EXHIBIT 15

STORMWATER SITE PLAN FOR

PARK PLACE MIDDLE SCHOOL

MONROE, WASHINGTON

HARMSEN & ASSOCIATES INC

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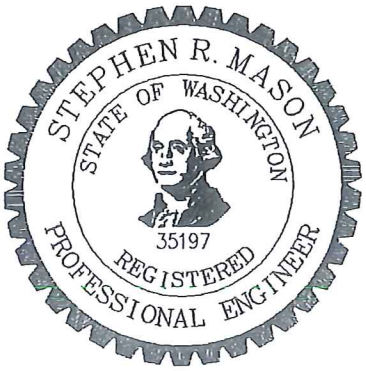
FEBRUARY 4, 2016



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PROJECT OVERVIEW

This Stormwater Site Plan has been prepared for the redevelopment of the Park Place Middle School located at 1408 West Main Street in Monroe, Washington, see Figure 1: Vicinity Map. The project consists of the removal of the majority of the existing buildings to be rePlaced with a single new building. The gymnasium and library buildings will remain. New parking access drives will be constructed around the buildings. The ballfields to the south and west of the buildings will remain, but be reconstructed in turf. The entire property covers 21 acres with 16.6 acres being redeveloped. The bus maintenance area (3.2 acres), and the southern vegetated area (1.2 acres), will remain undisturbed. Total proposed impervious surface is approximately 7.23 acres, (314,940 sf). See Figure 3: Developed Site Map in Appendix A.

METHODOLOGY

The drainage design for the project has been prepared based on the requirements of the 2005 Department of Ecology Stormwater Management Manual (DOE Manual) as adopted by the City of Monroe. WWHM3 as provided by DOE has been used for determining basin runoff and for sizing of the stormwater facilities. An Excel spreadsheet has been used to create stage-storage-discharge tables for the bioretention cells.

Based on the flow charts in Figure 2.3 of the DOE Manual and the site parameters, the project is subject to Minimum Requirements 1-10.

The project site parameters are:

- The project will create 5,000 sf of new or rePlaced impervious area.
- The project will disturb more than 7,000 sf.
- The project does not convert ¾ acre of pasture to lawn.
- The project does not convert 2.5 acres of forest to pasture.

MR 1: PREPARATION OF STORMWATER SITE PLANS

DRAINAGE PLAN DESCRIPTION

Stormwater runoff the site will be collected and conveyed to infiltration facilities located around the site. The runoff from the paving areas will generally sheet flow into one of seven bioretention cells, or be conveyed to one by curb or catch basin and pipe. The roof and courtyard runoff will flow to one of several infiltration trenches.

WATER QUALITY MEASURES

Following is a list of the proposed construction water quality BMPs. See MR 3: Water Pollution Source Control for more information. The proposed BMPs are as follows:

BMP C101, Preserving Natural Vegetation
BMP C103, High Visibility Fence
BMP C105, Construction Entrance
BMP C107, Construction Road/Parking Area Stabilization
BMP C120, Temporary and Permanent Seeding
BMP C121, Mulching
BMP C123, Plastic Covering
BMP C125, Topsoiling/Composting
BMP C140, Dust Control
BMP C200, Interceptor Dike and Swale
BMP C207, Check Dams
BMP C220, Storm Inlet Protection
BMP C233, Silt Fence
Temporary Infiltration Pond

DETENTION SIZING

Flow control will consist of an infiltration into the underlying soils using bioretention cells and infiltration trenches. As a result there will be no surface runoff from the site. See Minimum Requirements #6 & 7 for additional information.

CONVEYANCE CALCULATIONS

The primary conveyance of runoff will be sheet flow in the parking areas and downspout collectors for the building. Where necessary catch basins and pipe will collect and convey runoff, but these will be kept to a minimum. The use of many smaller infiltration facilities scattered around the site will keep individual drainage basins small with corresponding low peak runoff rates. Conveyance calculations are not warranted.

STORMWATER TREATMENT BMP'S

The roof and courtyard runoff is considered clean and treatment is not required. The runoff from the new parking and access drive will flow to bioretention cells for treatment and infiltration. See Minimum Requirement #6 for additional information.

PROTECTION OF WETLANDS
There are no wetlands on or adjacent to the site.

OPERATIONS AND MAINTENANCE
The specific requirements for the ongoing operation and maintenance of the proposed storm water systems is detailed in Minimum Requirement #10.

EXISTING CONDITIONS SUMMARY

DESCRIPTION
The site is the Park Place Middle School located at 1408 West Main Street in Monroe, Washington, see Figure 1: Vicinity Map. Currently there are several buildings on the site connected by covered walkways. The majority of the existing buildings will be removed to be rePlaced with a single new building. The gymnasium and library buildings will remain. Currently there is parking on the northwest and northeast portions of the site and a bus loop north of the buildings. There are ball fields to the south and west of the buildings. They will remain, but be reconstructed in synthetic turf. The entire property covers 21 acres with 16.6 acres being redeveloped. The bus maintenance area (3.2 acres), and the southern vegetated area (1.2 acres), will remain undisturbed. The topography of the site slopes at an average of 0.5% from elevation 60 at the northeast corner to 56 along the south property line. See Figure 2: Existing Site Map in Appendix A for more information.

SOILS DESCRIPTION
Associated Earth Sciences, Inc has performed soils exploration on the site and has documented the underlying soils in their report titled *Subsurface Exploration, Geological Hazards and preliminary Geotechnical Engineering Report*. Associated Earth Sciences also prepared an addendum addressing the potential for stormwater infiltration titled *In-situ Infiltration Testing and Design Infiltration Rate Recommendations*. Their reports document the underlying soils, ground water conditions, and general site design recommendations. They also discuss the testing procedures and processes used for determination of the infiltration rates used for the design of the proposed infiltration systems.

The primary issues for infiltration on this site are the need to penetrate through the upper several feet dense soils to the more permeable sub soils, high winter ground water conditions and the infiltration rate of the subsoils. Associated Earth Sciences have estimated the elevation for the bottom of each facility needed to punch through the upper soils, and the seasonal high ground water elevation. Based on these estimates most facilities will maintain 3 feet of separation from the high ground water condition. An infiltration rate of 4 inches per hour has been used for the design of the infiltration trenches. For additional information see the geotechnical reports provided under separate cover.

EXISTING BASIN
Infiltration through the use of bioretention cells and infiltration trenches is the proposed method of controlling storm water in the developed condition. Calculation of runoff from the corresponding existing condition basins is not necessary.

UPSTREAM ANALYSIS

The site is bounded by West Main Street to the north, single family residences to the northeast, the bus maintenance facility to the northwest, a commercial site to the southwest and a large wetland to the south. With the surrounding properties being very flat and the drainage system in West Main Street intercepting any runoff from the north, there is no significant upstream runoff that enters the site.

DOWNSTREAM ANALYSIS

Infiltration of the storm water runoff from the developed site is proposed. This matches the existing conditions where there is essentially no surface discharge from the site. As such there is no downstream drainage that will be impacted by the discharge of surface water from the proposed development.

MR 2: CONSTRUCTION STORMWATER POLLUTION PREVENTION (SWPP)

See full DOE SWPPP under separate cover.

MR 3: WATER POLLUTION SOURCE CONTROL

CONSTRUCTION STORMWATER BMPs

A Storm Water Pollution Prevention Plan, SWPPP, is part of the construction drawings prepared for the project, and includes the following erosion control Best Management Practices:

Preserve Natural Vegetation (BMP C101)
Do not clear past the designated clearing limits.

High Visibility Fencing (BMP C103)
Use in combination with BMP C233, silt fence along the west boundary as indicated on the plans. High visibility fencing should be installed along the south and east property lines.

Construction Entrance (BMP C105)
Install construction entrance as located on the plans per Std Detail 206.

Construction Road/Parking Area Stabilization (BMP C107)
Once grading in future paved areas has reached subgrade, the gravel base course of material indicated on the applicable paving section is to be Placed on the subgrade to stabilize exposed surfaces. Surfaces protected this way include sidewalks, and the construction staging area and parking.

Temporary & Permanent Seeding (BMP C120)
Permanent seeding shall be used to stabilize exposed soils and shall be performed under the direction of the landscape plans and specifications.

Mulching (BMP C121)
Stabilize exposed surfaces with 4" sterile straw mulch when surfaces are to be unworked for the seasonal time frames listed in the TESC Notes and SWPPP Narrative. Mulch can be used to temporarily stabilize soils under future pavement; however, all mulch must be removed prior to Placement of base courses. Alternatively, construction road/parking stabilization can be used in future paved areas.

Plastic Covering (BMP C123)
Use plastic sheathing to protect stockpiles. Stabilize with sand bags connected with rope.

Topsoiling (BMP C125)
Strip topsoil under pavement, walks and building. Stockpile separately for use on project landscaping.

Dust Control (BMP C140)
Contractor shall implement measures to prevent wind transport of dust from soil surfaces. Such measures can include but are not limited to the following: mulching areas not used for vehicle access, reducing speeds on haul roads, sprinkle exposed surfaces with water, surface haul roads with gravel.

Interceptor Dike and Swale (BMP C200)
Interceptor swales will be installed to intercept site runoff before it leaves the site and to direct site it to the temporary infiltration pond.

Check Dams (BMP C207)
Check dams will be installed in the interceptor swale to slow flow velocities and allow sediment deposition.

Storm Inlet Protection (BMP C220)
West Main Street: Place inserts per plan detail in existing catch basins as indicated on the plan.

Onsite catch basins: as new catch basins are installed, these shall also be protected until the drainage area is stabilized.

Silt Fence (BMP C233)
Install silt fence in locations indicated on the plan per Std Detail 204.

Temporary Infiltration Pond
As necessary, temporary infiltration ponds will be constructed in the vicinity of grading operations.

PERMANENT SOURCE CONTROL BMPs

The following source controls apply:

- Container storage of wastes;
- Vegetation management;
- Cleaning of paved surfaces;
- Storm drainage maintenance;

MR 4: PRESERVATION OF NATURAL DRAINAGE

Infiltration of the storm water runoff from the developed site is proposed. In the current condition there is a discharge from the school to the wetlands located southwest of the school site. Infiltrating the stormwater as proposed will more closely match the natural predeveloped drainage patterns. As such there is no downstream drainage that will be impacted by the discharge of surface water from the proposed development. By allowing the runoff to continue to infiltrate using bioretention cells and infiltration trenches, the natural drainage will be preserved.

MR 5: ON-SITE STORMWATER MANAGMENT

Pavement Areas:
Storm water management for the parking areas will consist of treatment and infiltration of the area runoff using bioretention cells.

Roof Areas:
Storm water management for the building's roof runoff will be infiltrated using bioretention cells and infiltration trenches.

Lawn and Landscaped Areas:
Post Construction Soil Quality and Depth: BMP T5.13 will be implemented on disturbed and landscaped areas.

The site contains a total of 19 drainage basins. Following is a description for each drainage basin on the site. Basins 1-8 are for in parking areas, basins 9-17 are the roof and courtyard drainage areas and basins 18-19 are the ball fields. See Figure 4: Drainage Basin Map in Appendix A.

PARKING AREA BASINS

BASIN 1

The basin consists of the northwest parking area, west access drive, a portion of the building entry courtyard and adjacent landscaping. It contains 1.29 acres and is tributary to Bioretention Cell #1. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	1.05 ac
Landscaping	0.24 ac

BASIN 2

The basin consists of the southern portion of the west parking area and adjacent landscaping. It contains 0.78 acres and is tributary to Bioretention Cell #2. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.62 ac
Landscaping	0.16 ac

BASIN 3

The basin consists of the western half of the bus loading area, adjacent sidewalk and landscaping. It contains 0.41 acres and is tributary to Bioretention Cell #3. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.31 ac
Landscaping	0.10 ac

BASIN 4

The basin consists of the eastern half of the bus loading area, site access drive, and adjacent sidewalk and landscaping. It contains 0.51 acres and is tributary to Bioretention Cell #4. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.38 ac
Landscaping	0.13 ac

BASIN 5

The basin consists of the east access drive to the library building and adjacent walkways and landscaping. It contains 0.36 acres and is tributary to Bioretention Cell #5. There is a potential bid alternate that would provide additional parking area tributary to this basin and increase the size of the basin to 0.50 acres. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.24 ac/0.33 ac (with alternate)
Landscaping	0.12 ac/0.17 ac (with alternate)

BASIN 6

The basin consists of the eastern and southern paved areas around the library building and adjacent walkways and landscaping. It contains 0.48 acres and is tributary to Bioretention Cell #6. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.29 ac
Landscaping	0.19 ac

BASIN 7

The basin consists of the western and northern paved areas around the library building, loading area and adjacent walkways and landscaping. It contains 0.63 acres and is tributary to Bioretention Cell #7. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.43 ac
Landscaping	0.20 ac

BASIN 8

The basin consists of the bus loading area turn around and adjacent walkways and landscaping. It contains 0.37 acres and is tributary to Bioretention Cell #8. See MR 6 & 7 for additional information on the treatment and infiltration facility sizing. The basin consists of the following land uses:

Pavement & walks	0.27 ac
Landscaping	0.10 ac

BUILDING ROOF BASINS

BASIN 9

The basin consists of a portion of the roof at the eastern end of the building and the adjacent courtyard area. It contains 0.18 acres and is tributary to Infiltration Trench #1. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof & walks	0.16 ac
Landscaping	0.02 ac

BASIN 10

The basin consists of a portion of the south side of the roof and the adjacent courtyard area. It contains 0.42 acres and is tributary to Infiltration Trench #2. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof & walks	0.40 ac
Landscaping	0.02 ac

BASIN 11

The basin consists of the remainder of the south side roof, the east side of the gym roof and the adjacent large courtyard area. It contains 0.96 acres and is tributary to Infiltration Trench #3. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof & walks	0.84 ac
Landscaping	0.12 ac

BASIN 12

The basin consists of a large portion of the gym roof portion of the roof at the eastern end of the building and the adjacent courtyard area. It contains 0.66 acres and is tributary to Infiltration Trench #4. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof & walks	0.64 ac
Landscaping	0.02 ac

BASIN 13

The basin consists of a portion of the roof at the northwestern corner of the building. It contains 0.22 acres and is tributary to Infiltration Trench #5. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof	0.22 ac

BASIN 14

The basin consists of the western most courtyard area along the north side of the building and a portion of the adjacent north side roof. It contains 0.31 acres and is tributary to Infiltration Trench #6. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof & walks	0.31 ac

BASIN 15

The basin consists of the middle courtyard area along the north side of the building and a portion of the adjacent north side roof. It contains 0.25 acres and is tributary to Bioretention Cell #9. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof & walks	0.25 ac

BASIN 16

The basin consists of the eastern most courtyard area along the north side of the building and a portion of the adjacent north side roof. It contains 0.23 acres and is tributary to Bioretention Cell #10. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof & walks	0.23 ac

BASIN 17

The basin consists of the roof of the library building. It contains 0.25 acres and is tributary to Infiltration Trench #9. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Roof	0.25 ac

BALL FIELD BASINS

BASIN 18

The basin consists of the western ball field area and adjacent walkways. It contains 3.14 acres and is tributary to Infiltration Trenches #7A and #7B. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Walks	0.20 ac
Landscaping	2.94 ac

BASIN 19

The basin consists of the eastern ball field area and adjacent walkways. It contains 4.1 acres and is tributary to Infiltration Trenches #8A and #8B. See MR 7 for additional information on the infiltration facility sizing. The basin consists of the following land uses:

Walks	0.14 ac
Landscaping	3.96 ac

MR 6: RUNOFF TREATMENT

With more than 5,000 sf of pollution generating impervious surface the site requires runoff treatment.

BASINS 1-8
Runoff from these basins includes areas subject to vehicular use and require treatment.

BIORETENTION CELLS
Runoff Treatment has been addressed through the design of several bio-retention cells. Bioretention cells incorporate amended soils and vegetation that use the chemical, biological, and physical properties of plants, microbes, and soils to remove, or retain, pollutants from stormwater runoff prior to infiltration.

The underlying soils are sandy gravel. Per Associated Earth Sciences the long terms infiltration rate is 4"/hr. This exceeds that of the percolation rate of the amended soil so underdrains are not needed.

The *Low Impact Development Technical Guidance Manual for Puget Sound* was referenced to design the specific facilities for this site. The following items are common for all bioretention cells:

Side slopes	3:1
Amended Soil Depth	18"
Amended Soil Infiltration Rate	2"/hr
Maximum Surface Storage Depth	12"
Subdrainage	None, native soil exceeds 2"/hr

The amended soils will help support plant and microbial growth and provide additional stormwater storage capacity with a designed voids ratio of 40% as recommended by the design manuals. To meet treatment requirements, in excess of 91% of the runoff must filter through the amended soils.

The bioretention cells are also designed to meet flow control requirements by infiltrating 100% of the stormwater runoff from the tributary basin.

TREATMENT FACILITY SUMMARY

There are eight bioretention cells spaced throughout the site that provide treatment and infiltration of the parking and vehicular circulation routes. The basin number, facility identification, required bottom area and percent infiltrated is listed for each facility. See attached WWHM3 screen shots and Excel spreadsheets for sizing calculations:

BASIN ID	FACILITY TYPE & ID	BOTTOM AREA (SF) AMENDED SOIL	PERCENT INFILTRATED
#1	Bioretention Cell #1	2,430	100%
#2	Bioretention Cell #2	1,450	100%
#3	Bioretention Cell #3	720	100%
#4	Bioretention Cell #4	840	100%
#5	Bioretention Cell #5	560(840)Alt	100%
#6	Bioretention Cell #6	684	100%
#7	Bioretention Cell #7	1080	100%
#8	Bioretention Cell #8	450	100%

BASINS 9-19

These basins consist of the building roof, isolated courtyard areas and the ball fields that are not subject to any vehicular traffic and therefore do not require treatment. Each basin and applicable infiltration facility is summarized below:

MR 7: FLOW CONTROL

BASINS 1-8

Runoff from these basins is 100% infiltrated in the corresponding bioretention cell. No additional Flow Control is necessary, see discussion in previous section of report.

BASINS 9-19

These basins consist of the building roof and isolated courtyard areas that are not subject to any vehicular traffic and therefore do not require treatment. Either an infiltration trench or bioretention cell is used to provide flow control for each basin. The individual basins and applicable infiltration facilities are summarized below:

INFILTRATION TRENCHES

The facilities have been designed to infiltrate 100% of the basin runoff meeting the flow control requirements. The following items are common for all infiltration trenches:

Side slopes	vertical
Design Void Ratio	40%
Design Infiltration Rate	4"/hr

BIORETENTION CELLS

The facilities have been designed to infiltrate 100% of the basin runoff meeting the flow control requirements. The following items are common for all bioretention cells:

Side slopes	3:1
Amended Soil Depth	18"
Amended Soil Infiltration Rate	2"/hr
Maximum Surface Storage Depth	12"
Subdrainage	None, native soil exceeds 2"/hr

FLOW CONTROL FACILITY SUMMARY

There are nine infiltration trenches and two bioretention cells spaced throughout the site that provide infiltration of the roof, courtyard and play area runoff. The basin number, facility identification, length (area for bioretention cells), width and depth are listed for each facility. See attached WWHM3 screen shots for sizing calculations:

BASIN ID	FACILITY TYPE & ID	LENGTH (AREA)	WIDTH	DEPTH	PERCENT INFILTRATED
#9	Infiltration Trench #1	75'	6'	3.5'	100%
#10	Infiltration Trench #2	170'	7'	3.0'	100%
#11	Infiltration Trench #3	170'	20'	2.0'	100%
#12	Infiltration Trench #4	205'	9'	3.0'	100%

#13	Infiltration Trench #5	105'	6'	3.0'	100%
#14	Infiltration Trench #6	30'	20'	4.0'	100%
#15	Bioretention Cell #9	360 sf		N/A	100%
#16	Bioretention Cell #10	300 sf		N/A	100%
#17	Infiltration Trench #9	105'	7'	3.0'	100%
#18	Infiltration Trench #7	960'	2'	4.5'	100%
#19	Infiltration Trench #8	920'	2.5'	5.0'	100%

MR 8: WETLANDS PROTECTION

There are no wetlands or other critical areas on or near the site.

MR 9: BASIN/WATERSHED PLANNING

The City of Monroe does not have any specific drainage basin or watershed requirements.

MR 10: OPERATION AND MAINTENANCE

The following operation and maintenance guidelines are taken from the 2005 DOE Manual.

General:

1. Proper maintenance of public and private stormwater facilities is necessary to insure they serve their intended function
2. Drainage systems shall be inspected at least annually. A representative of the local government shall also inspect private facilities at least annually to insure compliance by the owner of the following maintenance requirements.
3. Any deterioration threatening the structural integrity of the facilities shall be immediately repaired. These include such things as rePlacement of clean-out grates, catch basin lids, and rock in emergency spillways.
4. Debris shall be regularly removed from surface basins used for either peak-rate control or stormwater treatment.

STREAM BANK EROSION CONTROL INFILTRATION TRENCH

Maintenance & Inspection Schedule

- The observation well should be monitored periodically. For the first year after completion of construction, the well should be monitored on a quarterly basis and after every large storm. During the period October I through March 31 inspections shall be conducted monthly. A log book shall be maintained by the responsible person designated by the local government indicating the rate at which the facility dewaters after large storms and the depth of the well for each observation. Once the performance characteristics of the structure have been verified, the monitoring schedule can be reduced to an annual basis unless the performance data indicate that a more frequent schedule is required.

Sediment Removal

- Sediment buildup in the top foot of stone aggregate or the surface inlet should be monitored on the same schedule as the observation well. A monitoring well in the top foot of stone aggregate shall be required when the trench has a stone surface. Sediment deposits shall not be allowed to build up to the point where it will reduce the rate of infiltration into the trench.

APPENDIX A
MAPS & SCS SOILS DESCRIPTION

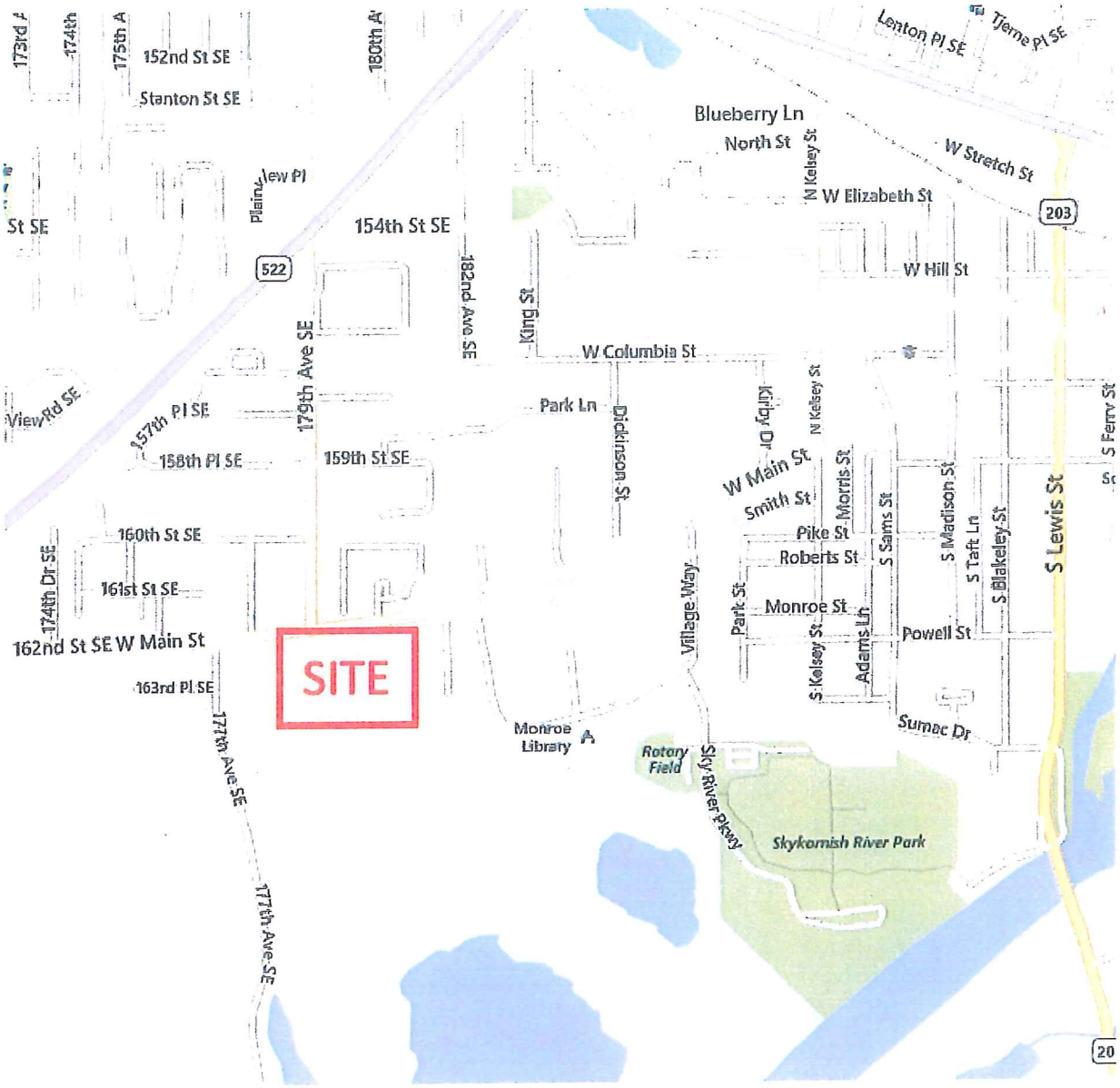


FIGURE 1: VICINITY MAP

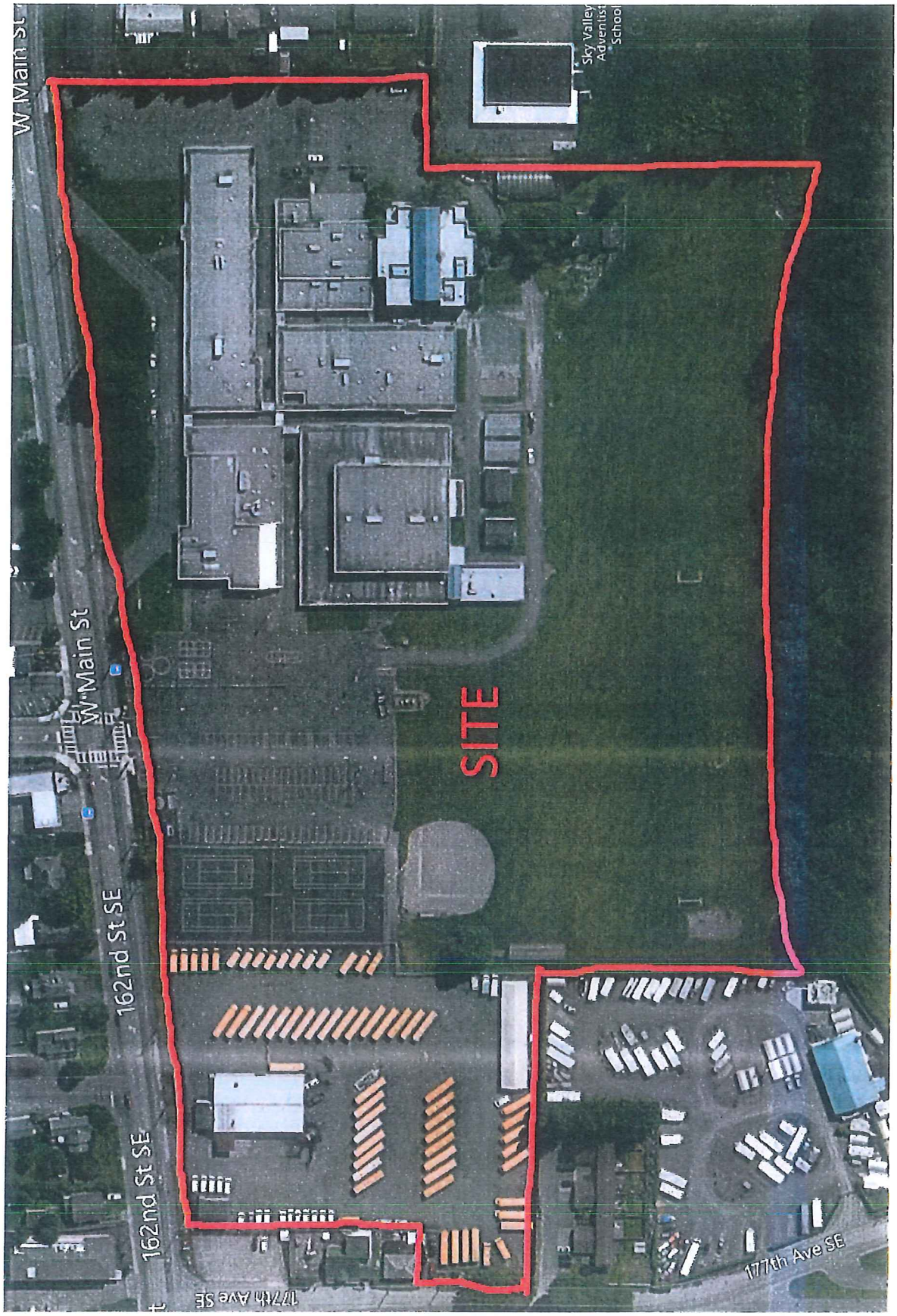


FIGURE 2: EXISTING SITE MAP

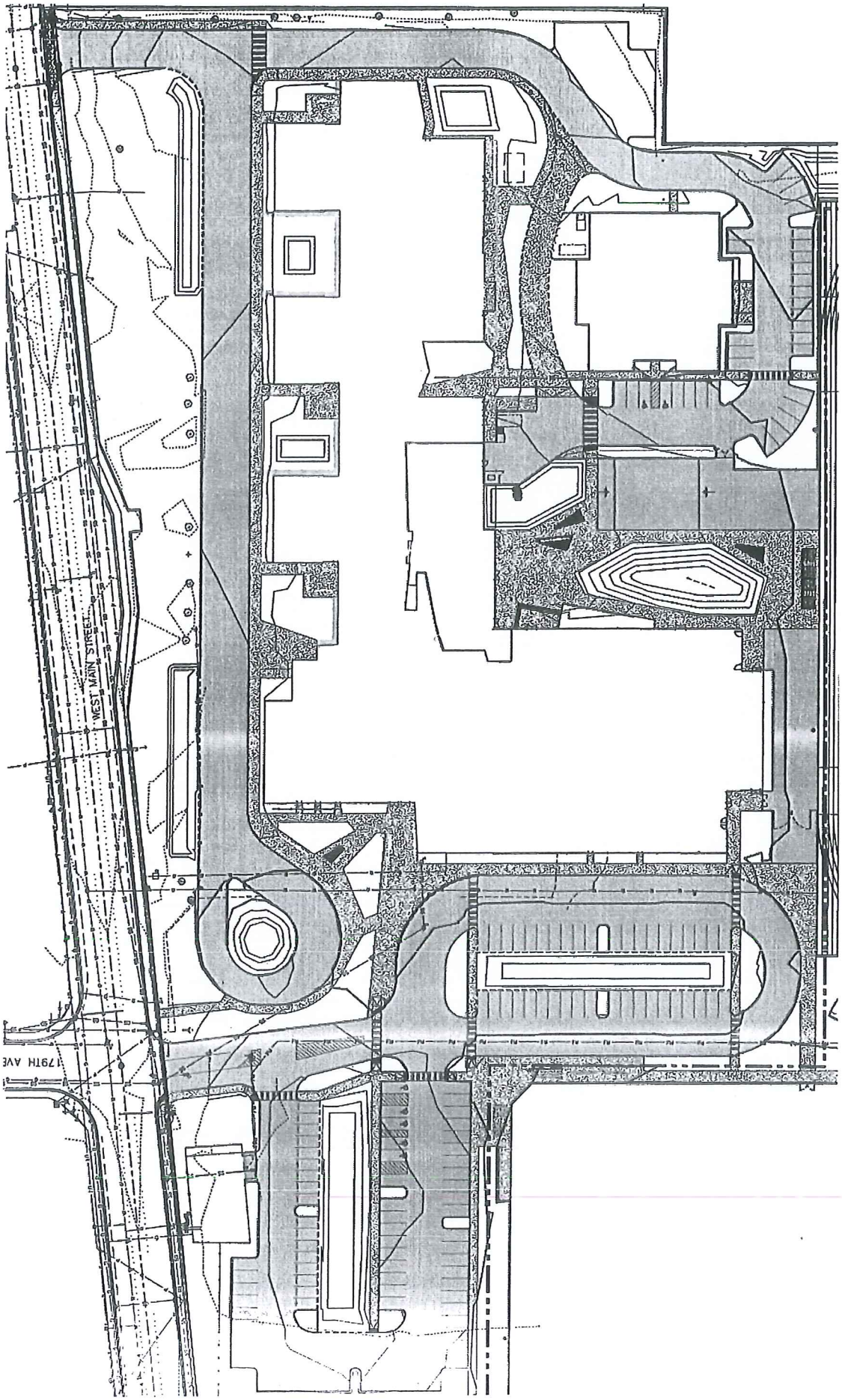


FIGURE 3: DEVELOPED SITE MAP

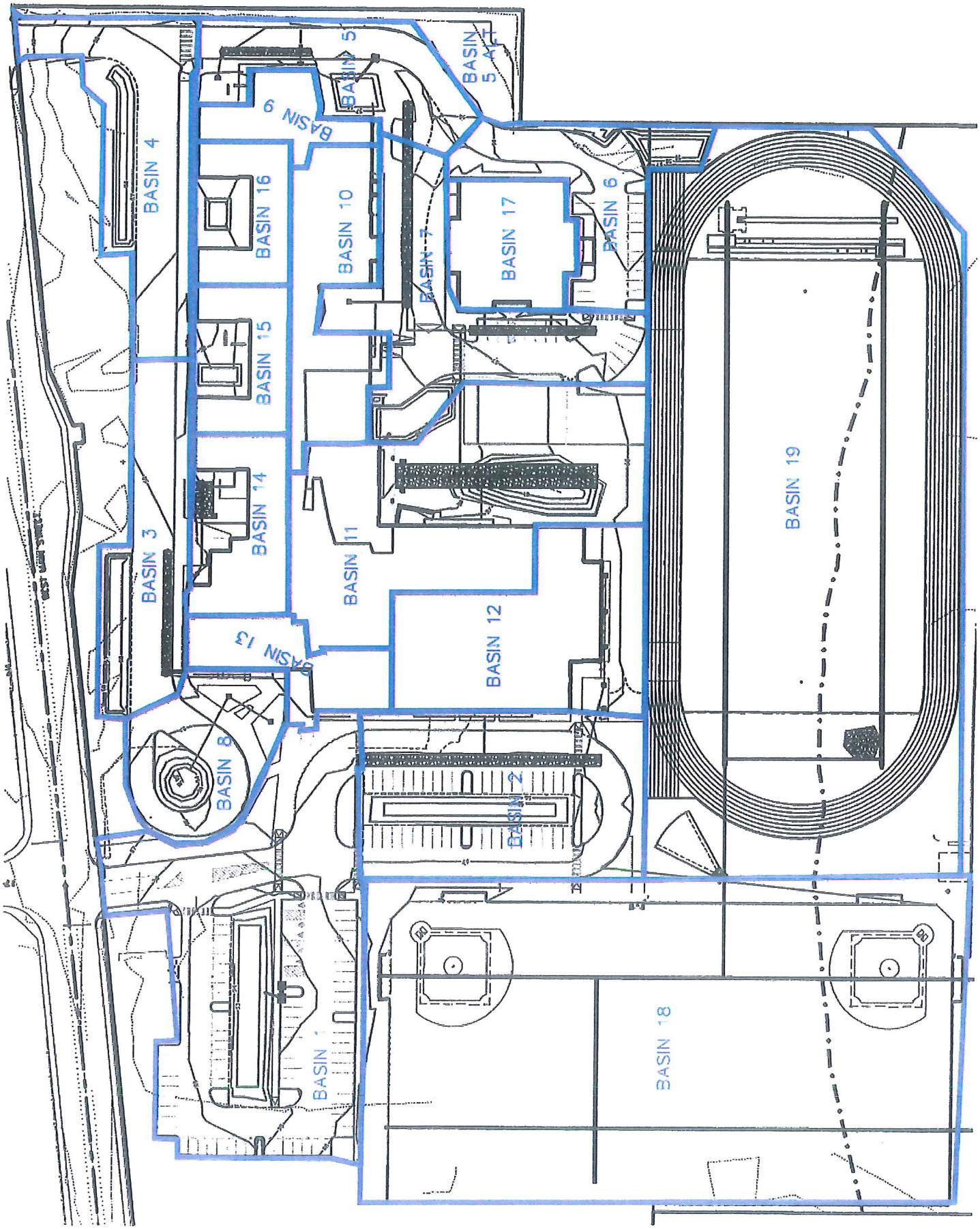
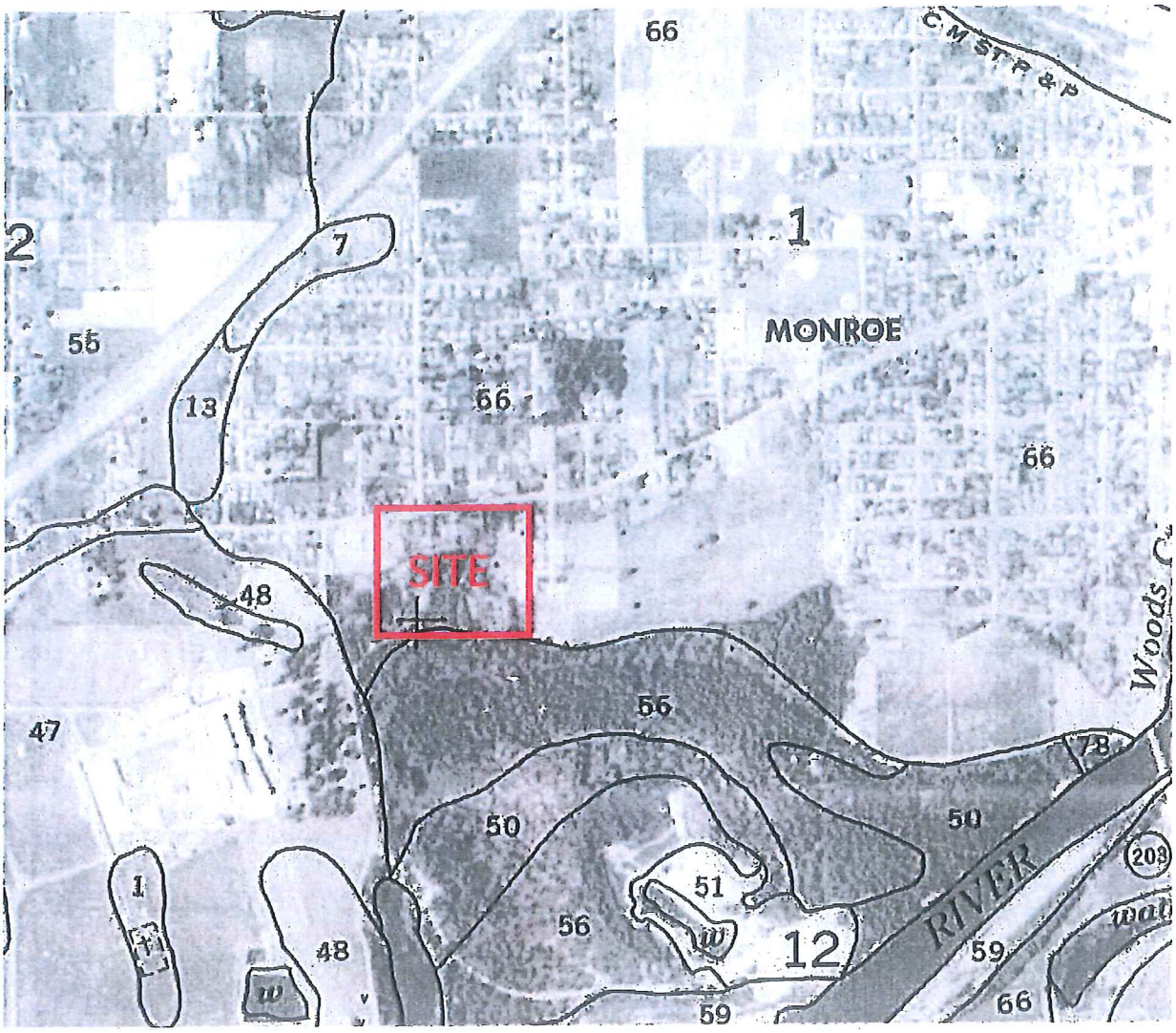


FIGURE 4: DRAINAGE BASIN MAP



SCS SOILS MAP

66-Sultan silt loam. This very deep, moderately well drained soil is on flood plains. It formed in alluvium. Areas are 10 to 15 acres in size. The native vegetation is mainly conifers. Elevation is 10 to 120 feet. Slope is 0 to 2 percent. The average annual precipitation is about 45 inches, the average annual air temperature is about 49 degrees F, and the average frost-free season is 150 to 200 days.

Typically, the surface layer is dark grayish brown silt loam about 12 inches thick. The upper part of the underlying material is dark grayish brown silty clay loam about 30 inches thick. The lower part to a depth of 60 inches or more is olive brown, stratified very fine sandy loam and sand. In some areas the surface layer is silty clay loam or loam or the soil is somewhat poorly drained.

Included in this unit are small areas of Menzel soils on terraces, Puget soils in depressional areas on flood plains, Puyallup soils on stream terraces, and Sultan Variant soils on flood plains. Included areas make up about 15 percent of the total acreage. .

Permeability of this Sultan soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. A seasonal high water table is at a depth of 24 to 48 inches from November to April. Runoff is slow, and the hazard of water erosion is slight. Rare periods of flooding occurs from November to April.

This unit is used mainly as cropland and for hay and pasture. It is also used for homesite development. A few areas are used as woodland.

This unit is suited to use as cropland. Proper row arrangement, field ditches, and vegetated outlets are needed to remove excess water on the surface. Tile drainage can be used to lower the water table if a suitable outlet is available.

A suitable cropping system is one that includes 2 or 3 years of sweet corn and 4 or 5 years of grasses and legumes. Growing an annual crop of vegetables and including an annual winter cover crop to be used as green manure is also a suitable cropping system.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Returning crop residue to the soil and practicing minimum tillage reduce compaction. Grain and grasses respond to nitrogen; legumes respond to phosphorus, boron, sulfur, and lime; and vegetables and berries respond to nitrogen, phosphorus, and potassium.

This unit is suited to hay and pasture. Grazing when the soil in this unit is wet results in compaction of the surface layer and poor tilth. Open ditch or tile drains can be used for drainage. Use of proper stocking rates, pasture rotation, and restricted grazing during wet periods helps to keep the pasture in good condition.

Periodic mowing and spreading of droppings help to maintain uniform growth and discourage selective grazing. Proper grazing practices, weed control, and fertilizer are needed for maximum quality of forage. Legumes benefit from applications of agricultural lime.

This unit is suited to use as woodland. On the basis of a 50-year site curve, the estimated mean site index for red alder is 87. The estimated mean annual increment at culmination (CMAI) for red alder at 40 years of age is 96 cubic feet per acre.

The main limitation for the harvesting of timber is seasonal soil wetness, which limits the use of equipment to dry periods. Use of wheeled and tracked equipment when the soil in this unit is wet produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are sticky and slippery when wet, and they may be impassable during rainy periods. Logging roads require suitable surfacing for year-round use.

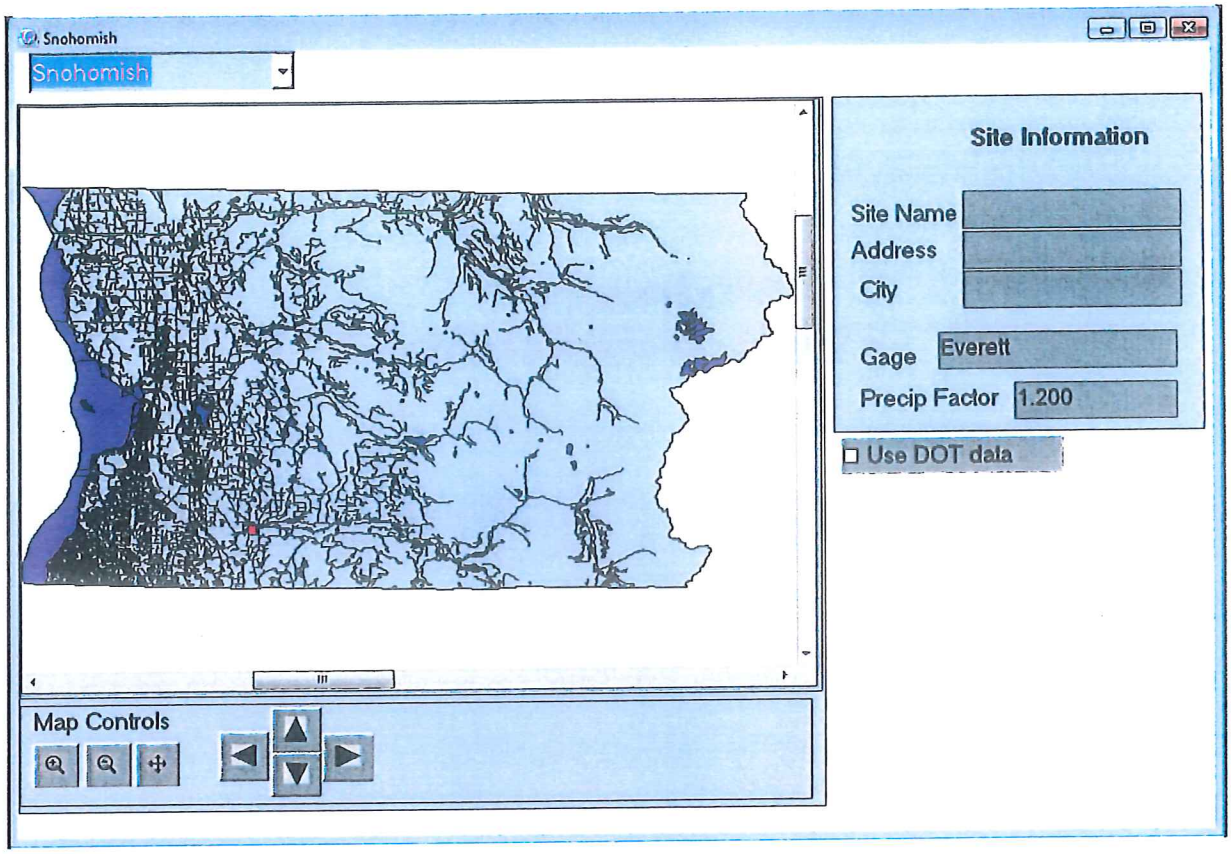
If seed trees are present, natural reforestation of cutover areas by red alder occurs readily. Reforestation can be accomplished by planting Douglas-fir or western redcedar seedlings. When openings are made in the canopy, invading brushy plants, if not controlled, can delay the establishment of seedlings.

The main limitation for homesites is the hazard of flooding. Dikes and channels that have outlets to bypass floodwater can be used to protect buildings from flooding. Tile drainage around footings reduces wetness. The main limitations for septic tank absorption fields are the seasonal high water table and moderately slow permeability. Use of long absorption lines helps to compensate for the moderately slow permeability. Cutbanks are not stable and are subject to caving in.

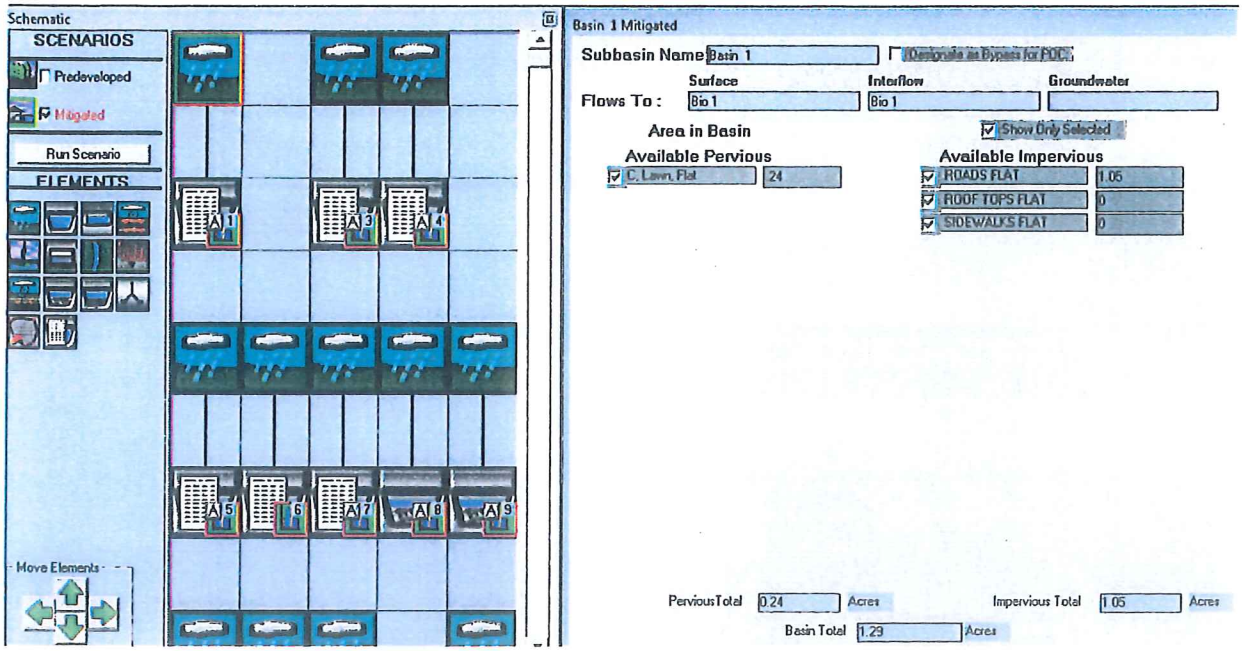
This map unit is in capability subclass IIw.

SCS SOILS DESCRIPTION

APPENDIX B
WWHM3 SCREEN SHOTS



SITE LOCATION

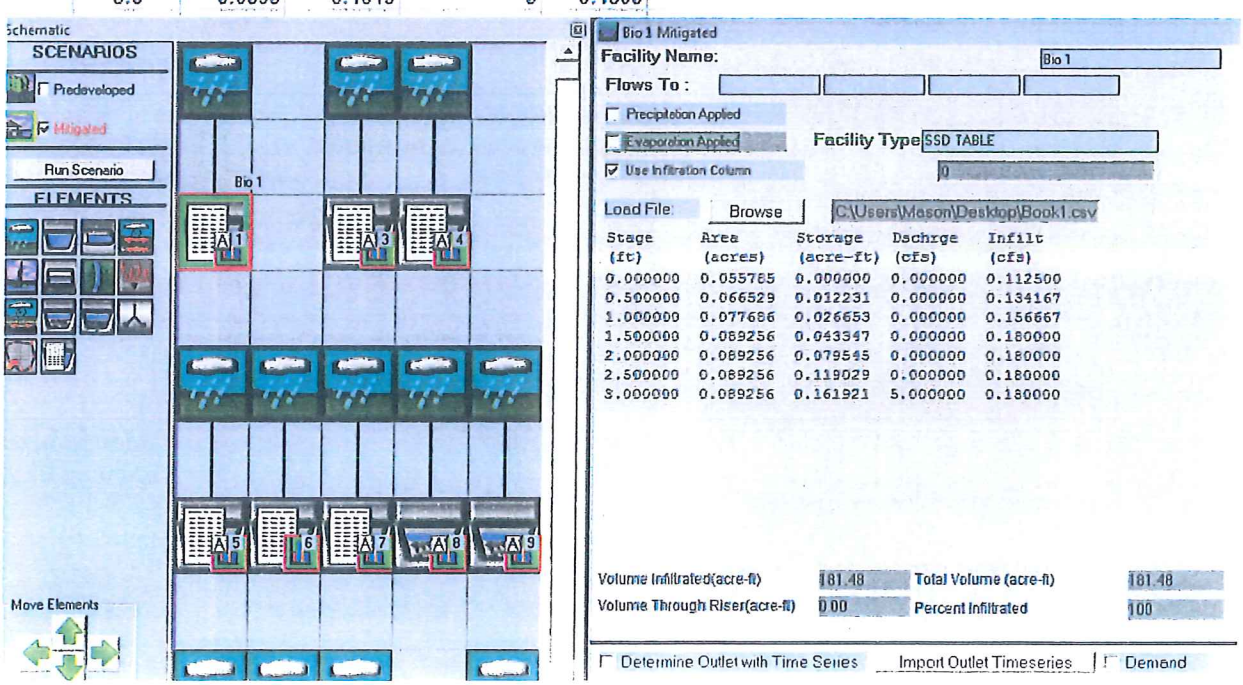


BASIN 1 – BIORETENTION CELL #1

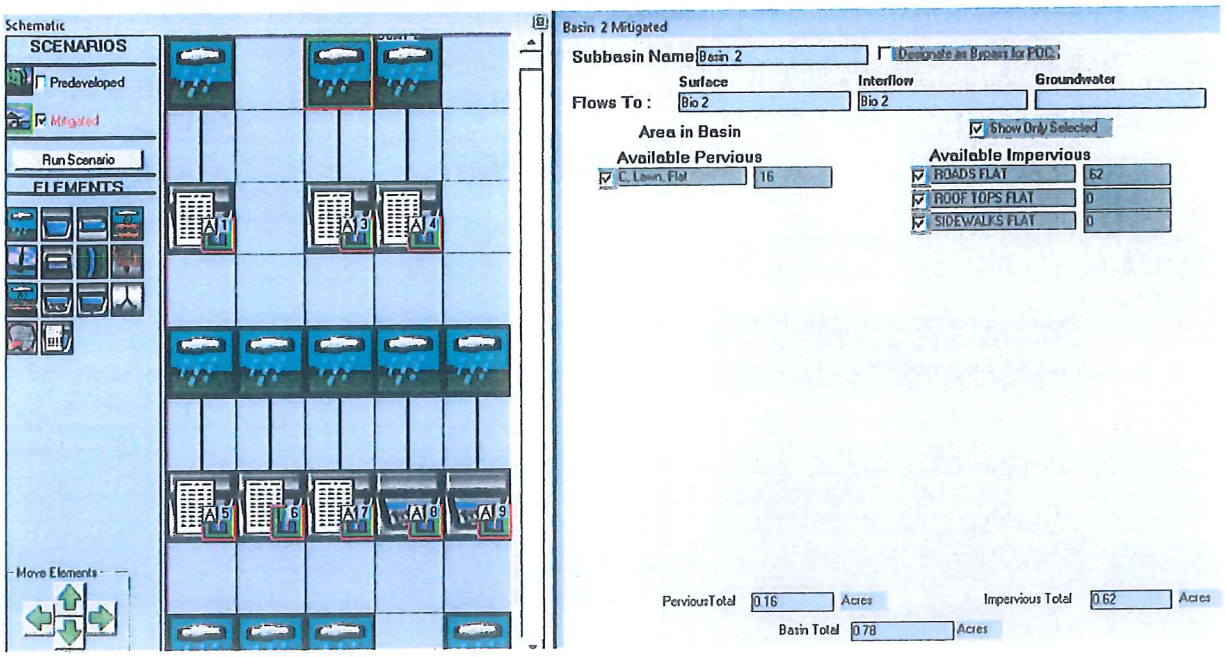
1

Bottom Length	135	ft
Bottom Width	18	ft
Infiltration Rate	2	in/hr

STAGE	AREA	STORAGE	DISCHARGE	INFIL
0.0	0.0558	0.0000	0	0.1125
0.5	0.0665	0.0122	0	0.1342
1.0	0.0777	0.0267	0	0.1567
1.5	0.0893	0.0433	0	0.1800
2.0	0.0893	0.0795	0	0.1800
2.5	0.0893	0.1190	0	0.1800
3.0	0.0893	0.1619	5	0.1800



BIORETENTION CELL #1

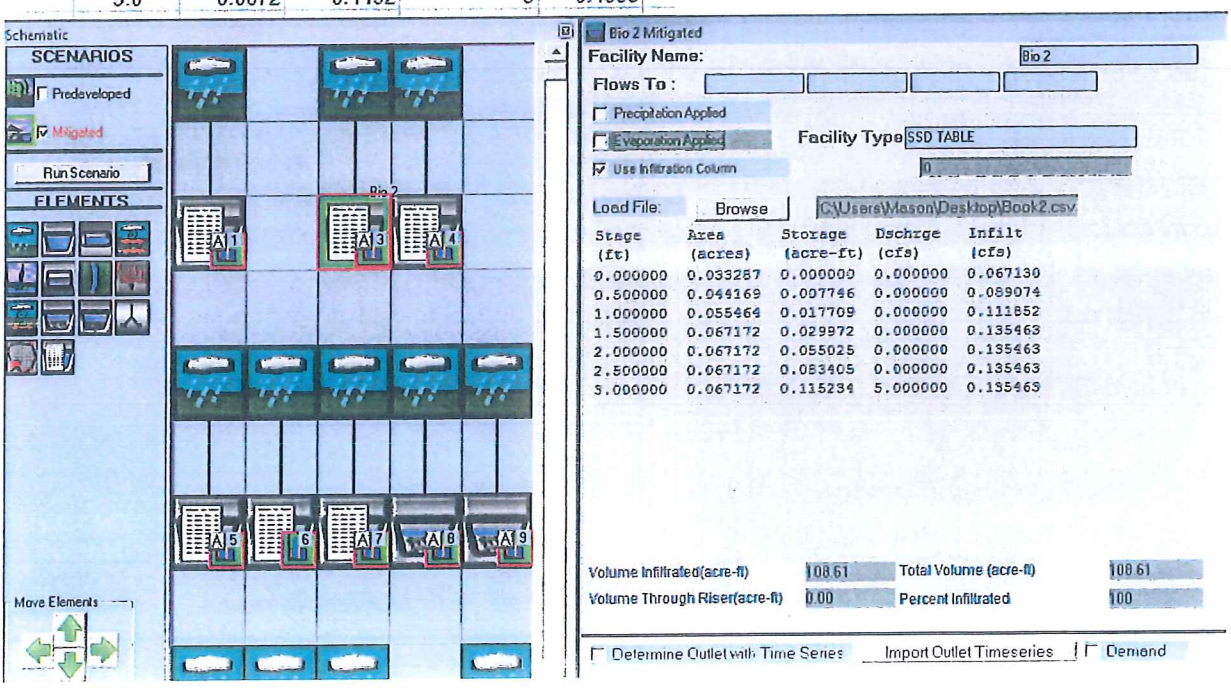


BASIN 2 – BIORETENTION CELL #2

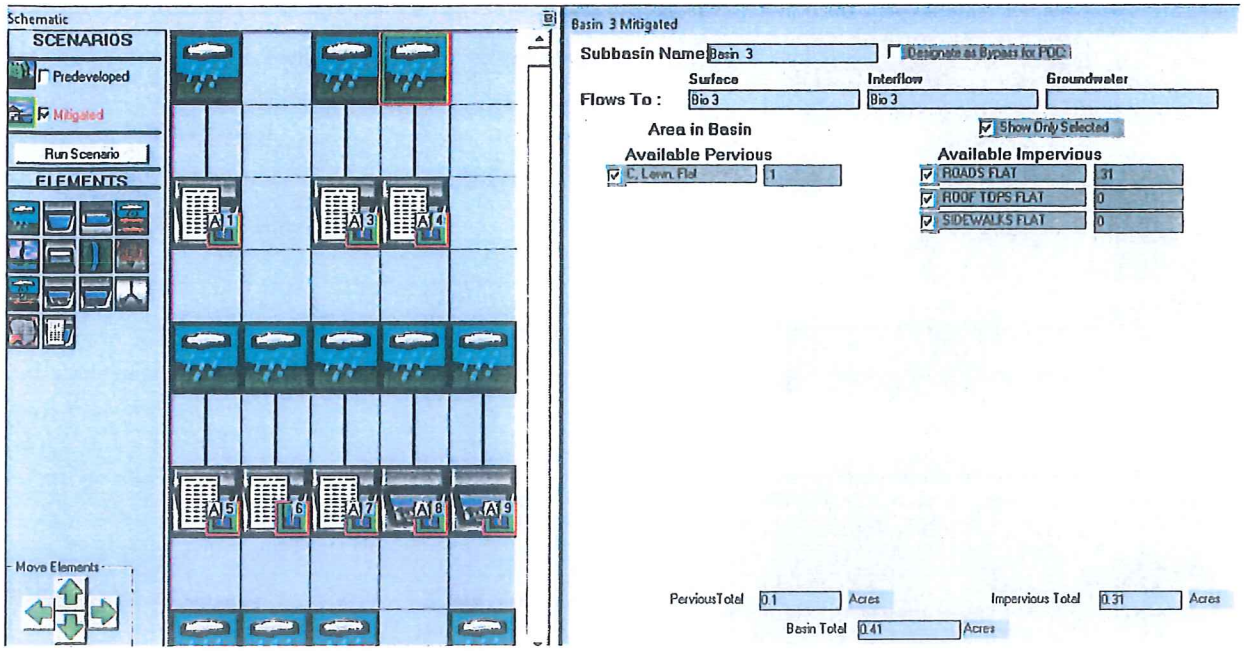
2

Bottom Length	145	ft
Bottom Width	10	ft
Infiltration Rate	2	in/hr

STAGE	AREA	STORAGE	DISCHARGE	INFIL
0.0	0.0333	0.0000	0	0.0671
0.5	0.0442	0.0077	0	0.0891
1.0	0.0555	0.0177	0	0.1119
1.5	0.0672	0.0300	0	0.1355
2.0	0.0672	0.0550	0	0.1355
2.5	0.0672	0.0834	0	0.1355
3.0	0.0672	0.1152	5	0.1355



BIORETENTION CELL #2

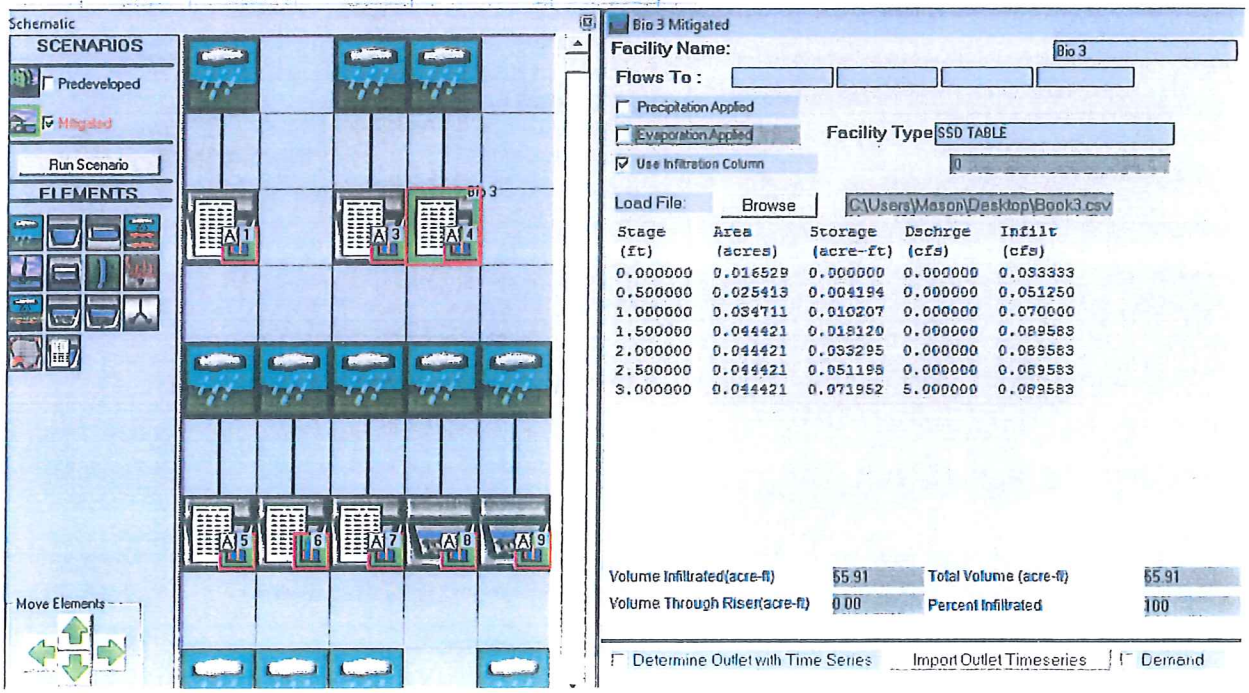


BASIN 3 – BIORETENTION CELL #3

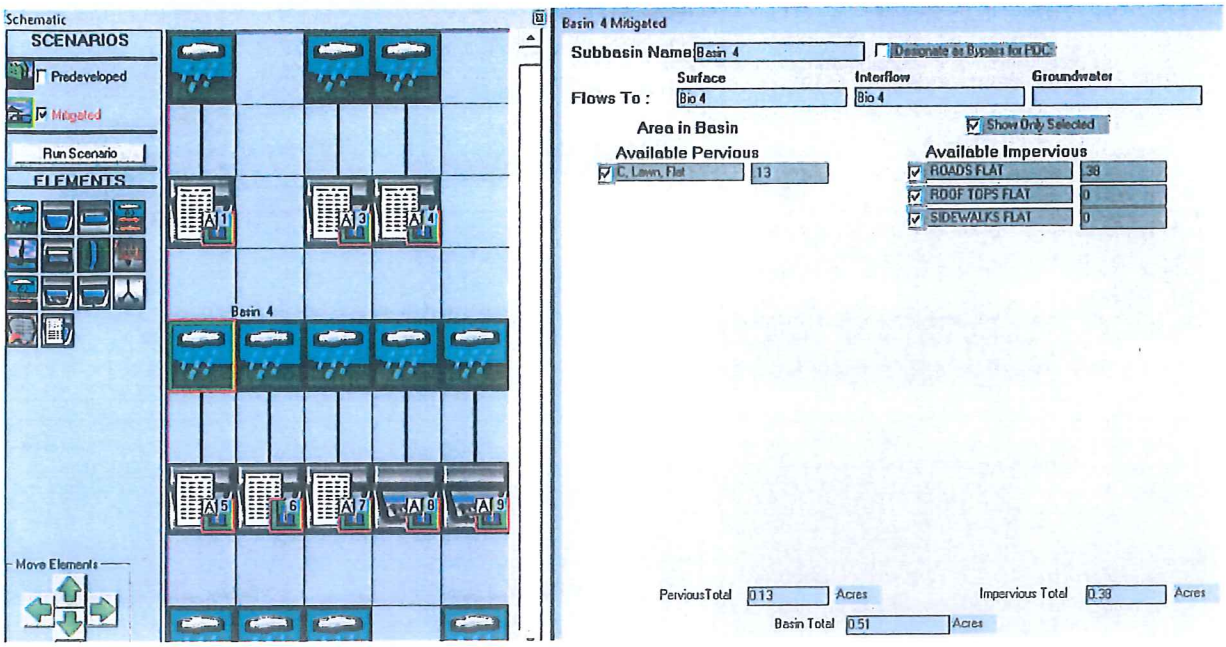
3

Bottom Length	120	ft
Bottom Width	6	ft
Infiltration Rate	2	in/hr

STAGE	AREA	STORAGE	DISCHARGE	INFIL
0.0	0.0165	0.0000	0	0.0333
0.5	0.0254	0.0042	0	0.0513
1.0	0.0347	0.0102	0	0.0700
1.5	0.0444	0.0181	0	0.0896
2.0	0.0444	0.0333	0	0.0896
2.5	0.0444	0.0512	0	0.0896
3.0	0.0444	0.0720	5	0.0896



BIORETENTION CELL #3

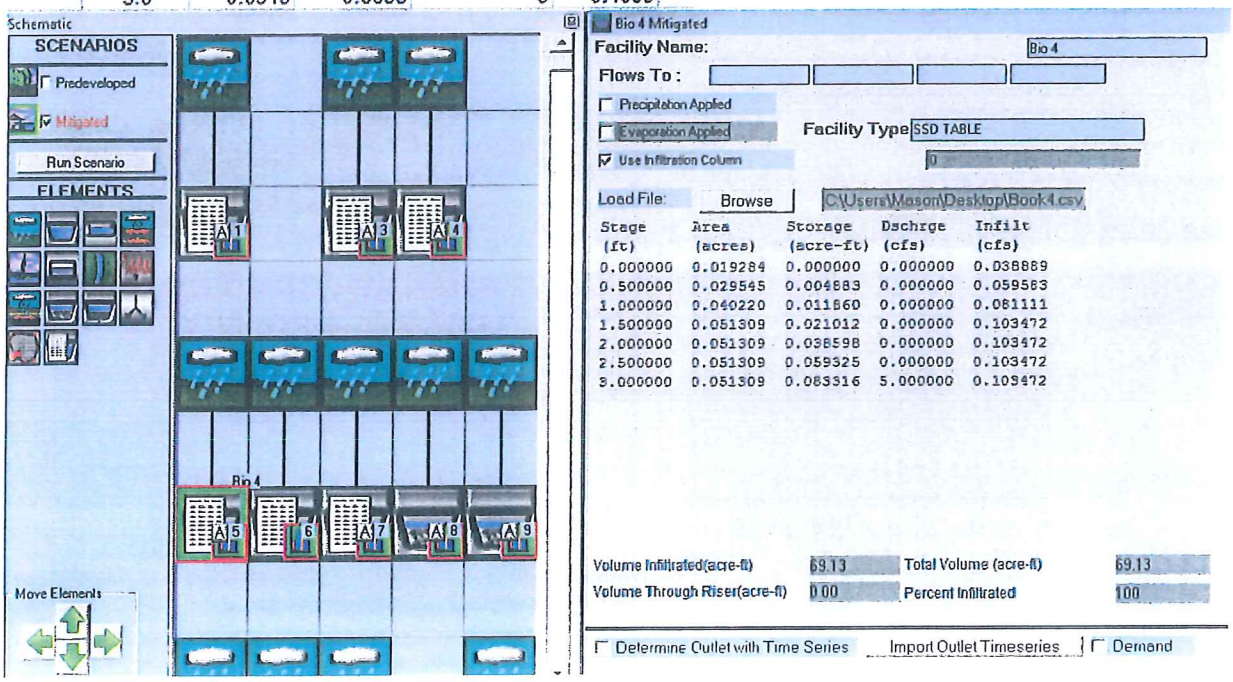


BASIN 4 – BIORETENTION CELL #4

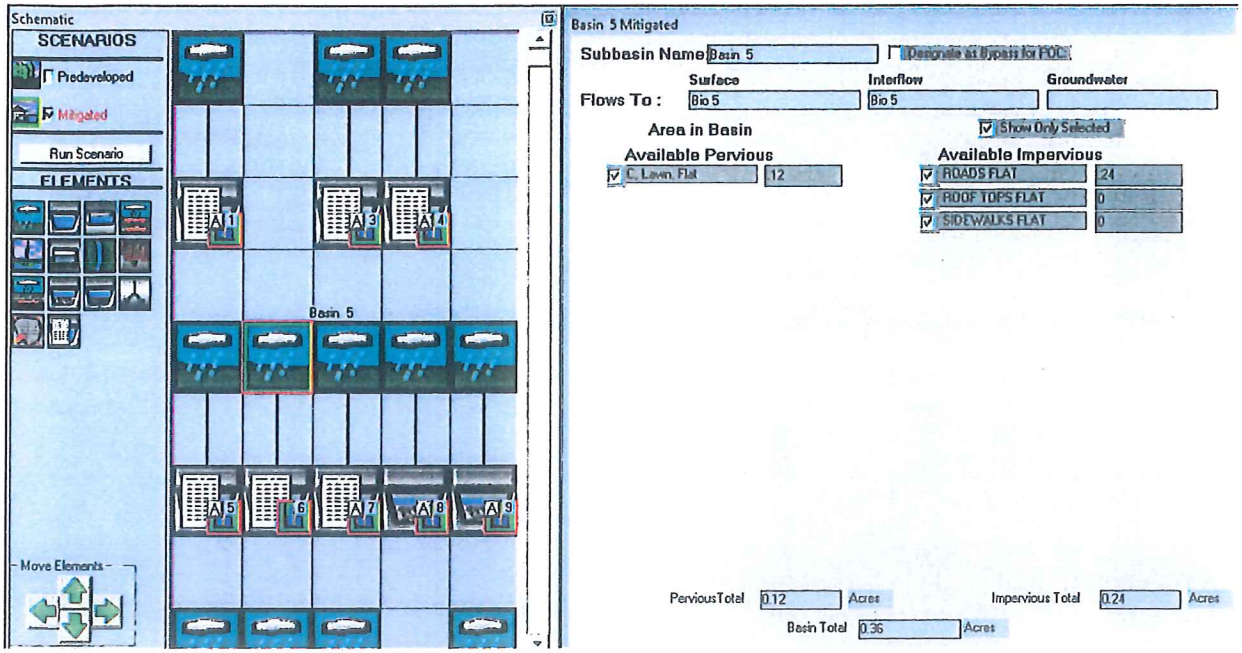
4

Bottom Length	140	ft
Bottom Width	6	ft
Infiltration Rate	2	in/hr

STAGE	AREA	STORAGE	DISCHARGE	INFIL
0.0	0.0193	0.0000	0	0.0389
0.5	0.0295	0.0049	0	0.0596
1.0	0.0402	0.0119	0	0.0811
1.5	0.0513	0.0210	0	0.1035
2.0	0.0513	0.0386	0	0.1035
2.5	0.0513	0.0593	0	0.1035
3.0	0.0513	0.0833	5	0.1035



BIORETENTION CELL #4

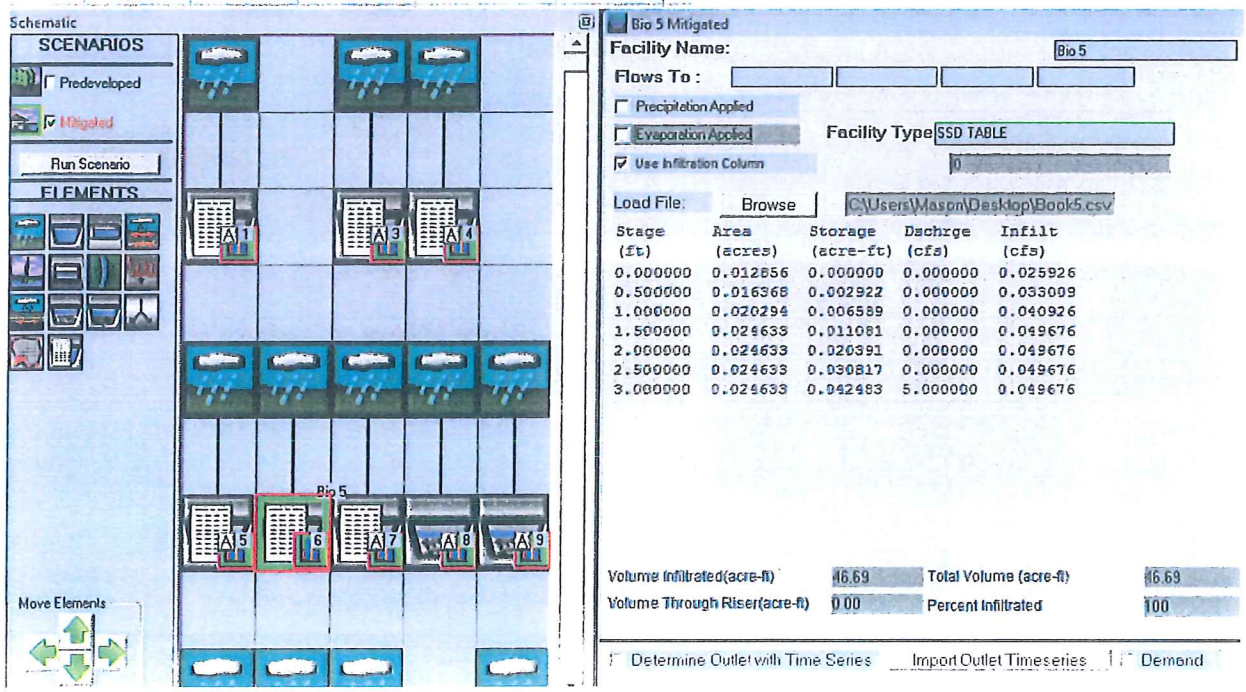


BASIN 5 – BIORETENTION CELL #5

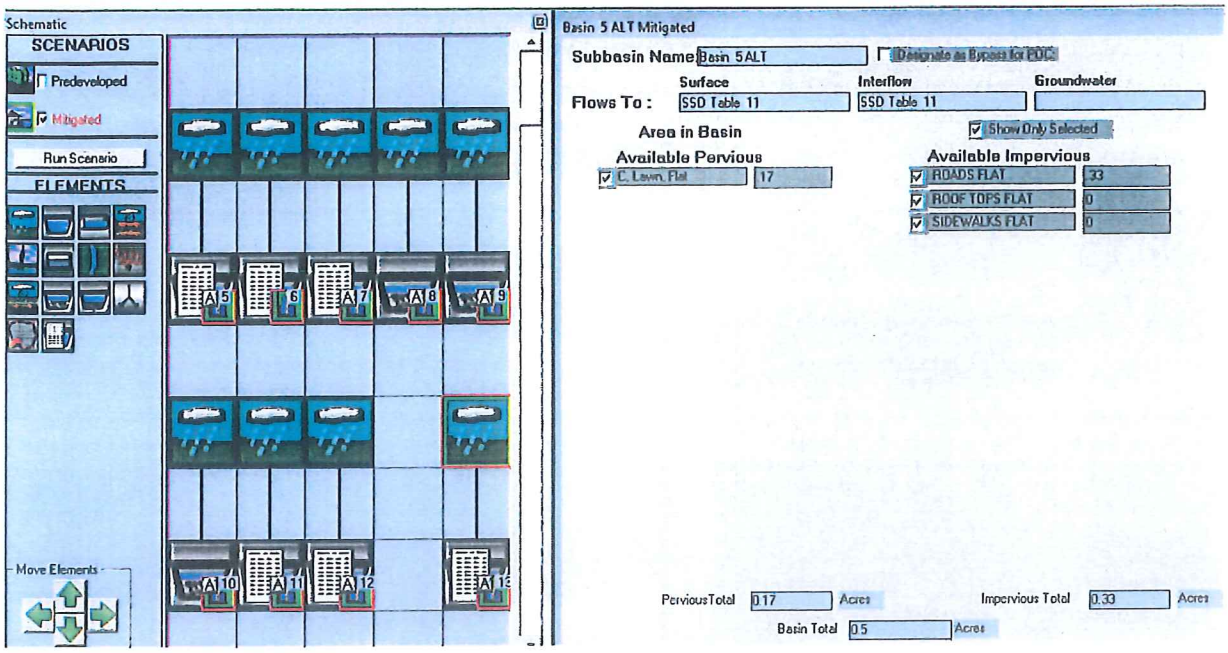
5

Bottom Length	28	ft
Bottom Width	20	ft
Infiltration Rate	2	in/hr

STAGE	AREA	STORAGE	DISCHARGE	INFIL
0.0	0.0129	0.0000	0	0.0259
0.5	0.0164	0.0029	0	0.0330
1.0	0.0203	0.0066	0	0.0409
1.5	0.0246	0.0111	0	0.0497
2.0	0.0246	0.0204	0	0.0497
2.5	0.0246	0.0308	0	0.0497
3.0	0.0246	0.0425	5	0.0497



BIORETENTION CELL #5

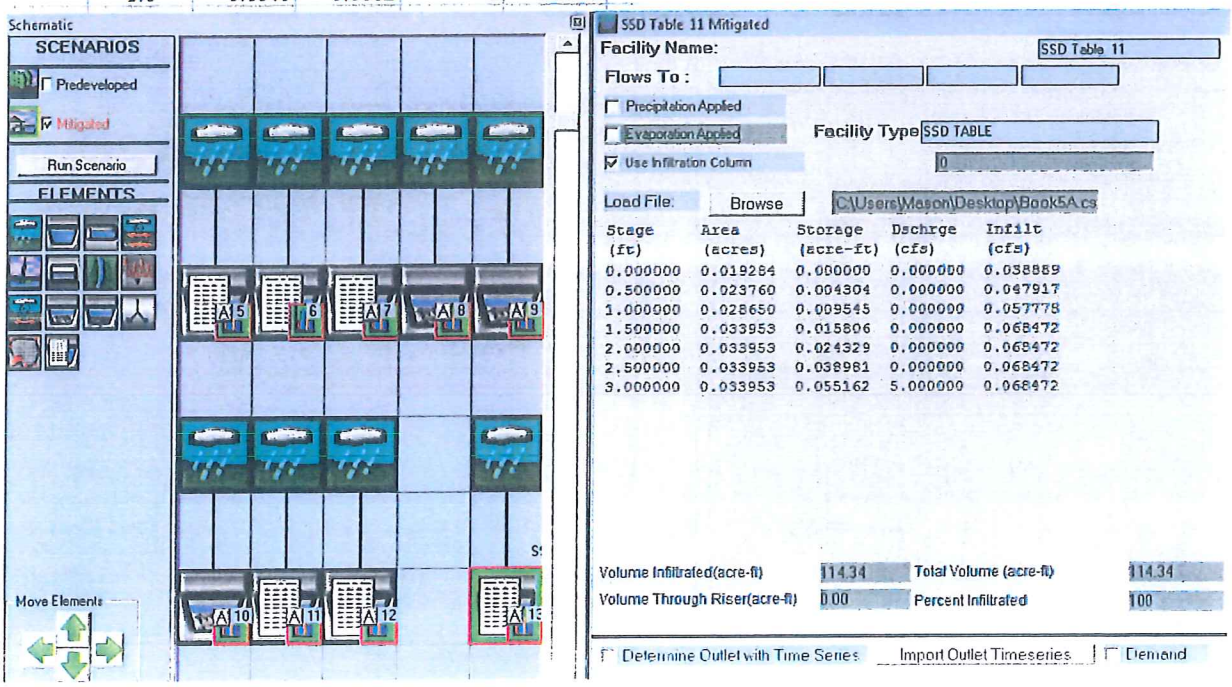


BASIN 5 ALTERNATE – BIORETENTION CELL #5

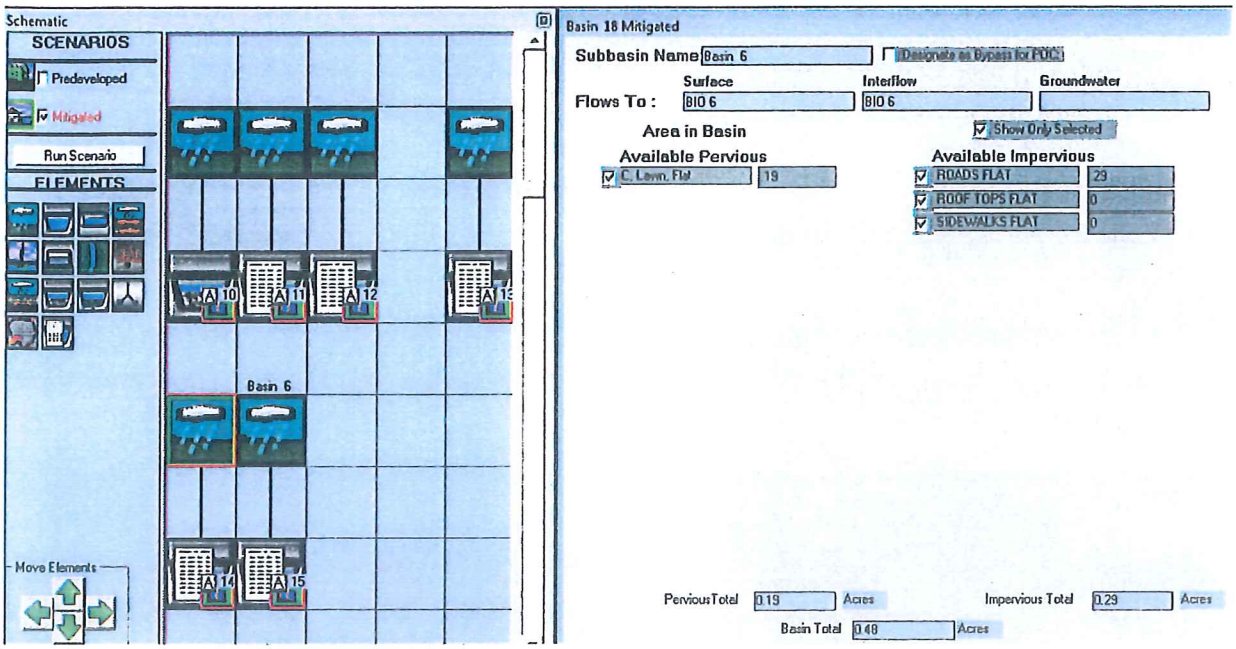
5 ALT

Bottom Length	42	ft
Bottom Width	20	ft
Infiltration Rate	2	in/hr

STAGE	AREA	STORAGE	DISCHARG	INFIL
0.0	0.0193	0.0000	0	0.0389
0.5	0.0238	0.0043	0	0.0479
1.0	0.0287	0.0095	0	0.0578
1.5	0.0340	0.0158	0	0.0685
2.0	0.0340	0.0243	0	0.0685
2.5	0.0340	0.0390	0	0.0685
3.0	0.0340	0.0552	5	0.0685



BIORETENTION CELL #5 ALTERNATE

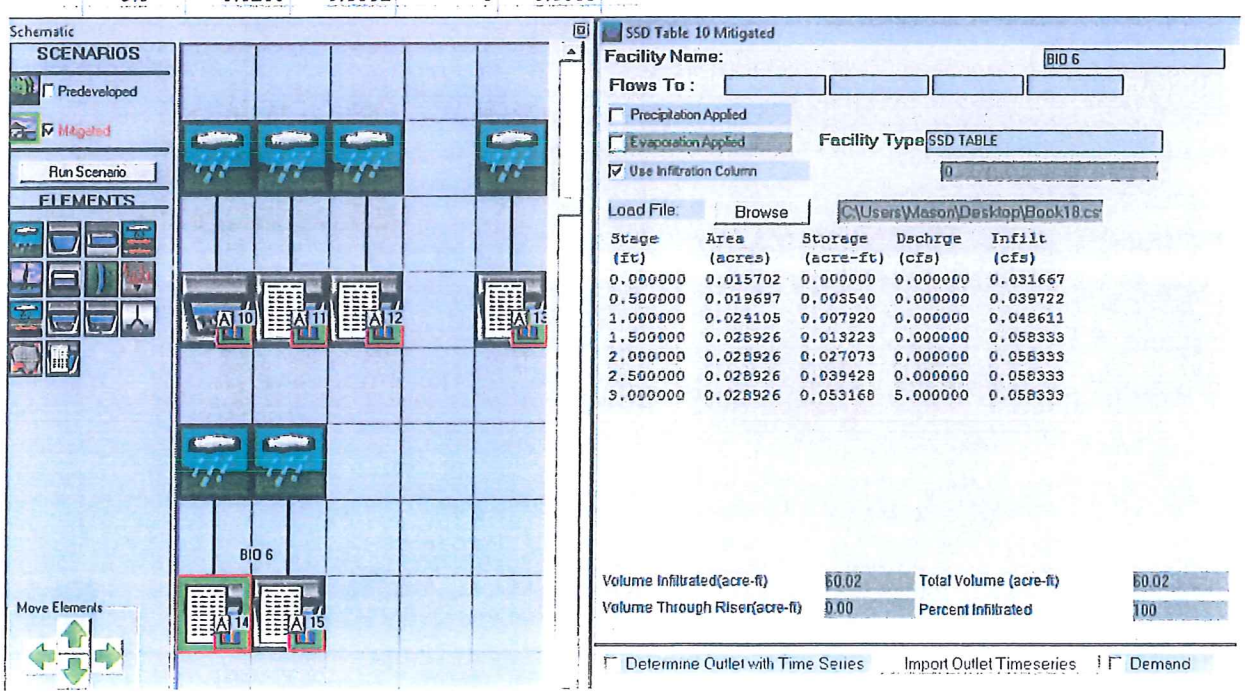


BASIN 6 – BIORETENTION CELL #6

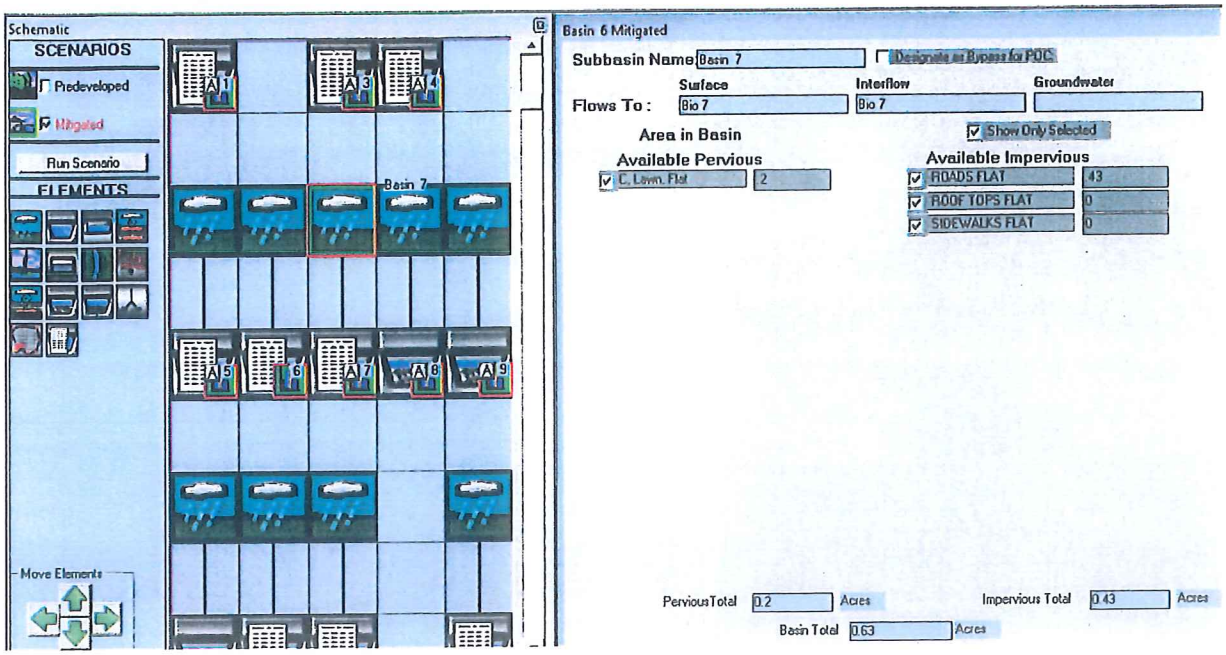
6

Bottom Length	36	ft
Bottom Width	19	ft
Infiltration Rate	2	in/hr

STAGE	AREA	STORAGE	DISCHARG	INFIL
0.0	0.0157	0.0000	0	0.0317
0.5	0.0197	0.0035	0	0.0397
1.0	0.0241	0.0079	0	0.0486
1.5	0.0289	0.0132	0	0.0583
2.0	0.0289	0.0271	0	0.0583
2.5	0.0289	0.0394	0	0.0583
3.0	0.0289	0.0532	5	0.0583



BIORETENTION CELL #6

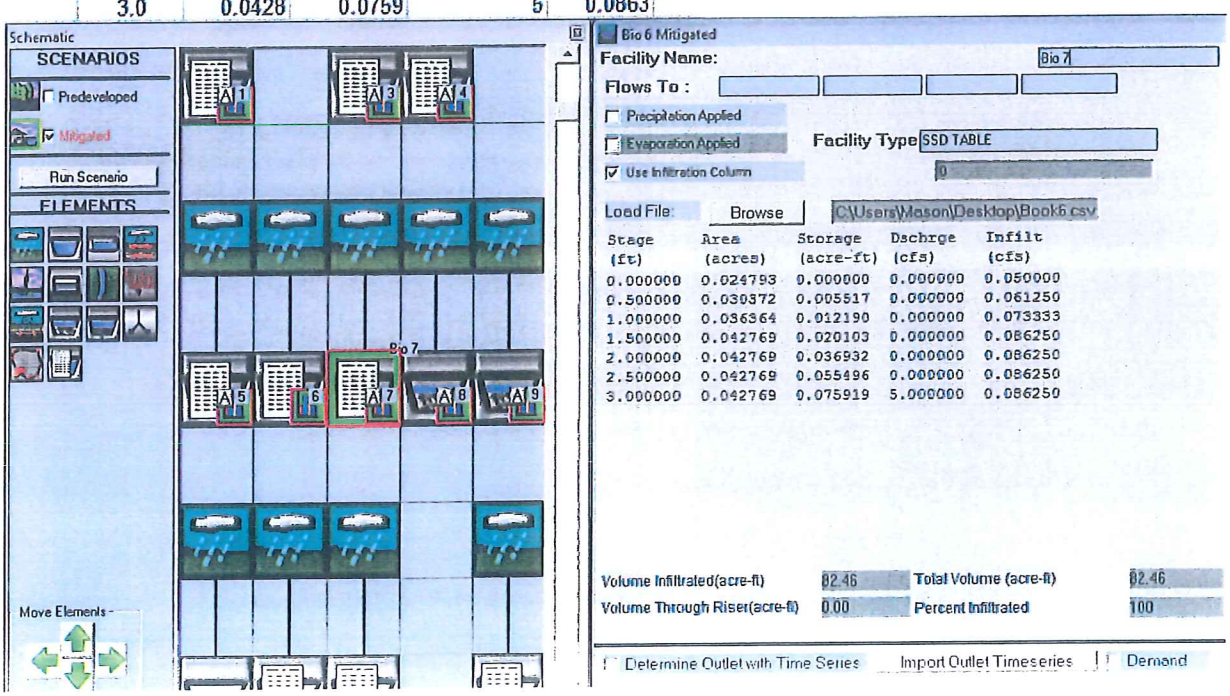


BASIN 7 – BIORETENTION CELL #7

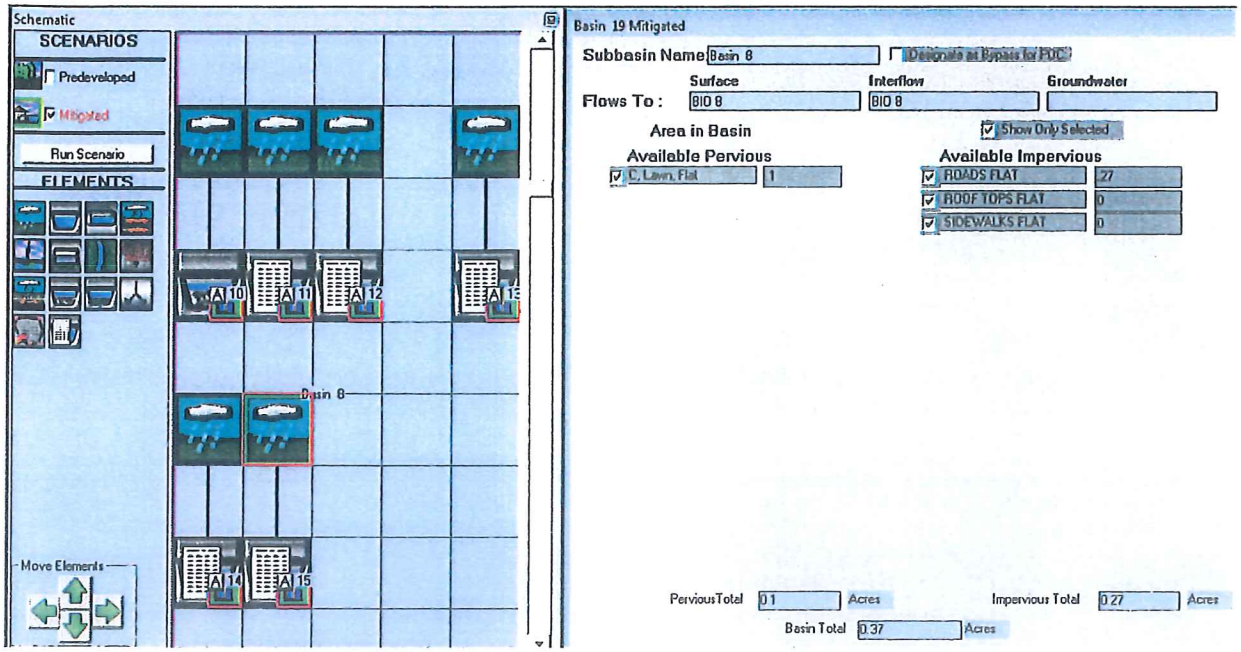
7

Bottom Length	60	ft
Bottom Width	18	ft
Infiltration Rate	2	in/hr

STAGE	AREA	STORAGE	DISCHARGE	INFIL
0.0	0.0248	0.0000	0	0.0500
0.5	0.0304	0.0055	0	0.0613
1.0	0.0364	0.0122	0	0.0733
1.5	0.0428	0.0201	0	0.0863
2.0	0.0428	0.0369	0	0.0863
2.5	0.0428	0.0555	0	0.0863
3.0	0.0428	0.0759	5	0.0863



BIORETENTION CELL #7

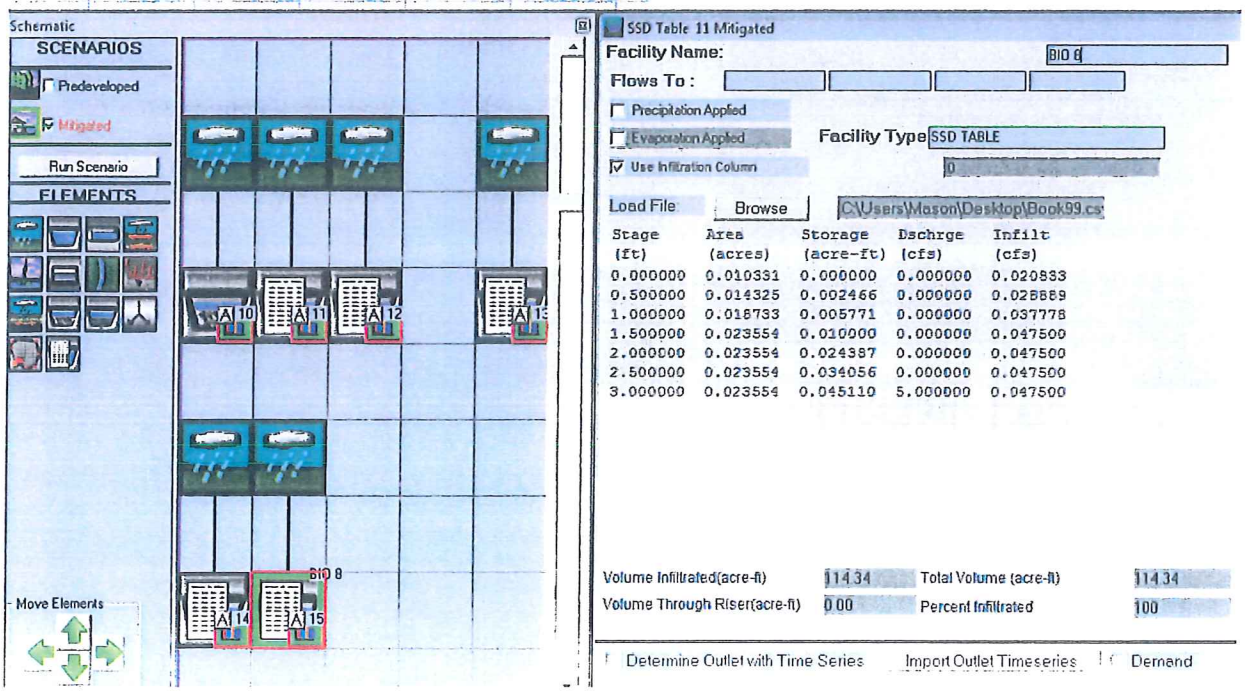


BASIN 8 – BIORETENTION CELL #8

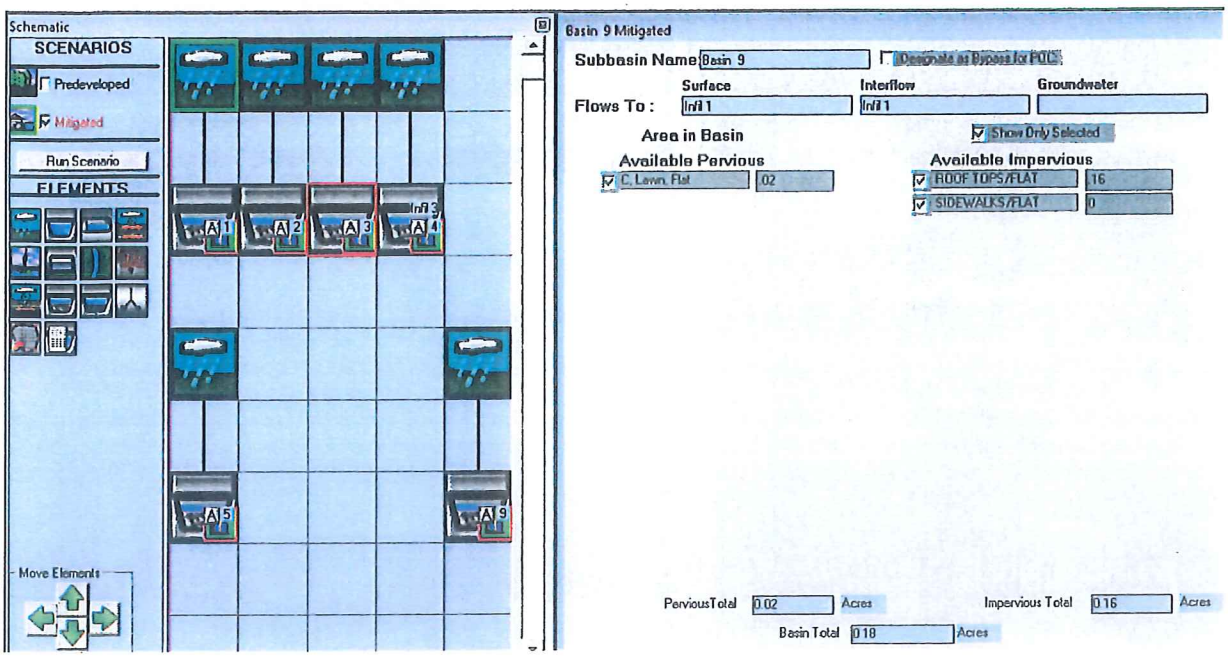
8

Bottom Length	10	ft
Bottom Width	45	ft
Infiltration Rate	2	in/hr

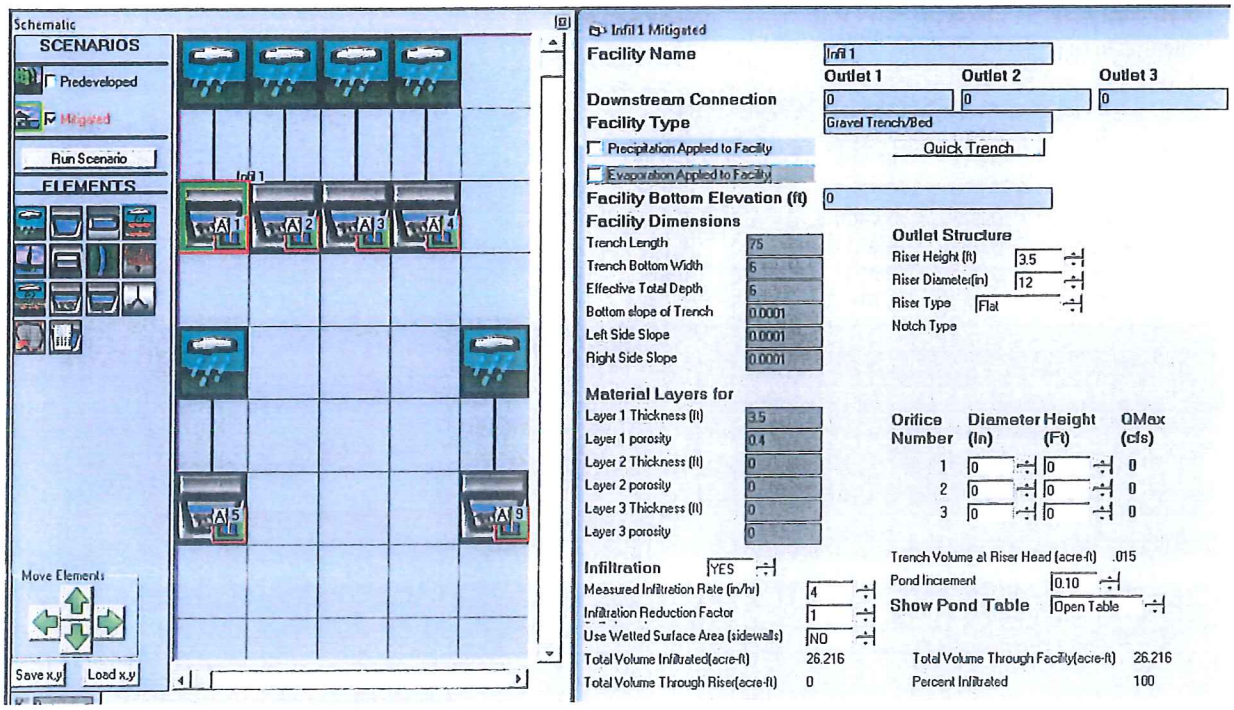
STAGE	AREA	STORAGE	DISCHARG	INFIL
0.0	0.0103	0.0000	0	0.0208
0.5	0.0143	0.0025	0	0.0289
1.0	0.0187	0.0058	0	0.0378
1.5	0.0236	0.0100	0	0.0475
2.0	0.0236	0.0244	0	0.0475
2.5	0.0236	0.0341	0	0.0475
3.0	0.0236	0.0451	5	0.0475



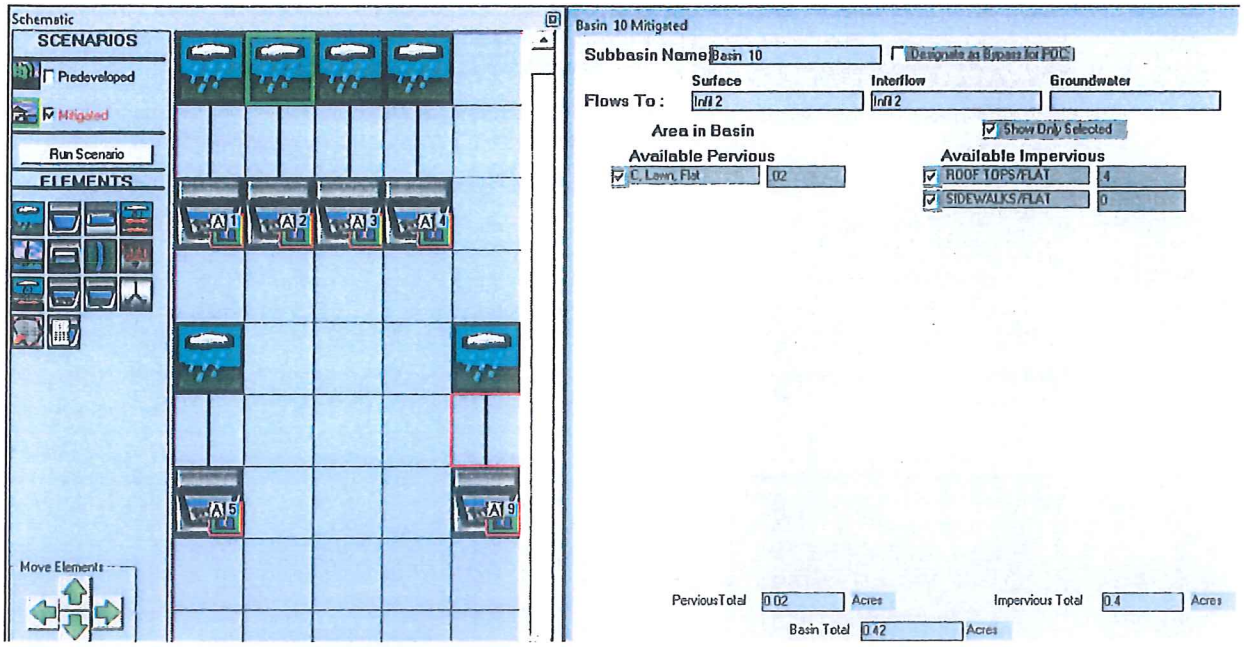
BIORETENTION CELL #8



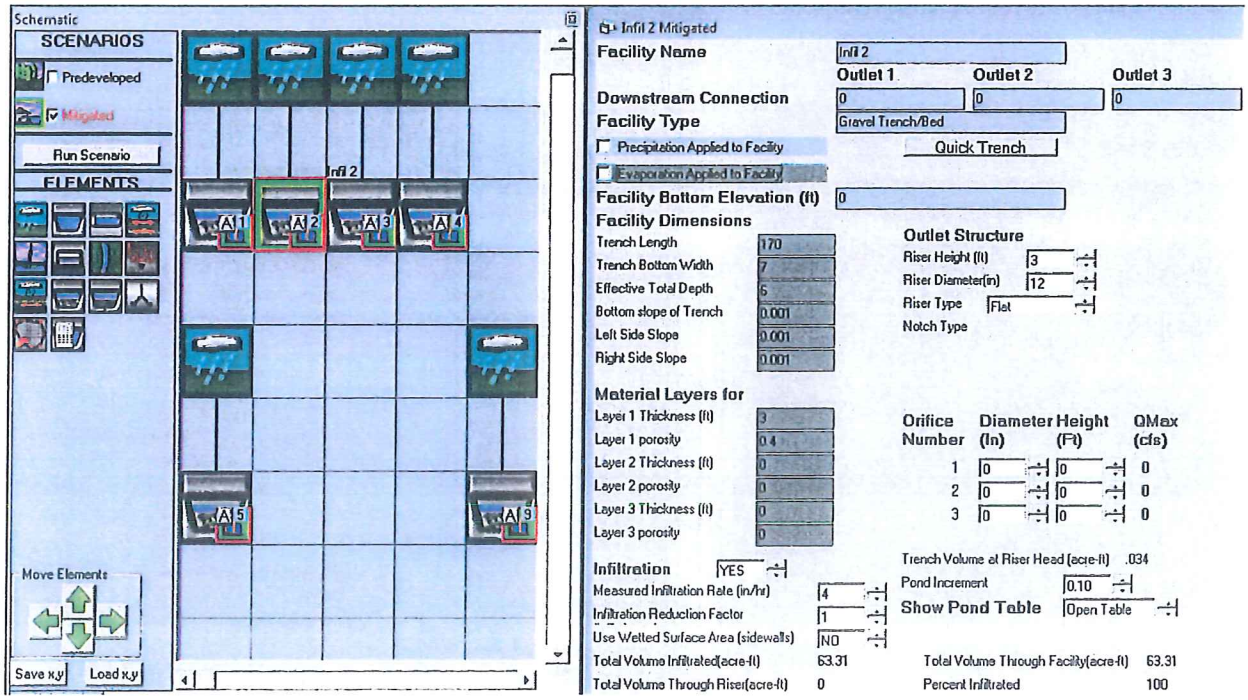
BASIN 9 – INFILTRATION TRENCH #1



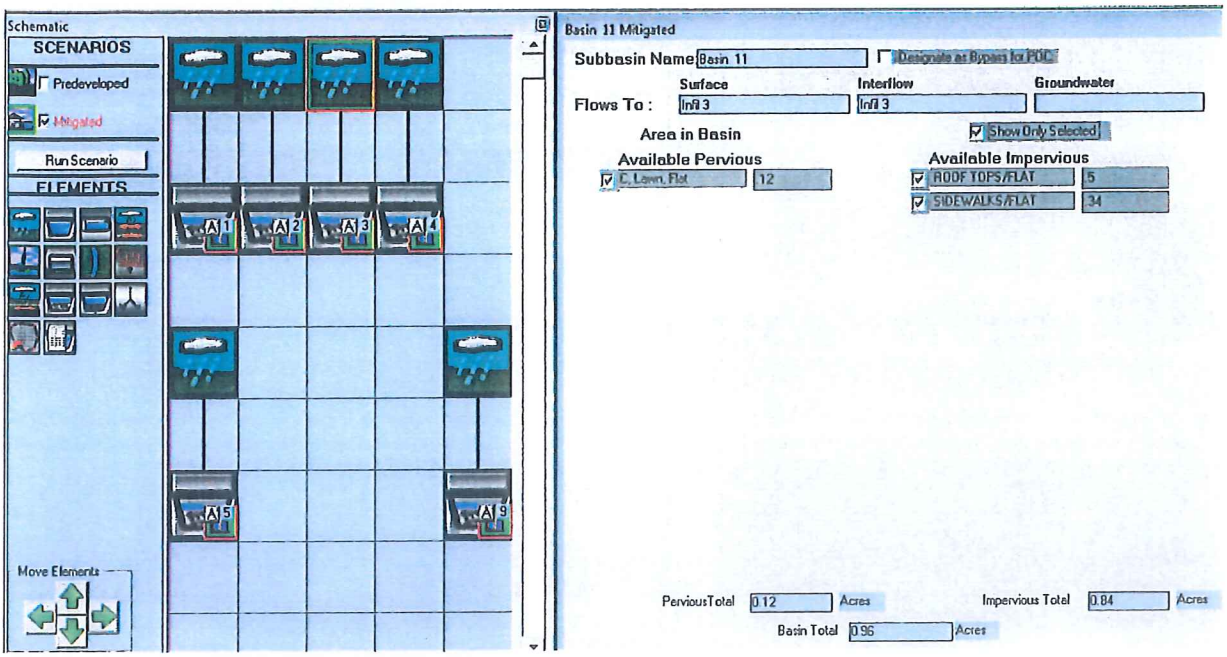
INFILTRATION TRENCH #1



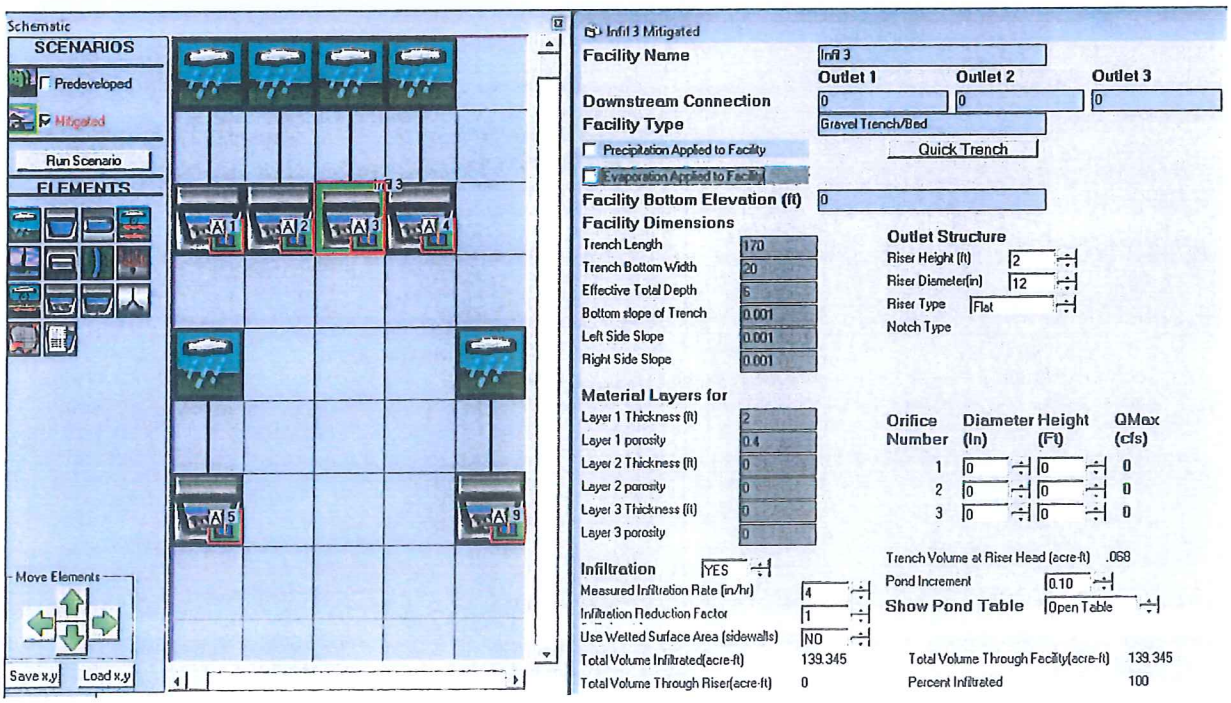
BASIN 10 – INFILTRATION TRENCH #2



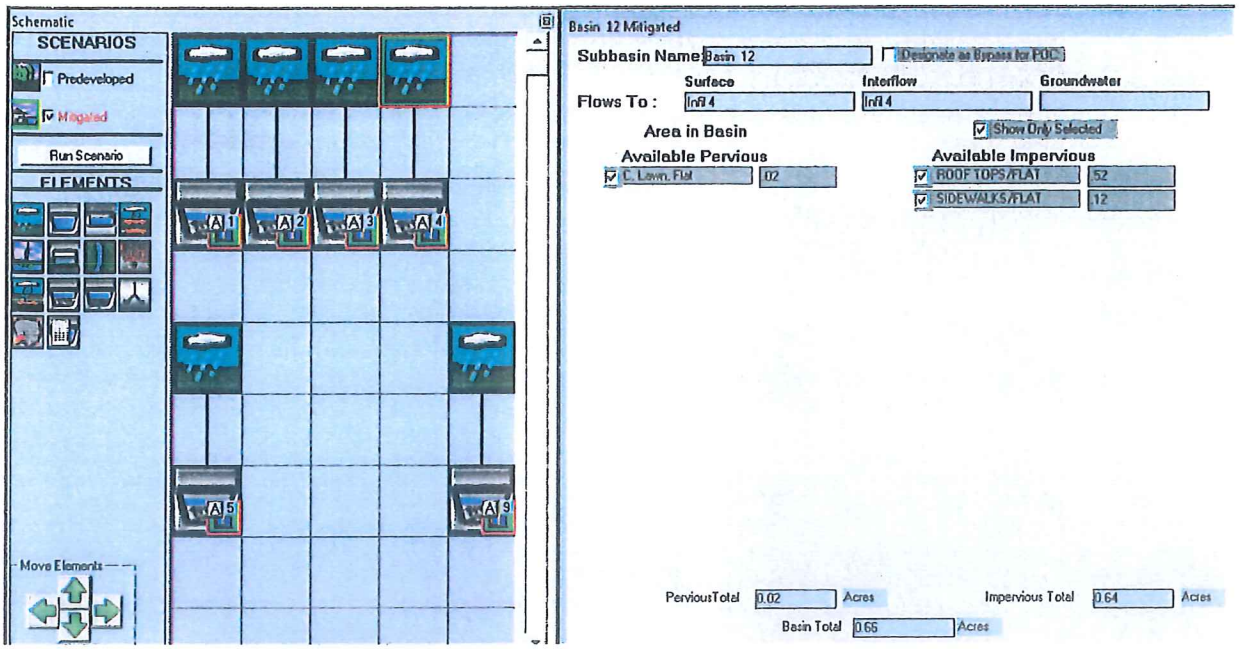
INFILTRATION TRENCH #2



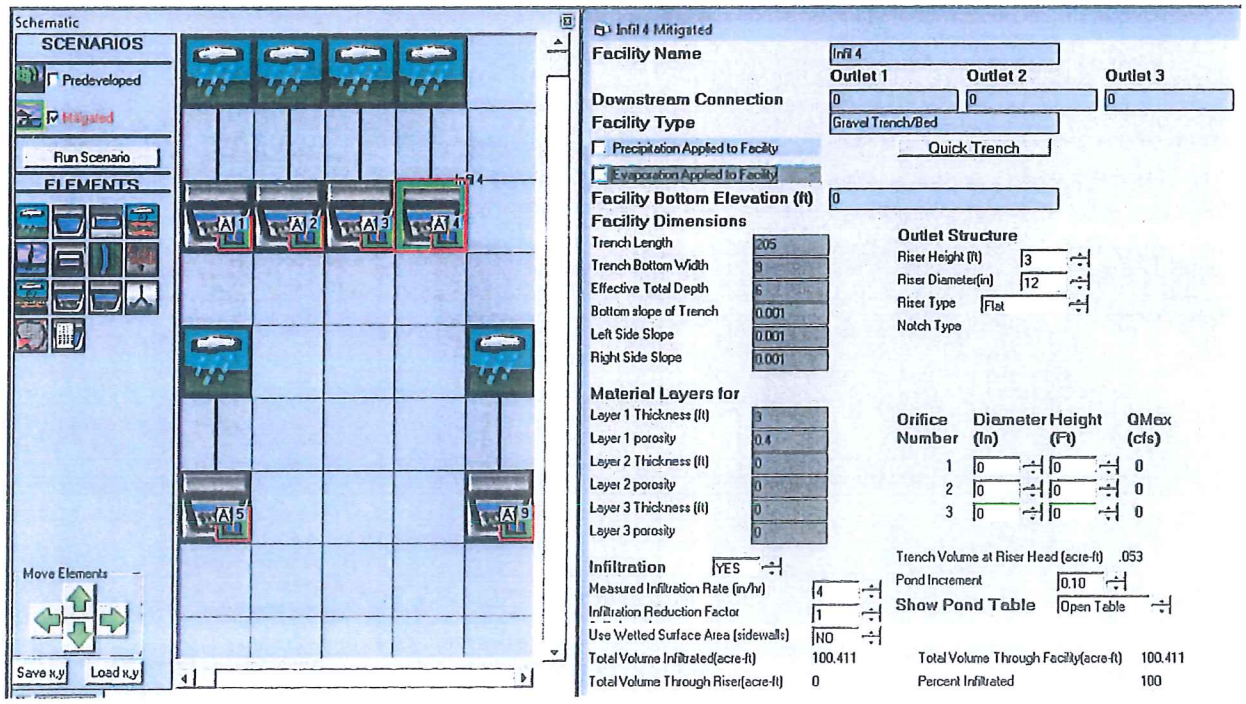
BASIN 11 – INFILTRATION TRENCH #3



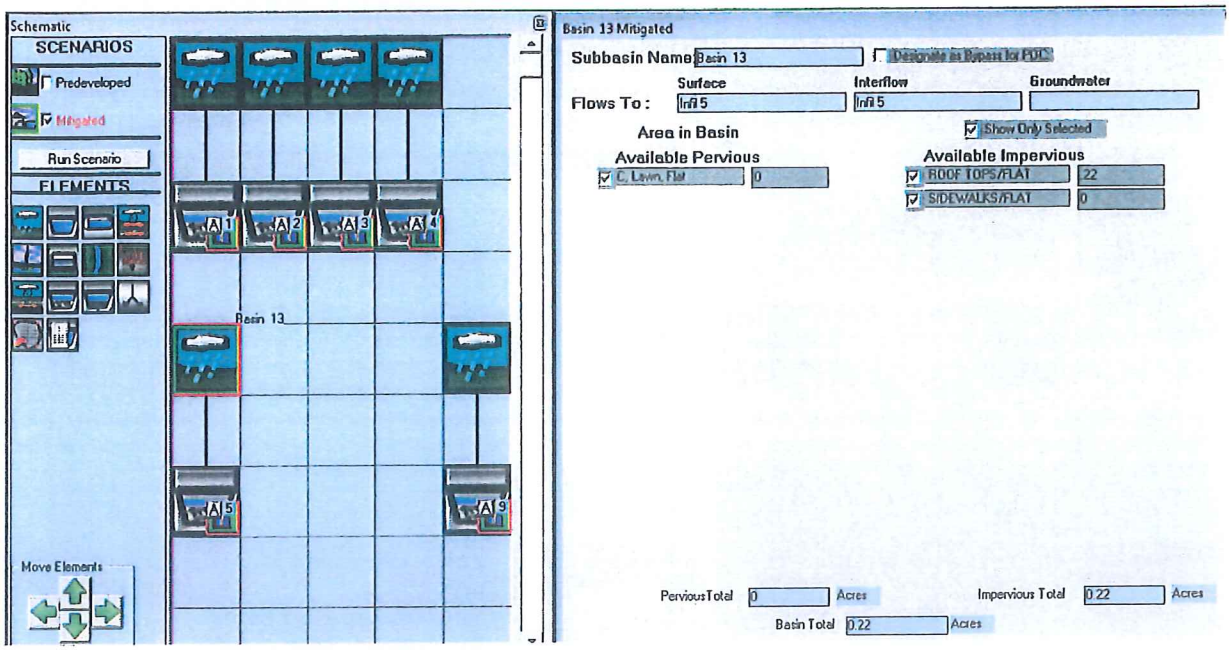
INFILTRATION TRENCH #3



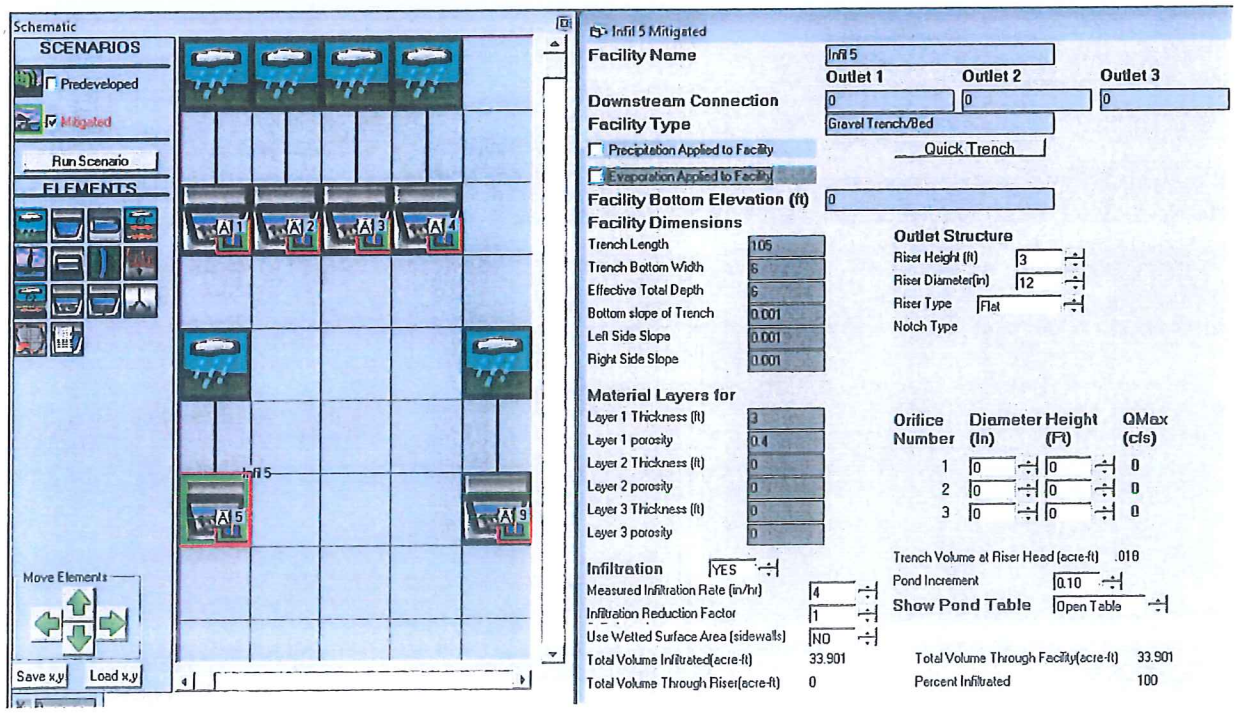
BASIN 12 – INFILTRATION TRENCH #4



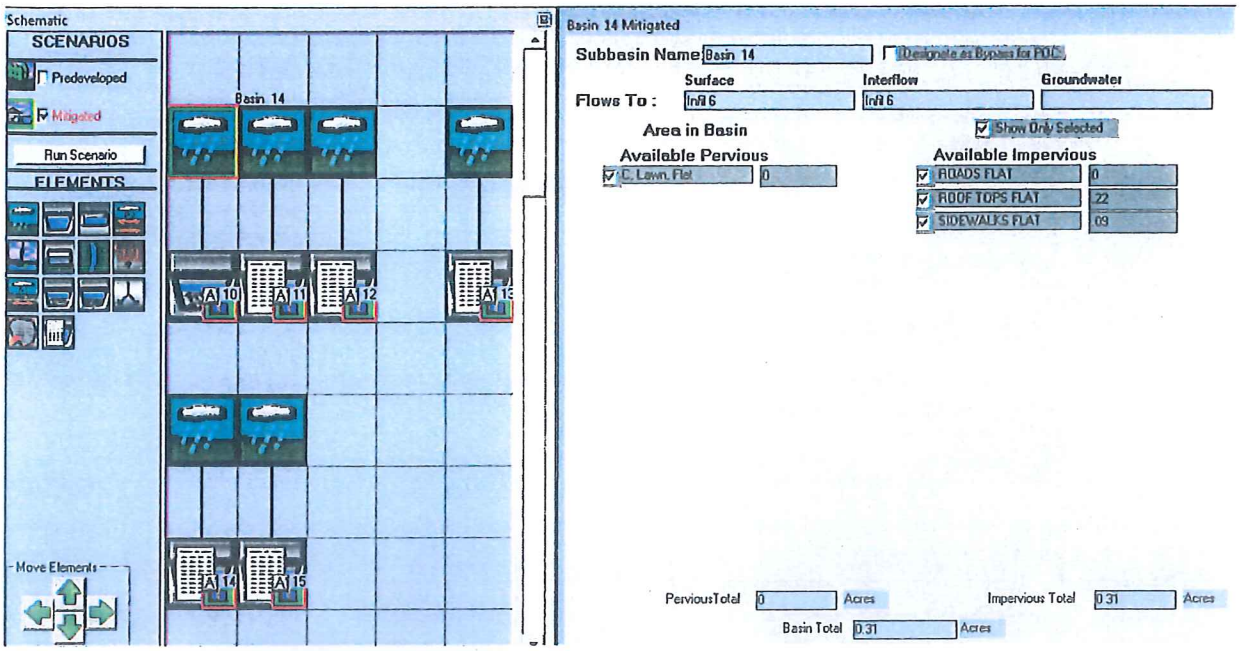
INFILTRATION TRENCH #4



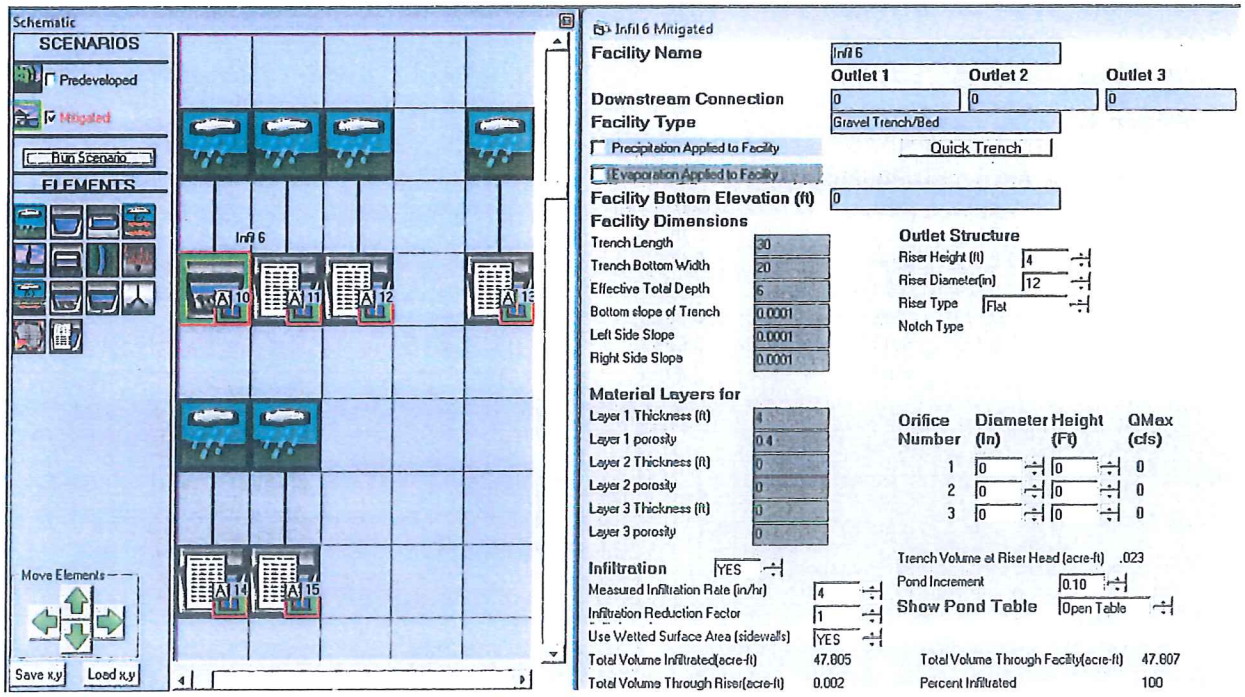
BASIN 13 – INFILTRATION TRENCH #5



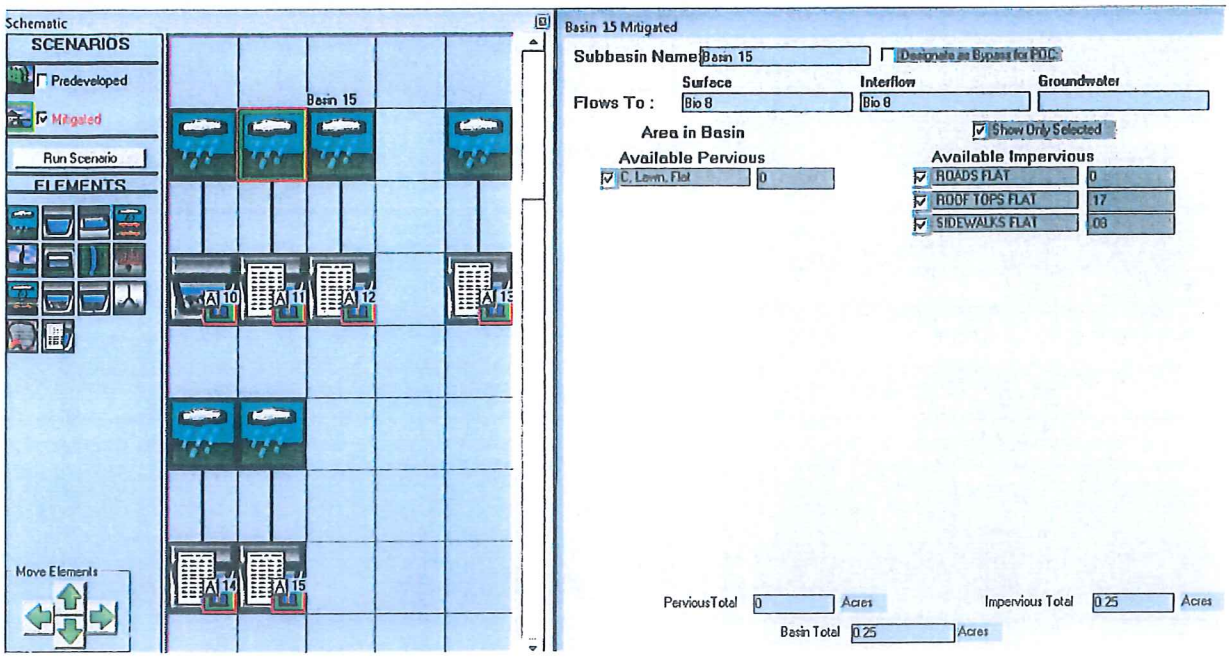
INFILTRATION TRENCH #5



BASIN 14 – INFILTRATION TRENCH #6

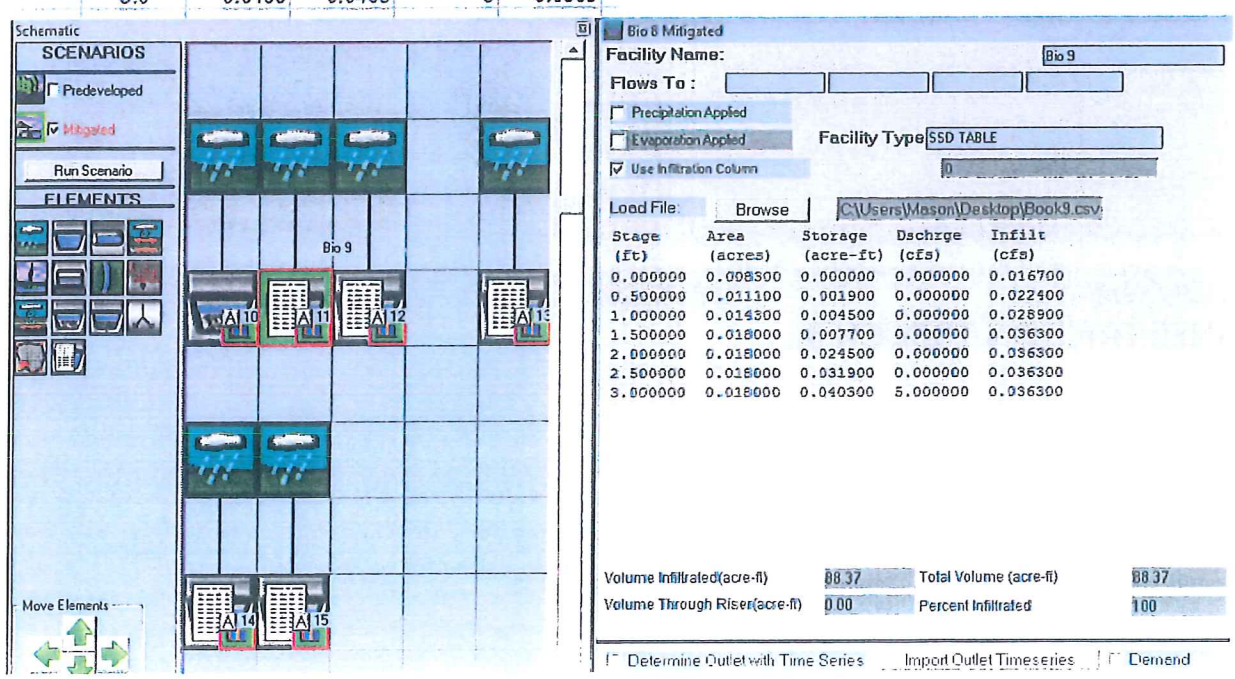


INFILTRATION TRENCH #6

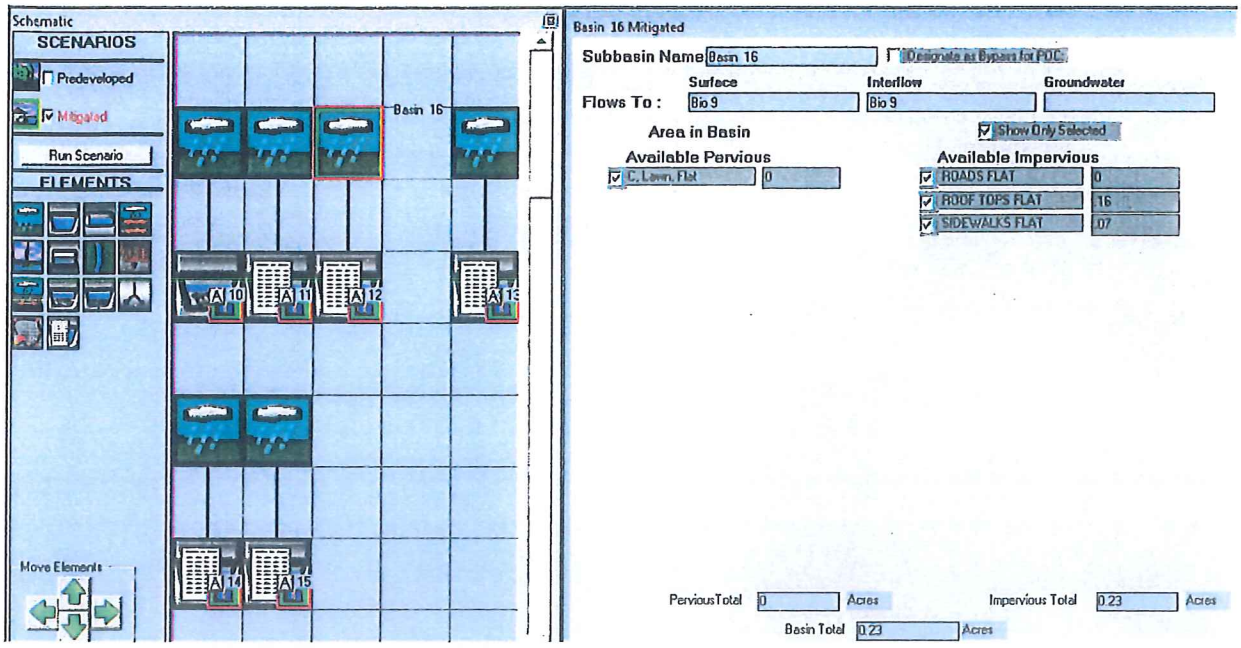


BASIN 15 – BIORETENTION CELL #9

15				
Bottom Length	18	ft		
Bottom Width	20	ft		
Infiltration Rate	2	in/hr		
STAGE	AREA	STORAGE	DISCHARG	INFIL
0.0	0.0083	0.0000	0	0.0167
0.5	0.0111	0.0019	0	0.0224
1.0	0.0143	0.0045	0	0.0289
1.5	0.0180	0.0077	0	0.0363
2.0	0.0180	0.0245	0	0.0363
2.5	0.0180	0.0319	0	0.0363
3.0	0.0180	0.0403	5	0.0363



BIORETENTION CELL #9

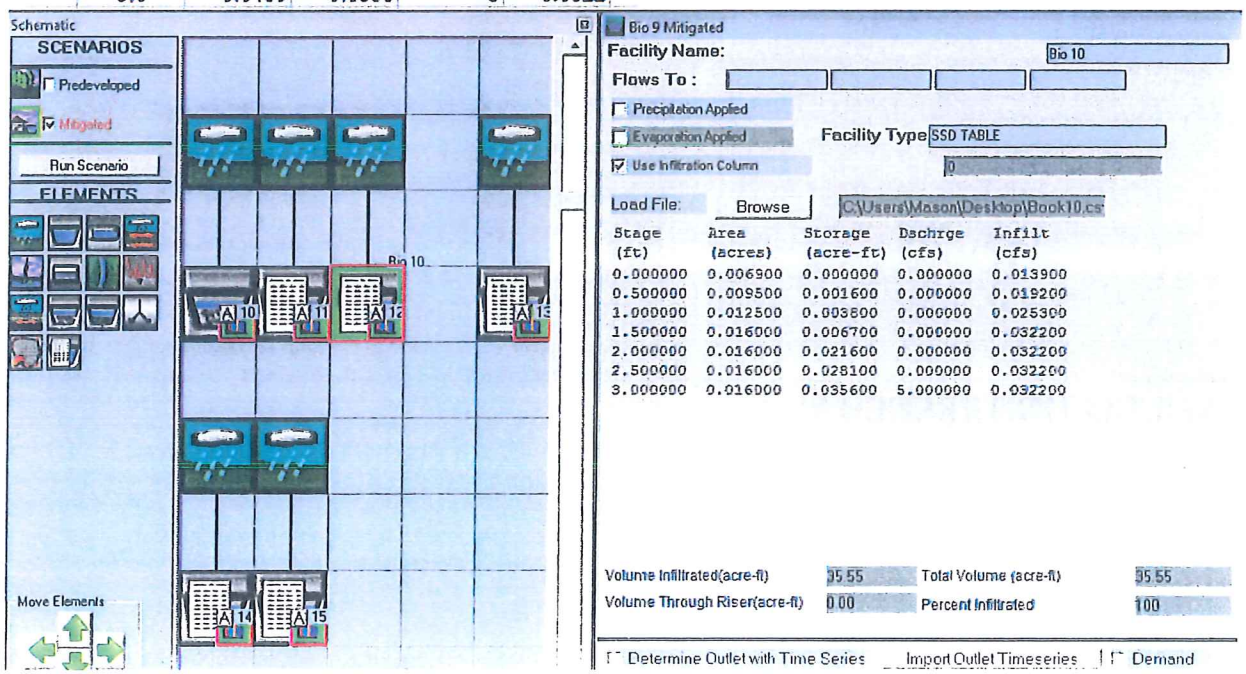


BASIN 16 – BIORETENTION CELL #10

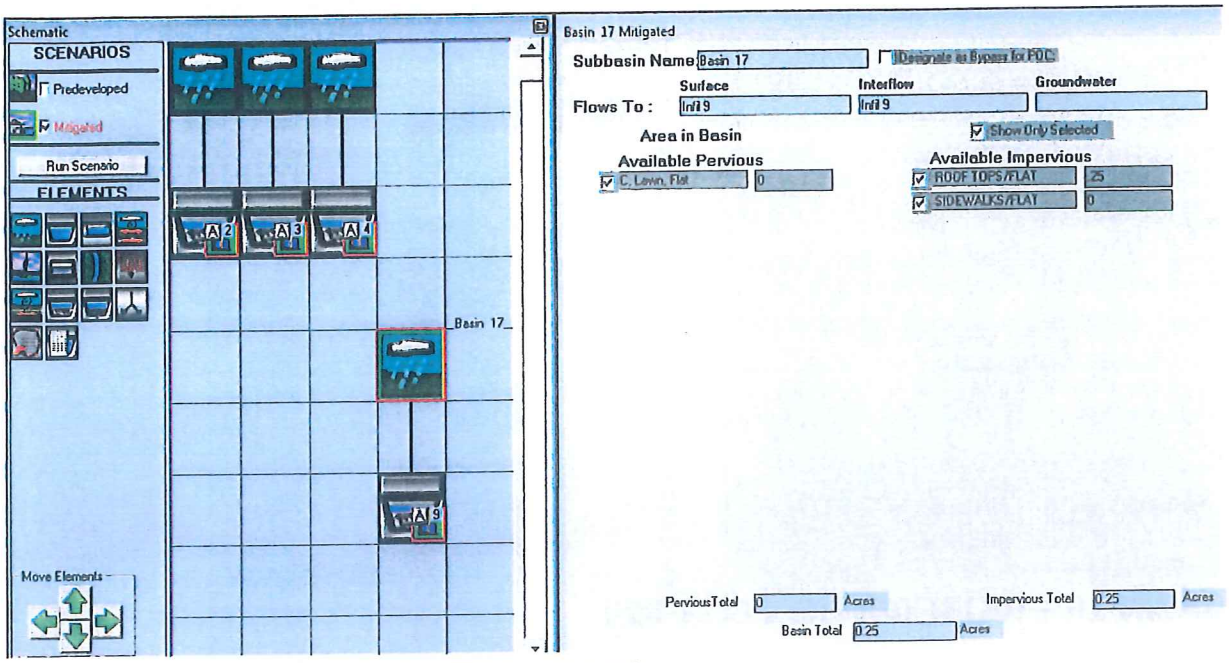
16

Bottom Length	15	ft
Bottom Width	20	ft
Infiltration Rate	2	in/hr

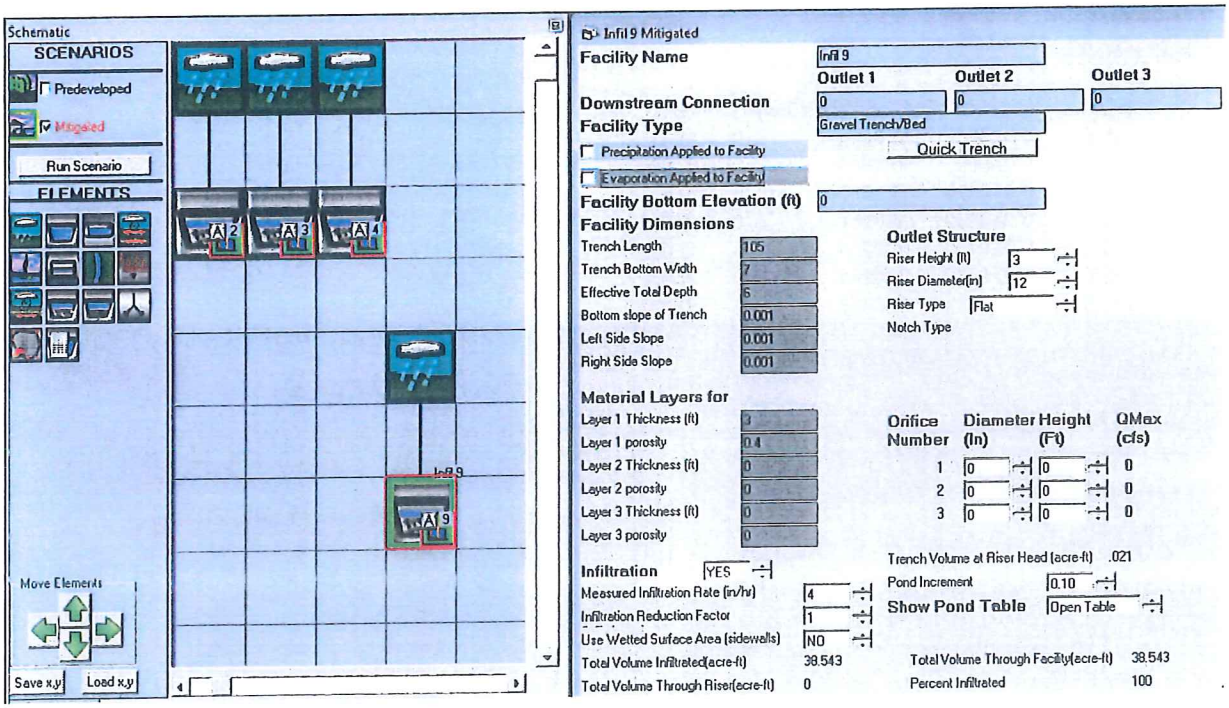
STAGE	AREA	STORAGE	DISCHARG	INFIL
0.0	0.0069	0.0000	0	0.0139
0.5	0.0095	0.0016	0	0.0192
1.0	0.0125	0.0038	0	0.0253
1.5	0.0160	0.0067	0	0.0322
2.0	0.0160	0.0216	0	0.0322
2.5	0.0160	0.0281	0	0.0322
3.0	0.0160	0.0356	5	0.0322



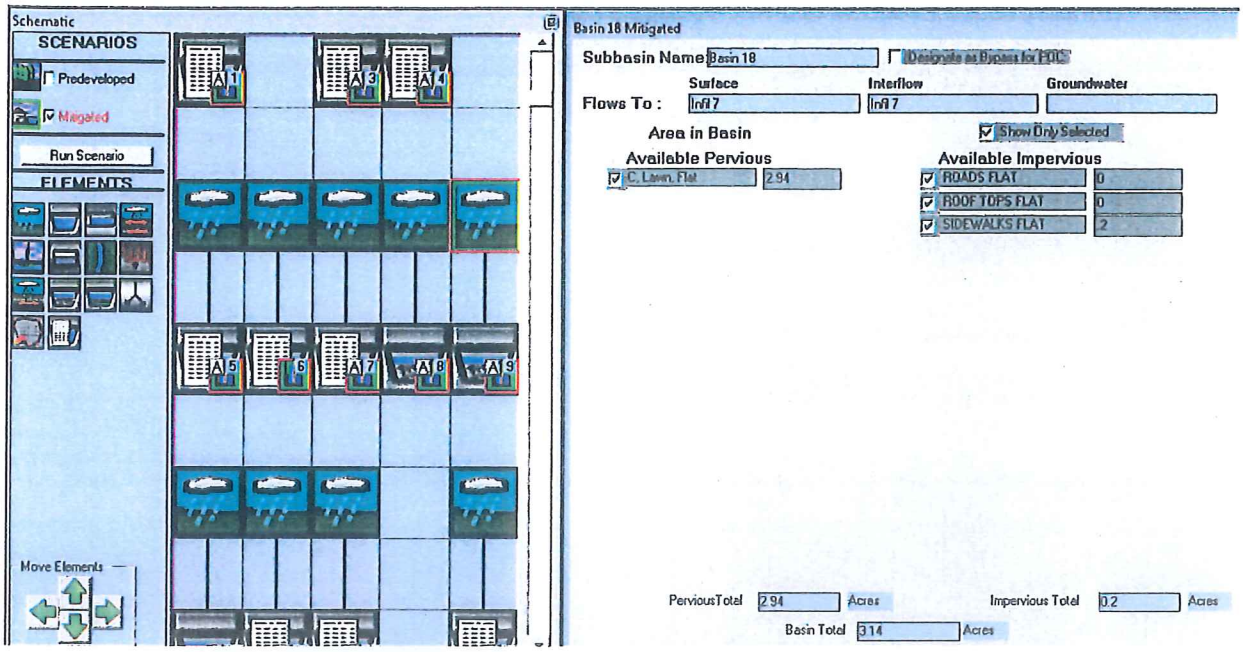
BIORETENTION CELL #10



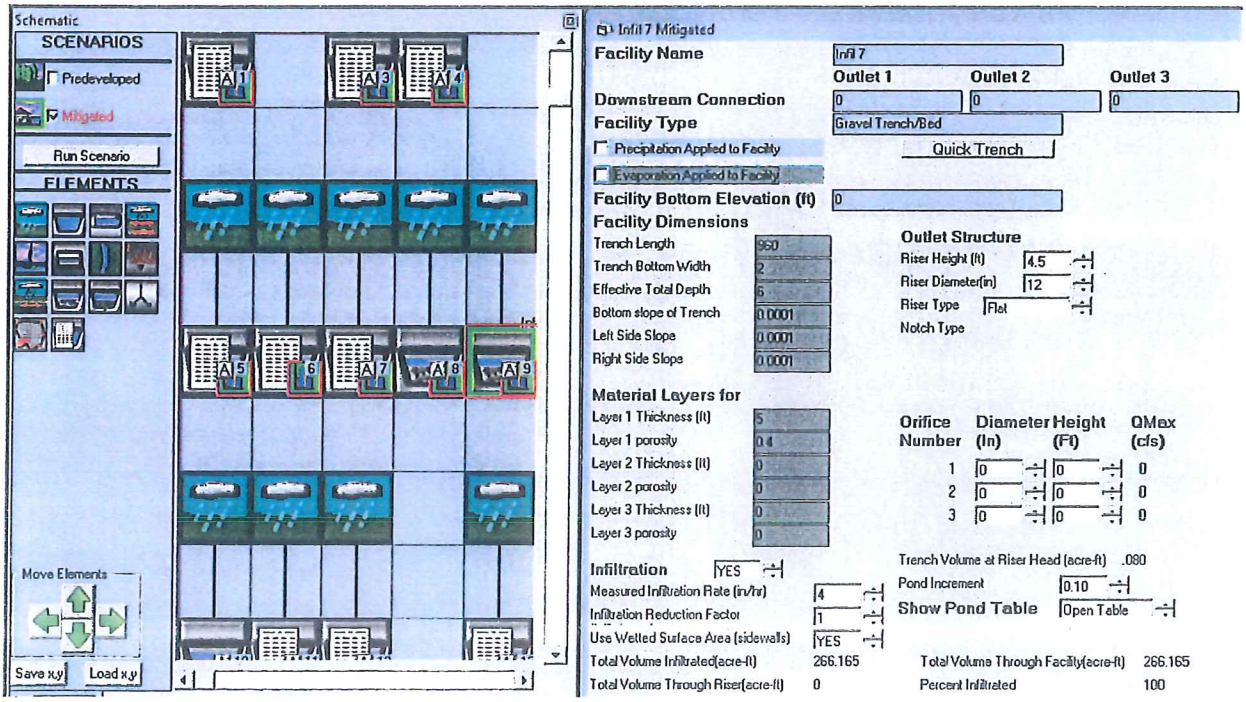
BASIN 17 – INFILTRATION TRENCH #9



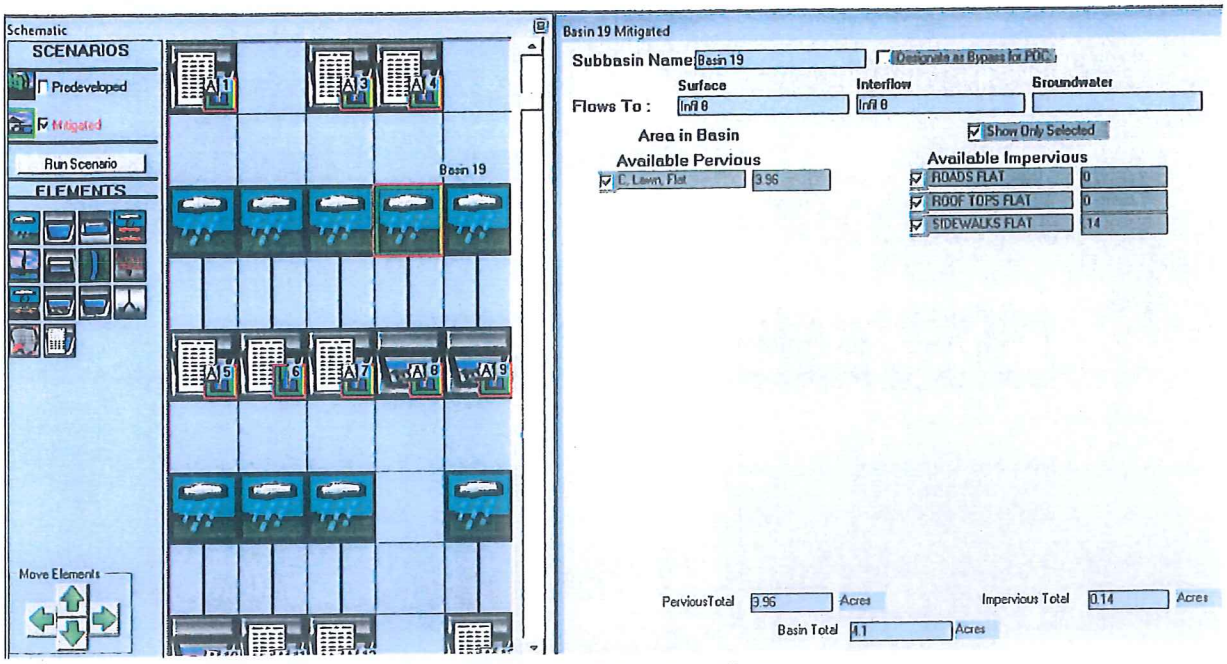
INFILTRATION TRENCH #9



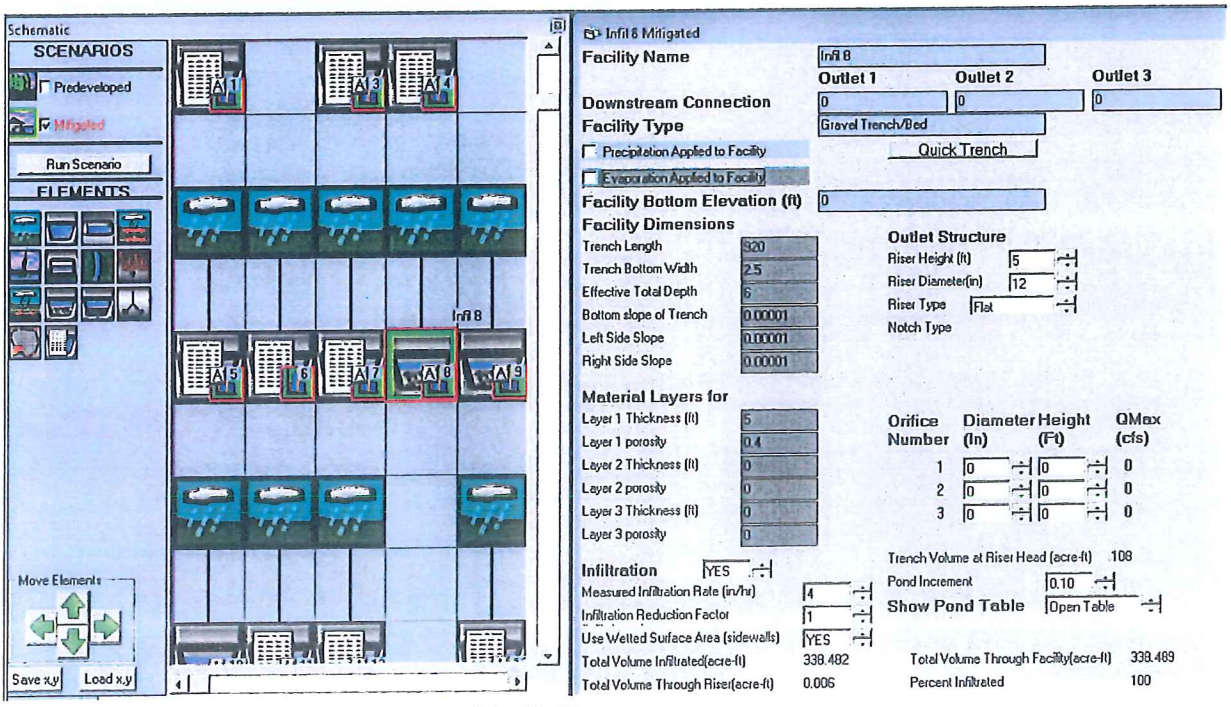
BASIN 18 – INFILTRATION TRENCHES #7A & B



INFILTRATION TRENCHES #7A & B



BASIN 19 – INFILTRATION TRENCHES #8A & B



INFILTRATION TRENCHES #8A & B