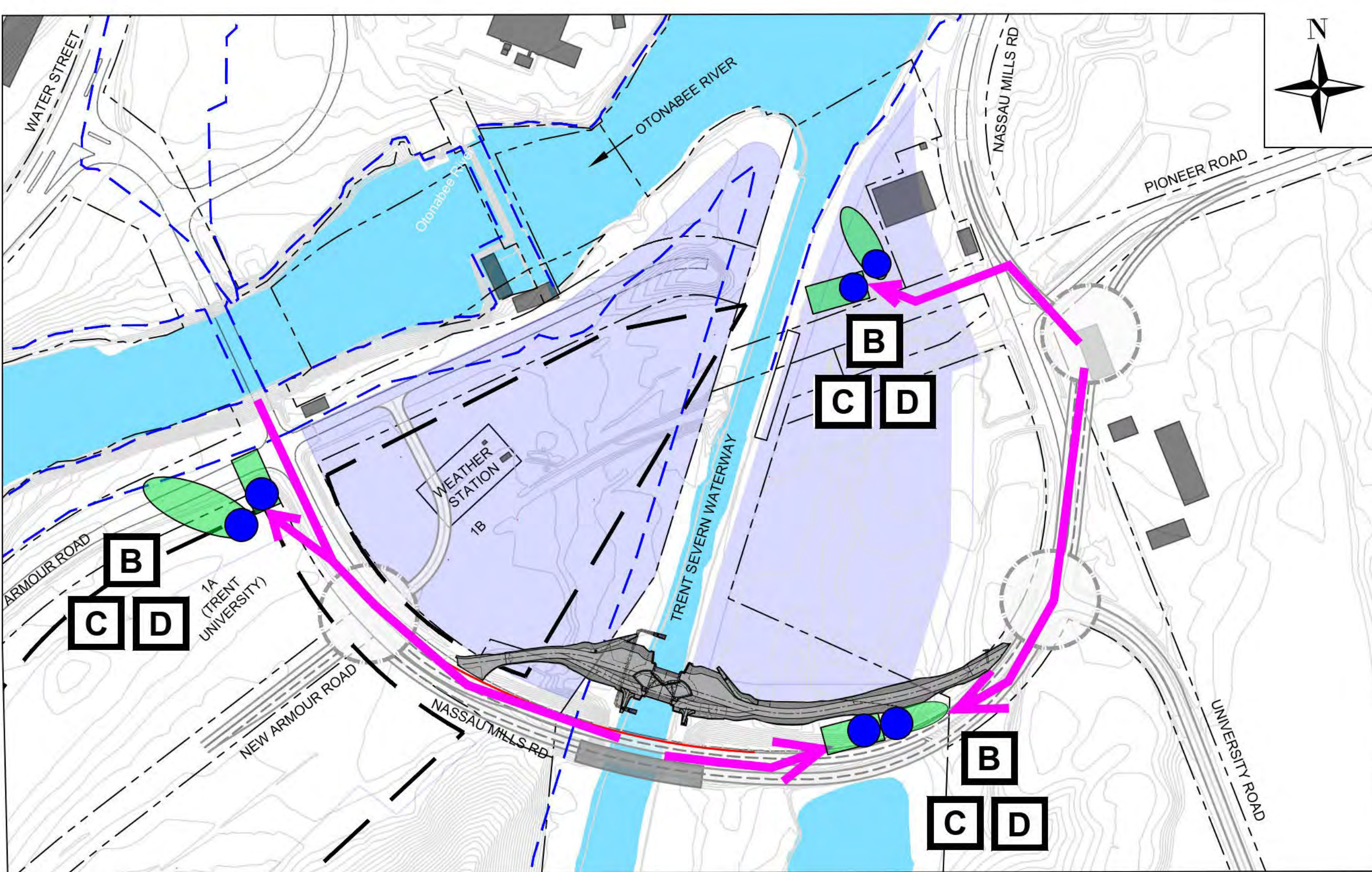
 - o Due to localized road improvements, stormwater management is recommended to be integrated into existing storm system

Stormwater Options – East Campus / Nassau Mills Road

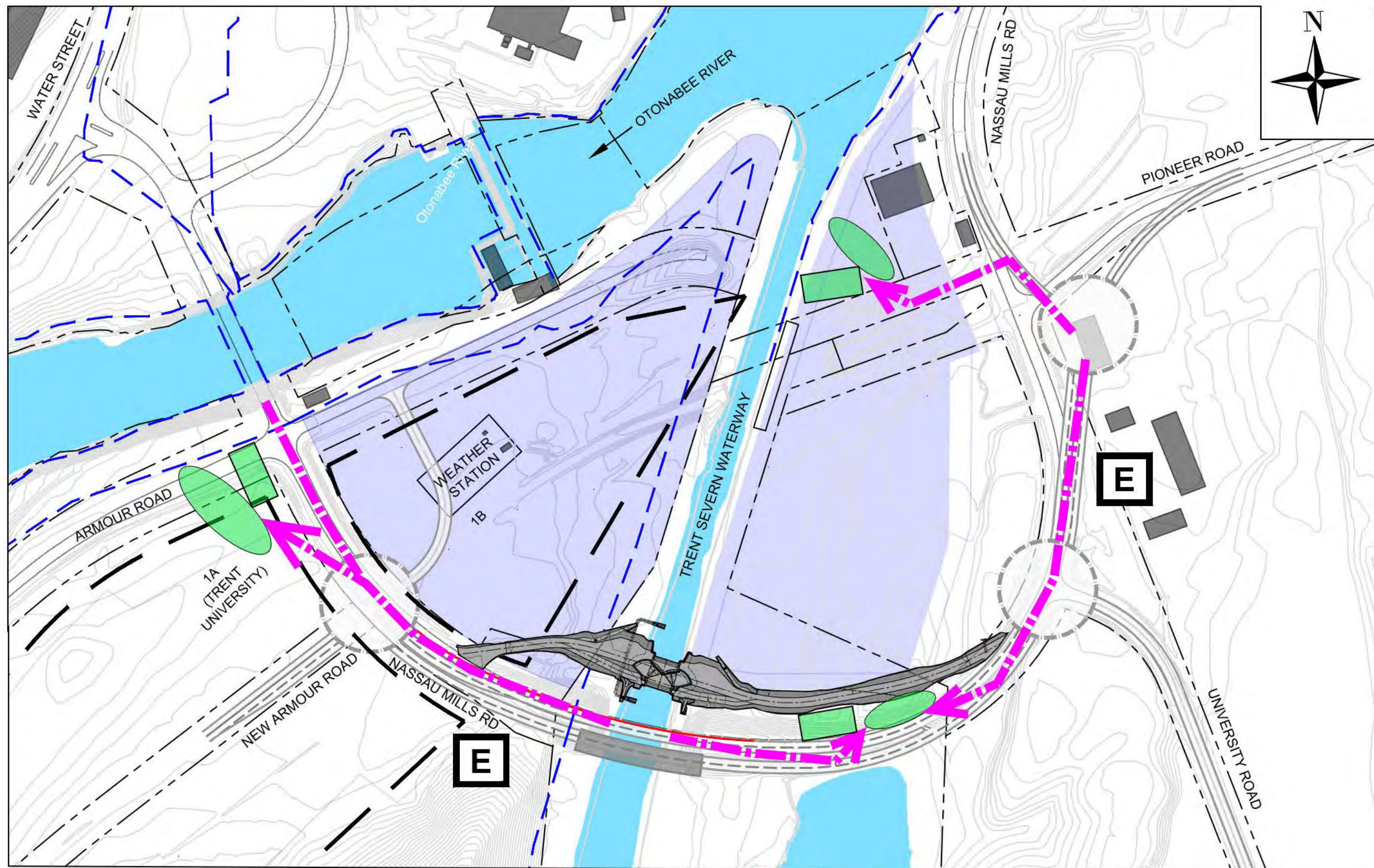
Alternatives: Armour Rd – Pioneer Rd – University Rd Intersections



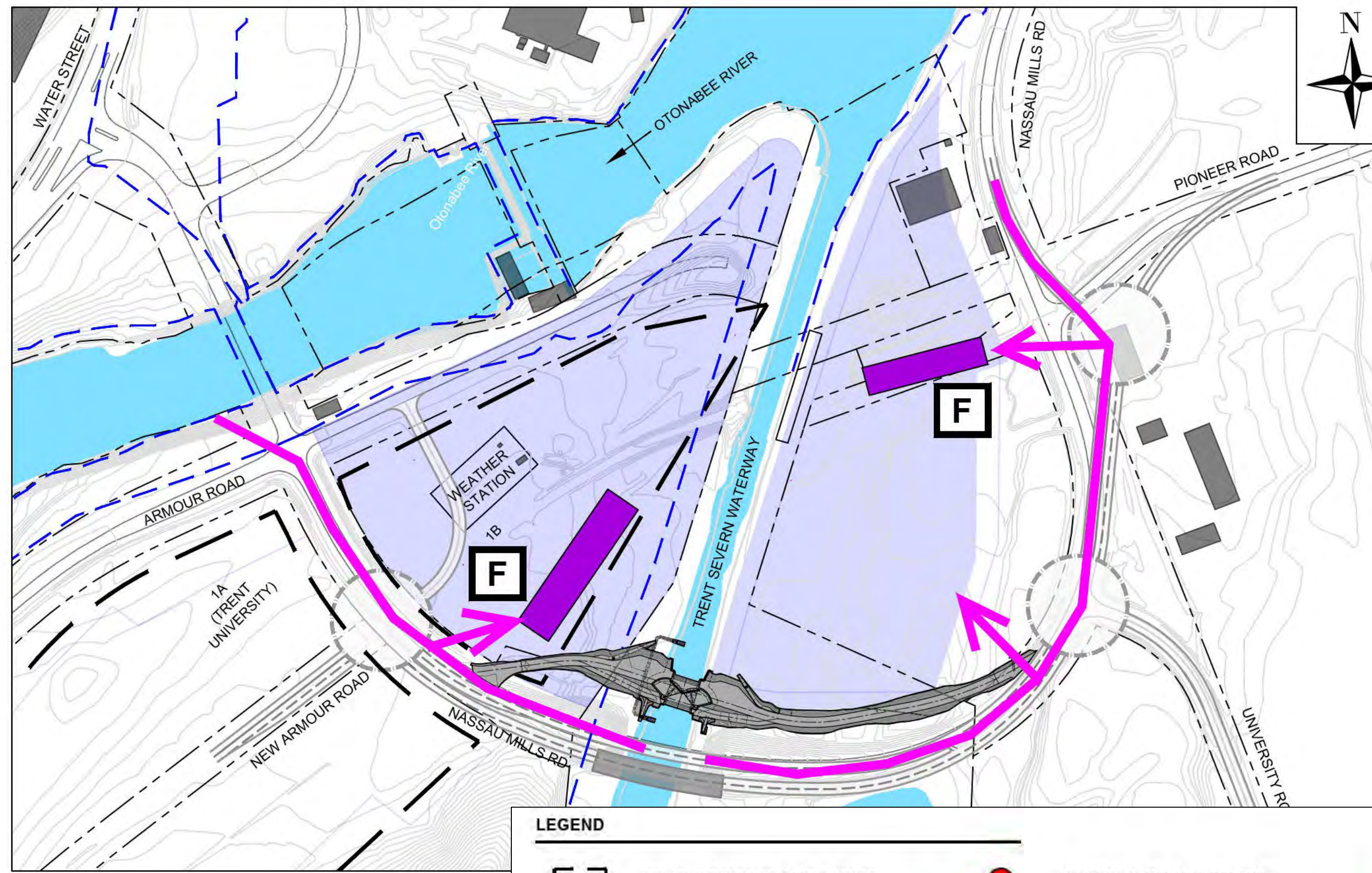
OPTION A
Oversized Storm Sewer Pipe Storage with Oil Grit Separator



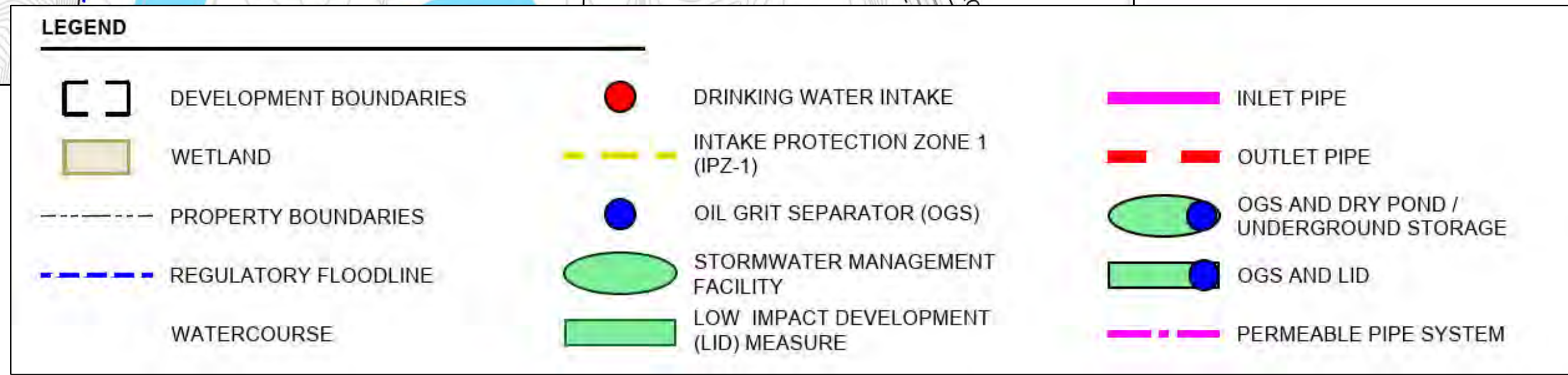
OPTION B, C and D
B – Storm Sewers with Oil Grit Separator with Balance of Flow to Dry Pond / Underground Storage
C – Storm Sewers with Oil Grit Separator with Balance of Flow to Low Impact Development Measure
D – Storm Sewers with Low Impact Development Measure Only



OPTION E
Perforated Pipe System Integrated with Storm Sewers with Balance of flow to Dry Pond or Low Impact Development Measures

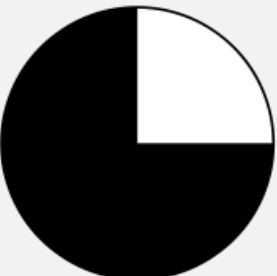
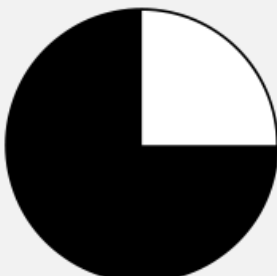
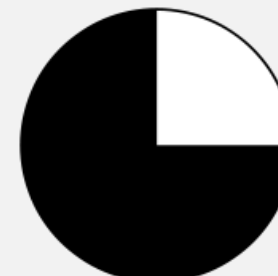
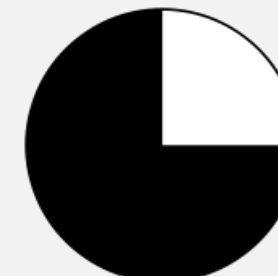
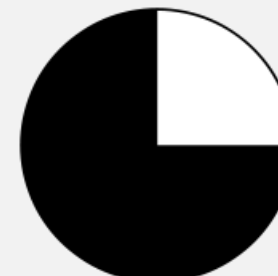
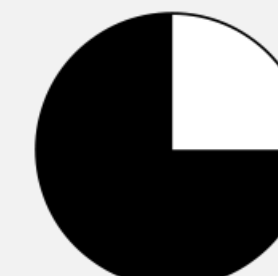
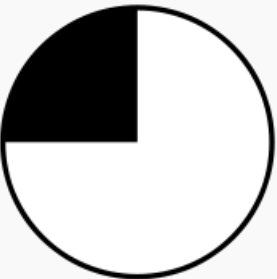
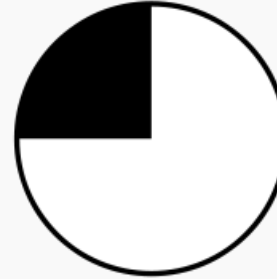
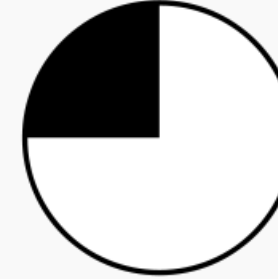
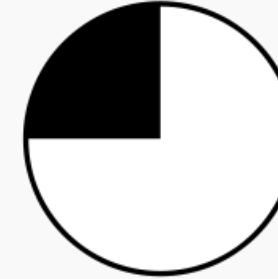
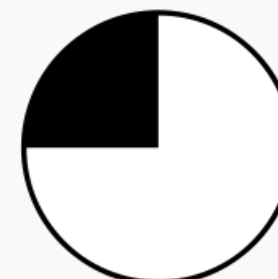
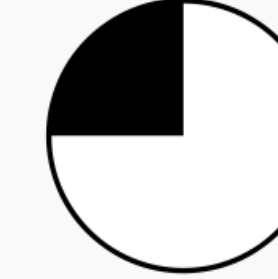
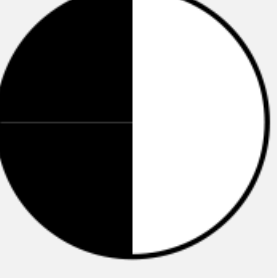
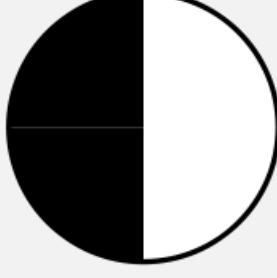
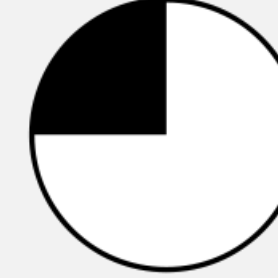
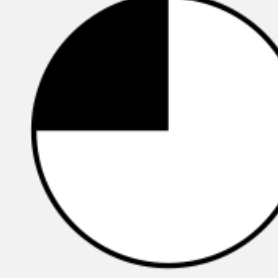
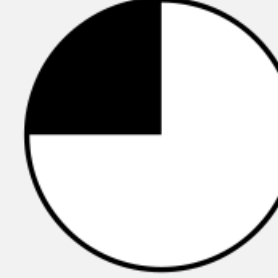
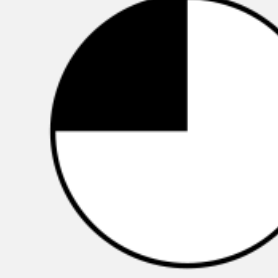
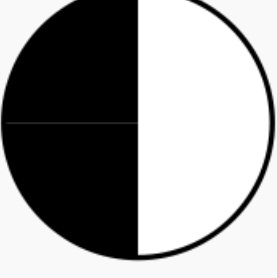
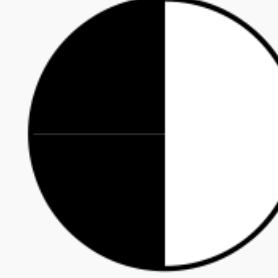
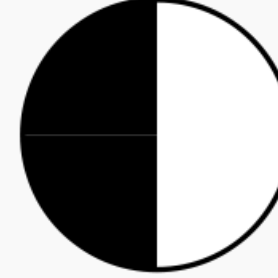
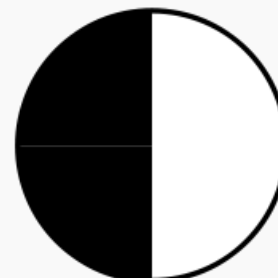
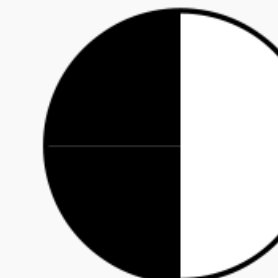
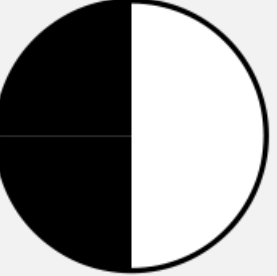
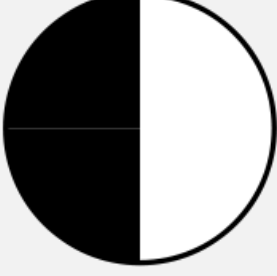
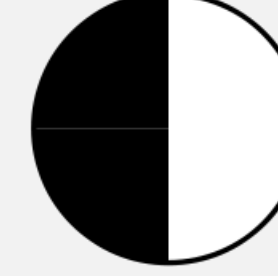
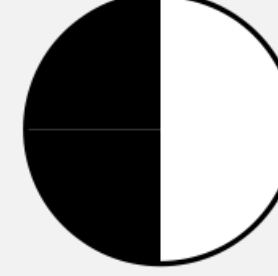
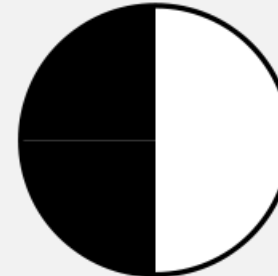
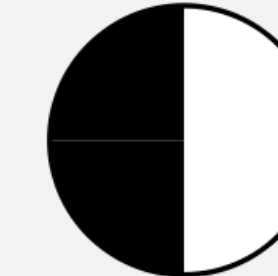


OPTION F
Shared Stormwater Measures with Future Development



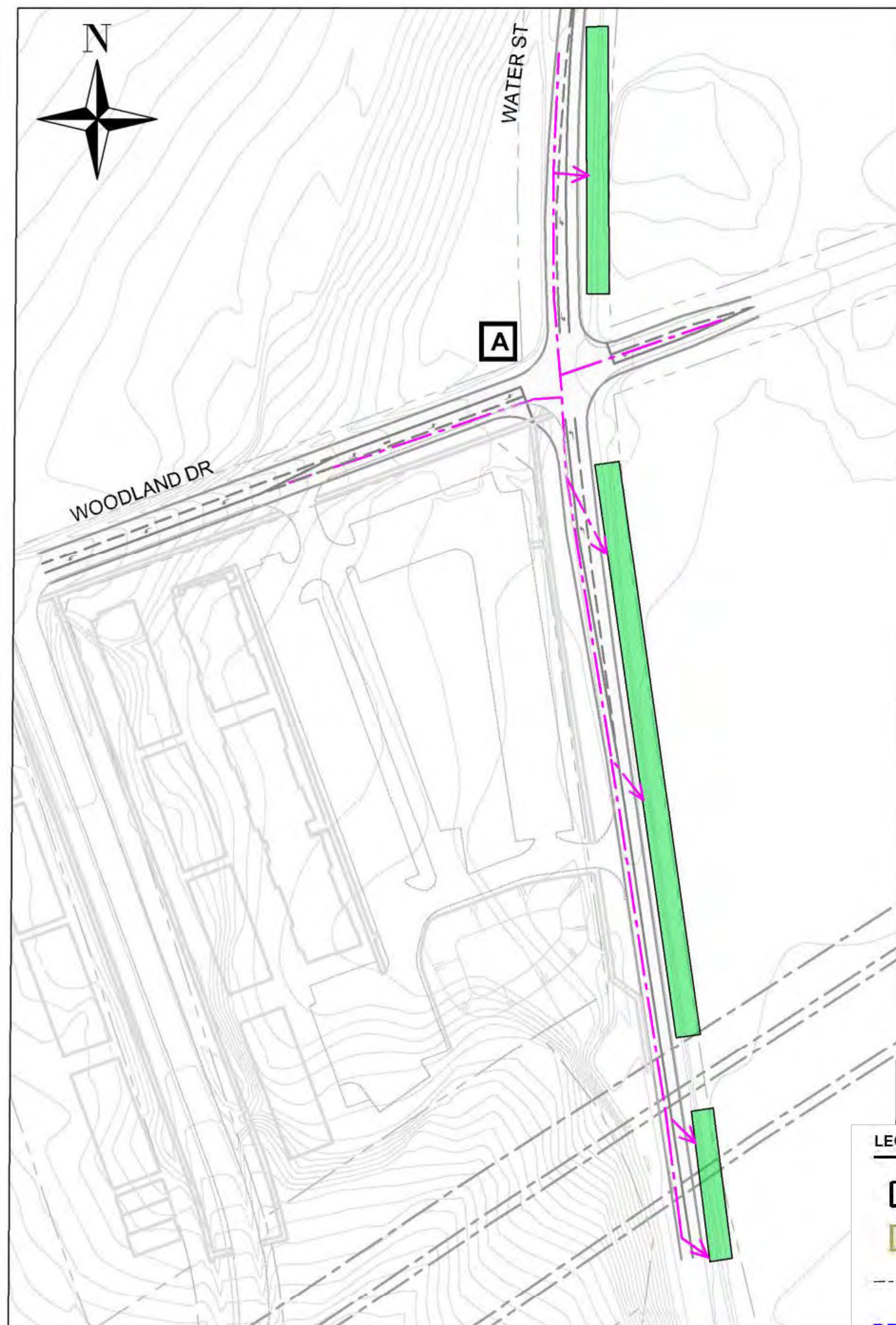
Evaluation of Stormwater Options – East Campus / Nassau Mills Road Alternatives: Armour Rd – Pioneer Rd – University Rd

Most Preferred     Least Preferred

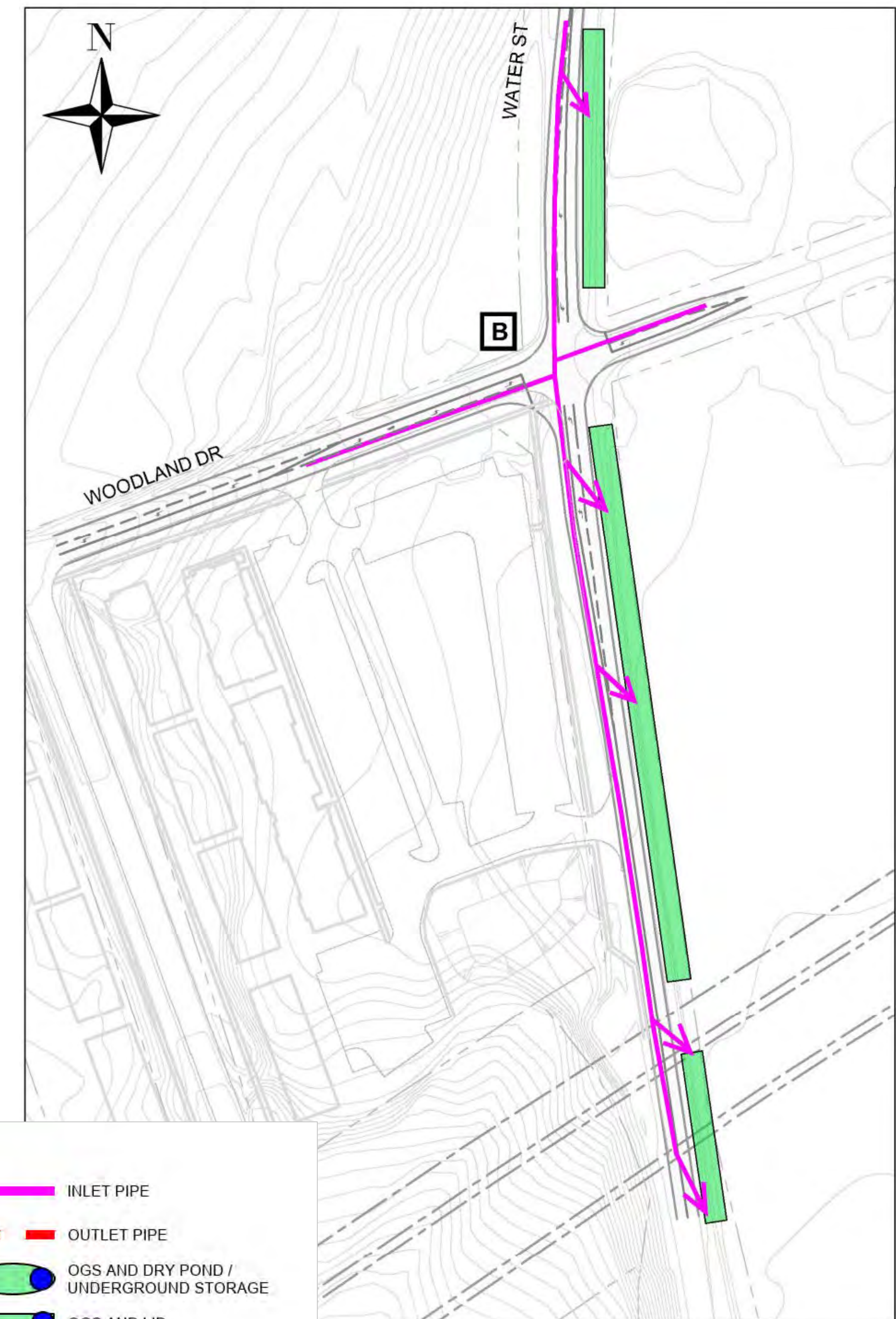
Criteria Group	Option A Oversized Storm Pipe with Oil Grit Separator	Option B Oil Grit Separator and Dry Pond/Underground Storage	Option C Oil Grit Separator and Low Impact Development Measure	Option D Low Impact Development Measure Only	Option E Perforated Pipe System to Dry Pond or Low Impact Development Measure	Option F Shared Stormwater Facility with Development
Natural Environment						
Cultural Environment						
Physical Environment						
Socio-Economic Environment						
Technical						

- Option B is Preferred because:**
- o Addresses water quality and quantity treatment for the area
 - o Treats runoff from entire road and not just widening or improvements
 - o Allows integration of solution with recreation and natural environment
 - o Reduces impact on groundwater and wells within the area
 - o Can be implemented in stages

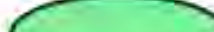
Stormwater Options – Water Street at Woodland Drive



OPTION A
Perforated Pipe System Integrated with
Storm Sewers in Urban Section with Low
Impact Development Measures
Incorporated into Widened Roadside
Ditches

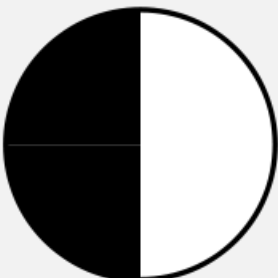
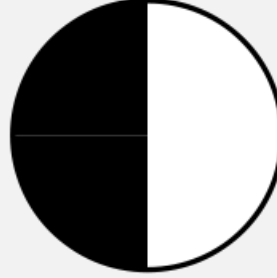
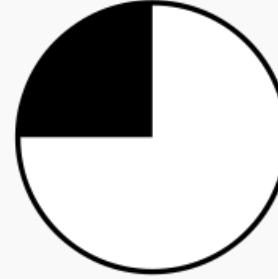
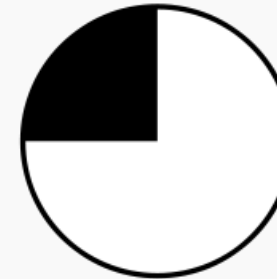
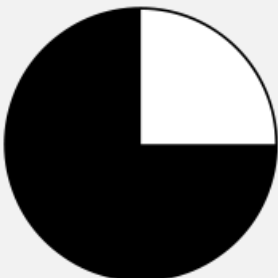
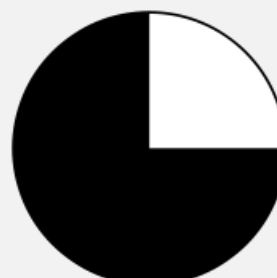
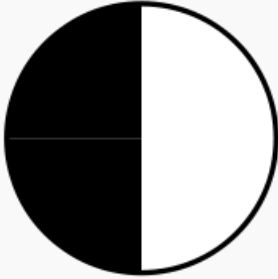
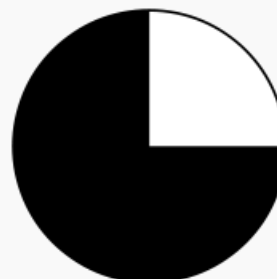
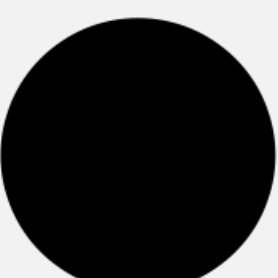
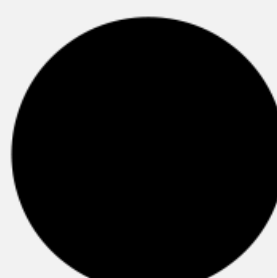


OPTION B
Oversized Storm Sewers in Urban
Section with Low Impact
Development Measures Incorporated
into Widened Roadside Ditches

LEGEND					
	DEVELOPMENT BOUNDARIES		DRINKING WATER INTAKE		INLET PIPE
	WETLAND		INTAKE PROTECTION ZONE 1 (IPZ-1)		OUTLET PIPE
	PROPERTY BOUNDARIES		OIL GRIT SEPARATOR (OGS)		OGS AND DRY POND / UNDERGROUND STORAGE
	REGULATORY FLOODLINE		STORMWATER MANAGEMENT FACILITY		OGS AND LID
	WATERCOURSE		LOW IMPACT DEVELOPMENT (LID) MEASURE		PERMEABLE PIPE SYSTEM

Evaluation of Stormwater Options – Water St at Woodland Dr

Most Preferred     Least Preferred

Criteria Group	Option A Perforated Pipe System and Low Impact Development Measures	Option B Oversized Pipes and Low Impact Development Measures
Natural Environment		
Cultural Environment		
Physical Environment		
Socio-Economic Environment		
Technical		

- Option B is Preferred because:**
- o Addresses water quality and quantity treatment for the area
 - o Treats runoff from entire road and not just widening or improvements
 - o Allows integration of solution with recreation and natural environment
 - o Can be implemented in stages

Next Steps - Stormwater

- The project team will consider all comments received from this consultation and from a Public Information Centre to be held in the future. The PIC will present refined alternatives, preliminary evaluation and preliminary design alternatives.
- After receiving comments, the project team will confirm or update the Preliminary Preferred Options.
- Preliminary Designs will involve:
 - Develop SWM pond designs
 - Identify property requirements for SWM facilities including ponds, enhanced swales and oil-grit separators
 - Provide cost estimates
 - Develop implementation plan considering the needs of related transportation infrastructure and development
- The project team will then hold another round of consultation before preparing the Environmental Study Report for public review

Comments

How can you provide comments?

- Visit the Project website. Go to <http://www.peterborough.ca/> and click on: "Doing Business", "Studies and Projects" and look under "Projects" for "North End – Trent University Area Transportation and Wastewater Management Class Environmental Assessment"
- Send comments by email to:
NorthEndEA@Peterborough.ca

Questions?

If you have any additional questions:

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