

F. SURFACE WATER AND DRAINAGE

This section addresses the impact that development places on the study area with respect to increased stormwater flows. Detailed estimates of the volume and rate of stormwater runoff under existing and proposed conditions, and methods of mitigating the impacts have been made and are included in Appendix 3. Design parameters for the proposed facilities have been made in accordance with the ordinances of the Town of Colonie and the regulations of the New York State Department of Environmental Conservation.

The study area lies within the boundaries of the northern end of the Town of Colonie and is comprised of approximately four thousand one hundred (4,100) acres. Hydrologic models that have been developed for this area include outlying tributary drainage areas. The composite drainage area (the area within the study limits plus the tributary drainage areas), totals approximately seven thousand two hundred sixty (7,260) acres. The study area and tributary drainage areas are shown on Exhibit II-F-1.

To determine pre and post development runoff, the Q-TR55 computer program by Haestad Methods, Inc. was used which incorporates the USDA Soil Conservation Service Model TR-55. For the purposes of the Model, the drainage areas delineated on Exhibit II-F-1 are divided into sub-watersheds, which are also shown on Exhibit II-F-1. Topographic input parameters for the model are taken from 7-1/2 minute USGS topographic mapping and field visits.

Existing drainage patterns are shown on Exhibit II-F-1 and existing estimated stormwater flows are summarized on Exhibit II-F-2. These are briefly discussed below.

Area 1 - Is approximately two thousand twenty (2,020) acres. Drainage area 1 drains essentially to the east and comprises the Dry Creek, a Class D stream and its tributaries which drain through the City of Watervliet and eventually into the Hudson River. A large detention basin exists in this area to limit flood flows to the City of Watervliet. This facility is apparently owned by the City of Watervliet, which is currently conducting a study of the dam.

Area 2 - This area contains approximately two thousand one hundred fifty two (2,152) acres which are drained by Salt Kill Creek, which is classified as a Class D stream and drains east to the Hudson River. No major detention facilities exist in this area.

Area 3 - This drainage area contains approximately one thousand four hundred thirty (1,430) acres, and drains to the west from Route 9 then north past Route 87. Flow from the area is conveyed to the Mohawk River via the Class D stream, Delphus Kill. No major detention facilities exist in this area.

Area 4 - Drainage Area 4 runs in a northerly direction to the Mohawk River via many small unnamed tributaries, which are all Class D. The total drainage area within the study area is five hundred fifty four (554) acres which contains no major detention facilities.

Area 5 - This area contains one thousand ninety three (1,093) acres. The flow from this area drains to the Mohawk River via an unnamed tributary and contains no major detention facilities. A large portion of this drainage area lies outside the study area.

Impacts and Mitigation Measures

Estimated stormwater flows are based on projected development for the 1999 and 2009 planning periods. Future development as depicted on Exhibit II-B-3

is expected to be consistent with future land use as projected in the LUMAC Technical Report. The expected stormwater flows for both the ten (10) and twenty (20) year planning periods are summarized in Exhibit II-F-2 and a more detailed discussion of the impact of future development on the study area is included in Appendix 3.

The basic element to consider in developing a stormwater management plan for study area is limiting peak flows at the study area limits to their current levels or below. It may also be desirable to limit flows at certain points within the study area to their current levels or below to minimize the degree of improvements required in the lower reaches of the drainage area. Any stormwater management plan implemented by the Town should be in compliance with current Town stormwater management requirements and NYSDEC regulations where applicable. See Appendix 3 for a more detailed discussion of design requirements.

The Stormwater Management "Master Plan" ultimately implemented should include a combination of stormwater management techniques applied to various areas. The two (2) basic techniques for stormwater management presented in this section are on-site detention facilities and centralized detention facilities. Also included in the list of alternatives is detention versus retention/recharge. The possible combinations of the above yield the following:

- Centralized detention with upstream conveyance facilities
- *On-site detention with downstream conveyance facilities*
- Centralized retention/recharge with upstream conveyance facilities
- On-site retention/recharge

These techniques represent engineering solutions to increased amounts of stormwater runoff due to development. The relative benefits, costs and the limitations imposed by the study area characteristics are discussed in detail in Appendix 3.

Total detention volumes required for both the ten (10) and twenty (20) year planning periods have been estimated for each area and are summarized in Table II-F-1. In addition to the quantity of stormwater to be stored, the relative costs of these facilities has also been estimated and summarized in Table II-F-1. The costs outlined on the table include only construction and ROW costs in 1988 dollars for centralized detention facilities.

The cost associated with the construction and maintenance of centralized detention facilities will include the cost of constructing several associated measures such as: grading, seeding, collection system installation, and easements. Additionally, there will be costs associated with conveyance of upstream and downstream flows. Table II-F-1 illustrates the anticipated costs of these facilities based on the following assumptions:

| | |
|------------------------|----------------|
| Detention Facility | \$15,000/ac-ft |
| Land Acquisition | \$20,000/ac |
| Installed Storm Sewers | \$ 80/ft |
| Culvert Improvements | \$ 1,100/lf |

The anticipated cost of storm sewer improvements are based on the installation of the storm sewer pipes in the locations as shown on Exhibit II-F-1. Likely locations of centralized detention facilities are shown on Exhibit II-F-3. A detailed discussion of which stormwater management techniques are appropriate for each particular area is included in Appendix 3.

In order to ensure that the costs to construct the drainage facilities outlined in Table II-F-1 are accurate, the Town should monitor building trends in the study area, annually. This will allow the Town to make adjustments to the anticipated mitigation costs to accommodate changing conditions such as inflation and changing ROW costs. The Town will also be able to make adjustments if

development occurs at different densities or if growth is slower or faster than the growth projected in this DGEIS.

TABLE II-F-1

| Drainage Area | Ac-ft Estimated Storage Volume | | (1988) Estimated Cost | Estimated Cost Per Acre | |
|---------------|--------------------------------|------|-----------------------|-------------------------|--------------|
| | 1999 | 2009 | | Commercial | Residential |
| 1 | 45 | 0 | \$1,471,279.00 | \$ 5,740.00 | \$ 2,870.00 |
| 2 | 97 | 1.7 | \$1,852,000.00 | \$ 7,560.00 | \$ 3,780.00 |
| 3 | 39 | 45 | \$1,568,000.00 | \$13,400.00 | None Planned |
| 4 | N/A ¹ | 15 | \$ 804,550.00 | \$11,920.00 | \$ 5,960.00 |
| 5 | 21 | 36 | \$1,115,000.00 | \$ 4,340.00 | \$ 2,170.00 |

¹ No development is expected to occur in Drainage Area 4 during planning period 1.

Although few existing trouble areas were identified by Town personnel, localized impacts to existing stormwater conveyance facilities, such as upgrading existing drainage culverts and channels to alleviate the inundation of roadways and adjacent land within the study area should be addressed on a project-by-project basis.

Proposed location of central detention facilities have been sited in conjunction with future land uses as specified in the LUMAC Technical Report and projected development shown on Exhibit II-B-3 of this DGEIS. The watercourse protection law recommended in the LUMAC Technical Report that identifies the following objectives was also considered:

- "a. To encourage planning and development of natural and man-made watercourses and adjacent lands in ways which will restore, protect and enhance the recreational and visual amenities;

- b. to preserve and protect surface water carrying capacity;
- c. to maintain surface absorption and water retention capabilities of adjacent land thereby minimizing sedimentation and erosion due to rapid runoff;
- d. to protect upstream and downstream land from increasing potential for periodic excessive flooding due to removal of riparian vegetation, dredging, filing, damming or channelization;
- e. to prevent degradation or loss of stream-related wetlands; to maintain the stream to waterway free from litter, trash or other debris; and
- f. to control adjacent activities that will cause organic or chemical pollution to such watercourses."

The regional stormwater management plan presented in this section possesses the same objectives as above. This plan proposed to mandate items a, b and f specifically by requiring developers to provide conveyance facilities and limit post-development runoff to pre-development levels or below. Regional stormwater management facilities could potentially serve as public recreation facilities. The implementation of the plan presented in this study will inherently address items c, d, and e in that the detention of excessive stormwater runoff can be used to recharge groundwater (if soils are suitable), create or mitigate adequate wetland water levels, and retain valuable topsoil before it reaches major adjacent watercourses.

In addition to an increased potential for flooding, the increase in stormwater runoff due to development of the study area impacts the financial responsibilities of the Town of Colonie. Since the residences to be constructed

derive the benefit of the detention facilities it follows that the developer should bear the financial burden of these improvements. This could possibly be in the form of an impact fee which is discussed in greater detail in Section II, M, Economics, and Appendix 3. The main component of the financing alternative specified above is the development of a rate structure which assesses each parcel/project based on its contribution to the stormwater runoff at buildout.

In order to create and execute an effective regional stormwater management plan for the study area, a plan of implementation needs to be adopted. A basic plan for the establishment of centralized facilities is presented below.

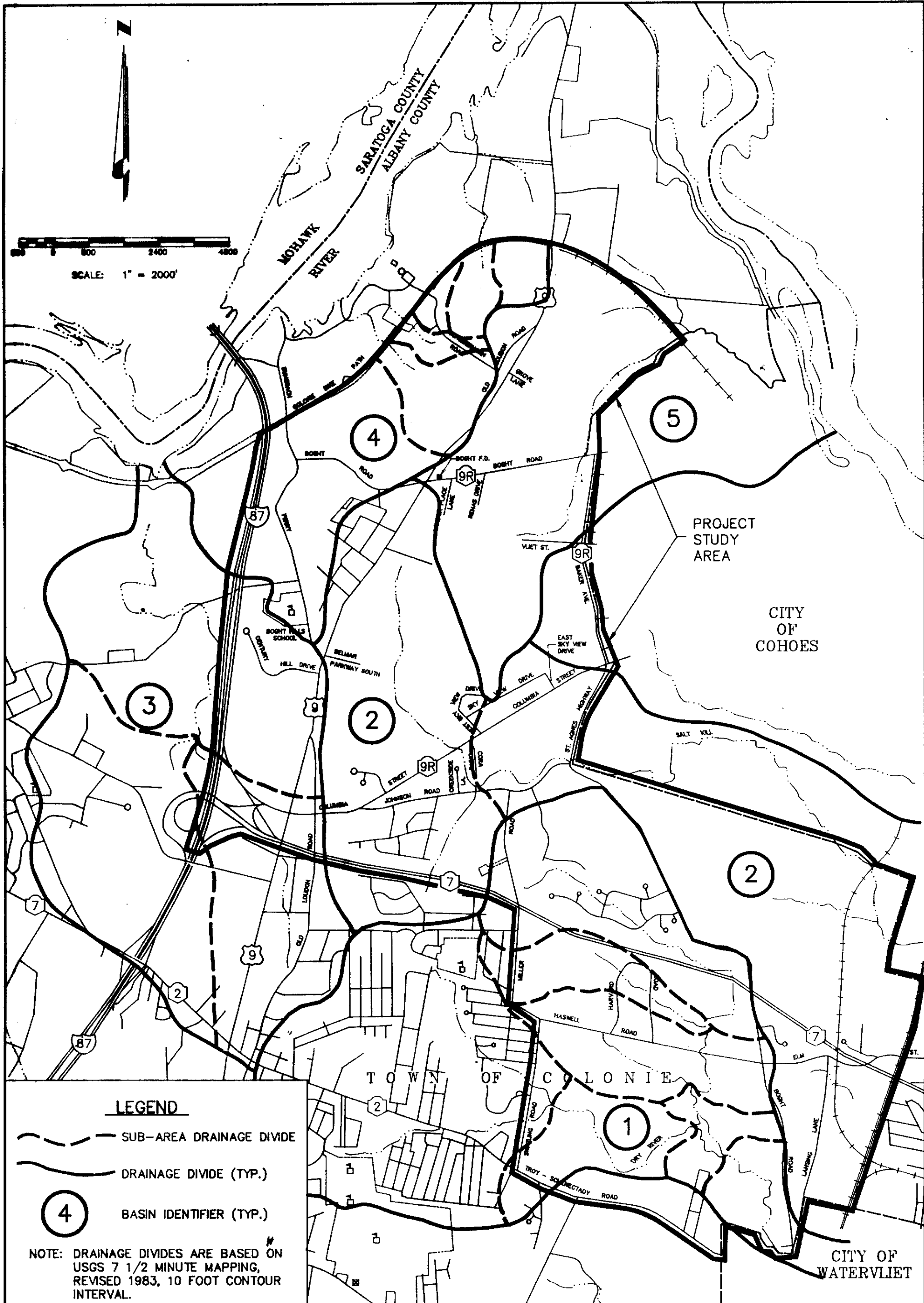
Basic Plan for Implementation of Centralized Stormwater Facilities

- o Enact ordinance requiring future development's compliance with the regional concept of stormwater management within the watershed.
- o Commission a detailed hydrologic/hydraulic analysis for the watershed which would detail alternatives and costs for centralized facilities within the watershed.
- o Town selects stormwater management alternative to be implemented.
- o Acquire land/easements for the centralized facility.
- o Solicit bids for the construction of facility.
- o Enact ordinance establishing rate structure for developers contribution based on detailed hydrologic/hydraulic analysis mentioned above.
- o On-going contributions by developers for payback of initial construction costs and on-going maintenance.

A review of how pending applications fit into the centralized facility concept is included in Appendix 3.

The information provided above has defined the existing drainage patterns and associated stormwater flows within the study area. The effects of the proposed ten (10) year and twenty (20) year planning periods on the flow of stormwater have been analyzed and recommendations for mitigating these effects have been made. A plan for further study and implementation has been outlined. A discussion of different stormwater management techniques and how they can be implemented by the Town has been presented. In addition, levels of costs have been estimated and alternatives for funding have been discussed.

The feasibility of centralized detention facilities within the study area has been demonstrated in all of the drainage areas except area 3. Within area 3, on-site detention basins should be considered with either centralized or on-site flood control facilities.



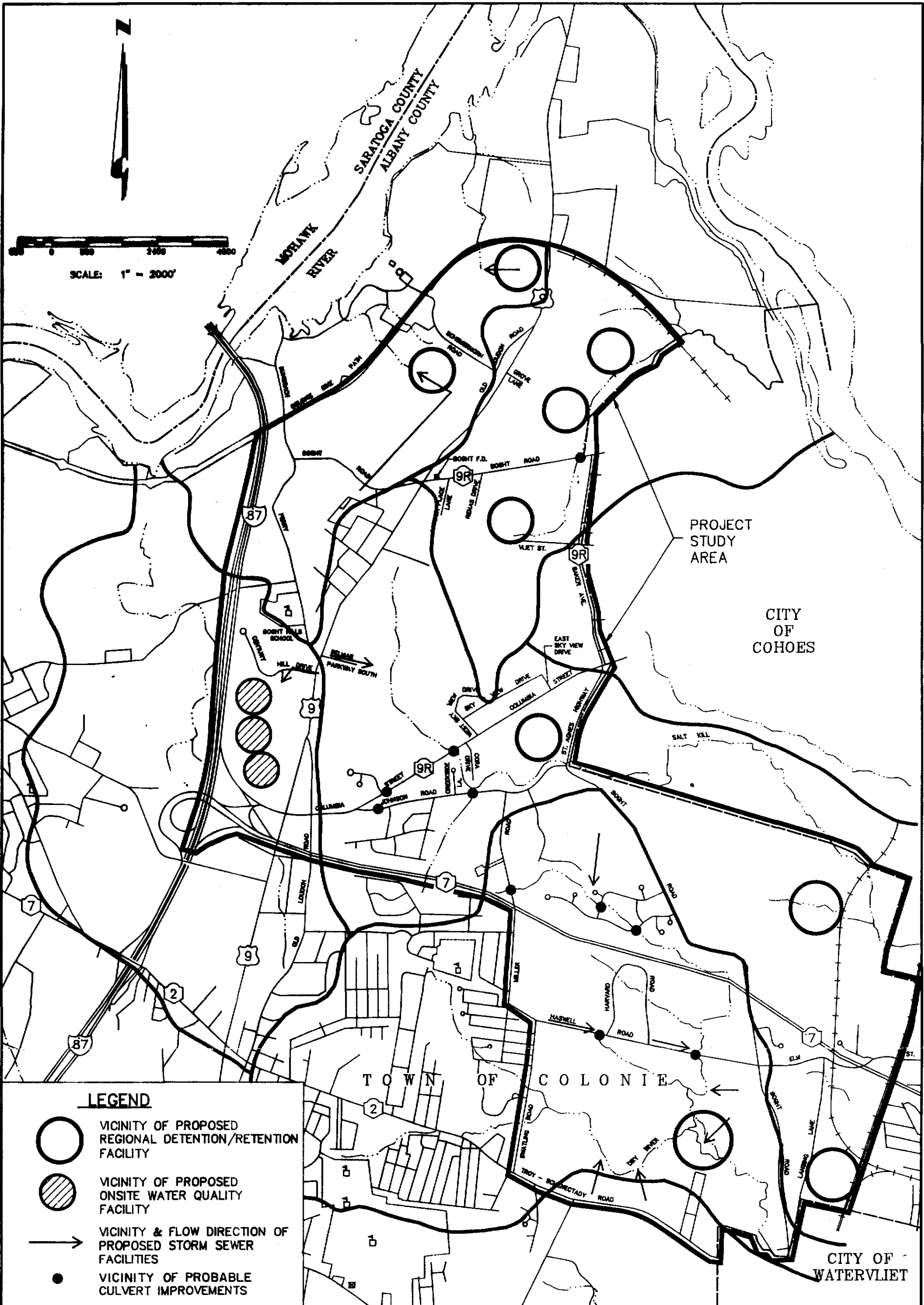
| DRAINAGE BASIN | 5 YR STORM | | | 10 YR STORM | | | 25 YR STORM | | | 100 YR STORM | | |
|----------------|----------------|---------------|---------------|----------------|---------------|---------------|----------------|---------------|---------------|----------------|---------------|---------------|
| | Existing Cond. | 1999 Buildout | 2009 Buildout | Existing Cond. | 1999 Buildout | 2009 Buildout | Existing Cond. | 1999 Buildout | 2009 Buildout | Existing Cond. | 1999 Buildout | 2009 Buildout |
| AREA 1 | 1112 | 1178 | 1184 | 1576 | 1618 | 1625 | 1811 | 1840 | 1848 | 2490 | 2490 | 2494 |
| AREA 2 | 900 | 1309 | 1329 | 1316 | 1913 | 1922 | 1535 | 2238 | 2247 | 2164 | 3146 | 3156 |
| AREA 3 | 512 | 546 | 571 | 797 | 841 | 942 | 931 | 1058 | 1098 | 1421 | 1499 | 1544 |
| AREA 4 | 209 | N/A* | 366 | 331 | N/A* | 523 | 425 | N/A* | 623 | 637 | N/A* | 895 |
| AREA 5 | 389 | 408 | 702 | 596 | 621 | 994 | 702 | 731 | 1151 | 1028 | 1064 | 1599 |

* THERE IS NO PROJECTED 1999 BUILDOUT FOR THIS AREA



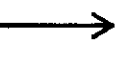



CLOUGH, HARBOUR & ASSOCIATES
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PEAK STORMWATER FLOWS
(CFS)



LEGEND

-  VICINITY OF PROPOSED REGIONAL DETENTION/RETENTION FACILITY
-  VICINITY OF PROPOSED ONSITE WATER QUALITY FACILITY
-  VICINITY & FLOW DIRECTION OF PROPOSED STORM SEWER FACILITIES
-  VICINITY OF PROBABLE CULVERT IMPROVEMENTS



CLOUGH, HARBOUR & ASSOCIATES
ENGINEERS & PLANNERS

PROPOSED DRAINAGE FACILITIES