ATTACHMENT 3:

International Terminal Expansion – Stormwater Management Impact Study Technical Memorandum (AECOM, July 2014)

July 2014

TECHNICAL MEMORANDUM

To: Alex Ollerman
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From: Bob Anderson
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Subject: **International Terminal Expansion – Stormwater Management Impact Study**
Comprehensive Environmental Compliance Services
MAA SV-10-001B – Task Order No. 17 Addendum
Baltimore/Washington International
Thurgood Marshall Airport

The Maryland Aviation Administration (MAA) is considering the expansion of the international terminal at Baltimore/Washington International Thurgood Marshall Airport (BWI). In support of this effort, AECOM is providing guidance on stormwater management requirements for this project. The purpose of this technical memorandum (TM) is to conceptually assess stormwater requirements for removal of Pond B14 and addition of new impervious surfaces. For this analysis, the Pond B14 was considered to be a reach as defined in the draft Institutional Management Plan (IMP), dated July 2014. The stormwater impacts for this study focused on two areas of concern: treatment requirements for the land use conversion of pervious to impervious and pipe capacity of the main stormwater pipes from Pond B14 to Pond B15 during the five-year design storm.

1. Development modifications requirements: The proposed project consists of approximately 13.2 acres of existing impervious and new impervious area. Based on MDE's redevelopment and new development requirements of Environmental Site Design (ESD) to the Maximum Extent Practical (MEP), 1.4 ac-ft of treatment would be required according to the following table. The previous memorandum submitted by AECOM in May 2013 identified three infiltration trench options, each treating 0.8 ac-ft, so two of these options would need to be implemented. The figure depicting the three infiltration trench locations can be found in Exhibit 2 of previous memorandum and in Attachment 1 of this TM. If MAA used Muddy Bridge Branch water quality credits, 10.5 impervious acres of credit would be needed of the 34.5 acres available; however, channel protection treatment would still be required, which could be achieved using one of the infiltration options, underground detention, or capacity in Pond B15.

Development Type	Impervious Area (ac)	Rainfall Target (in)	Treatment Volume (ac-ft)	
			ESD	WQ portion
Redevelopment	5.5	1	0.2	0.2
New development	7.7	2	1.2	0.6
Total	13.2	--	1.4	0.8

2. Pipe capacity demand: The addition of impervious area and loss of peak flow reduction from the Pond B14 reach would increase the peak flows to the storm drain pipe network between Pond B14 and B15. AECOM utilized the drainage area parameters defined for

the existing and proposed conditions in the draft IMP and existing pipe network information from the 1987 as-built drawings and MAA's GIS data to develop conceptual models for the main line of the pipe network as shown in Attachment 2. Two conceptual models were developed to account for the difference in pipe sizes. A summary of full flow capacities from both pipe size scenarios is provided in the attached table.

The conceptual models indicate that the pipe network would not be able to handle the increase in flow for the five-year design storm. Multiple approaches or combinations of approaches could be implemented to mitigate the increase in flow, including flow reduction through detention in the drainage area or capacity upgrades through pipe network modification. This study is not intended to provide design of proposed improvements, and the following recommendations are intended to provide a planning level assessment of the potential stormwater mitigation options. Detailed analysis of the drainage area and field survey of the study area, including the pipe network (pipe sizes and invert elevations) should be conducted to develop a more accurate dataset for a detailed model. Inconsistencies between available data sources were noted in the pipe network (pipe sizes and invert elevations) that significantly affect the results of both conceptual models. The conceptual models consider the main line of the existing storm drain network shown in Attachment 2 and do not include the pipe networks feeding into these sections of pipe. The following two flow mitigation reduction options are presented to be implemented separately; however, reduced versions of both could potentially be combined to achieve the capacity requirements of the design storm.

a. Peak flow reduction (detention) – The proposed changes would require an estimated 2.3 ac-ft of storage[1] in the drainage area to adequately convey the five-year design storm through the existing storm drain network. This could be provided through a range of options including underground detention and infiltration practices as depicted in the previous memorandum dated May 2013, or through other ESD practices including grassed swales, rainwater harvesting, and strategic impervious conversion.

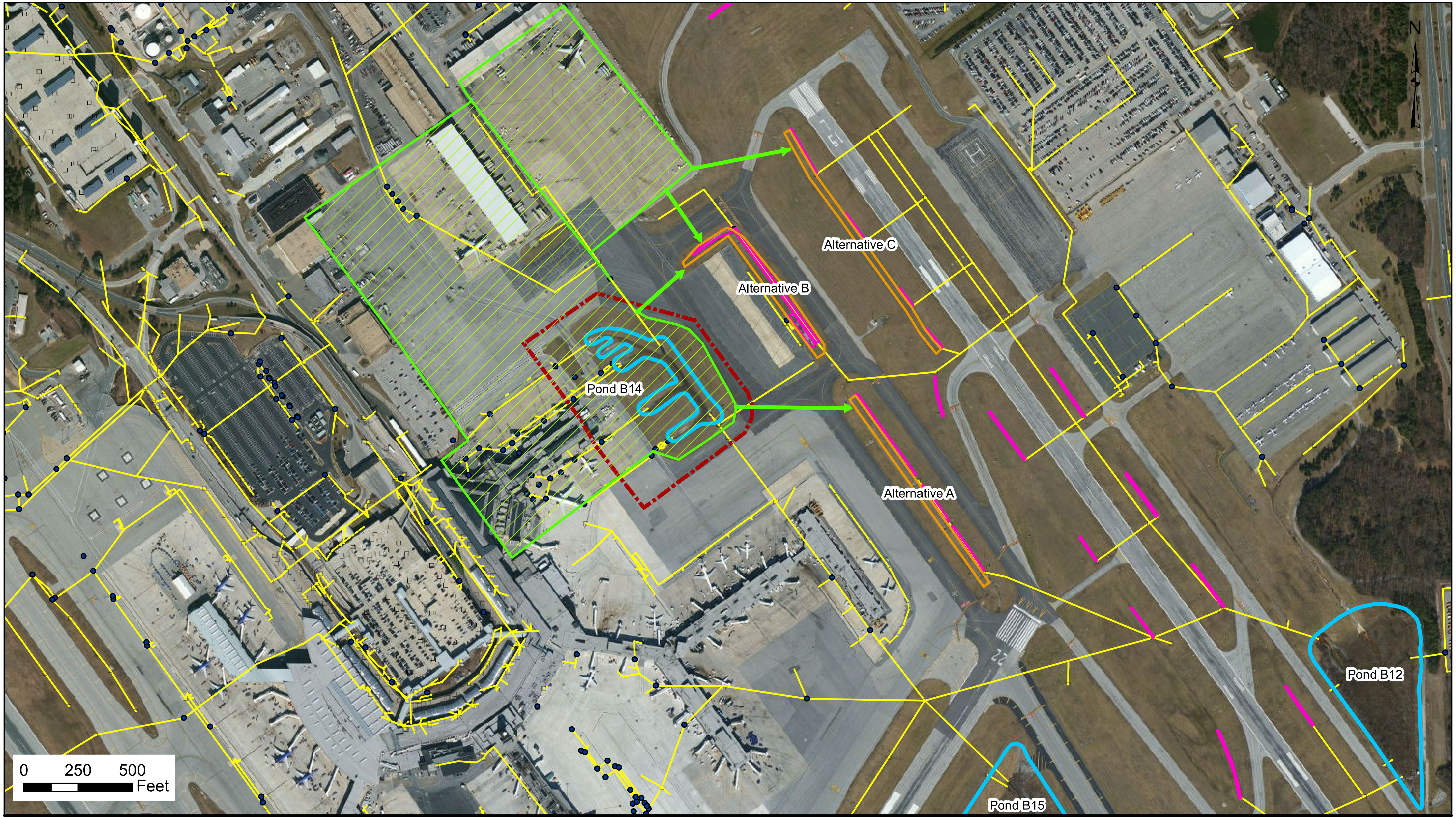
b. Capacity increase – The conceptual models indicate that the pipes between Ponds B14 and B15 are under capacity for the proposed flows. Pipe capacity can be increased through larger pipes, parallel pipes, or invert modifications. AECOM analyzed one pipe upgrade option using both sets of pipe sizes and the invert elevations from the as-built drawings. Other solutions and combinations may be more practical and result in more efficient replacement. Therefore, alternatives to address flows via pipe capacity upgrades should be analyzed during design or more detailed modeling. The pipe upgrade option evaluated for this study consists of increasing pipe segments A through J to 72 inches. This option does not alleviate surcharging or backup at pond locations, but does alleviate surcharging at catch basins or manholes. The full flow capacity of the proposed pipes for this upgrade option can be found in attached table.

The general options are listed in the table below. Option 1 involves constructing or expanding infiltration practices for minimum storage of 2.3 ac-ft. If at least 0.8 ac-ft of the detention were provided through infiltration basins shown in the previous memorandum, the stormwater ESD

[1] Depending on the method used to calculate the estimated storage volume, the 2.3 ac-ft of storage is the minimum estimate for the five-year storm. Storage volumes of up to 3 ac-ft were calculated using more conservative estimates. The storage volume depends on routing the detention system, which was not modeled in this analysis.

requirements for the project could also be met without using available water quality credits. The options are summarized below.

Option 1	ESD treatment for 2.3 ac-ft (infiltration trenches, or equal) No pipe modifications
Option 2	ESD treatment for 1.4 ac-ft (infiltration trenches, or equal) Detention of 0.9 ac-ft (underground detention) No pipe modifications
Option 3	ESD treatment for 1.4 ac-ft (infiltration trenches, or equal) Increase pipe size, or equal
Option 4	Water quality credits Channel protection treatment in Pond B15 Increase pipe size, or equal



Potential Infiltration Practice Location

Potential Area to Connect with Infiltration Practice

Assumed Project LOD (13.5 AC)

Existing BMPs

Extended Detention Pond

Infiltration Practice

Storm Sewer Line

BWI BALTIMORE/WASHINGTON INTERNATIONAL Thurgood Marshall AIRPORT

International Terminal Expansion- SWM Impact Study

Exhibit 2- Conceptual Infiltration Locations

Date: May 2013

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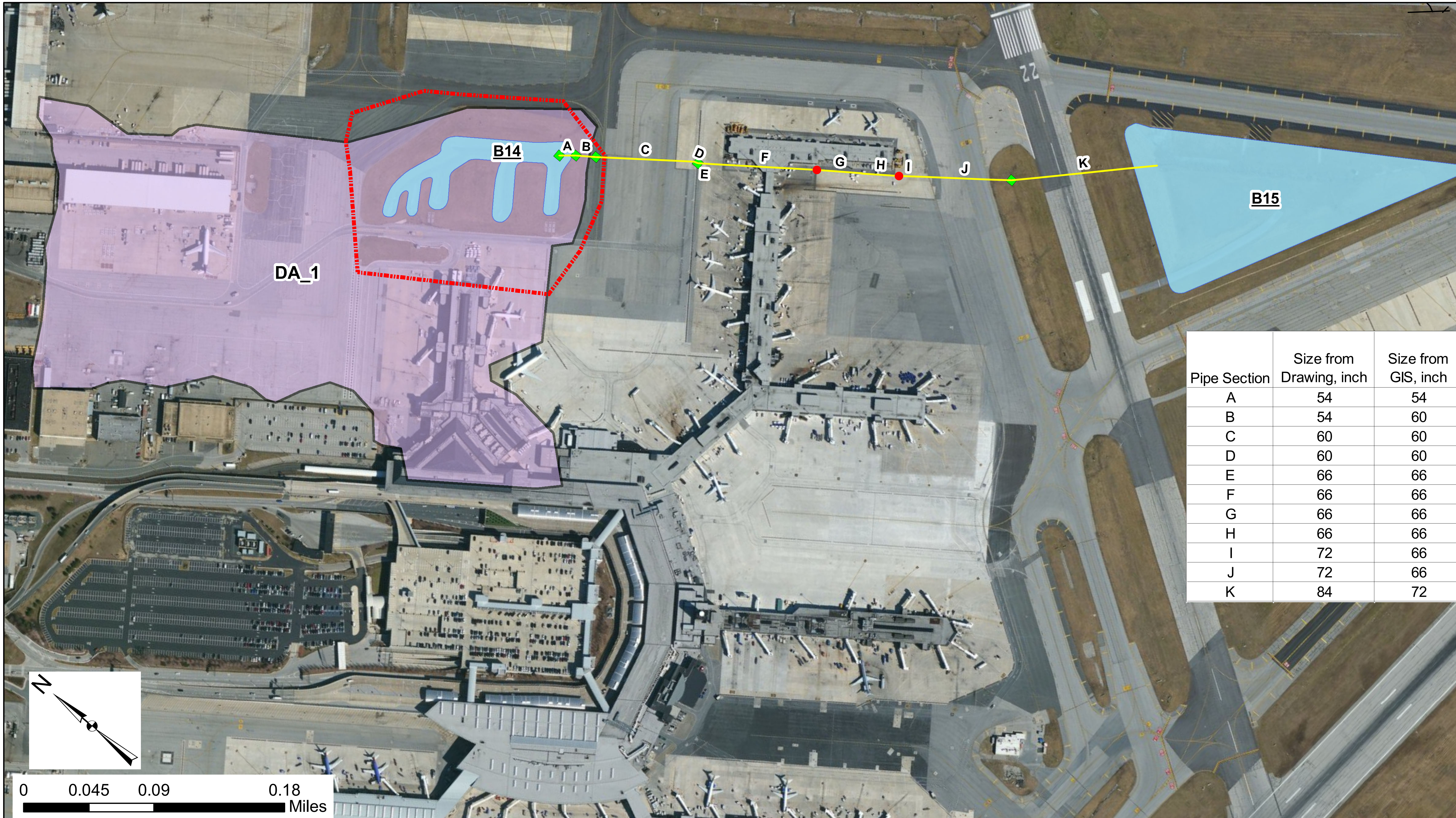

Pipe Section	Size from Drawing, inch	Size from GIS, inch
A	54	54
B	54	60
C	60	60
D	60	60
E	66	66
F	66	66
G	66	66
H	66	66
I	72	66
J	72	66
K	84	72

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Limit of Disturbance (LOD)

Stormwater Inlet

Stormwater Manholes

Stormwater Line

Stormwater Pond

Drainage Areas

International Terminal Expansion

Stormwater Management Impact Study

Date: July 2014

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Conceptual Model Outputs for Three Pipe Size Scenarios

					Existing Pipes Scenarios				Proposed Pipes Scenario	
					Size from Drawing		Size from GIS		72" Pipes	
Pipe Section	Total Flow (ft^3/s)	Length (ft)	Invert up (ft)	Invert down (ft)	Diameter (in)	Capacity (Full Flow) (ft^3/s)	Diameter (in)	Capacity (Full Flow) (ft^3/s)	Diameter (in)	Capacity (Full Flow) (ft^3/s)
A	225	60	139.1	138.3	54	226	54	226	72	487
B	225	74	137.3	136.9	60	192	54	145	72	312
C	225	358	135.8	133.7	60	200	60	200	72	325
D	225	15	133.7	133.6	60	204	60	204	72	331
E	318	52	132.4	132.0	66	279	66	279	72	352
F	318	382	132.0	129.4	66	279	66	279	72	352
G	318	165	128.4	127.2	66	287	66	287	72	362
H	318	136	127.2	126.2	66	287	66	287	72	362
I	318	67	125.3	125.0	66	235	72	297	72	297
J	386	343	125.0	123.3	66	234	72	295	72	295
K	660	532	110.0	105.1	72	406	84	613	72	406