EXHIBIT 6
CUP16-02

PRELIMINARY STORMWATER REPORT

FOR

LACAMAS HEIGHTS ELEMENTARY SCHOOL

CAMAS, WASHINGTON

Job No.: MLMA-02

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SECTION 1 – SUMMARY REPORT

Introduction and Background

This is the stormwater report for the Lacamas Heights Elementary School project. This report is submitted concurrently with the project land-use application.

This proposal consists of constructing a new single story elementary school with associated access roads, parking, playgrounds, utilities, and landscaping. These improvements are considered on-site improvements and private stormwater facilities are proposed to manage runoff from these areas and will be owned and maintained by the Camas School District (CSD).

A new public roadway is being constructed on the school property to provide access to the school. The new roadway, right-of-way, and all related construction will be dedicated to the City of Camas, who will maintain the associated off-site stormwater facilities.

Existing Site Characteristics

The existing site contains approximately 12,850 SF of existing impervious surfaces (two residences and outbuildings) with bands of trees aligning the west and north site borders. Several hydrogeomorphic wetlands are present within the subject site and a Lacamas Lake tributary transects the northern half of the site. Site vegetation primarily consists of grass in open areas with mature conifers and several oak trees concentrated near the existing residences and the Lacamas Lake tributary. The wetlands are drained to the west and south, where water is conveyed under NE 232nd Avenue and NE 9th Street through multiple culverts. There is one wetland that drains to the east side of the property.

Site Soils

The Clark County Soils Survey classifies these soils as Lauren Loam, Lauren Gravelly Loam, Cove Silty Clay Loam and McBee Silty Clay Loam. An on-site soils study by a geotechnical engineer describe the soils as three different soil types, depending on the location and depth. The USDA provides Hydrologic Soil Group designations, in which Lauren is listed as Hydrologic Group B. However, based on the geotechnical report findings, Hydrologic Group D (SG4) is a more appropriate classifications for the near surface soils on this site.

In-situ infiltration testing performed in October 2016 by Columbia West Engineering yielded infiltration rates ranging from 0-5.9inches per hour, as defined by the soil's approximate vertical coefficient of permeability (k).

Groundwater was encountered ranging from 3'-8.5' below existing ground surface.

Design Criteria

This project consists of converting approximately 7,800 SF of existing impervious surface to natural vegetation, constructing approximately 235,886 SF of new impervious surface. The total project disturbed area is approximately 9.75 acres.

The zoning is R-7.5 (Residential 7,500) and therefore the project is considered an urban development. Because the existing impervious surface (12,850 SF) is less than 35% of the total project site (424,652 SF), the project is considered a New Development. New Developments that add more than 5,000 SF of impervious surface are required to meet Minimum Requirements 1-9 for <u>new</u> impervious surfaces.

Minimum Requirement #1 – Preparation of Stormwater Site Plans

The civil drawings show the proposed on-site and off-site stormwater systems.

Minimum Requirement #2 – Construction Stormwater Pollution Prevention

The contractor is responsible for conforming to City of Camas's Erosion Prevention & Sediment Control Codes (CMC 14.06). A construction SWPPP is required for this project, and the 12 elements of the Construction SWPPP must be considered and controls developed.

1. Preserve Vegetation/Mark Clearing Limits - Land disturbing activities will be limited to the extent practicable. The Lacamas Lake Tributary and Wetlands will be protected from activity. Silt fence and tree protection fencing will be utilized to mark the clearing limits.
2. Establish Construction Access - A gravel construction entrance will be installed to minimize sediment tracking off-site.
3. Control Flow Rates –Collected stormwater runoff is proposed to be detained on-site in a pond and off-site in an underground detention facility, and released at the City's flow control requirements.
4. Install Sediment Controls - The contractor shall install sediment controls per City of Camas standard details.
5. Stabilize soils - The project will replace any permanent vegetation that may be disturbed with this project.
6. Protect Slopes – There are no steep (>40%) slopes within the project area.
7. Protect Drain Inlets - The contractor shall install sediment controls per City of Camas standard details.
8. Stabilize Channels and Outlets – There are no existing or proposed channels associated with the project. All new outlets will be stabilized with rock.
9. Control Pollutants - The contractor shall conform to the Erosion Prevention & Sediment Control Code (CMC 14.06).
10. Control Dewatering – Some dewatering may be required on this site.
11. Maintain BMPs - The contractor shall conform to the Erosion Prevention & Sediment Control Code (CMC 14.06).
12. Manage the Project - The contractor shall conform to the Erosion Prevention & Sediment Control Code (CMC 14.06).

Minimum Requirement #3 – Source Control of Pollution

There are no existing or proposed sources of pollution on the project site requiring special BMP's under this minimum requirement.

Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls

The project will maintain the existing Lacamas Lake Tributary, NE 232ND culverts and wetlands.

All proposed stormwater outfall locations will be stabilized with rock.

Minimum Requirement #5 - On-Site Stormwater Management

There is not enough natural vegetation on the project site (outside of the wetland boundaries) to consider Full Dispersion. Furthermore, there are limited areas to disperse runoff in accordance with the dispersion BMP's design criteria, where it will not receive high-traffic use by students and community members.

The project does propose to utilize bioretention facilities for stormwater treatment and infiltration (although it's limited) in the on-site detention facility.

Minimum Requirement #6 – Runoff Treatment

This project proposes to treat the pollution generating impervious surfaces using bioretention facilities (or other approved BMPs) designed in accordance with the City of Camas Stormwater Design Standards Manual (Resolution #1193). The proposed bioretention facilities are sized to infiltrate greater than 91% of the incoming runoff file using the WWHM software program. See Section 2 for the screen shot of each of the six on-site modeled bioretention facilities to show that the 91% infiltration requirement is satisfied.

The bioretention facilities will be located upstream of the detention facility for the on-site system, and downstream of the detention facility in the off-site system. Import treatment soil media will be utilized for all bioretention facilities at an increased depth of 24" to increase phosphorus removal, given that the project is located within the Lacamas Lake watershed.

Minimum Requirement #7 – Flow Control

<u>On-Site</u>

A new flow control facility will be provided for the on-site system, proposed as a pond with slow infiltration through the bottom. The assumed tested infiltration rate is 0.7 inches per hour, of which a factor of safety of 4 will be applied. This is based on the tested rate in Soil Type 2 of 0.7 inches per hour in TP-1S. The pond bottom elevation is set at 5' above the anticipated high groundwater table. Groundwater monitoring will be performed in this location in the Winter/Spring of 2017.

Since the project is required to meet the flow control standard for all new impervious and converted surfaces, the existing basin in the predeveloped model is sized at 414,163 SF (equal to the new impervious and converted surface) for the on-site system. Since the site has historically drained to wetlands, the predeveloped condition is required to be modeled as the existing condition (prairie). As mentioned above, the Hydrologic Group selected is Group D. There are two points-of-compliance for the on-site project areas (Lacamas Lake Tributary and SW Wetland,). Detained stormwater will be released from the pond through a flow splitter that will convey water both to the tributary and SW Wetland.

<u>Off-Site</u>

Detention for the off-site areas is proposed as an underground detention facility (chambers or perforated pipe in a gravel bed). As with the on-site areas, all pre-developed areas for off-site basins are assumed the existing condition because the runoff has historically drained to a wetland (prairie and forest). There is a single point of compliance for the off-

site basin (the southwest wetland). A french drain at the back of sidewalk will intercept water from north of the roadway and convey it under the road to the wetland, bypassing the new road's stormwater system.

Minimum Requirement #8 – Wetlands Protection

There are six wetlands on the project site. Wetlands will be protected and enhanced. The proposal includes no direct wetland impacts, only indirect wetland and buffer impacts. Wetland and buffer enhancements, as well as wetland creation are part of the mitigation plan for this project. All mitigation will be accomplished on-site.

Minimum Requirement #9 – Operation and Maintenance

All maintenance of the proposed on-site stormwater collection, conveyance, treatment, and infiltration facilities will be provided by the Camas School District.

After dedication to the City of Camas, maintenance of all off-site stormwater facilities will be provided by the City.

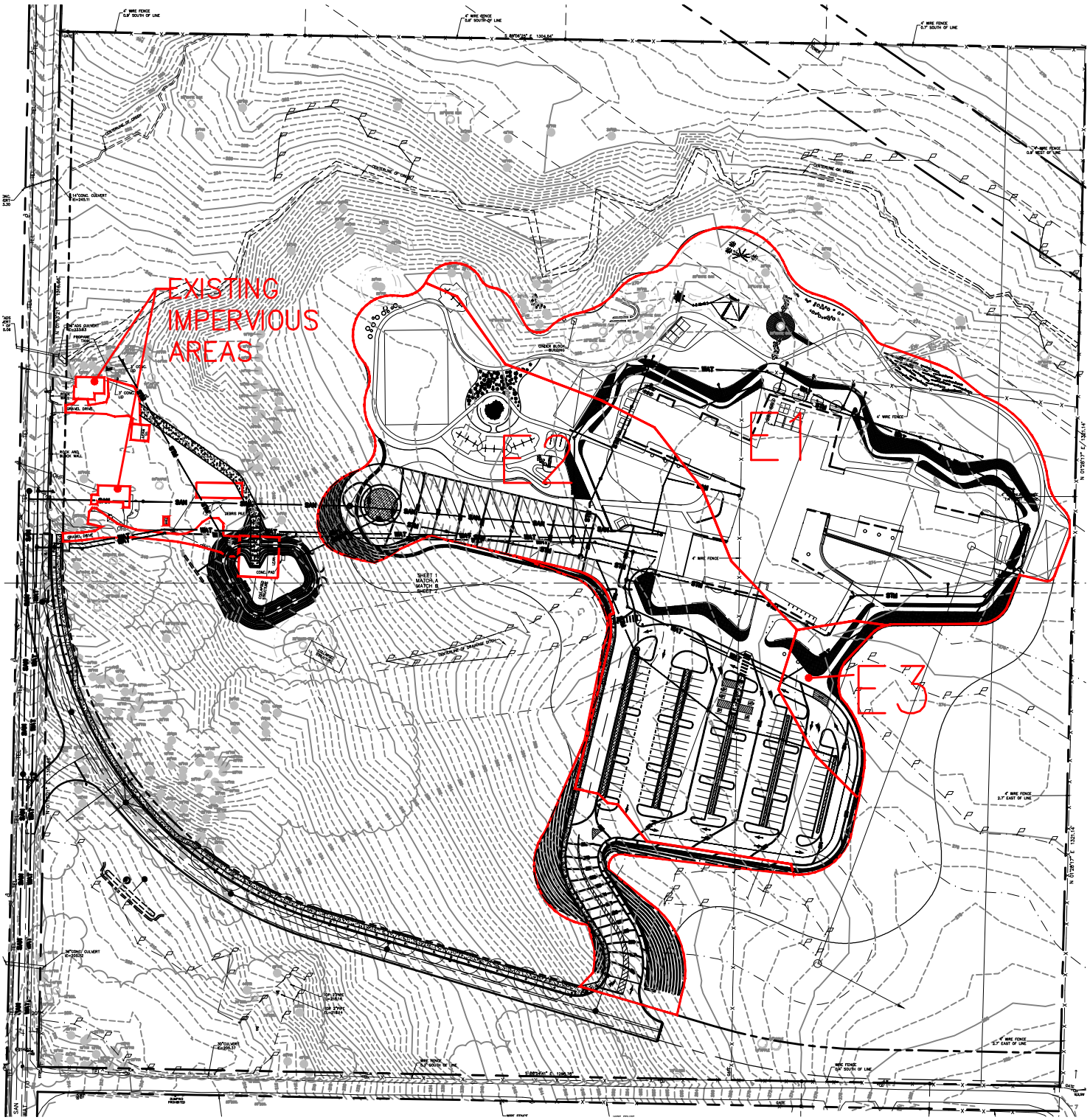
Conveyance

All proposed stormwater pipes will be sized to flow the 10-year peak flow as determined using a 24-hour peak flow method without surcharge in the final design.

END OF SUMMARY REPORT

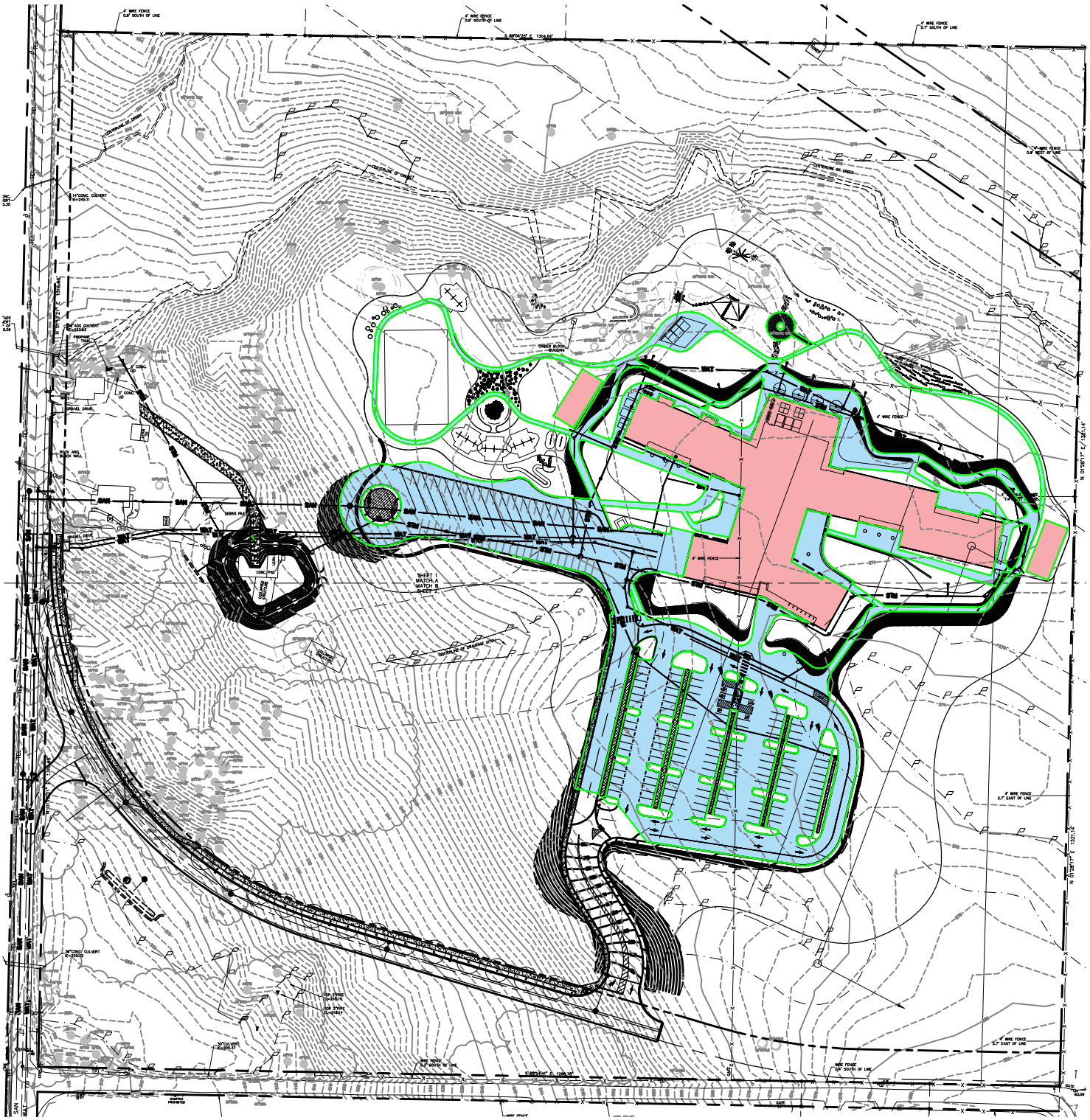
SECTION 2 – ON-SITE STORMWATER ANALYSIS AND CALCULATIONS

Lacamas Heights E.S. - Vicinity Map



EXISTING BASINS

SCALE: 1"=180'



PROPOSED BASINS

SCALE: 1" 180'

Lacamas Heights E.S.

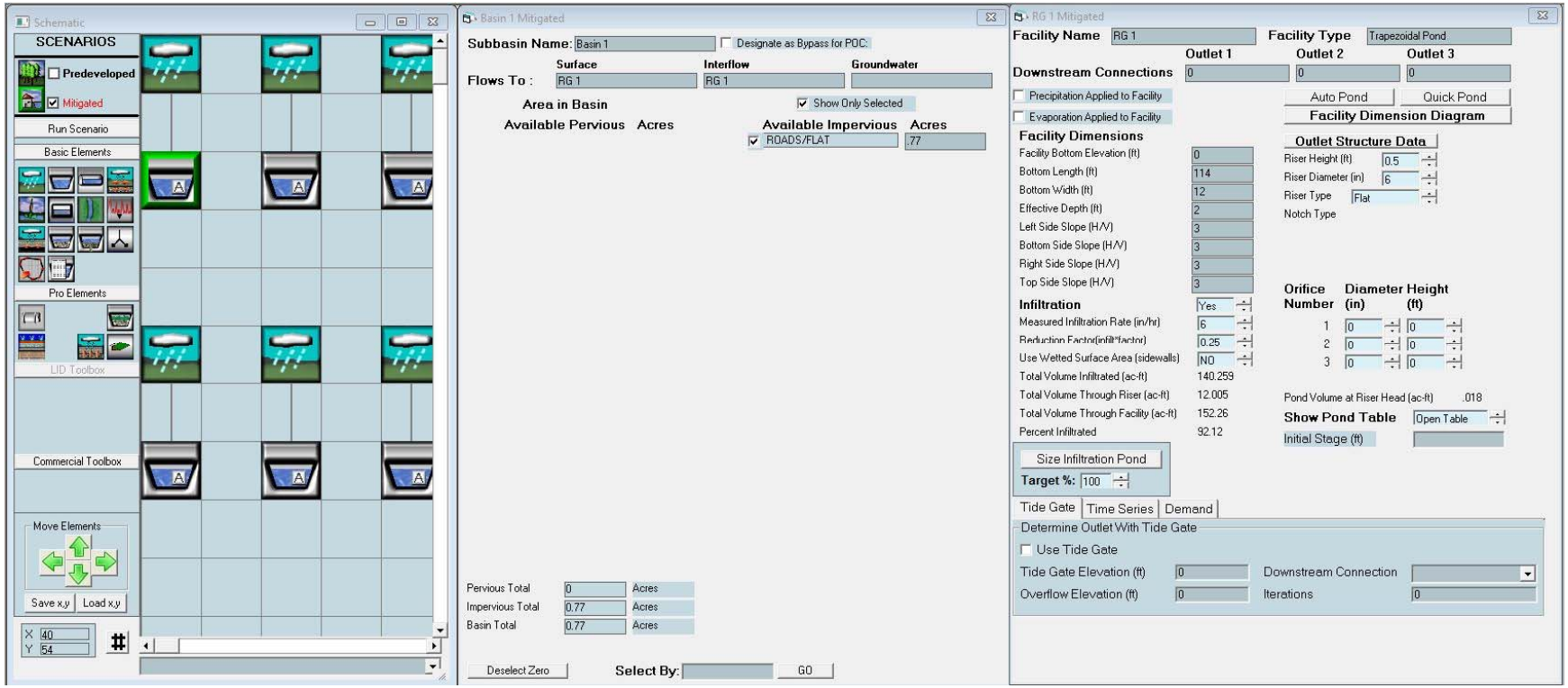
Drainage Basin Area Tabulation for WWHM Flow Control Modeling

Existing Basins

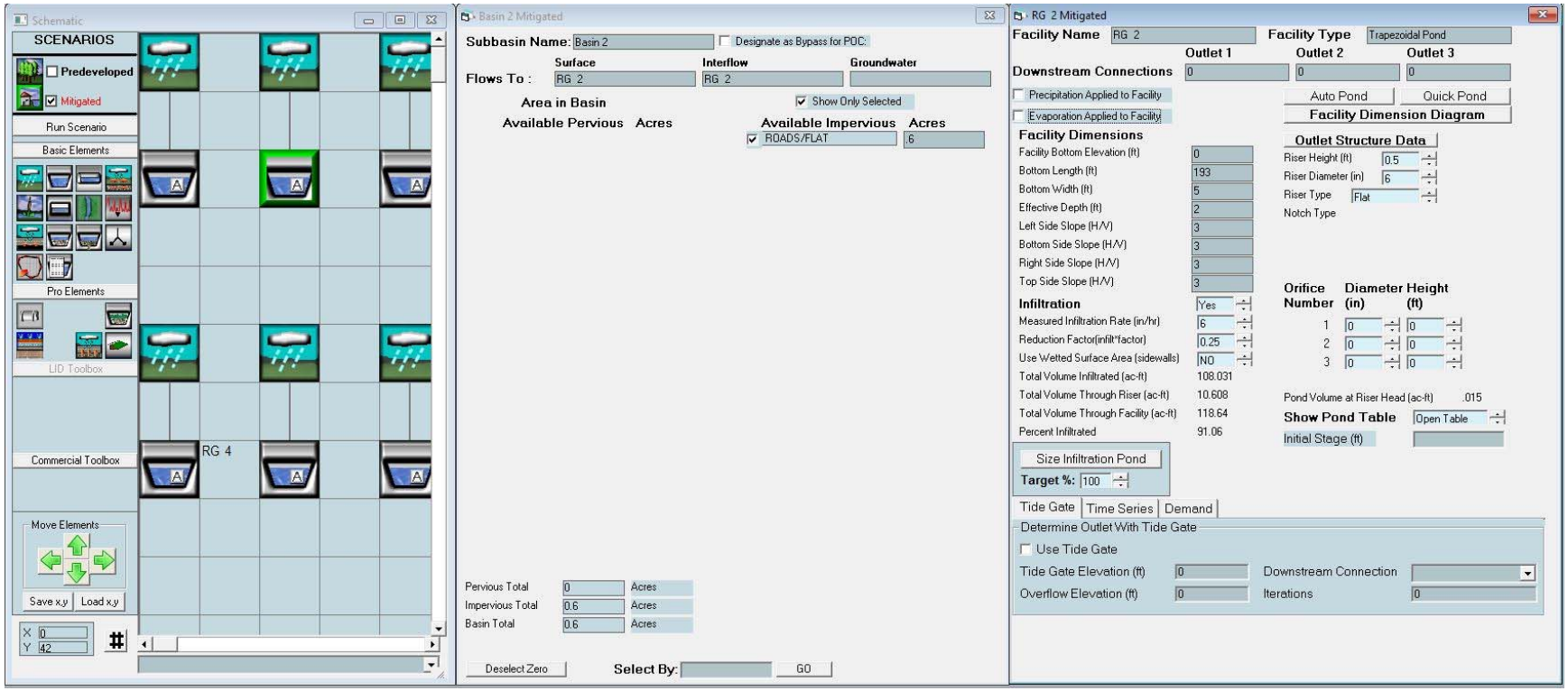
Basin	Description	Imperv. Area (SF|Ac)		Prairie Area (SF|Ac)		Total Area (SF)	Total Area (Ac)
E1	North	0	0.00	199,479	4.58	199,479	4.58
E2	West	0	0.00	201,129	4.62	201,129	4.62
E3	East	0	0.00	13,555	0.31	13,555	0.31
							9.51

Proposed Basins

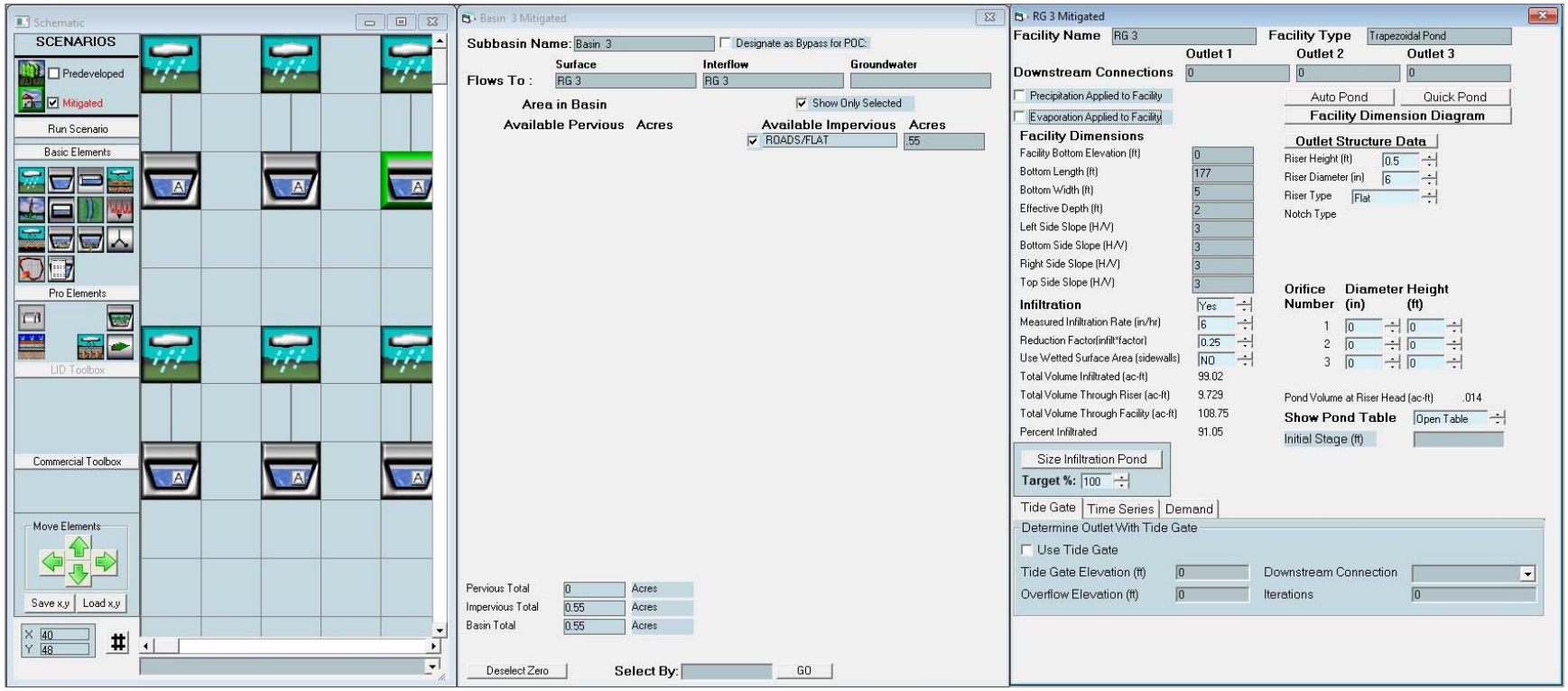
Basin	Description	Imperv. Area (SF|Ac)		Lawn Area (SF|Ac)		Total Area (SF)	Total Area (Ac)
System RG - To New Bioretention Facility							
RG1	Bus Parking	33,735	0.77	0	0.00	33,735	0.77
RG2	Bus Drive Aisle	26,083	0.60	0	0.00	26,083	0.60
RG3	Parking	24,123	0.55	0	0.00	24,123	0.55
RG4	Parking	10,029	0.23	0	0.00	10,029	0.23
RG5	Parking	11,918	0.27	0	0.00	11,918	0.27
RG6	Parking	2,731	0.06	0	0.00	2,731	0.06
			2.49		0.00		2.49
System A - To New Detention Pond							
A1	AC/Sidewalk	159,175	3.65	0	0.00	159,175	3.65
A2	Building	54,374	1.25	0	0.00	54,374	1.25
A3	Portables	4,200	0.10	0	0.00	4,200	0.10
A4	Pervious	0	0.00	196,414	4.51	196,414	4.51
			5.00		4.51		9.51



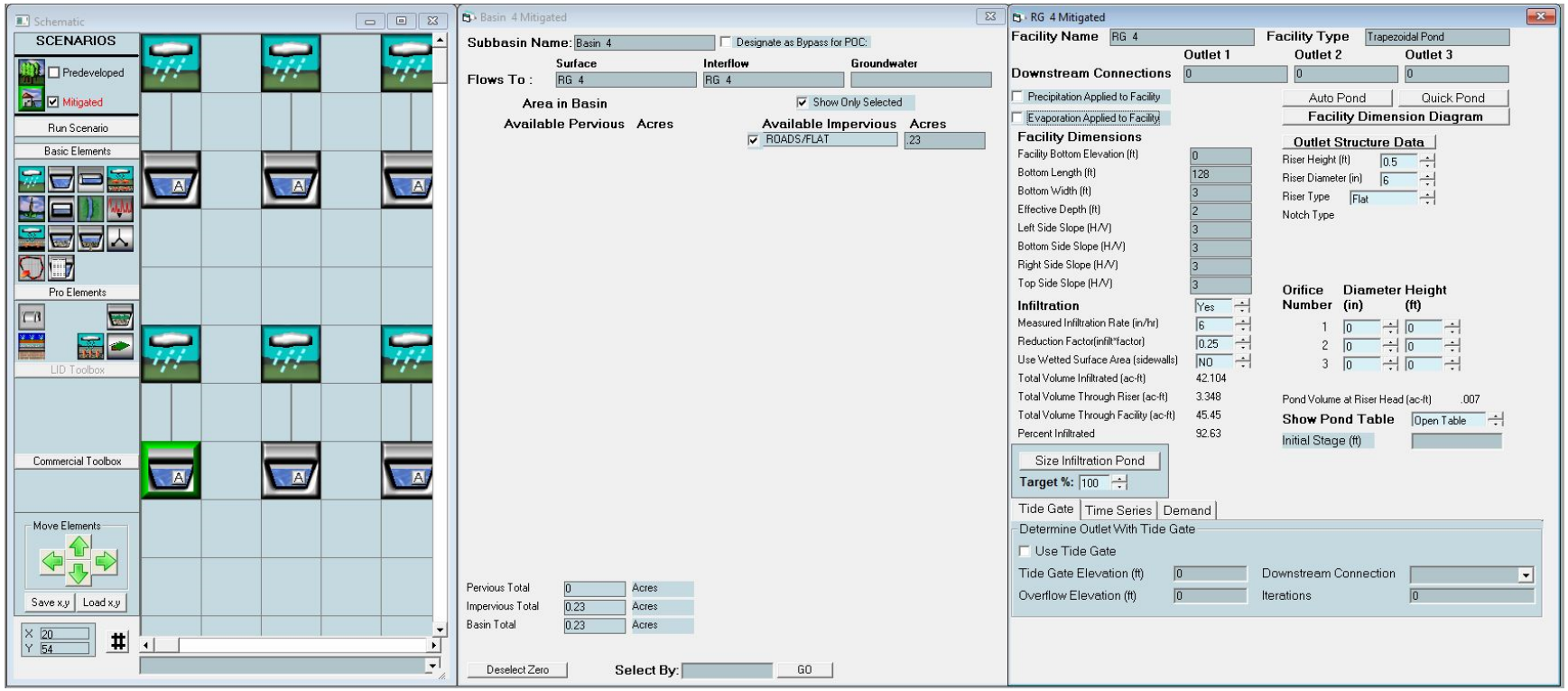
Bio-Retention #1



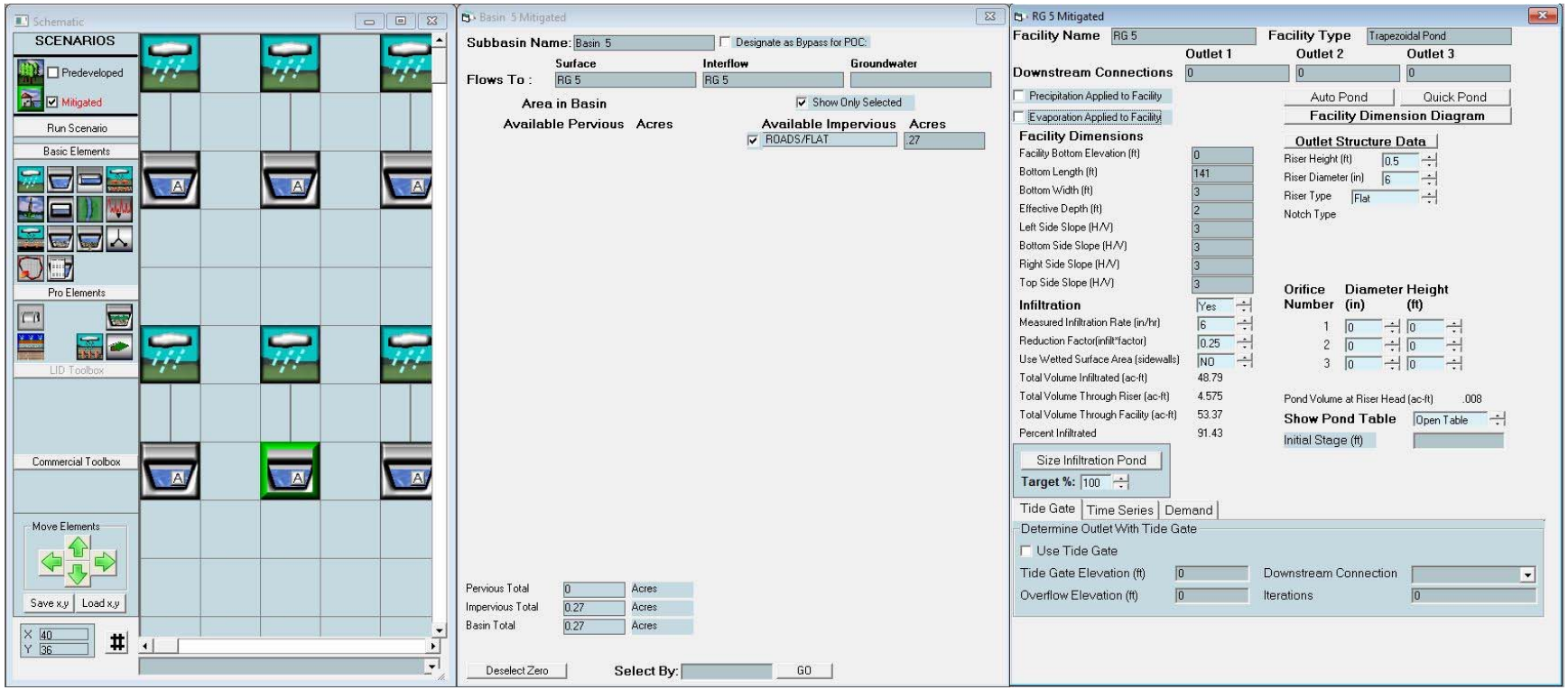
Bio-Retention #2



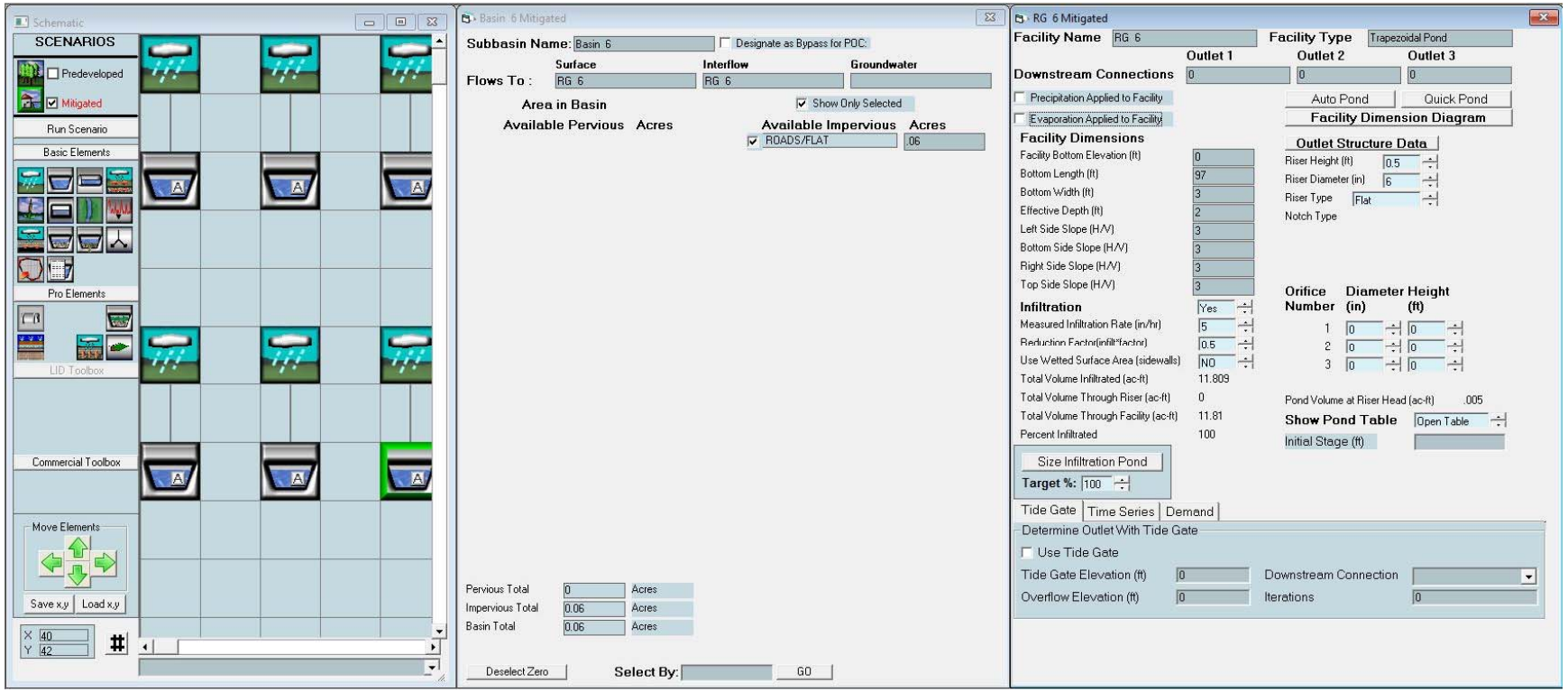
Bio-Retention #3



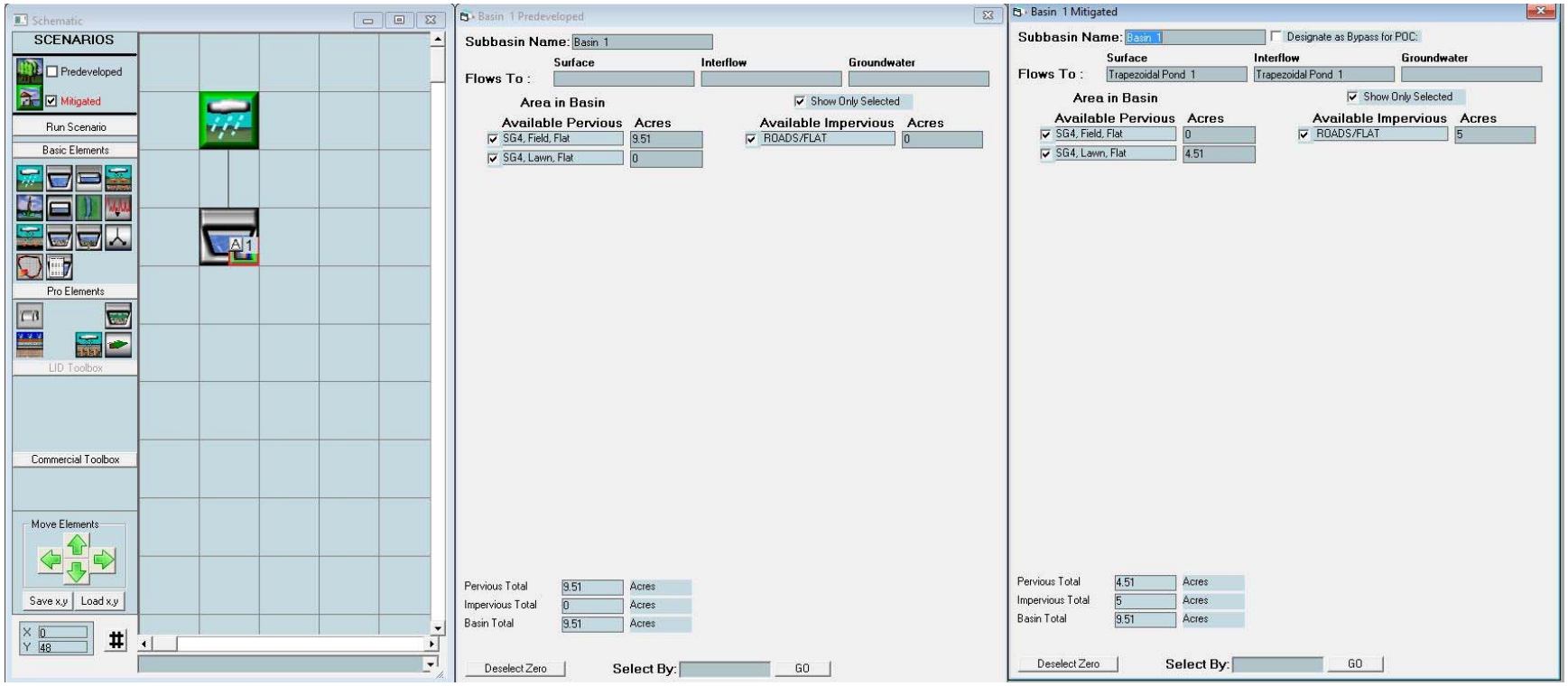
Bio-Retention #4



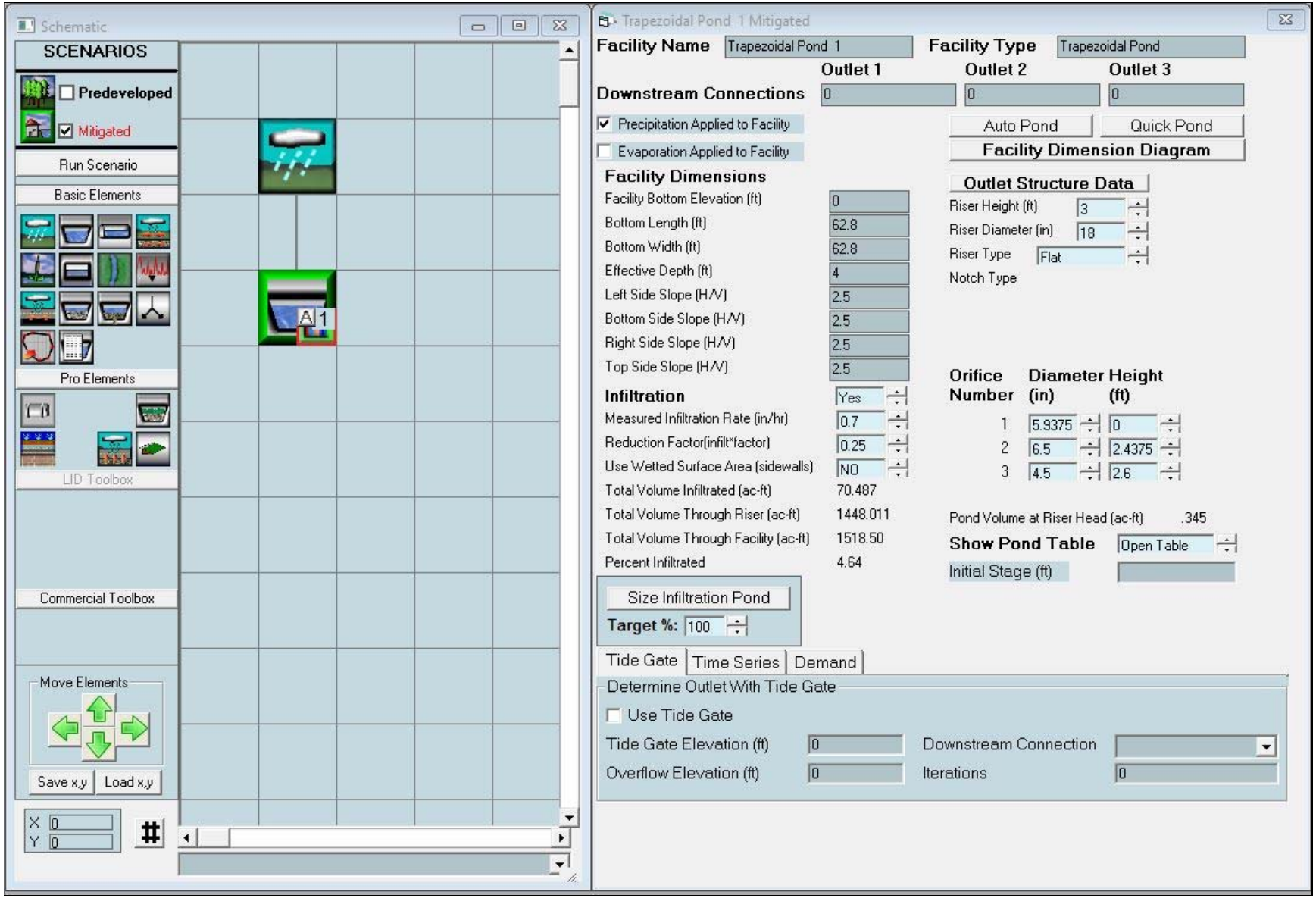
Bio-Retention #5



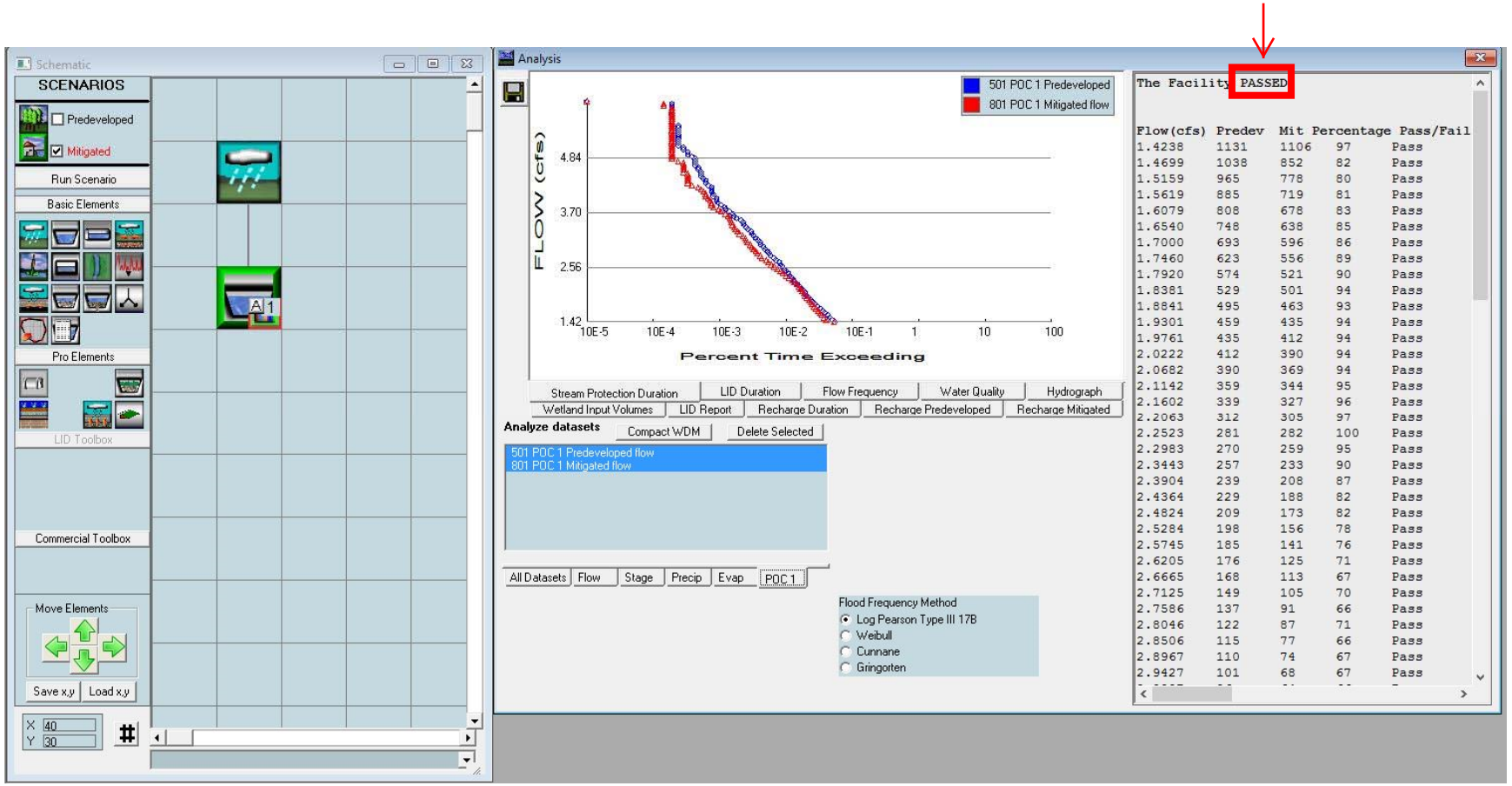
Bio-Retention #6



Basin Information



Detention Pond Summary


Schematic
SCENARIOS
Predeveloped
Mitigated
Run Scenario
Basic Elements
Pro Elements
LID Toolbox
Commercial Toolbox
Move Elements
Save x,y
Load x,y
X 40
Y 30
A1
Analysis
501 POC 1 Predeveloped
801 POC 1 Mitigated flow
FLOW (cfs)
4.84
3.70
2.56
1.42
10E-5
10E-4
10E-3
10E-2
10E-1
1
10
100
Percent Time Exceeding
Stream Protection Duration
LID Duration
Flow Frequency
Water Quality
Hydrograph
Wetland Input Volumes
LID Report
Recharge Duration
Recharge Predeveloped
Recharge Mitigated
Analyze datasets
Compact WDM
Delete Selected
501 POC 1 Predeveloped flow
801 POC 1 Mitigated flow
All Datasets
Flow
Stage
Precip
Evap
POC 1
Flood Frequency Method
Log Pearson Type III 17B
Weibull
Cunnane
Gringorten
The Facility PASSED
Flow(cfs) Predev Mit Percentage Pass/Fail
1.4238 1131 1106 97 Pass
1.4699 1038 852 82 Pass
1.5159 965 778 80 Pass
1.5619 885 719 81 Pass
1.6079 808 678 83 Pass
1.6540 748 638 85 Pass
1.7000 693 596 86 Pass
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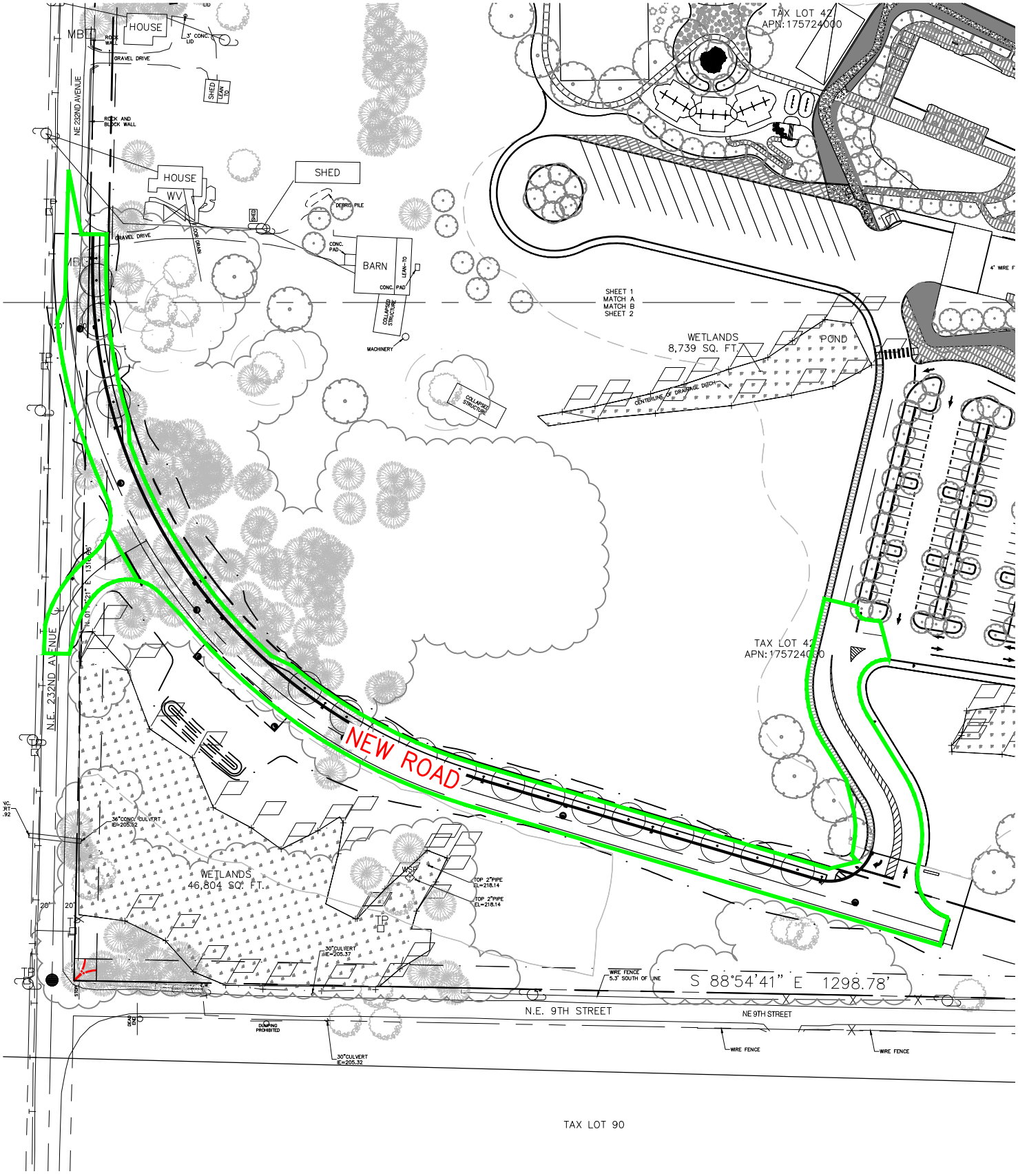
SECTION 3 – OFF-SITE STORMWATER ANALYSIS AND CALCULATIONS



OFF-SITE ROADWAY BASIN

OFF-SITE BASIN SUMMARY TABLE

Existing Condition - Phase 1

	s.f.	Total acre			acre	
Impervious		1,985	0.05	Moderate (5-15%)		0.05
Forest		20,934	0.48	Moderate (5-15%)		0.24
				Steep (>15%)		0.24
Pasture		39,971	0.92	Moderate (5-15%)		0.92
		62,890	1.44			1.44

Proposed Condition - Phase 1

	s.f.	Total acre			acre	
Impervious - To Detent.		53,546	1.23	Flat (0-5%)		0.74
				Moderate (5-15%)		0.49
Impervious - To Wetland		3,381	0.08	Flat (0-5%)		0.08
Lawn		5,963	0.14	Flat (0-5%)		0.07
				Moderate (5-15%)		0.07
		62,890	1.44			1.44

OFF-SITE WWHM SCREEN SHOTS