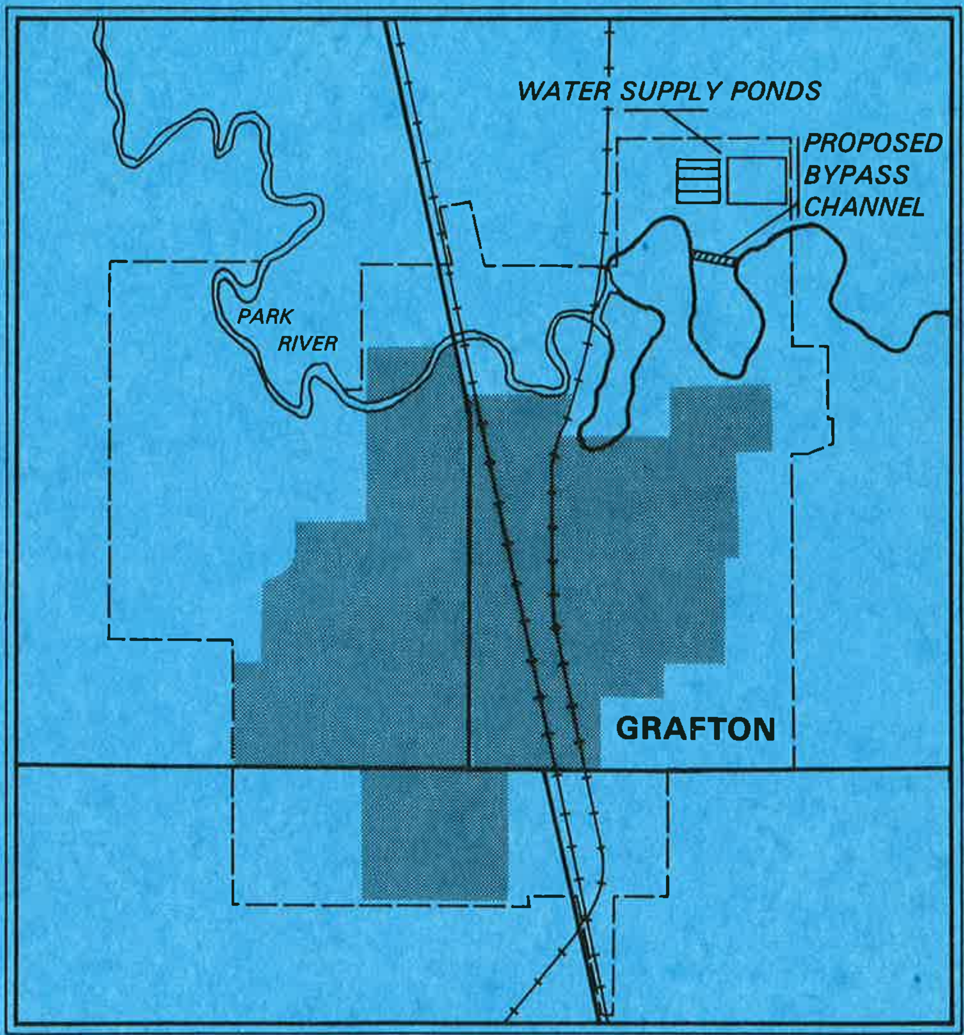
PRELIMINARY ENGINEERING REPORT

GRAFTON FLOOD CONTROL PROJECT

GRAFTON, NORTH DAKOTA

SWC PROJECT NO. 1771



NORTH DAKOTA
STATE WATER COMMISSION
FEBRUARY, 1983

PRELIMINARY ENGINEERING REPORT

GRAFTON FLOOD CONTROL PROJECT
SWC PROJECT #1771

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North Dakota State Water Commission
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Grafton Bypass Channel

I. INTRODUCTION

A proposed flood bypass channel was discussed within the May, 1980, ND State Water Commission Preliminary Engineering Report on the Snagging and Clearing of the Park River. Located on the northeastern edge of the City of Grafton, it would carry flood flows across the neck of an oxbow. This would shorten the channel length and increase the capacity of the Park River at this point.

The bypass channel is the fourth phase of a flood control plan for the Park River at Grafton. Phase 1, consisting of the snagging and clearing of a portion of the Park River, was accomplished during the winter of 1980-1981. Replacing Wakeman Avenue Bridge, planned for 1983, constitutes Phase 2. Alterations to the Burlington Northern (BN) Railroad Bridge, located downstream from the Wakeman Avenue Bridge, is the third phase of the flood control plan. Construction may take place on this bridge within the next two years.

An agreement for the investigation and preliminary design of the flood bypass channel was signed in August of 1982 (See Appendix A). As required by this agreement, a field survey was conducted along the proposed route. After determining design flows, the preliminary design of the bypass channel was completed. The design details, benefits to be received, and a preliminary cost estimate of the proposed project are summarized.

II. DESCRIPTION OF SITE

As shown in Figure 1, the proposed bypass channel is located in the SW¼ of Section 7, Township 157 North, Range 52 West. It is located on the neck of an oxbow of the Park River. One of Grafton's water supply dams, Vigness Dam, is also situated on this oxbow.

Upstream from the proposed site the Park River cuts a meandering course through the northern portion of Grafton. Nearly five river-miles upstream is the confluence of the three principle headwater streams, the South, Middle, and North Branches of the Park River.

The Park River's main channel normally has a depth in the range of 15 to 20 feet and a channel width of 70 to 130 feet. Its capacity averages 2,000 to 3,000 cubic feet per second (cfs).

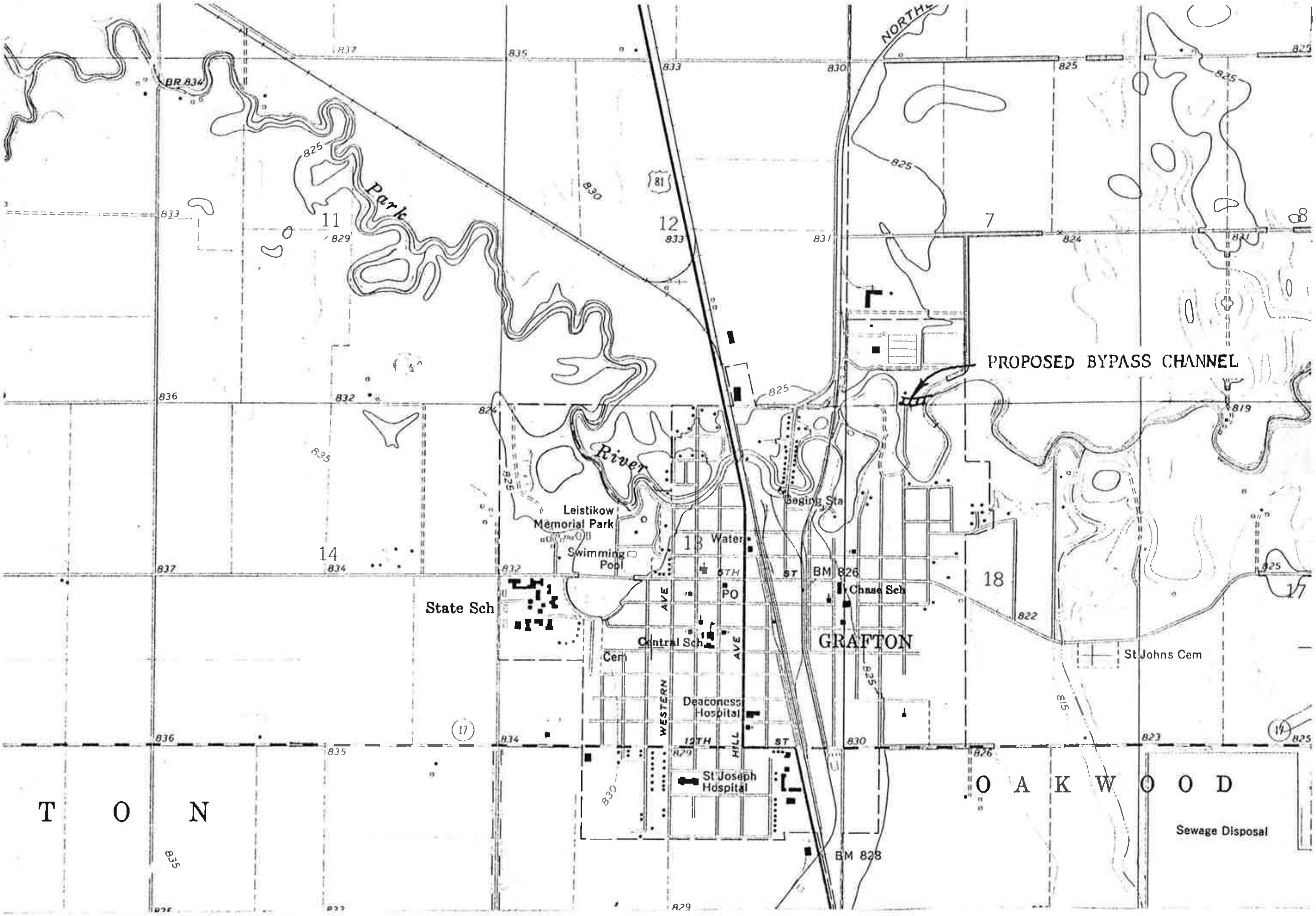

Figure 1 - LOCATION OF PROPOSED BYPASS CHANNEL

III. STATEMENT OF PROBLEM

Nearly all floods on the Park River occur in early spring. Snowmelt, sometimes accompanied by rainfall, causes rapid runoff in the escarpment region along the headwaters branches. Homme Dam, located on the South Branch of the Park River, and several Soil Conservation Service (SCS) reservoirs on the Middle Branch tend to retard the runoff from the area above their outlets. This may cause the downstream peaks to be slightly reduced.

When large spring runoff from the north, middle, and south branches enter the Park River concurrently, flooding is caused along the main channel in the vicinity of Grafton. Large areas of rural land are inundated due to the flat topography and low river banks.

The majority of the City of Grafton is located within the floodplain. Flooding is shallow and of long duration. A small degree of flooding causes damages to residential structures. As the flood level increases, commercial structures in the center of town are also damaged.

IV. HYDROLOGY AND HYDRAULICS

Streamflow records were obtained from the U.S. Geological Survey gaging station located on the Park River, upstream of the Wakeman Avenue Bridge in Grafton. Records of elevations and discharge were available from 1932 to 1979. All data prior to 1950 was adjusted to reflect the effects of upstream reservoirs. Using this data, the discharge-frequency curve was analytically computed for the City of Grafton. The corresponding flow for various frequency events was determined.

Flood Frequency	Flow (cfs)
10	4,800
20	7,900
50	12,300
100	15,800
500	24,200

Water surface profiles were calculated for the Park River in the vicinity of Grafton for several frequency flood events. They were determined by the Corps' Hydrologic Engineering Center (HEC-2 Water Surface Profiles) computer program. This is a backwater program utilizing the standard step method to determine water surface profiles. When subcritical flow exists, as is prevalent in the Park River, the program starts at a known water elevation and proceeds upstream to calculate the water elevations.

Data required for this program includes cross sections, bridge dimensions, and several coefficients used to determine energy losses. These coefficients were calibrated so the results would match the known high water marks of the 1965 and 1979 floods.

A channel roughness coefficient ranging from 0.040 to 0.045 was used to represent the characteristics of the channel before the 1980 snagging and clearing project was completed. Many obstructions were removed from the channel at this time. Although the roughness coefficient was reduced, it is difficult to determine the degree of reduction. Because a large flood has not occurred since 1980, it is not possible to calibrate the new roughness coefficient by duplicating a flood. Therefore, it was arbitrarily determined that the new roughness coefficient should range between 0.035 and 0.040. The roughness coefficient for the overbank area, ranging from 0.040 to 0.070, would remain the same. Conditions have not been improved in this area.

The Wakeman Avenue Bridge and the Burlington Northern Railroad Bridge just downstream from Wakeman Avenue are being considered for improvement. For both crossings, the span length will be increased and the low chord elevation of the bridge will be raised. Also, four piers will be removed from the center of the Burlington Northern Railroad Bridge.

Separate HEC-2 runs were made to determine the effects that the snagging and clearing and the improved bridges would have on the water surface profiles. The results showed that a decrease in the water surface elevation was obtained by the snagging and clearing project. Although no appreciable reduction in the water surface profiles are evident by the bridge alterations, conditions will be improved. Any chance of water being backed up due to ice jams will be decreased by eliminating four piers below the BN Railroad Bridge.

The channel, downstream of the proposed bypass channel, will affect the water surface elevations upstream from it. Due to its limited capacity, this section of channel will back up water. Therefore, the water elevations will be higher than what would normally be expected.

The bypass channel was designed assuming the improved bridges were in place. Reduced water surface elevations, due to the completed snagging and clearing project were also taken into account. The bypass channel was designed to handle 2,500 cfs of the 4,800 cfs occurring during the 10-year event. Flows in the oxbow would be reduced to 2,300 cfs.

Revisions were made to the HEC-2 program to reflect the reduced flow through the 3,200 feet of the oxbow for the 10-year event. Downstream channel effects, due to a limited capacity, were taken into account in this program. A water surface elevation of 821.6 MSL was calculated for Park River at the upstream end of the bypass channel. At the downstream end, the Park River had an elevation of 821.0 MSL.

To determine the bypass channel dimensions, a HEC-2 model was run from the downstream end, starting at an elevation of 821.0 MSL, to the upstream end of the bypass channel. Several channel sizes were evaluated by this trial and error procedure until the upstream water surface elevation was calculated to be 821.6 MSL. This elevation would match the elevation obtained for the original channel of the Park River.

V. DESIGN

As mentioned earlier, the bypass channel was designed to handle 2,500 cfs of the 4,800 cfs occurring during the 10-year event. Several other conditions should be met when designing the bypass channel. The inlet to the bypass channel should be set at an elevation of 815.3 MSL, 1 foot higher than the crest of Vigness Dam. The bypass channel could then remain dry during a large portion of the year. Cattails should not be able to accumulate under these conditions. Also, a flow rate of 160 cfs will discharge over the water supply dam before the bypass channel will be in use. Water will be prevented from becoming stagnant, assuring that the water quality will not be reduced from existing conditions.

In order to prevent scouring, the design velocities were kept below 3.0 fps. Side slopes of 4:1 are proposed in order to provide stability to the banks.

A bottom width of 110 feet is required in order to meet all criteria. Starting at the downstream end, a channel slope of 0.045 percent will be used from Station 0+00 to 0+83 (See Plate 1). The ground elevation at Station 0+83 will be 806.0. A drop structure, consisting of a 25 percent slope will be constructed between Station 0+83 and Station 1+19. The upstream elevation of this drop will be 815.1 MSL. Upstream from the drop, the slope will return to 0.045 percent. This slope will continue to Station 5+25, resulting in an elevation of 815.3 MSL at the upstream end of the bypass channel.

Calculations showed that the previously planned vertical drop structure could adequately be replaced by the 25 percent slope. The channel bottom between the drop and the river is at an elevation of

806.0 MSL. It should not be necessary to excavate this section to 803.6 MSL, the channel bottom of the Park River. By the time the bypass channel is in use, the water surface elevation of the Park River, at the lower end of the bypass, should be more than 1 foot higher than 806.0 MSL. Thus, the energy obtained by the water flowing over the steep slope will be dissipated within the tailwater. No serious scouring problems should occur.

The alignment of the bypass channel was positioned so that its outflow would be parallel to the flows of the Park River. This should reduce any bank erosion problems. To improve the angle by which the Park River enters the bypass channel, a horizontal curve with a deflection angle of 30^{o} and a radius of 574 feet was designed (See Plate 1).

With a 110 foot bottom width, the bypass channel will be wider than the Park River. Twenty feet downstream from the drop, the north side slope of the bypass channel will taper into the north bank of the downstream channel. This transition will extend 150 feet downstream from the drop. There is no room for tapering on the southern portion of the bypass channel. The velocities from the bypass channel, however, will be less than those on the Park River. Also, the direction of the bypass flows is the same as the flows in the channel immediately downstream. Therefore, the flows should mix and erosion on the bank opposite the bypass channel should not be more than normal.

Several alterations are required on the existing roadway that runs through the oxbow area. A Texas Crossing will be built across the channel (See Figure 2 and Plate 2). Designed to allow flows to overtop it, the roadway will be 2.5 feet above the channel bottom. The roadway

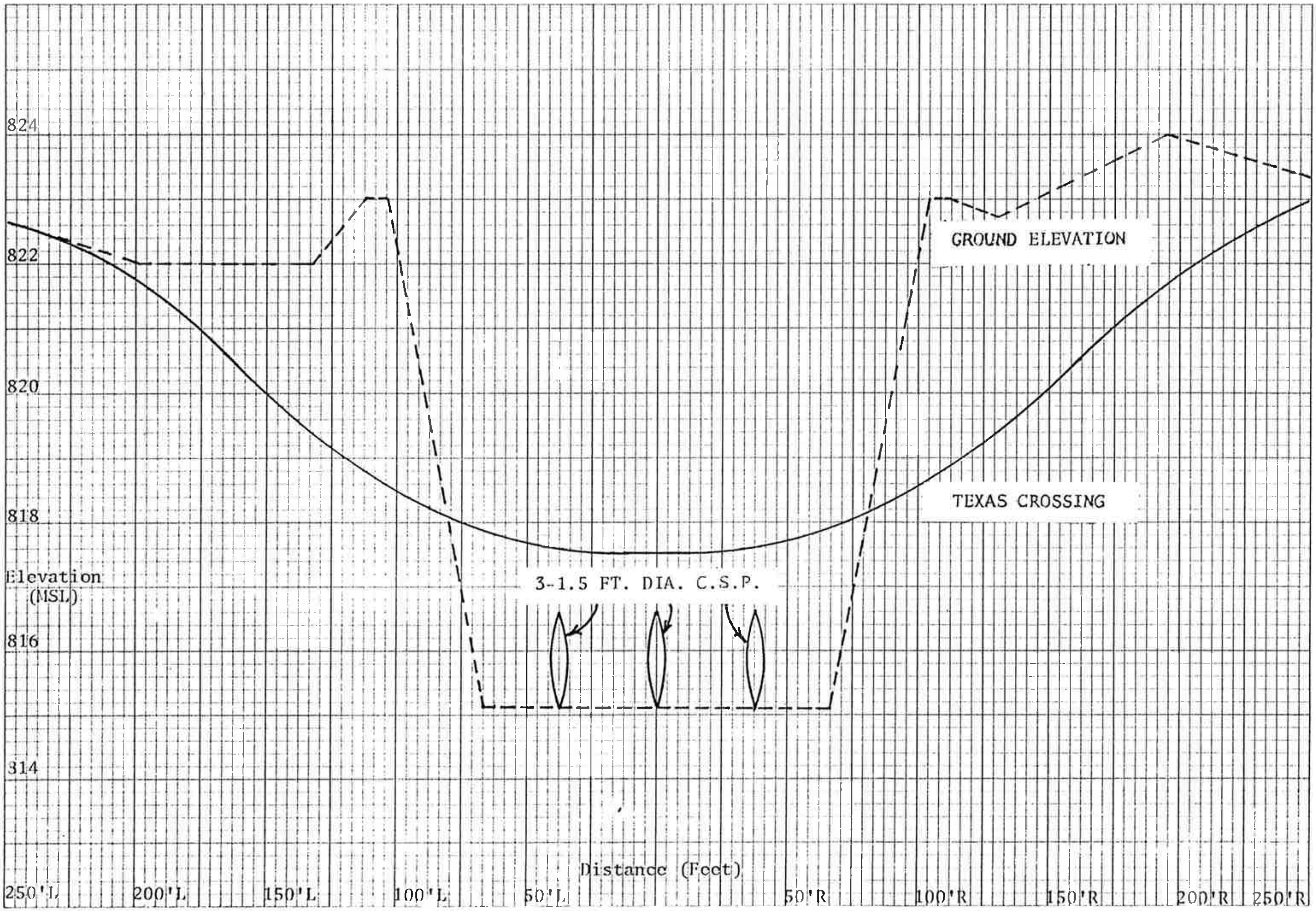

Figure 2 - PROFILE VIEW OF TEXAS CROSSING

will have a 30 foot width and a flat grade through the channel. Vertical curves will be used to transition the roadway profile from a 0.0% to a 4.0% grade. Three 18-inch diameter pipes will be installed through the crossing to handle low flows and allow the channel to drain. Flows over 30 cfs will overtop the crossing.

The alignment of the roadway will have to be modified for a length of 1,000 feet to avoid the section of the channel having the 25 percent bottom slope. As shown in Plate 2, the crossing will intersect the bypass channel at an angle of approximately 50 degrees. A transition area will be required in order to match the new portion of the roadway with the old.

From cross sections taken of the proposed site, it appears that a peak elevation of 823.0 MSL currently exists along the fringe of the Park River. The bypass channel would cut through this section and allow flooding to occur at elevations less than 823 MSL, further inland. Flooding would not occur under existing conditions. To prevent this from happening, a dike shall be constructed along the edge of the bypass channel at elevation 823.0. The dike should tie into the roadways at this elevation.

There are a few sections along the bypass channel where excessive velocities and turbulence may exist. These areas, shown in Plate 1, should be protected by riprap. The first area is the entrance to the bypass channel. Riprap should be installed for the first 20 feet. It should extend across the channel bottom and up the side slopes to original ground. A stable inlet elevation to the bypass channel which is needed to protect the water supply reservoir will then be ensured.

Riprap should also be placed in a 10 foot strip on the downstream slope of the Texas crossing extending across the channel bottom. Protection should be given to the channel side slopes at the junction of the crossing and channel side slopes.

The drop structure will increase velocities and reduce the depth of flow. Riprap should be placed starting 10 feet upstream and ending 20 feet downstream of the drop. For the first 10 feet, riprap should extend to the top of the slopes. Through the drop and in the section below it, the riprap should extend up the channel sides for a vertical distance of 8 feet. During high flows, the tailwater from the existing downstream channel will decrease the velocity over the drop.

VI. BENEFITS

As shown in Plate 3, water surface elevations were reduced by snagging and clearing the channel. The greatest reductions were obtained for the more frequent events. Larger flows would exceed the channel boundaries. Since no improvements were made within this overbank area, its capacity would be unchanged and no added benefits would be realized.

The snagging and clearing project removed many obstructions within the channel. By improving the efficiency of the channel, its water surface elevation is decreased. This reduction, however, is a temporary condition. Over the years, debris will accumulate. Channel capacities will be reduced and the water surface elevations will be increased.

An insignificant difference in the water surface elevations will be evident from the proposed improvements to Wakeman Avenue Bridge and the BN Railroad Bridge downstream from there. Even for larger events, the benefits are negligible. However, the velocity through each crossing will be decreased, due to the larger flow area. By increasing the low chord elevation on Wakeman Avenue Bridge, the chance of it being overtopped will be greatly decreased. Four piers will be removed within the center of the Railroad Bridge. With this larger opening, the possibility of an ice jam, or the accumulation of debris, occurring is greatly reduced. Therefore, the potential of increased flooding occurring, due to water backed up behind the ice jam, will also be reduced.

Benefits received by the bypass channel are controlled by the capacity of the downstream channel. Even though the bypass channel increases the ability to move water through that portion of the river, the original conditions prevail downstream. This downstream section cannot handle the increased capacity and so causes water to back up within the Park River and the bypass channel. Therefore, the water surface elevations are greater than what they would be with no downstream effects.

Even so, as shown in Plate 4, the bypass channel will cause a further reduction in water surface elevations. During the 10-year event, a reduction will first become evident at Vigness Dam. The water surface elevation will be lowered by 0.5 foot at this point. Proceeding upstream, reductions will increase until reaching the upstream junction of the bypass channel. A difference of 1.0 foot will be obtained here. From this point, the water surface elevation proceeds to approach the elevation occurring under existing conditions. At Kittson Avenue Bridge, the bypass channel is responsible for a reduction in the water surface elevation of 0.4 foot.

Although the bypass channel will cause water elevations to be decreased during the 10-year event, it is difficult to determine the actual benefits received. Table 1 shows the length of overbank area inundated, with and without the bypass channel. This data is dependent on the elevations obtained from the field survey conducted by the Corps of Engineers. Within the oxbow, which is proposed to be cut off by the bypass channel, the right bank is capable of containing the entire flow under current conditions. The houses within that area would not be flooded during a 10-year event, even under existing conditions. (As benefits from the snagging and clearing project decrease, however, these houses will be flooded more frequently. Yearly reductions in damage, due to the bypass channel, would then increase.) There are a few isolated points further upstream where the overbank flood area would be greatly reduced if the bypass channel were in operation. It is difficult to determine whether these low areas are contained, or if the flood water could spread out over a large area.

For floods larger than the 10-year event, the entire land area where the bypass channel is proposed to be constructed will be inundated. Any effects of the bypass channel would then be reduced. This condition also makes it very difficult to accurately determine these effects. Reductions in water surface elevations for the 20 and 50-year event are also shown in Plate 4. The effect of the bypass channel, given as the width of land inundated at each section, is shown in Tables 2 through 4.

TABLE 1

EFFECTS OF BYPASS CHANNEL
10 Year Event - Q = 4,800 C.F.S.

Location	Without Bypass Channel			With Bypass Channel		
	Elevation (MSL)	DPLB (Feet)	DPRB (Feet)	Elevation (MSL)	DPLB (Feet)	DPRB (Feet)
100 feet US from Vigness Dam	821.9	635	-	821.3	465	-
100 feet US from Burgamott Avenue Bridge	822.2	-	-	821.4	-	-
100 feet US from Burgamott Avenue Bridge	822.4	30	-	821.5	12	-
100 feet DS from RR Bridge (Proposed)	823.7	-	1100	822.9	-	-
100 feet US from RR Bridge (Proposed)	823.9	-	174	823.1	-	92
100 feet DS from Wakeman Avenue Bridge (Proposed)	824.5	29	-	823.8	22	-
100 feet US from Wakeman Avenue Bridge (Proposed)	824.8	-	92	824.1	-	61
50 feet US of Water Supply Dam	825.0	2013	1648	824.5	1862	1184
10 feet DS from RR Bridge	825.0	299	55	824.5	231	48
100 feet US from Highway 81 Bridge	825.2	258	146	824.8	257	79
50 feet DS from Kittson Avenue Bridge	825.3	93	-	824.9	-	-

US - Upstream
DS - Downstream
DPLB - Distance past left bank
DPRB - Distance past right bank

TABLE 2

EFFECTS OF BYPASS CHANNEL
20 Year Event - Q = 7,900 C.F.S.

Location	Without Bypass Channel			With Bypass Channel		
	Elevation (MSL)	DPLB (Feet)	DPRB (Feet)	Elevation (MSL)	DPLB (Feet)	DPRB (Feet)
100 feet US from Vigness Dam	823.3	2000*	4092*	822.7	903	-
100 feet US from Burgamott Avenue Bridge	823.8	1458	33	823.2	1208	3
100 feet US from Burgamott Avenue Bridge	824.1	744	-	823.3	49	-
100 feet DS from RR Bridge (Proposed)	825.7	2758	2160	825.0	1935	1980
100 feet US from RR Bridge (Proposed)	825.9	1222	957	825.0	1211	933
100 feet DS from Wakeman Avenue Bridge (Proposed)	826.3	1243	45	825.6	40	-
100 feet US from Wakeman Avenue Bridge (Proposed)	826.9	1677	191	826.4	1302	168
50 feet US of Water Supply Dam	827.0	2568	3475	826.5	1597	3021
10 feet DS from RR Bridge	827.0	573	201	826.4	492	76
100 feet US from Highway 81 Bridge	827.4	266	408	827.0	265	185
50 feet DS from Kittson Avenue Bridge	827.4	529	4	827.0	245	-

*extends to end of cross section
US - Upstream
DS - Downstream
DPLB - Distance past left bank
DPRB - Distance Past right bank

TABLE 3

EFFECTS OF BYPASS CHANNEL
50 Year Event - Q = 12,300 C.F.S.

Location	Without Bypass Channel			With Bypass Channel		
	Elevation (MSL)	DPLB (Feet)	DPRB (Feet)	Elevation (MSL)	DPLB (Feet)	DPRB (Feet)
100 feet US from Vigness Dam	824.1	2000*	4092*	823.8	2000*	4092*
100 feet US from Burgamott Avenue Bridge	824.7	3544	3015	824.2	3531	37
100 feet US from Burgamott Avenue Bridge	825.5	1905	2495	824.4	915	-
100 feet DS from RR Bridge (Proposed)	826.8	3123	2984	825.9	2993	2160
100 feet US from RR Bridge (Proposed)	827.1	1235	990	826.3	1226	968
100 feet DS from Wakeman Avenue Bridge (Proposed)	827.5	2137	291	826.4	1318	55
100 feet US from Wakeman Avenue Bridge (Proposed)	828.1	2576	876	827.9	2426	304
50 feet US of Water Supply Dam	828.2	2901	4566	828.0	2845	4384
10 feet DS from RR Bridge	828.2	747	584	827.9	703	541
100 feet US from Highway 81 Bridge	829.3	741	610	829.0	740	588
50 feet DS from Kittson Avenue Bridge	829.3	1594	251	829.0	1482	243

*Extends to end of cross section
US - Upstream
DS - Downstream
DPLB - Distance past left bank
DPRB - Distance past right bank

TABLE 4

EFFECTS OF BYPASS CHANNEL
100 Year Event - Q = 15,800 C.F.S.

Location	Without Bypass Channel Elevation (MSL)	Without Bypass Channel DPLB (Feet)	Without Bypass Channel DPRB (Feet)	With Bypass Channel Elevation (MSL)	With Bypass Channel DPLB (Feet)	With Bypass Channel DPRB (Feet)
100 feet US from Vigness Dam	824.7	2000*	4092*	824.5	2000*	4092*
100 feet US from Burgamott Avenue Bridge	825.3	3560	2920	824.9	3549	2730
100 feet US from Burgamott Avenue Bridge	826.4	2113	3109	825.2	1835	2291
100 feet DS from RR Bridge (Proposed)	827.4	3133	3294	826.3	3115	2240
100 feet US from RR Bridge (Proposed)	827.9	1244	1939	827.1	1235	990
100 feet DS from Wakeman Avenue Bridge (Proposed)	828.2	2659	1450	827.0	1765	132
100 feet US from Wakeman Avenue Bridge (Proposed)	828.8	3100	969	828.6	2950	943
50 feet US of Water Supply Dam	828.9	3095	5203	828.7	3039	5021
10 feet DS from RR Bridge	828.8	835	599	828.6	806	594
100 feet US from Highway 81 Bridge	830.7	2800*	7878*	830.0	2800*	665
50 feet DS from Kittson Avenue Bridge	830.7	2115	1562*	830.0	1854	272

*Extends to end of cross section
US - Upstream
DS - Downstream
DPLB - Distance past left bank
DPRB - Distance past right bank

VII. COSTS

As shown in Table 5, this project is estimated to cost $107,000, not including the cost of acquiring land. Within the preliminary cost estimate is an item for the relocation of a water main. It appears that the 12-inch reinforced concrete (RC) water main will be exposed by the bypass channel. In order to prevent freezing, it should be relocated with at least 7 feet of cover. A power line and 2 machine sheds will also have to be relocated. Also, a slightly larger quantity for the stripping and spreading of topsoil may be required. This depends on whether the excavated material is to be spoiled at the bypass channel site or to be hauled to another site.

TABLE 5

PRELIMINARY COST ESTIMATE
Flood Bypass Channel - Grafton

ITEM	Quantity	Units	Unit Price	Cost
Stripping & Spreading Topsoil	22,000	S.Y.	0.20	4,400
Common Excavation	21,050	C.Y.	1.00	21,050
Crossing Earthwork	3,750	C.Y.	1.25	4,688
Roadway Gravel	210	C.Y.	20.00	4,200
Riprap Filter Material	300	C.Y.	15.00	4,500
Rock Riprap	600	C.Y.	25.00	15,000
Seeding	5	Acres	150.00	750
18" CMP	155	L.F.	20.00	3,100
18" Flap Gate		L.S.	325.00	325
Relocate Fence	300	L.F.	1.00	300
Relocate 12" RCP Water Main		L.S.	10,000.00	10,000
Relocate Power Line		L.S.	2,500.00	2,500
Relocate Machine Sheds	2	Shed	2,500.00	5,000
Tree Removal				
0.5 ft. to 1 ft. Dia.	100	Tree	25.00	2,500
1 ft. to 2 ft. Dia.	4	Tree	45.00	180
2 ft. to 3 ft. Dia.	40	Tree	90.00	3,600
	Subtotal			$ 82,093
	30% Contingencies			24,907
	Total			$107,000

Does not include cost of acquiring land

VIII. SUMMARY AND CONCLUSIONS

SUMMARY

The City of Grafton is prone to flooding from the Park River. Rapid runoff from snowmelt causes shallow flooding within the area. Even a small degree of flooding causes damage to residential structures.

A flood bypass channel is proposed in order to reduce damage caused by the more frequent flood events. The proposed site is located on the northeastern edge of Grafton, in the SW¼ of Section 7, Township 157 North, Range 52 West. Cutting across the neck of an oxbow on the Park River, the bypass channel would increase the capacity of the Park River through this section.

This project is the fourth phase of a flood control plan for the Park River at Grafton. The remaining phases consist of snagging and clearing the channel, replacing Wakeman Avenue Bridge, and replacing the BN Railroad Bridge downstream from there. Phase 1 was completed during the winter of 1980-1981, Phase 2 is anticipated to be constructed during 1983, and Phase 3 should be completed within the next two years. Reductions in water surface elevations, achieved by Phase 1, are shown in Plate 3. Replacing the two bridges will have an insignificant effect on the water surface elevations when neglecting ice. Removing four piers below the BN Railroad Bridge, however, would decrease the chances of an ice jam occurring, or debris collecting. Therefore, the likelihood of water being backed up several feet, due to this additional debris, would be reduced.

Water surface profiles for different frequency events were obtained by inputting data into the HEC-2 program. The results were calibrated to match known high water marks. Further alterations were made of the input to reflect the snagging and clearing and bridge replacements. The bypass channel was designed while assuming that these were in effect.

In order to obtain the most feasible design, the bypass was proposed to be constructed to handle 2,500 cfs of the 4,800 cfs occurring during a 10-year event.

The design includes a 525 foot bypass channel having a 110 foot bottom width and 4:1 side slopes. Its inlet elevation is 1 foot higher than the crest of Vigness Dam. This will prevent unwanted losses to the city's water reservoir. A profile grade of 0.045 percent was used to control velocities. To drop the flow back into the Park River, the profile grade was increased to 25 percent in one area. This steep area will be riprapped and will act as a drop structure. A small segment of channel below this drop will reunite the flows of the bypass and the existing channel.

A Texas crossing will be installed, intersecting the channel at approximately 50 degrees. The existing roadway through the oxbow area could remain in use most of the time.

Total cost for this project, excluding land acquisition, is estimated to be $107,000.

For the 10-year event, the water surface elevation was reduced 1.0 foot at the upstream end of the bypass channel (See Plate 4). Proceeding upstream, the elevation slowly approached the existing conditions. Only a 0.4 foot reduction is obtained at Kittson Avenue Bridge. Benefits also decrease downstream from the junction. Only 0.5 foot difference is evident at Vigness Dam. Backwater effects, caused by the limited capacity of the downstream channel, quickly eliminate any difference downstream from Vigness Dam.

CONCLUSIONS

Improvements due to the snagging and clearing project will slowly diminish. As any new obstructions accumulate in the river channel, the water surface elevations will increase. To a small degree, this will alter the effects of the bypass channel. Periodical maintenance of the channel is necessary to keep it operating efficiently.

From the information gathered, it appears that the bypass channel would eliminate a relatively small amount of damage during the 10-year event. Apparently, most of the area affected by the project would be land with no dwellings. Therefore, the reduction in damage would be relatively low. For floods larger than the 10-year event, a greater amount of land would be inundated. But, again, it appears that the majority of this land has no dwellings. The amount of damage which could be reduced by the bypass channel during these infrequent events, when converted to an annual basis, would be relatively small. It is possible, however, that there are low areas present where floodwaters could spread out, causing a large amount of damage. These areas may not be represented within the cross sections that were taken. It is also possible that some dwellings have been constructed within the affected area. All these possibilities would considerably change the benefits of the project.

The City of Grafton must determine whether this project is feasible. Does a reduction of water surface elevations ranging from one foot to 0.4 foot from the bypass to Kittson Avenue Bridge provide enough benefit to justify the $107,000 cost of this project? By knowing the location of any structure or low areas that may be affected, they may be able to make a judgement of the reduction in damage.

For flows greater than the 10-year event, the proposed bypass site will be inundated, causing the potential benefits from the bypass channel to be reduced. This condition also makes it very difficult to accurately determine the effects of the bypass channel. The apparent reductions in water surface elevations, for the 20 and 50 year events are shown in Plate 4. A smaller percentage of the flows would be handled by the bypass channel for events smaller than 10-year event. Therefore, any reductions in water surface elevations would be less. Also, for small events, the Park River would be within its banks. Little benefit would be obtained from the bypass channel for these small events.