ENGINEER'S REPORT ON

COUNTY DITCH 14

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ENGINEER'S REPORT - COUNTY DITCH 14

Pursuant to 1974 Minnesota Laws, Chapter 435, Section 1.0211, the Cities of Vadnais Heights and White Bear Lake, and the Town of White Bear have submitted petitions to Ramsey County for the improvement of County Ditch 14 westerly of Otter Lake Road.

The County Board has directed the County Engineer to prepare plans and a cost estimate for appropriate repair and improvement of County Ditch 14 westerly of Otter Lake Road. This report is to comply with the County Board directive. It will be restricted to the main branch of County Ditch 14 west of Otter Lake Road.

Existing Plans

The City of Vadnais Heights and the Township of White Bear have prepared plans and recommendations for County Ditch 14 between Otter Lake Road and the outlet at Lake Vadnais 3.6 miles downstream.

The White Bear Town report, dated April 1979, was prepared by the firm of Toltz, King, Duvall, Anderson and Associates, Incorporated. The report recommendations are as follows:

A. Increase capacity of culvert under Otter Lake Road to 130 cubic feet per second. Provide for ponding to elevation 917.2 east of Otter Lake Road.

B. Install outlet structure at west end of Rice Lake with capacity of 130 cubic feet per second. Provide for ponding to elevation 912.2 in Rice Lake.

C. Leave capacity of I-35E culvert as presently exists, at 96.9 cubic feet per second with headwater elevation of 906.6. Do not limit capacity to 40 cubic feet per second as recommended by Vadnais Heights, which would require ponding to elevation 909.1 east of I-35E.

D. Investigate feasibility of upgrading County Ditch 14.

E. Provide on-site detention ponding in the City of White Bear Lake.

Vadnais Heights' plans for County Ditch 14 are included in the Comprehensive Drainage Plan for the City.

The plan recommends that discharge from the east under I-35E be limited to 40 cubic feet per second. It recommends ponding to elevation 896.2 between County Road F and Edgerton Street with outlet capacity of 63 cubic feet per second under Edgerton Street.

A conflict exists between the respective plans of White Bear Lake and Vadnais Heights at I-35E. White Bear Lake recommends discharge capacity of 96.2 CFS, as exists with the present culvert under I-35E. Vadnais Heights recommends the capacity be limited to 40 CFS, which requires ponding to elevation 909.1 east of I-35E. Overtopping of the freeway would result for the 100 year storm or greater with the ponding at elevation 909.1.

Inspection and Survey

Field inspections of County Ditch 14 between Otter Lake Road and Lake Vadnais have been made of those sections accessible on foot, which is about 3.0 miles of the total length of 3.6 miles. In addition, profile evaluations of critical sections of the ditch at Otter Lake Road, the Rice Lake outlet, and Edgerton and Koehler Roads have been taken.

Based on the inspection and survey, the ditch appears to be most severely restricted at the culvert under Edgerton Street and the two under Koehler Road. Each of the culverts is at least half filled with silt, and the eastern of the Koehler Road culverts is about 80% silt-obstructed. There are also several high points in the ditch bottom that adversely affect the ditch capacity.

As a result of the condition of this section of the ditch and culverts, considerable debris has accumulated in the ditch east of Edgerton. The debris further impedes flow in the ditch and will continue to accumulate as long as

corrective measures are not taken.

Recommendations

Based on the inspection and survey, improvements along County Ditch 14 are recommended in four sections; see Figure One.

1. Otter Lake Road

   As recommended in the White Bear Lake report, the existing 36 inch diameter corrugated metal pipe should be replaced with a culvert able to deliver 130 cubic feet per second. The culvert should be a 42 inch diameter reinforced concrete pipe set with the upper invert elevation at 909.5 and the lower at 909.0. About 1,200 feet of County Ditch 14 to the west should be excavated to an elevation of 908.0, with an eight foot bottom width and 3:1 side slopes. Up to 4.4 feet of material must be removed. The total excavation quantity is estimated at 3,600 cubic yards.

2. Rice Lake Outlet

   The existing outlet of Rice Lake consists of a small timber bridge that provides access across County Ditch 14 but does not function to sufficient control flow to provide detention ponding upstream. The bridge should be replaced with an 88 X 54 inch reinforced concrete arch pipe set at invert elevation 908.0. The ditch should be excavated to an elevation of 907 to 150 feet east of the Rice Lake outlet. Excavation quantity is about 150 cubic yards.

   There are two existing culverts at crossings of County Ditch 14; the first is a 36 inch corrugated metal pipe 770 feet downstream of the Rice Lake outlet and the second is an 18 inch corrugated metal pipe 110 feet downstream of the first. The two existing crossings should be incorporated into a single crossing with a 73 X 45 inch reinforced concrete

arch pipe set at invert elevation 904.8. The ditch should be excavated to an elevation of 907 at the Rice Lake outlet, to 904 1,500 feet to the southwest. The total excavation quantity is about 4,000 cubic yards.

The ditch cross section from Rice Lake to 1,500 southwest should be an eight foot bottom width with 3:1 side slopes.

3. I-35E Dike and Pond Outlet

As recommended in the Comprehensive Drainage Plan of Vadnais Heights, the 100 year discharge under I-35E should be limited to 40 cubic feet per second and 212 acre feet of detention ponding should be provided just east of the freeway. This would result in ponding to an elevation of 909.1, requiring acquisition to an elevation of 910.1. Diking along the freeway for a distance of about 1,650 feet would also be necessary to protect it from flooding.

Provision of detention ponding to an elevation of 909.1 is one of two alternatives analyzed in the TKDA report to White Bear Lake; ponding to elevation 906.6 with greater flow capacity under I-35E is the other.

The first of the two alternatives is recommended here. It would lessen flow capacity requirements downstream through Vadnais Heights to Lake Vadnais. Additional land acquisition required to provide for ponding to elevation 909.1 instead of 906.6 amounts to about eleven acres.

The dike along the freeway should be constructed to elevation 910.1 with the exception of a small overflow section that should be at elevation 909.1. A 24 inch reinforced concrete pipe should be installed through the dike set at invert elevation 903. Construction of the dike would require about 1,800 cubic yards of material, assuming a ten foot top width and 4:1 side slopes.

4. Culvert and Ditch System at Edgerton Street and Koehler Road

The ditch should be excavated to remove accumulated silt beginning 1,300 feet east of Edgerton Street, extending through the Edgerton Street and the two Koehler Road culverts to 350 feet downstream of the second Koehler crossing. Total length of the section is about 3,800 feet. Up to 4.5 feet of material must be removed, and a preliminary estimate of required excavation volume is about 6,500 cubic yards.

The replacement culvert sizes and invert elevations are tabulated below:

Location	Culvert Size	Invert Elevation
Edgerton Street	42" diameter	892
Koehler Road East	42" diameter	891.8
West	42" diameter	888.5

Estimated Costs

1. Otter Lake Road

Culvert installation		$ 5,500
Ditch excavation		3,000
	Total	$ 8,800

2. Rice Lake Outlet

Removal of existing timber bridge and culverts	$ 1,500
Culvert installation - at outlet	9,700
- 900 feet downstream	6,700
Ditch excavation and restoration	4,600
Total	$22,500

3.	I-35E Dike and Pond Outlet		
	Dike construction		$ 3,700
	Culvert installation		1,800
	Channel excavation		500
		Total	$ 6,000
4.	Culvert and Ditch System at Edgerton Street and Koehler Road		
	Culvert installation		$21,000
	Roadway restoration		5,700
	Ditch excavation and restoration		8,400
		Total	$35,100
5.	Other Costs		
	Mobilization		$ 4,000
	Contingencies		4,000
		Total	$ 8,000
			$80,400
	Add 15% for Engineering and Administration		12,000
	Total Improvement Cost		$92,400

Ponding Areas

The proposed improvements require reserving land for detention ponding in three areas: Rice Lake west of Otter Lake Road, an area just east of I-35E, and an area between County Road F and Edgerton Street. The last area is entirely within the City of Vadnais Heights. The area is identified in the Comprehensive Drainage Plan of Vadnais Heights and the City will attempt to reserve the area through control of the platting process.

The other two areas were recommended for acquisition through the Ramsey County Open Space Program, but the recommendation was not accepted by the Open

Space Division. As a result, municipal action through acquisition, zoning, or wetland protection regulation must be relied on for provision of the required ponding capacity.

Municipal Cost Shares

Under Chapter 435 the County is to determine the share of costs for repair of the ditch to be borne by each of the governmental subdivisions in which the ditch is located. This section presents a proposed method of distributing the costs between the four municipalities within the watershed of County Ditch 14; the Cities of White Bear Lake, Vadnais Heights, and Gem Lake, and the Township of White Bear.

The recommended basis of cost distribution is for the municipalities to share the project cost based on a percentage of total runoff contributed. The ratio of the runoff to the rainfall which produced the runoff is known as the runoff coefficient "C."

Percentages of the total project cost to be allocated to each municipality is based on equivalent drainage areas, which are the product of the actual areas and the runoff coefficients. The following table lists runoff coefficients used for the various municipal land uses, the acreages of the land uses, the product of the two, and the percentages of the total equivalent area.

City/Township	Acres	"C" Factor	Equivalent Area	% of Total Equivalent Area
VADNAIS HEIGHTS				
0-4 Un./Acre	972.99	0.30	291.90	21.04
4-8 Un./Acre	140.76	0.40	56.30	4.06
8+ Un./Acre	63.85	0.50	31.93	2.30
Retail	66.75	0.60	40.05	2.89
Service/Office	81.26	0.60	48.76	3.51
Industrial	88.27	0.60	52.96	3.82
Auto-Commercial	0	0.60	0	0
Open Space	360.61	0	0	0
Parks	88.52	0.20	17.70	1.28
Public	17.41	0.60	10.45	0.75
County Roads	50.19	0.70	35.13	2.53
State Roads	264.14	0.70	184.90	13.33
Total	2,194.75		770.08	55.51
WHITE BEAR TOWNSHIP				
Single Family	56.42	0.40	22.57	1.63
Multiple Family	119.14	0.50	59.57	4.29
Industrial	147.28	0.60	88.37	6.37
Railroads	53.90	0.30	16.17	1.17
Wetlands	317.10	0	0	0
County Roads	10.06	0.70	7.04	0.51
State Roads	6.58	0.70	4.61	0.33
Total	710.48		198.33	14.30
GEM LAKE				
Very Low Res.	153.25	0.20	30.65	2.21
Low Res.	60.04	0.30	18.01	1.30
Med Res.	131.70	0.40	52.68	3.80
Open Space	24.49	0.20	4.90	0.35
Conservancy	43.90	0	0	0
Commercial	37.91	0.60	22.75	1.64
County Roads	24.18	0.70	16.93	1.22
Total	475.47		145.92	10.52

City/Township	Acres	"C" Factor	"C" X Acres	% of Total "C" X Acres
CITY OF WHITE BEAR LAKE				
Single Family	389.92	0.40	155.97	11.24
Multiple Family	77.63	0.50	38.82	2.80
Commercial	39.91	0.60	23.95	1.73
Industrial	14.91	0.60	8.95	0.65
Public	135.09	0.20	27.02	1.95
Semi-public	11.40	0.20	2.28	0.16
County Roads	15.50	0.70	10.85	0.78
State Roads	7.44	0.70	5.21	0.38
Total	691.80		273.05	19.69
GRAND TOTAL			1,387.38	

The land uses of open space, wetlands and conservancy in Vadnais Heights, White Bear Township and Gem Lake, respectively, were assigned a runoff coefficient of zero. This was done as a method of allowing credit for flood plain and detention ponding types of land uses.

The resulting cost distribution estimates are listed in the following table.

Municipality	Vadnais Heights	White Bear Town	Gem Lake	White Bear Lake	Totals
Total Cost %	55.49	14.30	10.52	19.69	100.00
Total Cost	$51,273	$13,213	$9,720	$18,194	$92,400
County R/W %	2.53	0.51	1.22	0.78	5.04
County R/W Cost	$ 2,338	$ 471	$1,127	$ 721	$ 4,657
State R/W %	13.33	0.33	-	0.38	14.04
State R/W Cost	$12,317	$ 305	-	$ 351	$12,973

DGS/clm