Worle Creek Sanitary Sewer Extension Study

Executive Summary

City of Ames

Ames, Iowa

January 2005

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Iowa.

Edwin R Slattery 1/19/05

Edwin R. Slattery, P.E. 1/19/2005

My license renewal date is December 31, 2006.

Pages or sheets covered by this seal: All

Stanley Consultants INC

A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

Executive Summary

Background

The City of Ames 1997 Land Use Policy Plan designated as a growth priority area an area located just southwest of the existing Ames city limits. The Southwest Growth Priority Area B was designated in the Annexation Study, Phase II, February 2000. In order to provide sanitary sewer service to this area, City staff proposed continuing the existing Worle Creek Outfall Sewer west along the Worle Creek corridor from State Avenue to County Line Road. Traditionally, trunk sewers are located along streams since these routes are the lowest elevation in the service area, allow the largest area to be serviced by gravity and minimize the use of expensive lift stations. Area residents raised concerns and expressed opposition to City Council that construction along Worle Creek could have significant negative impacts to the existing vegetation and wildlife habitat of the existing creek corridor.

In response to public opposition to a proposed trunk sewer line along the Worle Creek corridor, the Ames City Council passed Resolution No. 03-472 that directs City staff to complete a study to inventory and assess the natural and cultural resources of the area, to develop sewer routes and construction techniques that provide minimal disruption to the land, and to involve the public in the study process. The City contracted with Stanley Consultants to conduct the study and facilitate the public involvement process. Public input was received by holding a public meeting at the beginning of the study process and facilitating a series of Citizens Advisory Committee meetings to provide direction throughout the study.

Study Process and Findings

Five meetings were held with the committee. Stanley Consultants and its subconsultants presented the findings of the intensive environmental studies. The work of Dr. Keith Summerville of Drake University concluded that the entire Worle Creek area functions as a moderate to high quality greenbelt; it provides habitat for a diversity of animal species, some of which appear to be declining in abundance across their ranges but none of which are threatened or

endangered. The report recommended pursuing engineering options for sewer routing and construction that significantly reduces fragmentation of existing woodland habitat. Cathy Mabry McMullen, PhD, of Iowa State University's Department of Ecology, Evolution and Organismal Biology, concluded in her botanical inventory work that the corridor is of regional conservation value and recommended that the sewer largely avoid the wooded areas.

The results of the floral and faunal studies were decisive in determining the course of discussions and the final recommendations of the Citizens Advisory Committee not to build the sewer in the lowland area immediately adjacent to Worle Creek. These studies are the most current and comprehensive studies of the Worle Creek drainage area and should be used as references in future decision making.

The results of an archeological review conducted by the Office of the State Archaeologist were discussed. The report identifies those areas that will require additional investigation before construction can take place.

Discussions of alternative sewer routes and technologies were conducted with the Committee. Eight concepts were developed that included combinations of gravity sewers installed in the Worle Creek corridor and/or out of the creek corridor and included options with a regional pump station and an option with grinder pumps at each lot. The Committee's desire to locate the trunk sewer on high ground out of the environmentally sensitive Worle Creek corridor precluded the need to perform detailed investigations on alternative construction techniques and other means to lessen environmental impact. The concepts developed for outside of the Worle Creek corridor generally follow existing road rights-of-way or pass through currently disturbed agricultural lands. For each concept, pros and cons and budget level estimated construction costs were presented to, and discussed by, the Citizens Advisory Committee that provided a side-by-side comparison to facilitate selection of the most desirable concepts to be studied in more detail.

The Committee was asked to vote for two concepts that they viewed as acceptable. Only three of the 8 concepts received votes:

- Parallel gravity sewer lines on each side of Worle Creek.
- A complete grinder pump/force main system.
- Pumping the northwest area of the SWGPA B into the College Creek Outfall Sewer.

Pros, cons and budget level estimated construction costs for these three concepts are presented in Table 1. Figures 1, 2, and 3 show the proposed schematic layout of the main features for each of these concepts.

The concept that includes pumping the northwest area of the SWGPA B into the College Creek Outfall Sewer was viewed as a viable concept for only a limited time until the capacity of the College Creek Outfall Sewer is used up. Cost for this concept does not provide a significant savings compared to the gravity sewer line located on high ground on the north side of Worle Creek. This concept was eliminated leaving the preferred concepts as the parallel gravity sewer lines on each side of Worle Creek and the grinder pump/force main system.

Table 1 - Sewer Concept Pros, Cons and Estimated Costs

Sewer Route Concept	Pros	Cons	Budget Level Estimated Construction Cost
Gravity Sewer Concept (see Figure 1)	• No creek disturbance. • Serves most of developable area with gravity sewer. • Sewer is constructed in mostly open areas. • Minimal impact to environment. • Can stage construction.	• Nearly twice as much sewer pipe required as Concept 2A. • Some homes close to creek will need lift stations (grinder pumps). • Requires deep sewer ~25' in places.	$2,818,000
Grinder Pump/Force Main Concept (see Figure 2)	• Shallow small diameter sewer construction. • Cleanouts used instead of manholes. • Lower cost construction for public portion of system. • Can route sewer to avoid impact to environment. • No creek disturbance	• Permanent O&M costs. • Completely pumped system where gravity could be used. • Individual lots require holding tank and grinder pump. • Grinder pumps need maintenance on average every 8 years and replacement every 20 year on average. • Installed cost to each lot is approximately $4000.	$1,575,000
North side pumped to College Creek Sewer (see Figure 3)	• Can stage construction: development can begin in NW quadrant without sewer installed through eastern quadrants. • No creek disturbance. • Minimal impact to environment.	• College Creek sewer capacity is compromised. • Requires U.S. HWY 30 crossing. • Requires upsizing College Creek trunk sewer for continued development. • Permanent O&M costs.	$3,154,000

Costs for each system and the split between developer, City, and home builder (passed on to homeowner) became an integral part of the Committee discussion between the parallel gravity sewer lines on each side of Worle Creek and grinder pump/force main sewer concepts. Table 2 details a cost breakdown for both concepts. Typically, the City would pay for the trunk sewers, the developer would pay for the subdivision sewers and the home service connection cost would be passed directly to the lot owner.

Table 2 – Sewer Cost Breakdown

Sewer Segment	Unit Cost [1]	Total Cost for All Potential Units [1] [2]
Gravity Sewer Concept		
Home Service Connections (street sewer to house)	$1,500	$8,374,000
Subdivision Street Sewers (8" sewer pipe and manholes)	$1,663	$9,285,000
Trunk Sewers (15"-18" sewers with manholes)	$508	$2,819,000
Total Cost	*$3,671*	*$20,478,000*
Grinder Pump/Force Main Concept		
Home Service Connection (grinder pump, sump and 1¼" force main)	$4,000	$22,328,000
Subdivision Street Sewers (average 3" force main)	$280	$1,563,000
Trunk Sewers (10"-12" force mains)	$283	$1,577,000
Total Cost	*$4,563*	*$25,468,000*

(1) Estimated costs are budget level and do not include engineering and administration.

(2) City of Ames requires a development density of 6 units per net acre (where net acre is approximately 80% of service area) equaling a potential 5,582 units for the entire service area over the lifetime of the sewers.

Source: Stanley Consultants

An economic analysis is useful for comparing infrastructure that will have a typical replacement period and continuous maintenance costs over time. By conducting an equivalent uniform annual cost (EUAC) for each concept, the true cost of ownership of each system can be compared side by side. Table 3 shows the EUAC for the preferred concepts. The grinder pump/force main concept was further divided into the complete system and with force main materials only. The City would be responsible for the force mains and the homeowners would be responsible for pump maintenance and replacement.

Table 3 – Equivalent Uniform Annual Cost for Concepts 2C and 6

Concept	Equivalent Uniform Annual Cost
Gravity Sewer Concept (Assumes no salvage value at 50 years and yearly maintenance of $1600/mile of sewer.)	$1,366,000
Complete Grinder Pump/Force Main Concept (Assumes complete replacement every 20 years for pumps, replacement of force mains and sumps every 50 years and annual O&M cost of $40 per home and $1600/mile for force main.)	$2,482,000
Force Mains Only for Grinder Pump/Force Main Concept (Excludes pump station maintenance and replacement.)	$267,000

Source: Stanley Consultants

Some members of the Committee conducted research on the grinder pump technology and had contacted E|One Sewer System for more information about their system. The E|One Sewer System representatives were asked to attend a committee meeting to provide more information and address any questions from the Committee as a whole about the grinder pump/force main system. After review of the area, the representatives stated that the area on the north side of Worle Creek is better suited to be served by a gravity system. The south side of Worle Creek could be served by either a pumped system or gravity system.

Conclusions and Recommendations

The Committee discussed the option of using different concepts for the north and south portions of the service area. As the current development needs and topography differ between the north and the south sides of Worle Creek, one system may be adequate for one area and the other system for the other area. The Committee felt that there was currently a potential need for sewer service only on the north side of Worle Creek in Subarea A, and did not foresee any development occurring on the south side of Worle Creek in the near term.

The Committee concluded and will recommend to City Council the following:

- A gravity system on high ground on the north side of Worle Creek. The trunk sewer would generally follow 240th Street in the northwest area and along the service road through Iowa State University research plots to State Avenue. (See Figure 1.)
- The south side of Worle Creek may be served by a gravity system (as shown on Figure 1) or a pumped system located on high ground (see Figure 4) depending on the type and pace of actual development that will occur.

The Committee also stated that development of the area is not endorsed or encouraged by them, but if development occurs, this is the recommendation for sewer service to the area.

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NORTH

18"
18"
18"
18"
10"
10"
8"
8"
8"
8"

SOUTH DAKOTA AVENUE NE

Existing
Sanitary Sewer

STATE AVENUE

U.S. HWY 30

RIM= 1030
IE= 1010
Gravity Sewer 6248' OF 15"

Gravity Sewer 5425' OF 18"

RIM= 1005
IE= 980

RIM= 1015
IE= 994

1954' OF 18"

RIM= 1022
IE= 1010

GRINDER PUMP
SERVICE AREAS

RIM= 938.5
IE= 920.7

21"
21"
15"
8"
8"
8"
15"
8"
15"
15"

1015' OF 8"

RIM= 960
IE= 949.6

7936' OF 15"

RIM= 1020
IE= 990

DARTMOOR ROAD

COUNTY LINE ROAD

Gravity Sewer

Gravity Sewer 2950' OF 15"

3010' OF 15"

RIM= 990
IE= 980

Existing Sanitary Sewer

Citizens Advisory Committee
Recommended Plan
Complete Gravity System
Figure 1

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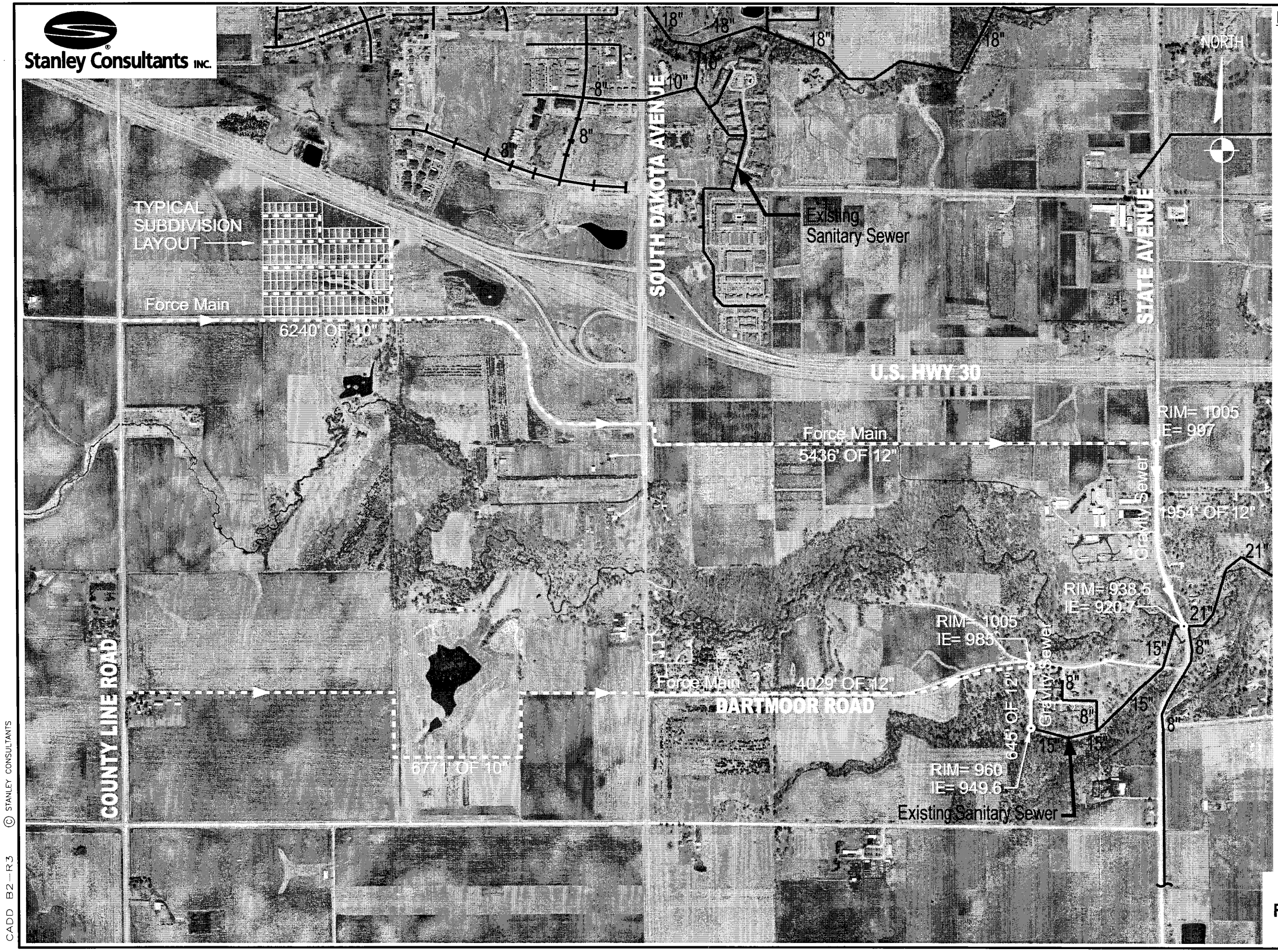
NOTES:

1. EVERY LOT REQUIRES A COLLECTION SUMP AND GRINDER PUMP.



Grinder Pump/ Force Main System
Figure 2

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North Side Pumped To College Creek Sewer

Figure 3

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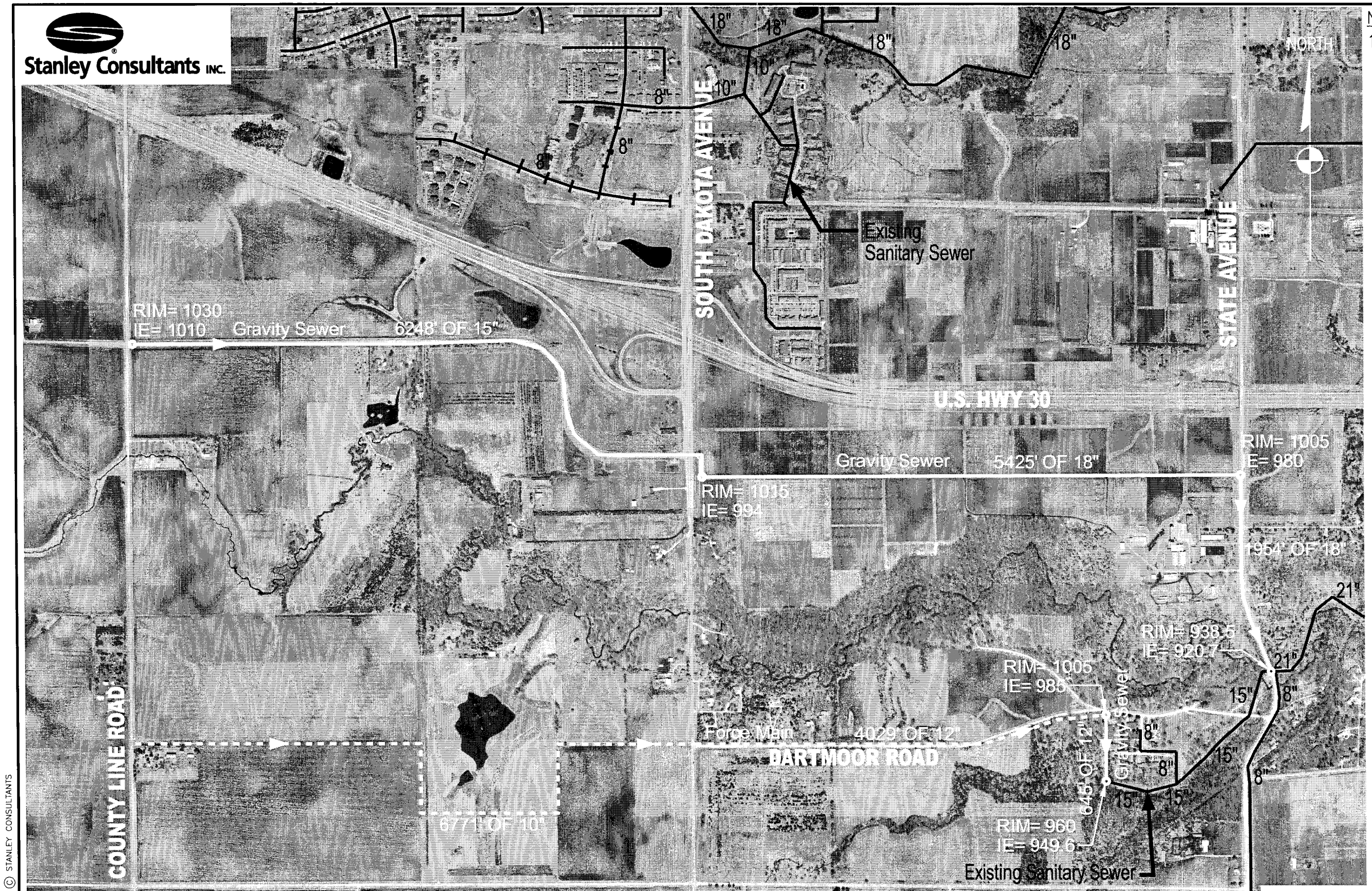
NOTES:

1. EVERY LOT ON THE GRINDER PUMP/FORCE MAIN SYSTEM ON THE SOUTH SIDE OF WORLE CREEK REQUIRES A COLLECTION SUMP AND GRINDER PUMP.



Citizens Advisory Committee
Recommended Plan
Combination Gravity/Grinder Pump & Force Main System
Figure 4