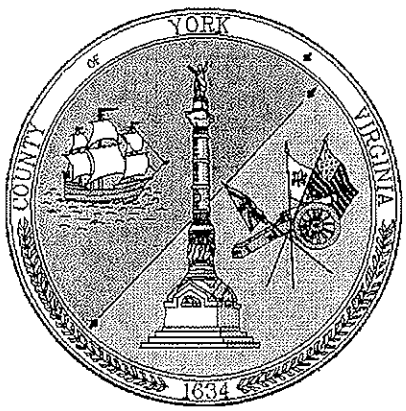
PRELIMINARY ENGINEERING REPORT

FOR THE

TABB LAKES DRAINAGE PROJECT

PREPARED FOR:
YORK COUNTY, VIRGINIA



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Project Overview

The Tabb Lakes subdivision is located in the southern part of York County (see Figure 1). It is bounded by Victory Boulevard to the north, and Route 17 to the west. The study area includes this subdivision and the downstream system to the Poquoson River.

The subdivision was constructed in the late 1970's by a private developer. As part of the development, two man-made lakes were excavated to receive stormwater runoff from the subdivision. In recent years, during intense rainfall events, the water level in the lakes has risen such that the ditches and pipes leading to the lakes back up and minor flooding occurs in the neighborhood.

In response to residents' concerns about the recurring flooding, York County has commissioned LandMark Design group to conduct a study to evaluate the drainage system and prepare recommendations for system improvements.

Existing Hydrology

The drainage areas for the two lakes as well as areas contributing to the ditches upstream and downstream of Victory Boulevard were modeled using the SCS Method with a Type-II distribution, 24-hour storm hydrograph. Peak runoff rates from each drainage area for the two, ten, 25, 50, and 100-year storms are shown in Table 1. The drainage area map is shown in Figure 2.

TABLE 1 – PEAK RUNOFF RATES (CFS)

Area	2-year storm	10-year Storm	25-year storm	50-year storm	100-year storm
To Upper Lake	128.76	299.80	347.04	410.83	475.24
To Lower Lake	98.76	232.68	269.77	320.09	370.98
To Ditch between Lower Lake and Victory Blvd	67.75	166.49	194.24	231.90	270.11
To Ditch between Victory Blvd and Hampton Hwy	75.38	223.34	266.66	326.28	387.54

Existing Hydraulics

The Upper and Lower Lakes provide storage capacity for some of the volume of runoff generated during storm events. The amount of water stored versus the amount of water discharged from the lakes at a particular time is a function of the outlet configuration (i.e. pipe sizes and slopes) and the downstream receiving channel conditions (i.e. free discharge versus downstream tailwater conditions). When the lakes can discharge more water during a shorter period of time, less water is stored, and thus, the lake level does not rise as much. At Tabb Lakes the ability of the two lakes to handle stormwater runoff without flooding the neighborhood is limited by three conditions all with repercussive effects:

- A partially blocked outlet pipe: Blocking the outlet pipe from the Lower Lake reduces the capacity of the outlet and artificially raises the water surface level in both lakes, which reduces the amount of storm storage volume available during storm events. Currently, the bottom half of the existing 24" outlet-pipe located at the downstream end of the lower lake is blocked by a piece of plywood. This means the lakes have one less vertical foot of storm storage available before a storm begins. Reduced capacity in the lakes to store stormwater increases the frequency of flooding in the neighborhood.
- An improperly installed outlet pipe: Currently, the 24" outlet-pipe from the Lower Lake has a negative slope, which severely limits the flow capacity of outfall pipe.
- Limited capacity in the Victory Blvd culvert: Victory Blvd acts as a dam across a valley during storm events. Stormwater runoff ponds upstream of the road, is stored, and then discharged at a slower rate by the culvert under Victory Blvd. The ponded water upstream of

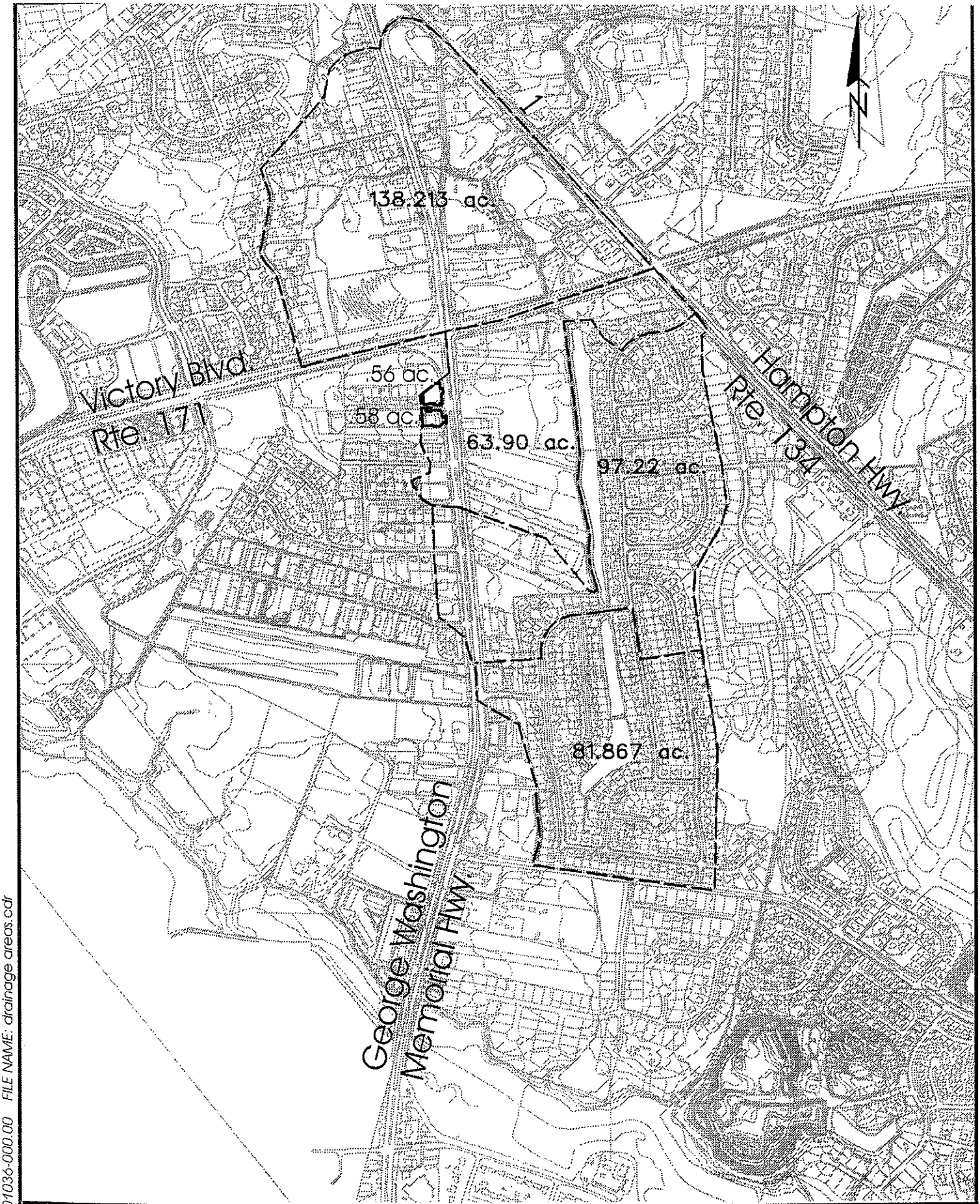

FIGURE 2

Drainage Areas
Tabb Lake Drainage Project
York County, Virginia

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Engineers • Planners • Surveyors • Landscape Architects • Environmental Scientists
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Victory Blvd is of sufficient depth to create a backwater effect and limit the discharge from the Lower Lake.

A preliminary analysis in HEC-RAS (Hydraulic Engineering Center – River Analysis System) 2.2 of the ditch from the Lower Lake to Yorktown Road showed that flows were backing up behind both Victory Blvd and Hampton Hwy and road overtopping was occurring during the ten-year storm. HEC-RAS 2.2 does not account for the actual volume of water in a storm or any storage over time. The model simply determines the water level required to achieve the peak flow in the system as if the peak flow were the base flow (the continuous flow) of a river. At a road crossing, for example, the output water surface elevation is a result of the required head pressure to push the flow through the culvert and cross-sectional area for flow over the roadway surface. However, during a storm, flows do not exactly resemble the base flow of a river. The peak flow rate during a storm occurs only for a very short time and there is a finite volume of water passing through the system, which is unlike a river where the base flow is generally constant and the volume is infinite. When storage of the storm volume is not accounted for, in many cases, the results show an inflated water surface elevation and more frequent road over-topping. This is the reason the model indicated that Victory Blvd and Hampton Hwy are overtopped during a ten-year storm instead of a less frequent storm. After speaking with Ms. Connie Bennett of York County, it was decided that roadway overtopping during the ten-year storm was unlikely because it had not occurred in recent memory. Therefore, another approach was required.

To better model the system dynamics, the area between the Lower Lake and Victory Blvd as well as the area upstream of Hampton Hwy were considered stormwater detention ponds. These areas were modeled in Hydraflow Hydrographs software along with the Upper and Lower Lakes. In this manner, storage volume and detention time could be accounted for in the model. The remaining portion of the ditch from Victory Blvd to the ponded area upstream of Hampton Hwy and the ditch downstream of Hampton Hwy were modeled in HEC-RAS. The Table 2 summarizes the results of the existing conditions model and full results can be found in Appendix 1 and 2.

TABLE 2 – EXISTING CONDITIONS

Storm	Tailwater at Hampton Pond[1] [HEC-RAS][2]	Peak Elevation in Hampton Pond[3] [Hydraflow]	Peak Discharge from Hampton Pond[4] [Hydraflow]	Tailwater at Victory Pond[5] [HEC-RAS]	Peak Elevation in Victory Pond[6] [Hydraflow]	Peak Discharge from Victory Pond[7] [Hydraflow]	Peak Elevation in Lower Lake[8] [Hydraflow]	Peak Discharge from Lower Lake [Hydraflow]	Peak Elevation in Upper Lake [Hydraflow]	Peak Discharge from Upper Lake [Hydraflow]
(year)	(feet)	(feet)	(cfs)	(feet)	(feet)	(cfs)	(feet)	(cfs)	(feet)	(cfs)
2	16.31	20.45	104.26	26.58	28.11	57.27	28.88	3.16	28.81	2.90
10	17.19	23.02	208.64	27.13	30.25	81.78	30.61	11.68	30.63	8.02
25	17.37	23.57	237.69	27.24	30.69	85.97	31.03	16.14	31.04	9.74
50	17.54	24.22	268.51	27.38	31.31	91.81	31.72	19.37	31.67	11.28
100	17.66	24.80	291.01	27.53	31.97	97.65	32.40	20.29	32.44	11.90

Notes:

Roadway Elevation at Hampton Hwy	26.06 feet
Roadway Elevation at Victory Blvd	30.98 feet
Lower Lake Outfall Pipe Invert	26.83 feet
Top of Bank Elevation at Lower Lake	30 feet
Top of Bank elevation at Upper Lake	32 feet

[1] Tailwater for the ponding upstream of Hampton Highway was taken from the water surface elevation at the upstream end of the ditch between Hampton Highway and Yorktown Road.

[2] Bracketed items refer to the software model in which the data was calculated.

[3] The peak elevation of the ponding upstream of Hampton Highway was used as the starting water surface elevation for the downstream end of the ditch between Victory Boulevard and Hampton Highway.

[4] The peak discharge from the ponding upstream of Hampton Highway was used as the flow in the ditch between Hampton Highway and Yorktown Road.

[5] Tailwater for the ponding upstream of Victory Boulevard was taken from the water surface elevation at the upstream end of the ditch between Victory Boulevard and Hampton Highway.

[6] The peak elevation of the ponding upstream of Victory Boulevard was used as the tailwater for the Lower Lake.

[7] The peak discharge from the ponding upstream of Victory Boulevard was used as the flow in the ditch between Victory Boulevard and Hampton Highway.

[8] The peak elevation in the Lower Lake was used as the tailwater for the Upper Lake.

Field survey performed by LandMark Design Group shows a low spot along Victory Blvd at elevation 30.98 feet and along Hampton Hwy at 26.06 feet. By modeling the areas upstream of Victory Blvd and Hampton Hwy as detention ponds, the elevation of these low spots is not reached in the model until the 50-year storm at Victory Blvd and a storm greater than the 100-year storm for Hampton Hwy. This more likely resembles actual conditions at the roads rather than the full overtopping during the ten-year storm shown in HEC-RAS.

With a peak elevation of 31.72 feet in the Lower Lake, the lake has overtopped its banks and will impact the houses along Shallow Lagoon during the 50-year storm, and possibly during the 25-year storm depending on finished floor elevations.

Future Hydrology

This study did not take into account any future development in the drainage basin; therefore, future runoff rates are unchanged from the existing conditions.

Future Hydraulics

To help increase the discharge from the lakes and reduce flooding impacts in the neighborhood, a new 24" outlet-pipe was added and the slope of the existing pipe was corrected. The twin 24" pipes are modeled with a 2% slope from the existing outlet elevation of 26.83 feet down to the receiving channel. Minor grading around the downstream end of the pipes will be required. While the main receiving channel does not require regrading to accommodate the new outfall pipe slope, creating a constant ditch section and installing vegetative stabilization from the outfall location to Victory Blvd is recommended to reduce erosion.

To reduce the amount of ponding upstream of Victory Blvd and reduce the tailwater effects on the Lower Lake, a new 48" pipe was added under Victory Blvd. This pipe should be located such that the ditch from the Lower Lake flows directly into the new pipe, eliminating the reverse turn the ditch currently makes into the existing 42" pipe. Table 3 summarizes the results of the future hydraulics analysis, and full results can be found in Appendix 3 and 4.

TABLE 3 – FUTURE CONDITIONS

Storm	Tailwater at Hampton Pond[1] [HEC-RAS][2]	Peak Elevation in Hampton Pond[3] [Hydraflow]	Peak Discharge from Hampton Pond[4] [Hydraflow]	Tailwater at Victory Pond[5] [HEC-RAS]	Peak Elevation in Victory Pond[6] [Hydraflow]	Peak Discharge from Victory Pond[7] [Hydraflow]	Peak Elevation in Lower Lake[8] [Hydraflow]	Peak Discharge from Lower Lake [Hydraflow]	Peak Elevation in Upper Lake [Hydraflow]	Peak Discharge from Upper Lake [Hydraflow]
(year)	(feet)	(feet)	(cfs)	(feet)	(feet)	(cfs)	(feet)	(cfs)	(feet)	(cfs)
2	16.31	20.44	103.70	26.81	27.42	67.48	28.00	14.41	28.20	4.54
10	17.33	23.45	231.84	27.80	29.23	127.81	29.87	30.34	29.90	21.08
25	17.51	24.11	263.21	28.01	29.82	143.55	30.41	28.79	30.47	19.17
50	17.66	24.79	290.74	28.19	30.35	156.81	31.00	34.58	31.08	21.52
100	17.76	25.54	311.92	28.36	30.86	168.92	31.53	45.38	31.56	26.13

Notes:

Roadway Elevation at Hampton Hwy	26.06 feet
Roadway Elevation at Victory Blvd	30.98 feet
Lower Lake Outfall Pipe Invert	26.83 feet
Top of Bank Elevation at Lower Lake	30 feet
Top of Bank elevation at Upper Lake	32 feet

[1] Tailwater for the ponding upstream of Hampton Highway was taken from the water surface elevation at the upstream end of the ditch between Hampton Highway and Yorktown Road.

[2] Bracketed items refer to the software model in which the data was calculated.

[3] The peak elevation of the ponding upstream of Hampton Highway was used as the starting water surface elevation for the downstream end of the ditch between Victory Boulevard and Hampton Highway.

[4] The peak discharge from the ponding upstream of Hampton Highway was used as the flow in the ditch between Hampton Highway and Yorktown Road.

[5] Tailwater for the ponding upstream of Victory Boulevard was taken from the water surface elevation at the upstream end of the ditch between Victory Boulevard and Hampton Highway.

[6] The peak elevation of the ponding upstream of Victory Boulevard was used as the tailwater for the Lower Lake.

[7] The peak discharge from the ponding upstream of Victory Boulevard was used as the flow in the ditch between Victory Boulevard and Hampton Highway.

[8] The peak elevation in the Lower Lake was used as the tailwater for the Upper Lake.

The addition of the 24" pipe, the correction of the slope on the existing 24" pipe, and the addition of the 48" pipe provide significant reductions in the flood elevations in the Upper and Lower Lakes. Table 4 summarizes the changes in peak water surface elevation from existing to future conditions.

TABLE 4 – ELEVATION CHANGE (FEET)

Storm (year)	Hampton Pond	Victory Pond	Lower Lake	Upper Lake
2	-0.01	-0.69	-0.88	-0.61
10	+0.43	-1.02	-0.74	-0.73
25	+0.57	-0.87	-0.62	-0.57
50	+0.57	-0.96	-0.72	-0.59
100	+0.74	-1.11	-0.87	-0.88

"-" Indicates a decrease in the water surface elevation from existing conditions.
"+" Indicates an increase in the water surface elevation from existing conditions.

Reductions in flood elevation in the Upper and Lower Lakes varies between seven and ten inches with even larger reductions at Victory Blvd. Under future conditions, the 100-year storm does not impact Victory Blvd; whereas, under existing conditions, the 50-year storm overtopped the road. The increased discharge rate at Victory Blvd has also increased the flood elevations at Hampton Hwy. However, under future conditions, the flood elevation still reaches the low point in Hampton Hwy during a storm greater than the 100-year storm. As in existing conditions, the 100-year storm does not impact Hampton Hwy.

Environmental Permitting

In February 2002, a pre-application meeting was held with Jennifer McCarthy of the Corps of Engineers to determine whether the proposed improvements were permittable and which permits would apply. The improvements that were discussed were:

1. Installation of a new outfall structure at the Lower Lake.
2. Installation of a low flow channel and possible riparian planting to reduce erosion within the ditch from the lower lake outfall structure to Victory Boulevard.
3. Installation of an additional culvert under Victory Boulevard.
4. Ditch improvements from Victory Boulevard to Hampton Highway.

With the exception of Item 4, it appears that the project improvements can be permitted using Nationwide Permits (NWP). No coordination with the Virginia Department of Environmental Quality (DEQ) would be required, and no mitigation would be required. The following Nationwide Permits would apply:

1. New outfall structure - NWP 3.
2. Channel improvements from the Lower Lake outfall to Victory Blvd, including installation of a low flow channel and possible riparian planting to reduce erosion - NWP 43.
3. New culvert under Victory. The culvert location determines permit applicability. A new culvert in the old location - NWP 3. A new culvert in a new location, which is the proposed solution, possibly no permit required.
4. Improvements from Victory downstream. Ms. McCarthy recommended working above the "ordinary high water mark" which would not be a regulated activity.

In all cases, disturbance of a wetland is a regulated activity. It is recommended that the areas where construction is anticipated be delineated for wetlands and confirmed by the Corps. Permits required will depend on the extent of disturbance and type of wetland disturbed.

Ms. McCarthy agreed to research the most applicable nationwide permit with the goal of authorizing the entire project (the twin 24" pipes, ditch improvements from the Lower Lake to Victory Blvd, and a new 48" culvert under Victory Blvd) with one permit, possibly a NWP 43 for stormwater management. Otherwise a NWP 3 will be required for the new pipes and a NWP 43 will be required for the ditch improvements. In any event, the permit submittal should include a plan view and cross sections of the existing and proposed channel configuration and the hydraulic analysis justifying the improvements. After the permit is prepared and submitted, the Corps believes approval may be anticipated within 45 days.

Conclusions and Recommendations

In order to reduce flood impacts in the Tabb Lakes neighborhood, we recommend improving the Lower Lake outfall by installing a new 24" pipe and relaying the existing 24" pipe, improving the ditch from the outfall to Victory Blvd by creating a more defined channel stabilized by vegetation, and improving conditions downstream of Tabb Lakes by installing a new 48" culvert under Victory Blvd. Alternative pipe combinations at the Lower Lake outfall may be reviewed during the design phase. For example, the twin 24" pipes could possibly be replaced with a single 36" or a 36" equivalent elliptical pipe.

We do not recommend altering the channel downstream of Victory Blvd because extensive permitting would be required for the impacts to wetlands and waters of the United States.

Since the Lower Lake outfall pipe is currently blocked in order to raise the normal water surface level, we believe there are citizen concerns regarding water quality and possible algae blooms from shallow lake depths. Therefore, the possibility of lowering the normal water surface below the existing outfall invert was not studied. However, lowering the normal water surface would supply greater storm storage volume at lower elevations and, thus, provide additional flood reduction benefits. If greater flood reductions are desired over those supplied by the recommended improvements, then lowering the normal water surface of the lakes would be the next step. Some dredging would likely be required to alleviate algae problems if the normal water surface is reduced.