TECHNICAL REVIEW COMMITTEE
FINAL RECORD OF DECISION AND ACTION ITEMS

TO: **TRC Voting Members**

FROM: Tanu Hiremath, P.E., (COH WW Eng)

DATE: April 10th, 2015

SUBJECT: Diversion and Abandonment of Kirkwood #3 Lift Station to New Harvest Moon Lift Station (WBS Nos. R-000536-0021-3)

A TRC Meeting was held for the subject project as follows:

Date: February 05, 2015
Time: 3:00 PM to 4:30 PM
Location: 611 Walker, 16th Floor, Room 16A

Attendees

Tanu Hiremath (COH – WW Eng) – Project Manager
Jeremy Austin (COH – WW Eng) – Project Manager
Ebi Nassiri (COH – WW Eng)
Edward Quiroz (ARCADIS) – Engineering Consultant
David Ridgway (ARCADIS) – Engineering Consultant
Poolkeshi Patel (ARCADIS) – Engineering Consultant
Jonathan Howard (ARCADIS) – Engineering Consultant
Joanne Kamman (COH – Construction)
Ali Khairandish (COH – WWOps)
Pratistha Pradhan (COH- IPB)
Fazle Rabbi (COH – IPB)
Mark Kirsche (COH)

Project Scope of Work and Objectives

The Project Scope of Work includes completing an evaluation of the consolidation plan to eliminate the Kirkwood #3 Lift Station to the new Harvest Moon Lift Station via 42-inch gravity relief sewer along Buffalo Bayou. It also includes the detail review and assessment of existing conditions, hydraulics, real estate, easements, alignments, construction costs, life-cycle cost analysis, constructability, sustainability, community impacts/opposition.

The alternatives for Kirkwood #3 lift station facility evaluated under this contract are as follows:

		Total Cost ($)[1]
1.	Alternative 1: Lift Station Elimination by Route 1	$14,158,000.00
2.	Alternative 2: Lift Station Elimination by Route 2	$ 9,802,000.00
3.	Alternative 3: Lift Station Elimination by Route 3	$14,663,000.00
4.	Alternative 4: Lift Station Replacement	$21,029,000.00

Alternative 2 was approved for implementation by the Technical Review Committee. The total cost for Alternative 2 is $9,802,000.00[1]

[1] Value represents the present worth (cost) over a total life-cycle period of 50 years.

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DRAFT RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

The following decisions were reached and action items assigned:

Decision Items:

1) Eliminate lift station by installation of approximately 5,200 linear feet of 42" diameter gravity relief sewer by trenchless construction methods to Harvest Moon lift station (FN 236) as per recommended route 2 with a total 50-year life cycle cost of approximately $ 9,802,000. The recommended 42" diameter sewer route runs from the intersection of Carriage Hill Drive and S. Kirkwood Drive going west for approximately 2,700 linear feet along Carriage Hill Drive and then runs north for approximately 1,400 linear feet along Lash Brook drive followed by the last segment of the relief sewer that runs for approximately 1,000 linear feet along the southern bank of Buffalo Bayou to the new Harvest Moon lift station.
    - Provide MH(s) as needed along relief sewer alignment.
    - Intercept incoming influent sanitary flow (existing 42" diameter sewer line) at the intersection of S Kirkwood Dr and Carriage Hill Dr with a new manhole and redirect flow to new 42" diameter gravity sewer to Harvest Moon LS.
    - Provide approximately 140 feet of 8" sewer line and laterals to serve the four houses on S Kirkwood Dr currently going to Kirkwood #3 LS and redirect this flow to new relief sewer at intersection of Carriage Hill Dr and S Kirkwood Dr.
    - Provide detail Traffic Control Plans as need for construction.
    - Provide Tree Protection Plan along sewer alignment.
    - Provide Phase I ESA with limited Wetlands Delineation/Screening and Phase II ESA (if needed).
    - Provide Storm Water Protection Plan (SWPP).
    - Provide CCTV Sewer inspection (if needed) for establishment of service connections for four houses along Kirkwood Drive.
    - Provide Project In-take and Metes & Bounds Surveys for proposed new 30-ft wide easement along buffalo bayou (1080 feet) from HCFCD, new 30-ft wide (50 feet) easement from private home owner, and necessary construction easements.
2) Complete build out for new Harvest Moon lift station to final firm capacity of 21.38 MGD which includes the following tasks:
    - Provide three (3) submersible pumps, each with individual capacity of 3,395 gpm with 140 HP (3-phase) motors compatible for VFD operation. Equipment (pumps/motors) should match equipment installed under new Harvest Moon lift station (WBS No. R-000267-111B-4) project.
    - Add surge control valves to both valve vaults at lift station.
    - Provide discharge piping, header and valves (check and plug valves) include brackets and piping supports for pumps.
    - Provide electrical controls, wiring and instrumentation for second chamber; as well as, final dual chamber operation.
    - Provide temporary by-pass pumping to complete built-out and internal connections between dual chambers of wet well.
    - Cut, Plug and Abandon In-place 14" diameter force-main beneath buffalo bayou from Harvest Moon LS in accordance with COH Standard Section 02222.

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3) Demolish existing Kirkwood #3 lift station which includes the following tasks:
   - Remove all structures to 4 feet below ground surface.
   - Demolish existing driveway and remove fence along Kirkwood drive.
   - Cut, plug, and abandon in place existing 14-inch and 24-inch diameter force main from Kirkwood lift station in accordance with COH Section 02222.
   - Remove 14-inch and 24-inch force mains from pipe-bridge and Kirkwood Drive Bridge over buffalo bayou.
   - Remove 30-inch force mains from Dairy Ashford Drive Bridge over Buffalo Bayou.
   - Cut and remove buried 30-inch and 24-inch force mains along north side of Buffalo Bayou between Dairy Ashford and Kirkwood Drive in accordance with HCFCD easement agreement.
   - Restore site including lift station site and disturb areas along buffalo bayou with topsoil and seed for grass.
   - Conduct post demolition property survey of former Kirkwood #3 lift station site and prepare necessary documents (as needed) to declared site as a real estate surplus.
4) Coordinate with Harris County Flood Control District (HCFCD) and U.S. Army Corps of Engineers (USACE) for portion of the sewer along Buffalo Bayou and force-main abandonment and provide necessary submittals for approvals.
5) Coordinate this project with the construction of the new Harvest Moon lift station (WBS No. R-000267-111B-4).

Action Items:

1. Confirm with WW Ops what is the desired flow options for sewage after elimination of Kirkwood #3 LS i.e.
Option 1 – Total combined flow from Kirkwood #3 and Harvest Moon LS will get rerouted to Turkey Creek WWTP with no option to send flow to West District WWTP
Option 2 – Allows option to send flow to Turkey Creek and/or West District WWTP(s)

Resolution: COH WW Ops confirmed (via email dated 02/26/2015) that after the elimination of Kirkwood #3 LS, the total combined flow from Kirkwood #3 and Harvest Moon will get rerouted to Turkey Creek WWTP (i.e. Option 1).
Responsible party: COH WW Ops

2. Provide a profile of the connection of the proposed 42" sewer line connecting to the new Harvest Moon LS.

Resolution: Completed and included with RDAI. (See attachment F)
Responsible party: ARCADIS

3. Clarify any conflicts with current or future projects in the area.

Resolution: ARCADIS reviewed available information and confirmed no conflicts.
Responsible party: ARCADIS

4. Check for daily traffic along the portion where the proposed sewer route crosses South Kirkwood drive.

Resolution: The bidirectional average daily traffic (ADT) along S Kirkwood Drive near Kirkwood #3 LS is 21,060 vehicles per day. A detail traffic control plan will be developed for this project during design.
Responsible party: ARCADIS

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5. **Clarify the steps taken to reduce the impact of this project on the green cover along the portion of the route on Buffalo Bayou.**

Resolution: At minimum the following will be done to preserve and/or minimize impact to "green cover".

a. *Development of Tree Protection Plan*
b. *Specify trenchless method for installation of proposed sewer line*
c. *During design minimize the number of manholes along sewer route.*

Responsible party: ARCADIS

6. **Verify the time period after which the mechanical equipment for a typical lift station needs to be replaced that is used in the life cycle analysis of Kirkwood #3 lift station.**

Resolution: City of Houston Planning confirmed that the replacement of the mechanical parts for a lift station is every 10 years based on the lift station LCCA document.
Responsible party: ARCADIS & COH

7. **Verify the force main flow velocity for the proposed/existing segments of 30-inch force main from the proposed new Harvest Moon lift station for the combined flows from the Dairy Ashford #1, Harvest Moon and Kirkwood #3 lift station service areas under the peak flow conditions (21.38 MGD/14,847 gpm) and average daily flow conditions (6.41 MGD/4,450 gpm).**

Resolution:

a. *For peak flow conditions: the velocity in the existing/proposed 30-inch force main is 6.7 fps. This meets the requirements for force mains included in the COH's Engineering Design Manual for Submersible Lift Stations.*
b. *For average daily flow conditions: the velocity in the existing/proposed 30-inch force main is 2.0 fps. This meets the TCEQ requirements force mains for pump stations with three or more pumps, see 30 TAC 217.67 (a)(3). The existing as well as the proposed segments of 30-inch force main do not meet the minimum velocity requirement of 2.5 fps set by the more stringent COH's Engineering Design Manual for Submersible Lift Stations.*

Responsible party: ARCADIS

Other Items:

Responded to City Council's Inquiry (See Attachment G)

Prepared By:

Eduardo Quiroz, P.E., CPM / ARCADIS U.S., Inc.

STATE OF TEXAS
EDUARDO QUIROZ
85559
LICENSED
PROFESSIONAL ENGINEER

Eduardo Quiroz, P.E., CPM

Date: 04/10/2015

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DRAFT RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

This is to confirm that the subject TRC-RDAI has been reviewed and accepted by the City of Houston, Technical Review Committee Members:

Tanu Hiremath — Date: 04/10/15
Tanu Hiremath, P.E. – Project Manager, Wastewater Engineering

Bill Zod — Date: 4-10-15
Bill Zod, P.E. – Managing Engineer, Wastewater Engineering

Ali Khalilandish — Date: 4/13/2015
Ali Khalilandish, P.E. – Managing Engineer, Wastewater Operation Branch

Joanne Kamman — Date: 4/14/15
Joanne Kamman, P.E. – Managing Engineer, Construction Branch

PP Fazle Rabbi — Date: 04/17/15
Fazle Rabbi, P.E. – Managing Engineer, Infrastructure Planning Branch

Ebi Nassiri — Date: 4/22/15
Ebi Nassiri, P.E. – Assistant Director, Wastewater Engineering

Ravi Kaleyatodi — Date: 4/23/15
Ravi Kaleyatodi, P.E., CPM – Senior Assistant Director, Engineering Branch

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Attachments:

A. TRC Executive Summary
B. Proposed and TRC Approved Project (sewer alignment/route, facility locations) maps.
C. Detail Construction Cost Estimates of the Proposed Alternatives
D. Selected Alternative and related Construction Cost Estimate
E. Copy of TRC presentation
F. Sign In Sheet
G. Other Data –
    G.1 - Responses to Councilman Inquiry
    G.2 – Profile of Connection of Proposed 42" Sewer at Harvest Moon LS

Distribution:

Ali Khairandish, P.E. (COH WW Ops)
Jeremy Austin, P.E. (COH WW Eng.)
Tanu Hiremath (COH WW Eng.)
Ebi Nassiri, P.E. (COH WW Eng)
Ravi Kaleyatodi, P.E., CPM (COH ECD)
Fazle Rabbi (COH Planning)
Pratistha Pradhan (COH Planning)
Edward Quiroz, P.E., CPM (ARCADIS)

RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

ATTACHMENT A
TECHINCAL REVIEW COMMITTEE (TRC)
EXECUTIVE SUMMARY

TRC EXECUTIVE SUMMARY
Selected Alternative (Alternative #2)
Items For Relief Sewer

1) Install 5,200 linear feet of sanitary sewer under existing pavement.
   Sewer Size: 42-inch (ID) pipe.
   Method of Construction: Trenchless by Microtunneling.
   Sewer Material: FRP, Clay, and/or Concrete.

2) Minimum 6-foot diameter manholes.
   Sealed and vent manholes along Flood Plain as necessary.

3) 1,080 -feet of new easement (30-ft wide) from HCFCD.

4) 50-feet of new easement (30-ft wide) from private home owner.

5) Abandon 730-feet of existing easement within fence line of private homes.

6) Temporary construction easement from HCFCD.

7) Provide by-pass/diversion pumping for 18-inch sanitary sewer currently flowing into Harvest Moon lift station for duration of construction.

8) Provide CCTV inspection of existing 18-inch sanitary sewer for abandonment.

9) Divert flow, grout fill, and abandon in-place approximately 730 feet of 18-inch sanitary sewer.

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TRC EXECUTIVE SUMMARY
Selected Alternative (Alternative #2)
Items For Harvest Moon Lift Station Site

1) Add pumps, piping and mechanical to spare side (unused side) of new Harvest Moon lift station to match existing.

2) Add associated electrical and VFDs for spare side (unused side) of new Harvest Moon lift station to match existing.

3) Add 12-inch surge protection valves to each valve vault at new Harvest Moon lift station.

4) Cut, plug and abandon 14-inch diameter force main from Harvest Moon lift station beneath Buffalo Bayou in place.

5) Tie-in proposed 42-inch sewer to new 8-ft diameter manhole at Harvest Moon lift station site.

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TRC EXECUTIVE SUMMARY
Selected Alternative (Alternative #2)
Items For Kirkwood#3 Lift Station Site

1) Intercept and divert influent sanitary flows incoming to Kirkwood #3 lift station to proposed 42-inch sanitary relief sewer.
2) Demolish existing Kirkwood #3 lift station and all associated infrastructure to 4-feet below the ground surface.
3) Leave in-place perimeter fencing on the north, south, and east sides.
4) Demolish and remove fence along Kirkwood Drive.
5) Demolish and remove driveways to lift station site.
6) Restore curb and gutter and side walk along Kirkwood Drive.
7) Demolish and remove all pavements from site.
8) Sod entire site after construction and demolition activities.
9) Cut, plug, and abandon existing Kirkwood #3 14-inch diameter force main.
10) Cut, plug, and abandon existing Kirkwood #3 24-inch diameter force main.
11) Cut, plug, and abandon existing 30-inch diameter force main from junction of Harvest Moon and Kirkwood #3 force mains to Dairy Ashford lift station.
12) Cut and remove existing 14-inch diameter force main on Pipe Bridge crossing Buffalo Bayou along Kirkwood Drive.
13) Cut and remove existing 24-inch diameter force main on Pipe Bridge crossing Buffalo Bayou along Kirkwood Drive.
14) Cut and remove existing 30-inch diameter force main on Pipe Bridge crossing Buffalo Bayou along Dairy Ashford Drive.

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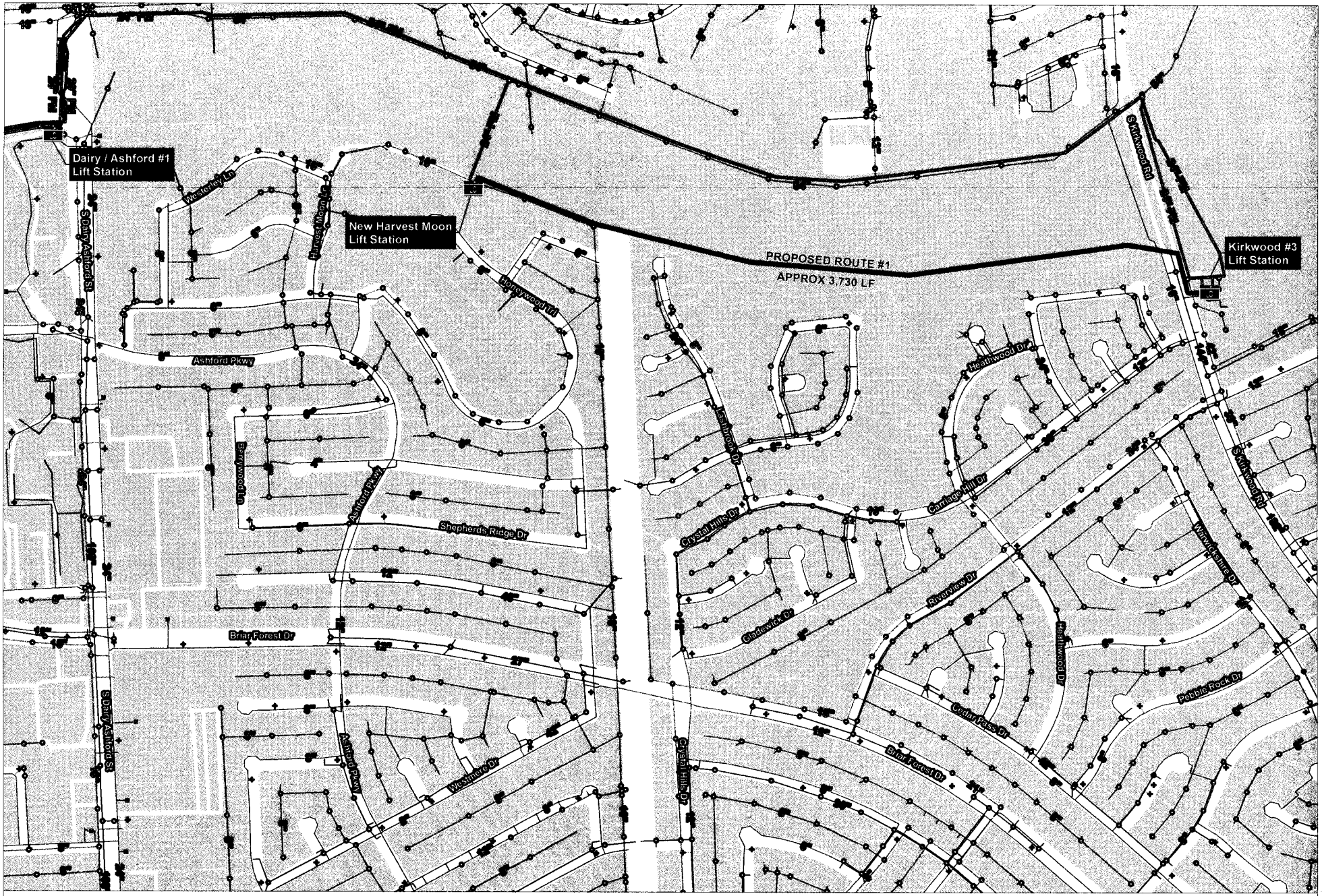
RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

ATTACHMENT B
PROPOSED AND TRC APPROVED PROJECT MAPS
(Sewer Alignment/route, facility locations)



Legend

Proposed Relief Sewers	*Houston GIMS Wastewater*	*Houston GIMS Stormwater*	*Houston GIMS Water*
Lift Station	Existing Manhole	Existing Manhole	Existing Hydrant
Sewer Alignment	Existing Force Main	Existing Gravity Main	Existing Meter
	Existing Gravity Main		Existing Pressure Main
			Existing Lateral

RDAI Attachments A through G

0 500 1,000 1,500 Feet

CITY OF HOUSTON

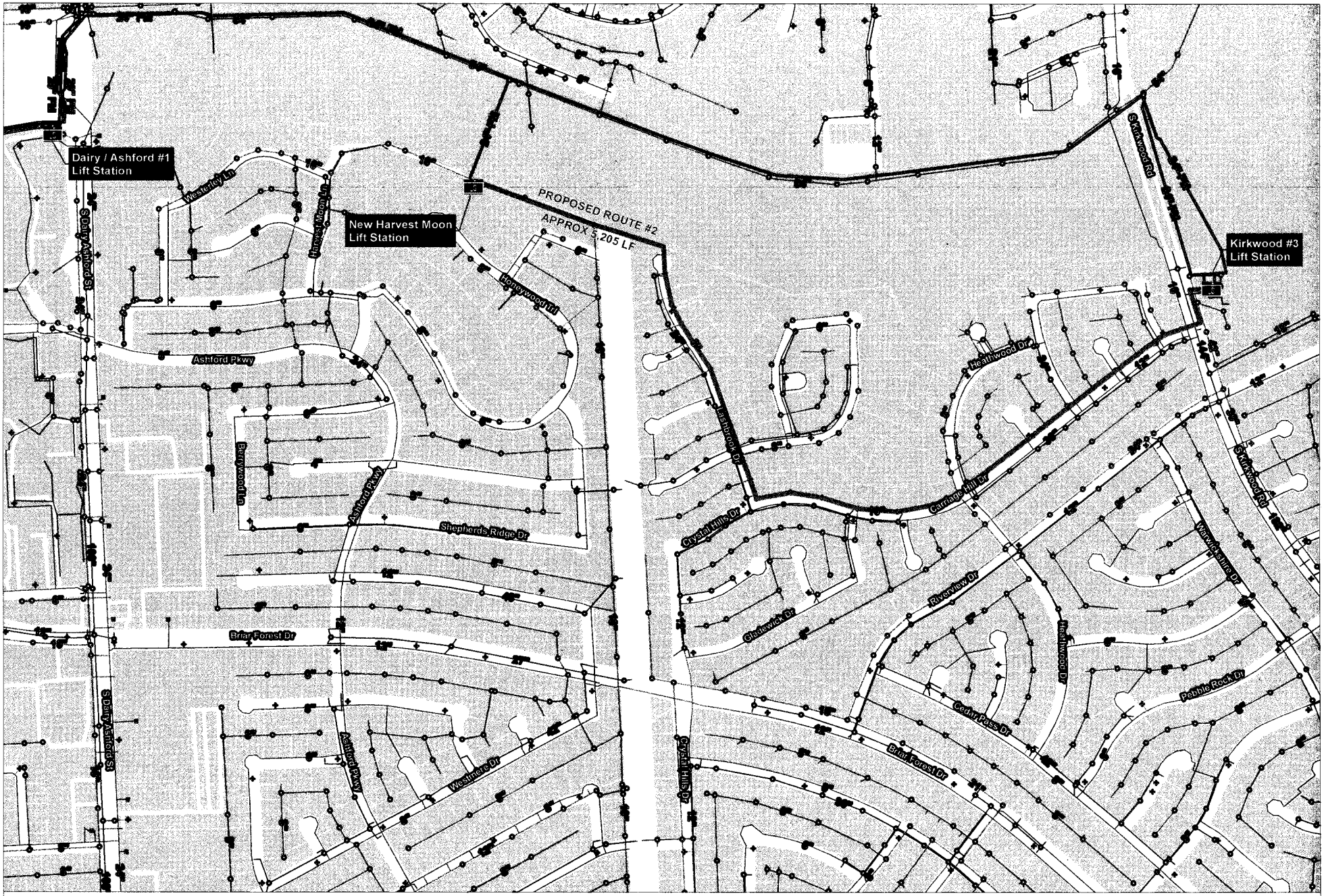
KIRKWOOD #3 LIFT STATION
DIVERSION AND ABANDONMENT

Alternative 1 - Proposed Route 1

WBS No. R-000536-0021-3

N W E S

ARCADIS
2929 Briarpark Dr, Suite 300
Houston, TX 77042
Tel: 713-953-4800 Fax: 713-977-4620
www.arcadis-us.com
Texas Registration Firm No. F-533



Legend

Proposed Relief Sewers	*Houston GIMS Wastewater*	*Houston GIMS Stormwater*	*Houston GIMS Water*
Lift Station	Existing Manhole	Existing Manhole	Existing Hydrant
Sewer Alignment	Existing Force Main	Existing Gravity Main	Existing Meter
	Existing Gravity Main		Existing Pressure Main
			Existing Lateral

RDAI Attachments A through G

0 500 1,000 1,500 Feet

CITY OF HOUSTON

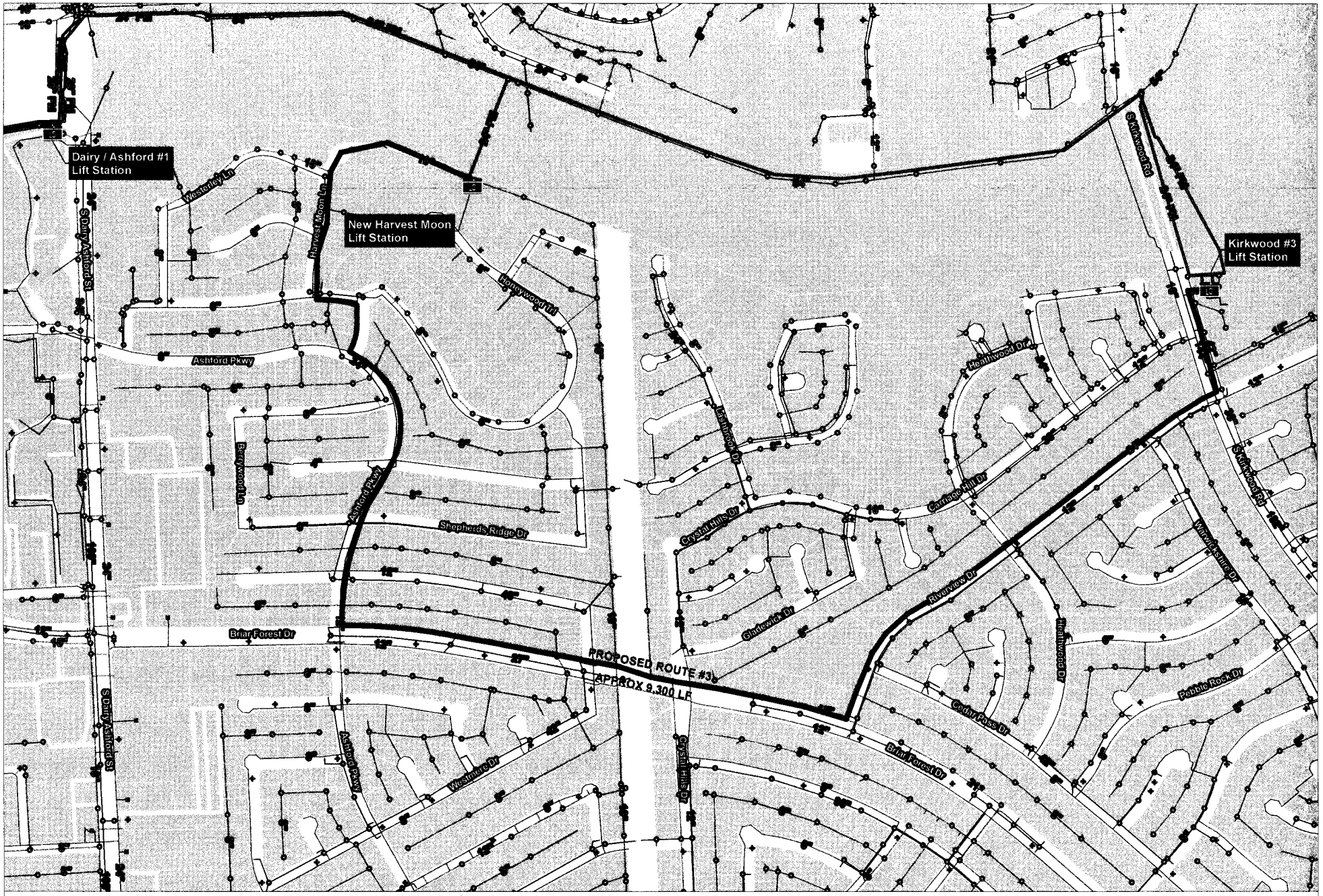
KIRKWOOD #3 LIFT STATION
DIVERSION AND ABANDONMENT

Alternative 2 - Proposed Route 2

WBS No. R-000536-0021-3

N W E S

ARCADIS
2929 Briarpark Dr, Suite 300
Houston, TX 77042
Tel: 713-953-4800 Fax: 713-977-4620
www.arcadis-us.com
Texas Registration Firm No. F-533



Legend

Proposed Relief Sewers	*Houston GIMS Wastewater*	*Houston GIMS Stormwater*	*Houston GIMS Water*
Lift Station	Existing Manhole	Existing Manhole	Existing Hydrant
Sewer Alignment	Existing Force Main	Existing Gravity Main	Existing Meter
	Existing Gravity Main		Existing Pressure Main
			Existing Lateral

RDAI Attachments A through G

0 500 1,000 1,500 Feet

CITY OF HOUSTON
KIRKWOOD #3 LIFT STATION
DIVERSION AND ABANDONMENT

Alternative 3 - Proposed Route 3

WBS No. R-000536-0021-3

N W E S

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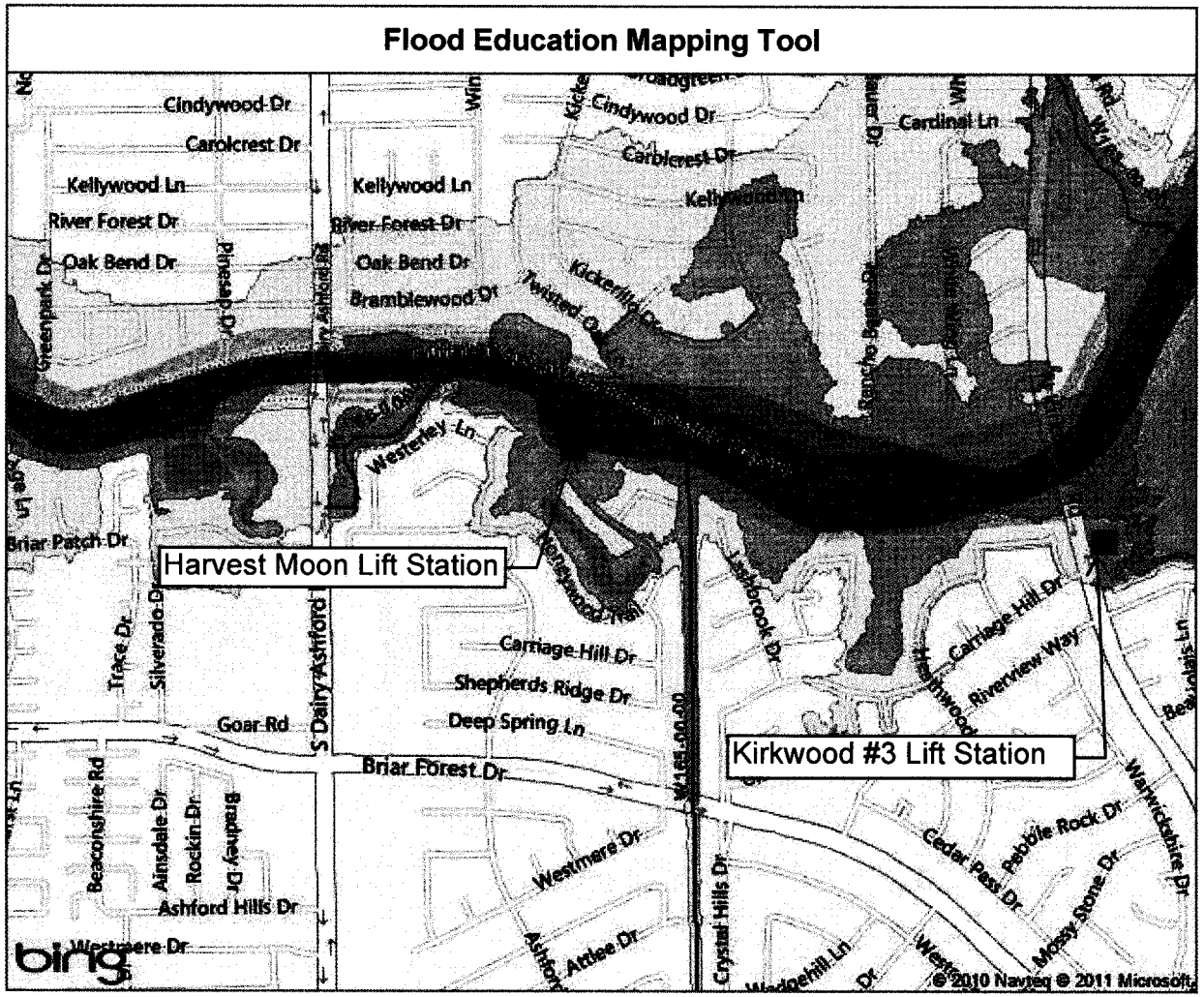
Texas Registration Firm No. F-533

Flood Education Mapping Tool



LEGEND

- Floodway
- 1% (100-year) Floodplain
- 0.2% (500-year) Floodplain
- 1% (100-year) Coastal Floodplain
- LOMR Boundary
- Open Channels
- Enclosed Channels
- Harris County Boundary

N

1 in = 1306 ft

(1 : 15674.85)

HARRIS COUNTY FLOOD CONTROL DISTRICT

DISCLAIMER: The Harris County Flood Control District's Flood Education Mapping Tool is for general information purposes only and may not be suitable for legal, engineering or surveying purposes. The floodplains shown on this mapping tool are those delineated on the Federal Emergency Management Agency's (FEMA) effective Flood Insurance Rate Map (FIRM or floodplain map) for Harris County that was adopted in 2007, as well as updates that have been made through a Letter of Map Revision (LOMR) since 2007. This mapping tool is not an effective FIRM. The effective FIRM is produced, maintained and published by FEMA and not by the Harris County Flood Control District. Please visit FEMA's Map Service Center at www.msc.fema.gov to view the effective FIRM for Harris County. For an official floodplain determination, please contact an insurance agent or mortgage lender.This map is a representation and approximation of the relative location of geographic information, land marks and physical addresses.

RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

ATTACHMENT C
DETAIL CONSTRUCTION COST ESTIMATES OF PROPOSED ALTERNATIVES

SUMMARY CONSTRUCTION COST TABLE

ARCADIS

OWNER: CITY OF HOUSTON
PROJECT: Diversion and Abandonment of Kirkwood#3 Lift Station to New Harvest Moon Lift Station
WBS NO. R-000536-0021-3

TABULATION OF ALTERNATIVES
Preliminary Engineering Report

# OF ITEMS: 58			Alternative 1 Route 1 Kirkwood #3 Relief Sewer Harvest Moon Part 2			Alternative 2 Route 2 Kirkwood #3 Relief Sewer Harvest Moon Part 2			Alternative 3 Route 3 Kirkwood #3 Relief Sewer Harvest Moon Part 2			Alternative 4 Replacement Lift Station Kirkwood #3 Lift Station		
ITEM	DESCRIPTION	UNIT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT
1	Mobilization	LS	1	$ 276,500.00	$ 276,500.00	1	$ 190,700.00	$ 190,700.00	1	$ 284,800.00	$ 284,800.00	1	$ 163,600.00	$ 163,600.00
2	Diversion Pumping (including pumping items)	LS	1	$ 120,000.00	$ 120,000.00	1	$ 133,835.00	$ 133,835.00	1	$ 5,000.00	$ 5,000.00	1	$ 25,000.00	$ 25,000.00
3	Flagmen	LS	1	$ 500.00	$ 500.00	1	$ 500.00	$ 500.00	1	$ 500.00	$ 500.00	1	$ 45,000.00	$ 45,000.00
4	Traffic Control & Regulation	LS	1	$ 98,400.00	$ 98,400.00	1	$ 260,317.00	$ 260,317.00	1	$ 35,000.00	$ 35,000.00	1	$ 25,000.00	$ 25,000.00
5	Tree and plant protection	LS	1	$ 55,000.00	$ 55,000.00	1	$ 29,414.00	$ 29,414.00	1	$ 75,000.00	$ 75,000.00	1	$ 20,000.00	$ 20,000.00
6	Inlet Protection Barrier	LF	3800	$ 7.00	$ 26,600.00	5200	$ 7.00	$ 36,400.00	9300	$ 7.00	$ 65,100.00	400	$ 7.00	$ 2,800.00
7	Sandbag barrier	LF	3800	$ 4.00	$ 15,200.00	5200	$ 7.00	$ 36,400.00	9300	$ 7.00	$ 65,100.00	400	$ 7.00	$ 2,800.00
8	Filter Fabric Fence (reinforced)	LF	304	$ 4.00	$ 1,216.00	416	$ 4.00	$ 1,664.00	744	$ 4.00	$ 2,976.00	400	$ 4.00	$ 1,600.00
9	Stabilized Construction Exit	SY	89	$ 45.00	$ 4,005.00	89	$ 29.00	$ 2,581.00	89	$ 25.00	$ 2,225.00	89	$ 20.00	$ 1,780.00
10	Site restoration	LF	3800	$ 12.00	$ 45,600.00	5200	$ 12.00	$ 62,400.00	9300	$ 12.00	$ 111,600.00	400	$ 12.00	$ 4,800.00
11	ByPass Forcemain Manhole 8 ft Diameter	LF	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	1	$ 50,000.00	$ 50,000.00
12	6-ft Dia. Precast Concrete Sanitary Manhole (Watertight & Corrosion Resistant)	EA	9	$ 25,000.00	$ 225,000.00	10	$ 25,000.00	$ 250,000.00	15	$ 25,000.00	$ 375,000.00	2	$ 25,000.00	$ 50,000.00
13	Extra depth, 6-foot diameter precast concrete manhole	VF	198	$ 450.00	$ 89,100.00	220	$ 450.00	$ 99,000.00	330	$ 450.00	$ 148,500.00	60	$ 450.00	$ 27,000.00
14	12-Inch Diameter External Drop for Manhole	Ea	1	$ 4,800.00	$ 4,800.00	1	$ 4,800.00	$ 4,800.00	0	$ -	$ -	0	$ -	$ -
15	Kirkwood #3 Lift Station - Demolition of existing lift structure, manholes, forcemains, sanitary sewer lines, all existing equipment, includes removal and disposal of miscellaneous debris and concrete, asbestos abatement and other materials from site to 4 feet below the surface and backfill area to ground surface. Salvage & Demolition of Existing Pumps, Piping, Valves, Electrical and Instrumentation Devices	LS	1	$ 120,000.00	$ 120,000.00	1	$ 120,000.00	$ 120,000.00	1	$ 120,000.00	$ 120,000.00	1	$ 120,000.00	$ 120,000.00
16	Remove & dispose of reinforced concrete pavement with or without overlay, with or with or base, all thicknesses	SY	676	$ 10.00	$ 6,760.00	925	$ 10.00	$ 9,250.00	1654	$ 10.00	$ 16,540.00	2978	$ 10.00	$ 29,780.00
17	Remove & dispose of existing manhole	EA	3	$ 5,000.00	$ 15,000.00	3	$ 5,000.00	$ 15,000.00	0	$ -	$ -	3	$ 5,000.00	$ 15,000.00
18	Clearing & Grubbing	AC	10	$ 90,000.00	$ 900,000.00	1.15	$ 90,000.00	$ 103,500.00	0	$ -	$ -	0	$ -	$ -
19	Trench Safety	LF	304	$ 1.00	$ 304.00	416	$ 1.00	$ 416.00	744	$ 1.00	$ 744.00	1	$ 25,000.00	$ 25,000.00
20	42-inch Sanitary Sewer by trenchless method	LF	3800	$ 1,200.00	$ 4,560,000.00	5200	$ 1,200.00	$ 6,240,000.00	9300	$ 1,200.00	$ 11,160,000.00	100	$ 2,200.00	$ 220,000.00
21	Recycled crushed concrete base course, 7-inch thick	TON	24	$ 45.00	$ 1,080.00	33	$ 45.00	$ 1,485.00	58	$ 45.00	$ 2,610.00	980	$ 45.00	$ 44,100.00
22	7-inch thick reinforced concrete pavement	SY	676	$ 90.00	$ 60,840.00	925	$ 129.00	$ 119,325.00	1654	$ 90.00	$ 148,860.00	2800	$ 90.00	$ 252,000.00
23	Concrete driveway including excavation 7-inch deep	SF	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	600	$ 25.00	$ 15,000.00
24	Concrete Sidewalk, 4 1/2-inch thick, 5 feet wide	SF	750	$ 25.00	$ 18,750.00	650	$ 25.00	$ 16,250.00	650	$ 25.00	$ 16,250.00	650	$ 25.00	$ 16,250.00
25	6-foot High Chain-Link Fence with 3-strand barb wire with PVC Slats	LF	100	$ 50.00	$ 5,000.00	100	$ 50.00	$ 5,000.00	0	$ -	$ -	720	$ 50.00	$ 36,000.00
26	4-foot Wide Chain-link Personnel Gate	EA	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	1	$ 1,000.00	$ 1,000.00
27	Double-Swing Wooden Gate 16' Wide	EA	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	1	$ 2,500.00	$ 2,500.00
28	Surge Proctection Valves and assoicated piping	EA	2	$ 24,000.00	$ 48,000.00	2	$ 24,000.00	$ 48,000.00	2	$ 24,000.00	$ 48,000.00	2	$ 24,000.00	$ 48,000.00
29	Stormwater Crossing Features (HCFCD)	LF	1800	$ 2,500.00	$ 4,500,000.00	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
30	Tree Migration HCFCD ROW	LS	1	$ 300,000.00	$ 300,000.00	1	$ 30,000.00	$ 30,000.00	0	$ -	$ -	0	$ -	$ -
31	Floodplain Migration - HCFCD ROW	LS	1	$ 100,000.00	$ 100,000.00	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -
32	Temproary Measures - HCFCD ROW	LS	1	$ 500,000.00	$ 500,000.00	1	$ 50,000.00	$ 50,000.00	0	$ 1,500.00	$ -	0	$ -	$ -
33	Sodding	SY	23333	$ 6.00	$ 140,000.00	3889	$ 5.00	$ 19,444.44	0	$ 4.00	$ -	0	$ -	$ -
34	Kirkwood #3 Lift Station Items: Supply and installation of five wet-well submersible pumps, cooling jackets, wet well discharge piping and brackets inside and outside of wet well, piping supports, all plug valves, check valves, air release valves, surge relief valve, valve and pipe supports, including any fittings, brackets, connections and any other miscellaneous accessories and appurtenances necessary for the operation of the lift stations	LS	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	1	$ 1,200,000.00	$ 1,200,000.00
35	Kirkwood #3 Lift Station - Supply and install Lift Station Control System, including but not limited to SCADA software engineering security and quality requirements, Primary instructmentation devices, control cabinet enclosures,power equipment, electrical and instrumentation system with devices, conduits, connections, boxes, enclosures, power poles, light pole and relocation of existing electrical utilities as needed, cathodic protection system, or any other miscellaneous accessories and appurtenances necessary for the operation of the lift station.	LS	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	1	$ 1,000,000.00	$ 1,000,000.00

SUMMARY CONSTRUCTION COST TABLE

ARCADIS

OWNER: CITY OF HOUSTON
PROJECT: Diversion and Abandonment of Kirkwood#3 Lift Station to New Harvest Moon Lift Station
WBS NO. R-000536-0021-3

TABULATION OF ALTERNATIVES
Preliminary Engineering Report

 # OF ITEMS: 58

			Alternative 1 Route 1 Kirkwood #3 Relief Sewer Harvest Moon Part 2			Alternative 2 Route 2 Kirkwood #3 Relief Sewer Harvest Moon Part 2			Alternative 3 Route 3 Kirkwood #3 Relief Sewer Harvest Moon Part 2			Alternative 4 Replacement Lift Station Kirkwood #3 Lift Station		
ITEM	DESCRIPTION	UNIT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT
36	Kirkwood #3 LS Electrical & Control Bldg complete including foundation.	LS	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	1	$ 371,000.00	$ 371,000.00
37	Kirkwood #3 Lift Station Structure by Cassion: Concrete structure and assoicated items for wetwell and valve vault including but not limited to excavation and backfill, new concrete, wet well hatches, fiberglass grating, force main and drain line connections; wet well ventilation piping with bird screen, grating, including miscellaneous accessories and appurtenances.	LS	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	1	$ 3,894,000.00	$ 3,894,000.00
38	Kirkwood #3 Lift Station - Odor Control Equipment, including tanks, pumps, I&C, secondary containment, and miscellenous items	LS	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	1	$ 300,000.00	$ 300,000.00
39	Install wet well protective liner	SF	0	$ -	$ -	0	$ -	$ -	0	$ -	$ -	5820	$ 35.00	$ 203,700.00
40	Harvest Moon Lift Station Items: Supply and installation of three wet-well submersible pumps, cooling jackets, wet well discharge piping and brackets inside and outside of wet well, piping supports, all plug valves, check valves, air release valves, surge relief valve, valve and pipe supports, including any fittings, brackets, connections and any other miscellaneous accessories and appurtenances necessary for the operation of the lift stations	LS	1	$ 800,000.00	$ 800,000.00	1	$ 800,000.00	$ 800,000.00	1	$ 800,000.00	$ 800,000.00	0	$ -	$ -
41	Harvest Moon Lift Station - Supply and install Lift Station Control System, including but not limited to SCADA software engineering security and quality requirements, Primary instructmentation devices, control cabinet enclosures,power equipment, electrical and instrumentation system with devices, conduits, connections, boxes, enclosures, power poles, light pole and relocation of existing electrical utilities as needed, cathodic protection system, or any other miscellaneous accessories and appurtenances necessary for the operation of the lift station.	LS	1	$ 916,896.00	$ 916,896.00	1	$ 916,896.00	$ 916,896.00	1	$ 916,896.00	$ 916,896.00	0	$ -	$ -
42	Extra hand excavation around obstructions	CY	50	$17.00	$ 850.00	50	$17.00	$ 850.00	50	$17.00	$ 850.00	50	$ 17.00	$ 850.00
43	Extra excavations around obstructions	CY	100	$30.00	$ 3,000.00	100	$30.00	$ 3,000.00	100	$30.00	$ 3,000.00	100	$ 30.00	$ 3,000.00
44	Extra machine excavation	CY	1000	$30.00	$ 30,000.00	1000	$30.00	$ 30,000.00	1000	$30.00	$ 30,000.00	1000	$ 30.00	$ 30,000.00
45	Extra replacement of backfill material	CY	1000	$6.00	$ 6,000.00	1000	$6.00	$ 6,000.00	1000	$6.00	$ 6,000.00	1000	$ 6.00	$ 6,000.00
46	Extra cement stabilized sand backfill	CY	50	$28.00	$ 1,400.00	50	$28.00	$ 1,400.00	50	$28.00	$ 1,400.00	50	$ 28.00	$ 1,400.00
47	Extra Ductile Iron Compact Fittings In Place	TON	1.5	$1,700.00	$ 2,550.00	1.5	$1,700.00	$ 2,550.00	1.5	$1,700.00	$ 2,550.00	1.5	$ 1,700.00	$ 2,550.00
48	Cement Stabilized Sand in Lieu of Lime	SY	350	$12.00	$ 4,200.00	350	$12.00	$ 4,200.00	350	$12.00	$ 4,200.00	350	$ 12.00	$ 4,200.00
49	Extra Class "A" concrete installed in place for structures	CY	5	$400.00	$ 2,000.00	5	$400.00	$ 2,000.00	5	$400.00	$ 2,000.00	5	$ 400.00	$ 2,000.00
50	Extra Grade 60 reinforcing steel in place	LB	2000	$1.00	$ 2,000.00	2000	$1.00	$ 2,000.00	2000	$1.00	$ 2,000.00	2000	$ 1.00	$ 2,000.00
51	Building Permit Allowance	EA	1	$20,000.00	$ 20,000.00	1	$20,000.00	$ 20,000.00	1	$20,000.00	$ 20,000.00	1	$ 20,000.00	$ 20,000.00
52	Lane Closure Permit Fee	EA	1	$1,000.00	$ 1,000.00	1	$1,000.00	$ 1,000.00	1	$1,000.00	$ 1,000.00	1	$ 1,000.00	$ 1,000.00
53	Street Cut Permit	EA	1	$1,000.00	$ 1,000.00	1	$1,000.00	$ 1,000.00	1	$1,000.00	$ 1,000.00	1	$ 1,000.00	$ 1,000.00
54	Utility Reimbursement	EA	1	$25,000.00	$ 25,000.00	1	$25,000.00	$ 25,000.00	1	$25,000.00	$ 25,000.00	1	$ 25,000.00	$ 25,000.00
55	Demolition Permit	EA	1	$10,000.00	$ 10,000.00	1	$10,000.00	$ 10,000.00	1	$10,000.00	$ 10,000.00	1	$ 10,000.00	$ 10,000.00
56	Floodplain Management Development Permit	EA	1	$10,000.00	$ 10,000.00	1	$10,000.00	$ 10,000.00	1	$10,000.00	$ 10,000.00	1	$ 10,000.00	$ 10,000.00
57	HCFCD Permit	EA	1	$150.00	$ 150.00	1	$150.00	$ 150.00	1	$150.00	$ 150.00	1	$ 150.00	$ 150.00
58	Miscellenous Items	EA	1	$25,000.00	$ 25,000.00		$25,000.00	$ -		$25,000.00	$ -	1	$ 250,000.00	$ 250,000.00
		Total			**$ 14,098,701.00**			**$ 9,721,727.44**			**$ 14,519,851.00**			**$ 8,581,860.00**

RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

ATTACHMENT D
SELECTED ALTERNATIVE AND RELATED CONSTRUCTION COST ESTIMATE

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Summary Table for Sanitary Sewer and Storm Water Culverts under "gravity flow"

Based Mannings Formula (See Calculation NO. 1 for Typical calculation)
English Units

COH design guidelines:

Velocity for SAN SWR min 2.3 fps..max 4.5 cfs for sewers 27" DIA or smaller
Velocity for SAN SWR min 3.0 fps.. for sewers greater than 27" DIA
Velocity for STR SWR min 3.90 fps ... max 8 fps

input value or selection based on design into applicable cells shown above.

			Input parameters based on design and Calculated values													
			Manning's coefficent	Hydraulic Radius	energy slope (head loss)	Invert elevation upstream	Invert elevation downstream	Pipe Run	Diameter of Pipe	Diameter of Pipe	Cross-sectional Area of Pipe	wetted perimeter	Velocity	Flow (max capacity)	Flow (max capacity)	Flow (max capacity)	
Type	Description of Pipe Segment ID	Parameter	n	R_h	S	H_1	H_2	L	D	D	A	P	V	Q	Q	Q	
		Units	unitless	ft	unitless	ft-msl	ft-msl	ft	in	ft	sq.ft	ft	fps	cfs	gpm	mgd	
Overall Route #1 - Kirkwood LS Relief Sewer To the New Harvest Moon Lift Station																	
SAN SWR	Proposed Manhole #1 @ N Kirkwood Road To New Harvest Moon Lift Station		0.013	0.875	0.0008	43.6	40.7	3722	42	3.5	9.6211	10.996	3.026	29.114	13067	19	Checks Out!!
Overall Route #2 - Kirkwood LS Relief Sewer To the New Harvest Moon Lift Station																	
SAN SWR	Proposed Manhole #1 @ N Kirkwood Road To New Harvest Moon Lift Station		0.013	0.875	0.0009	45.1	40.7	5141	42	3.5	9.6211	10.996	3.067	29.513	13246	19	Checks Out!!
Overall Route #3 - Kirkwood LS Relief Sewer To the New Harvest Moon Lift Station																	
SAN SWR	Proposed Manhole #1 @ N Kirkwood Road To New Harvest Moon Lift Station		0.013	0.875	0.0008	48.5	40.7	9281	42	3.5	9.6211	10.996	3.040	29.245	13126	19	Checks Out!!

Based on the calculations above, the maximum flow capacity of the proposed 42" sewer line is 19 MGD which is greater than 12.5 MGD, the peak wet weather flow @ Kirkwood #3 Lift Station (Refer attachment A)

ATTACHMENT A

From: Nagorski, Edward
Sent: Wednesday, August 27, 2014 3:59 PM
To: Patel, Poolkeshi
Subject: FW: Requesting ADF and PWWF flows for Dairy Ashford #1 LS and Kirkwood #3 Lift Station

---

From: Austin, Jeremy - PWE [mailto:Jeremy.Austin@houstontx.gov]
Sent: Thursday, May 24, 2012 4:26 PM
To: Nagorski, Edward
Subject: FW: Requesting ADF and PWWF flows for Dairy Ashford #1 LS and Kirkwood #3 Lift Station

---

From: Vu, Tim - PWE
Sent: Thursday, May 24, 2012 4:26 PM
To: Austin, Jeremy - PWE
Cc: Malla, Rajesh - PWE
Subject: RE: Requesting ADF and PWWF flows for Dairy Ashford #1 LS and Kirkwood #3 Lift Station

Jeremy,

Here are the design flows for the requested lift stations:

Dairy Ashford #1 LS: ADF = 0.65 mgd, PWWF = 4.3 mgd
Kirkwood #3 LS: ADF = 1.8 mgd, PWWF = 12.5 mgd

From: Austin, Jeremy - PWE
Sent: Thursday, May 24, 2012 8:41 AM
To: Vu, Tim - PWE
Cc: Malla, Rajesh - PWE; Jilani, Nooreen - PWE
Subject: FW: Requesting ADF and PWWF flows for Dairy Ashford #1 LS and Kirkwood #3 Lift Station

Please send us this information today, if possible. Thanks.

From: Nagorski, Edward [mailto:Edward.Nagorski@arcadis-us.com]
Sent: Wednesday, May 23, 2012 4:17 PM
To: Austin, Jeremy - PWE
Cc: Quiroz, Edward
Subject: Requesting ADF and PWWF flows for Dairy Ashford #1 LS and Kirkwood #3 Lift Station

Jeremy,

Please send a request to Tim Vu in regards to computing Average Daily Flows and Peak Wet Weather Flows for Dairy Ashford #1 Lift Station and Kirkwood #3 Lift stations. We need this due to Harvest Moon Lift Station's 12" Force Main connects into the 24" Force Main that begins at Kirkwood #3 Lift Station and ends at Dairy Ashford #1 Lift Station

Edward L. Nagorski, PE | Civil Engineer | edward.nagorski@arcadis-us.com

OWNER: CITY OF HOUSTON
PROJECT: Diversion and Abandonment of Kirkwood#3 Lift Station to New Harvest Moon Lift Station
WBS NO. R-000536-0021-3

# OF ITEMS: 48			Alternative 2 Route 2 Kirkwood #3 Relief Sewer Harvest Moon Part 2		
ITEM	DESCRIPTION	UNIT	TOTAL APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT
1	Mobilization	LS	1	$ 190,700.00	$ 190,700.00
2	Diversion Pumping (including pumping items)	LS	1	$ 133,835.00	$ 133,835.00
3	Flagmen	LS	1	$ 500.00	$ 500.00
4	Traffic Control & Regulation	LS	1	$ 260,317.00	$ 260,317.00
5	Tree and plant protection	LS	1	$ 29,414.00	$ 29,414.00
6	Inlet Protection Barrier	LF	5200	$ 7.00	$ 36,400.00
7	Sandbag barrier	LF	5200	$ 7.00	$ 36,400.00
8	Filter Fabric Fence (reinforced)	LF	416	$ 4.00	$ 1,664.00
9	Stabilized Construction Exit	SY	89	$ 29.00	$ 2,581.00
10	Site restoration	LF	5200	$ 12.00	$ 62,400.00
11	6-ft Dia. Precast Concrete Sanitary Manhole (Watertight & Corrosion Resistant)	EA	10	$ 25,000.00	$ 250,000.00
12	Extra depth, 6-foot diameter precast concrete manhole	VF	220	$ 450.00	$ 99,000.00
13	12-Inch Diameter External Drop for Manhole	Ea	1	$ 4,800.00	$ 4,800.00
14	Kirkwood #3 Lift Station - Demolition of existing lift structure, manholes, forcemains, sanitary sewer lines, all existing equipment, includes removal and disposal of miscellaneous debris and concrete, asbestos abatement and other materials from site to 4 feet below the surface and backfill area to ground surface. Salvage & Demolition of Existing Pumps, Piping, Valves, Electrical and Instrumentation Devices	LS	1	$ 120,000.00	$ 120,000.00
15	Remove & dispose of reinforced concrete pavement with or without overlay, with or with or base, all thicknesses	SY	925	$ 10.00	$ 9,250.00
16	Remove & dispose of existing manhole	EA	3	$ 5,000.00	$ 15,000.00
17	Clearing & Grubbing	AC	1.15	$ 90,000.00	$ 103,305.79
18	Trench Safety	LF	416	$ 1.00	$ 416.00
19	42-inch Sanitary Sewer by trenchless method	LF	5200	$ 1,200.00	$ 6,240,000.00
20	Recycled crushed concrete base course, 7-inch thick	TON	33	$ 45.00	$ 1,485.00
21	7-inch thick reinforced concrete pavement	SY	925	$ 129.00	$ 119,325.00
22	Concrete driveway including excavation 7-inch deep	SF	0	$ -	$ -
23	Concrete Sidewalk, 4 1/2-inch thick, 5 feet wide	SF	650	$ 25.00	$ 16,250.00
24	6-foot High Chain-Link Fence with 3-strand barb wire with PVC Slats	LF	100	$ 50.00	$ 5,000.00
25	Surge Proctection Valves and assoicated piping	EA	2	$ 24,000.00	$ 48,000.00
26	Stormwater Crossing Features (HCFCD)	LF	0	$ -	$ -
27	Tree Migration HCFCD ROW	LS	1	$ 30,000.00	$ 30,000.00
28	Floodplain Migration - HCFCD ROW	LS	0	$ -	$ -
29	Temproary Measures - HCFCD ROW	LS	1	$ 50,000.00	$ 50,000.00
30	Sodding	SY	3889	$ 5.00	$ 19,444.44
31	Harvest Moon Lift Station Items: Supply and installation of three wet-well submersible pumps, cooling jackets, wet well discharge piping and brackets inside and outside of wet well, piping supports, all plug valves, check valves, air release valves, surge relief valve, valve and pipe supports, including any fittings, brackets, connections and any other miscellaneous accessories and appurtenances necessary for the operation of the lift stations	LS	1	$ 800,000.00	$ 800,000.00

OWNER: CITY OF HOUSTON
PROJECT: Diversion and Abandonment of Kirkwood#3 Lift Station to New Harvest Moon Lift Station
WBS NO. R-000536-0021-3

# OF ITEMS: 48			Alternative 2 Route 2 Kirkwood #3 Relief Sewer Harvest Moon Part 2		
			TOTAL		
ITEM	DESCRIPTION	UNIT	APPROX. QUAN.	UNIT PRICE	TOTAL AMOUNT
32	Harvest Moon Lift Station - Supply and install Lift Station Control System, including but not limited to SCADA software engineering security and quality requirements, Primary instructmentation devices, control cabinet enclosures,power equipment, electrical and instrumentation system with devices, conduits, connections, boxes, enclosures, power poles, light pole and relocation of existing electrical utilities as needed, cathodic protection system, or any other miscellaneous accessories and appurtenances necessary for the operation of the lift station.	LS	1	$ 916,896.00	$ 916,896.00
33	Extra hand excavation around obstructions	CY	50	$17.00	$ 850.00
34	Extra excavations around obstructions	CY	100	$30.00	$ 3,000.00
35	Extra machine excavation	CY	1000	$30.00	$ 30,000.00
36	Extra replacement of backfill material	CY	1000	$6.00	$ 6,000.00
37	Extra cement stabilized sand backfill	CY	50	$28.00	$ 1,400.00
38	Extra Ductile Iron Compact Fittings In Place	TON	1.5	$1,700.00	$ 2,550.00
39	Cement Stabilized Sand in Lieu of Lime	SY	350	$12.00	$ 4,200.00
40	Extra Class "A" concrete installed in place for structures	CY	5	$400.00	$ 2,000.00
41	Extra Grade 60 reinforcing steel in place	LB	2000	$1.00	$ 2,000.00
42	Building Permit Allowance	EA	1	$20,000.00	$ 20,000.00
43	Lane Closure Permit Fee	EA	1	$1,000.00	$ 1,000.00
44	Street Cut Permit	EA	1	$1,000.00	$ 1,000.00
45	Utility Reimbursement	EA	1	$25,000.00	$ 25,000.00
46	Demolition Permit	EA	1	$10,000.00	$ 10,000.00
47	Floodplain Management Development Permit	EA	1	$10,000.00	$ 10,000.00
48	HCFCD Permit	EA	1	$150.00	$ 150.00
		Total			**$ 9,721,533.00**

RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

ATTACHMENT E
COPY OF TRC PRESENTATION

Diversion & Abandonment of Kirkwood #3 Lift Station
To New Harvest Moon Lift Station
WBS No. R-000536-0021-3

Imagine the result

WBS No. R-000536-0021-3
February 5, 2015

ARCADIS

INTRODUCTIONS PRESENTERS AND ATTENDEES

City of Houston

-Tanu Hiremath, P.E., CFM

Engineering Consultant

ARCADIS U.S., Inc.
2929 Briarpark Dr, Suite 300
Houston, Texas 77042
TX Engineering Firm # F-533

- Edward Quiroz, P.E., CPM
- Jonathan Howard, P.E.
- David Ridgway, P.E.
- Poolkeshi Patel, E.I.T.

Imagine the result

WBS No. R-000536-0021-3
February 5, 2015

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Outline of Presentation

- Introductions Presenters/Attendees
- Brief Health and Safety Moment
- Project Area and Mission Statement
- Existing Conditions – Kirkwood #3 Lift Station
- Statement of Problems – Kirkwood #3 Lift Station
- Review Alternatives
  - 3 elimination options, 1 – replacement option
- Review Selection/Recommendation Process
- Summary of Recommendations
- Closing (Comments/Questions)

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WBS No. R-000536-0021-3
February 05, 2015

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Health and Safety Moment

Sharing the Road with Trucks

- Stay out of blind spots. Even with mirrors, a truck driver will still have blind spots
- When driving beside a truck, drive on past, or back off
- When passing a truck, stay to the left side where the blind spot is smaller
- Never follow a truck too closely at high speeds. Allow extra distance that permits you to see traffic in front of the truck
- If a truck is following you too closely, move to another traffic lane
- Use caution when passing a truck. Do not pull back into the truck's lane until you can see its headlights in your rear view mirror
- Trucks need extra time to stop. Loaded tractor-trailers or semi trucks need as much as 100 yards -- the length of a football field -- to come to a complete stop

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February 05, 2015

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Project Area and Mission Statement

Project Location

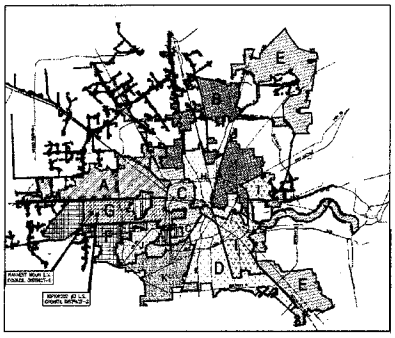
Council District G
Lift Stations under Contract

Kirkwood #3 Lift Station (FN 340)

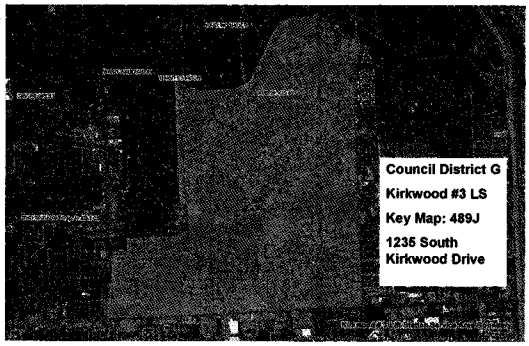
Key Map: 489J

Harvest Moon Lift Station (FN 236)

Key Map: 488M



Kirkwood #3 Lift Station (FN 340) Location Map



Mission Statement/Scope of Work

Provide evaluation of consolidation plan to eliminate Kirkwood #3 Lift Station to new Harvest Moon Lift Station via 42-inch relief sewer along Buffalo Bayou. Evaluate other viable alternatives based on the life cycle cost analysis. Scope included the following alternatives.

- Evaluation of three routes for elimination;
- Evaluation of replacement option.

Included detail review and assessment of existing conditions, hydraulics, real estate, easements, alignments, construction costs, life-cycle costs, constructability, sustainability, community impacts/opposition.

EXISTING CONDITIONS
Kirkwood #3 Lift Station (FN 340)

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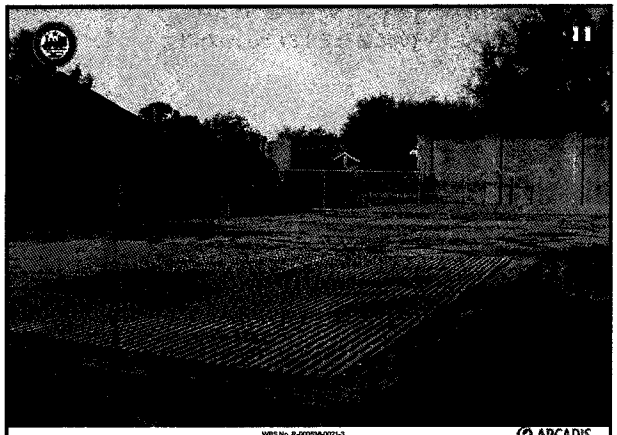

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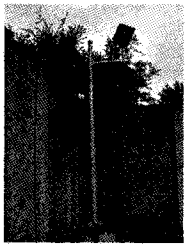
Kirkwood #3 Lift Station (FN 340)
Existing Conditions

Lift Station Wet Well Structure

- Average Daily Flow (ADF) = 1.8 MGD (1,250 GPM)
- 2-year Peak Wet Weather Flow (PWWF) Firm Capacity = 12.5 MGD or 8,681 GPM
- Peaking Factor (PF) = 6.94
- Wet Well Diameter = 25 feet

Pumps and Force Main

- Five submersible pumps (Fairbanks Morse) :
- Two dry weather pumps (not working)
  - 1,330/2,580 gpm (individual/parallel) Motors = 35 HP/1170 rpm
- Three wet weather pumps (2+1)
  - 4,320/9,300 gpm (individual/Firm) Motors = 60 HP/ 875 rpm
- Two force mains :
  - 14" force main pumping dry weather flow
  - 24" force main pumping wet weather flow
  - Flow sent to Turkey Creek WWTP with option to route to West District WWTP



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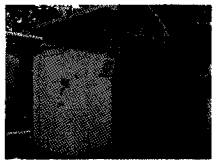
Kirkwood #3 Lift Station (FN 340)
Existing Conditions

- Lift station located outside the 100-year but inside 500-year flood plain
- 15" air vent for the wet well in good condition
- Site has an existing potable water supply connection
- Site has ferrous sulfate chemical feed system for odor control (not working)
- Wet well structure and protective coating in fair condition
- Wet well safety net/grating missing
- Site pavement in good condition
- Access driveway in good condition
- Minimal exterior lighting
- Lift Station and Force Main ≈18 years old



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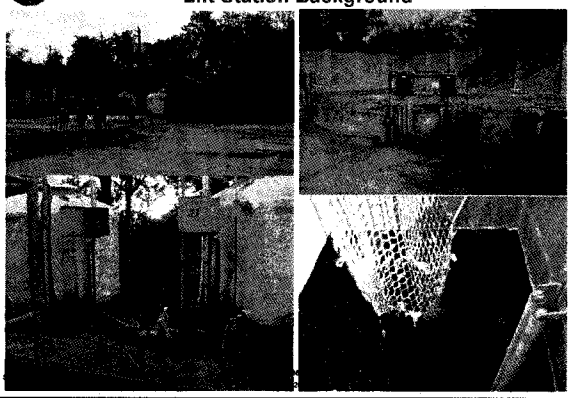
Kirkwood #3 Lift Station (FN 340)
Lift Station Background



STATEMENT OF PROBLEMS

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Kirkwood #3 Lift Station (FN 340)
Statement of Problems

- Control Bldg/Electrical not 1-foot above 500-year flood elevation
- Odor control equipment (i.e., ferrous sulfate chemical feed system) not in working order
- Safety grating/netting missing at wet well hatches
- Exterior lighting is inadequate (Single Yard Light for entire site)
- Two (2) SSOs within past 12 months from lift station due to electrical failures.
- Missing emergency provisions:
  - quick-connect mechanism or transfer switch - 30 §TAC §217.63(a)
- Wet well structure is not compliant with current TCEQ rules as follows:
  - Invert of gravity pipe not above liquid level of pump(s) "on" settings – 30 §TAC 217.60(b)(4)
  - Wet well volume too small – 30 TAC §217.60(b)(8)
  - 15" dia passive wet well vent undersized – 30 §TAC 217 (d)(1)(C)
  - Slope wet well floor (not >10% Slope) - 30 §TAC 217 (C)(e)(1)
  - Missing anti-vortex baffling (LS > 5 MGD) - 30 §TAC 217 (C)(e)(3)

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ALTERNATIVES

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Evaluation of Alternatives for Kirkwood #3 Lift Station

- **Alternative 1:** Lift Station Elimination by Route 1 (along Buffalo Bayou)
- **Alternative 2:** Lift Station Elimination by Route 2 (along Residential streets & Buffalo Bayou)
- **Alternative 3:** Lift Station Elimination by Route 3 (along major and minor thoroughfares)
- **Alternative 4:** Lift Station Replacement @ Existing Site Location

Rehabilitation was not considered as existing lift station wet well structure is non-compliant with TCEQ rules that can not be corrected via rehabilitation techniques.

Kirkwood #3 Lift Station (FN 340) Elimination Alternative 1

- Demolish existing Kirkwood #3 Lift Station, remove all structures to 4-feet below ground surface, including electrical service pole, pavements and restore the area
- Demolish and remove fence along Kirkwood drive
- Cut, plug and abandon existing 14-inch and 24-inch diameter force main
- Install approximately 3,730 L.F. of 42" diameter FRP, clay, and/or concrete sewer pipe
- Install minimum 6-foot diameter manholes (approximately 8 MHs) as needed along sewer route

Proposed Relief Sewer

- Capacity: 19 MGD (13,070 gpm)
- Size: 42-inch Internal Diameter
- Velocity > 3 fps
- Length: 3,730 L.F. (approx.)
- Material: FRP, Clay and/or Concrete
- Max. Depth: 34 feet (average)
- Method of Construction: Trenchless by Micro tunneling

Probable "Permits/Coordination"

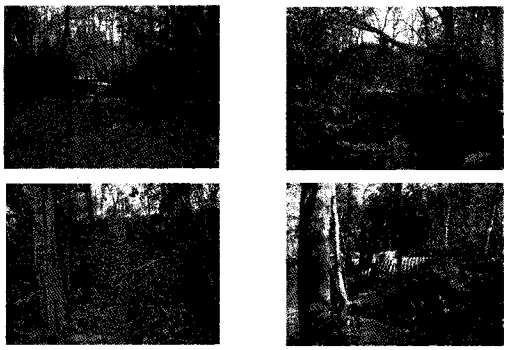
- Lane Closure Permit
- Pavement Cut Permit
- Coordination with Private Utilities (AT&T, Centerpoint, etc.)
- Coordination with HCFCD & USACE

Probable "Additional Services"

- Phase I ESA
- Topographical Survey
- Easement Survey
- Geotechnical
- Tree Protection Plan
- Traffic Control Plan
- SWPPP
- Reproduction Services

Kirkwood #3 Lift Station (FN 340) Elimination Alternative/ Route 1

Kirkwood #3 Lift Station (FN 340) Alternative Route 1



Kirkwood #3 Lift Station (FN 340)
Elimination Alternative 2

- **Demolish existing Kirkwood #3 Lift Station, remove all structures to 4-feet below ground surface, including electrical service pole, pavements and restore the area**
- **Demolish and remove fence along Kirkwood drive**
- **Cut plug and abandon existing 14-inch and 24-inch diameter force main**
- **Install approximately 5,200 L.F. of 42" diameter FRP, clay, and/or concrete sewer pipe**
- **Install minimum 6-foot diameter manholes as needed along sewer route**

Proposed Relief Sewer

- Capacity: 19 MGD (13,070 gpm)
- Size: 42-inch Internal Diameter
- Velocity > 3 fps
- Length: 5,200 L.F. (approx.)
- Material: FRP, Clay and/or Concrete
- Method of Construction: Trenchless by Micro tunneling

Probable "Additional Services"

- Phase I ESA
- Topographical Survey
- Easement Survey
- Geotechnical
- Tree Protection Plan
- Traffic Control Plan
- SWPPP
- Reproduction Services

Probable "Permits/Coordination"

- Lane Closure Permit
- Pavement Cut Permit
- Coordination with Private Utilities (AT&T, Centerpoint, etc.)
- Coordination with HCFCD & USACE

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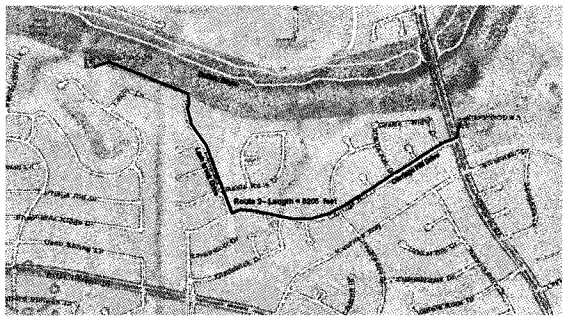
Kirkwood #3 Lift Station (FN 340)
Elimination Alternative/ Route 2



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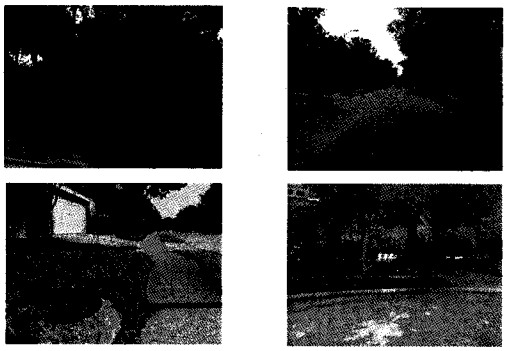
Kirkwood #3 Lift Station (FN 340)
Alternative Route 2



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Kirkwood #3 Lift Station (FN 340)
Elimination Alternative 3

- **Demolish existing Kirkwood #3 Lift Station, remove all structures to 4-feet below ground surface, including electrical service pole, pavements and restore the area**
- **Demolish and remove fence along Kirkwood drive**
- **Cut plug and abandon existing 14-inch and 24-inch diameter force main**
- **Install approximately 9,300 L.F. of 42" diameter FRP, clay, and/or concrete sewer pipe**
- **Install minimum 6-foot diameter manholes as needed along sewer route**

Proposed Relief Sewer

- Capacity: 19 MGD (13,070 gpm)
- Size: 42-inch Internal Diameter
- Velocity > 3 fps
- Length: 9,300 L.F. (approx.)
- Material: FRP, Clay and/or Concrete
- Method of Construction: Trenchless by Micro tunneling

Probable "Additional Services"

- Phase I ESA
- Topographical Survey
- Geotechnical
- Tree Protection Plan
- Traffic Control Plan
- SWPPP
- Reproduction Services

Probable "Permits/Coordination"

- Lane Closure Permit
- Pavement Cut Permit
- Coordination with Private Utilities (AT&T, Centerpoint, etc.)

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Kirkwood #3 Lift Station (FN 340) Elimination Alternative/ Route 3

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Kirkwood #3 Lift Station (FN 340) Replacement Alternative 4

Probable "Additional Services"

- Geotechnical
- Topographic Survey
- SWPPP
- Reproduction Services

Probable "Permits/Coordination"

- Coordination with Private Utilities (AT&T, Centerpoint, etc.)

- New submersible pump lift station structure sized to eliminate surcharging of collection system for 12.5 MGD capacity
- Existing lift station will continue to operate while replacement is constructed
- Odor Control equipment will be replaced
- New Control Building will be set above 500-yr flood elevation
- Design lift station structure and all accessories per standard guideline "J" Series lift station (3+1)
- Line lift station wet well concrete with protective coating
- Abandon In-place 14-inch diameter force main from Harvest Moon LS
- Abandon In-place 14-inch diameter dry-weather force main from Kirkwood #3 LS to West District WWTP

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Review Selection / Recommendation Process

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Kirkwood #3 LS (FN 340) Life-Cycle Cost Benefit Analysis (50 years)

KIRKWOOD #3 ELIMINATION LIFE CYCLE ANALYSIS

OPTION 1 - Route 1 Along Buffalo Bayou HCFCD ROW
Elimination of Kirkwood#3 and Built-out of Harvest Moon Lift Station.

	CONSTRUCTION COST[1]	O&M COST (50YR)	RENEWAL COST[2]	REPLACEMENT COST[3]	SUBTOTAL
Elimination and 42" Relief Sewer for Kirkwood #3 LS with built out of Harvest Moon LS	$ 14,098,701	$ 59,000	$ -	$ -	$ 14,157,701
	$ 14,098,701	$ 59,000	$ -	$ -	
				Grand Total	$ 14,158,000

OPTION 2 - Route 2 Along COH ROW with minor route along Buffalo Bayou HCFCD ROW
Elimination of Kirkwood#3 and Built-out of Harvest Moon Lift Station.

	CONSTRUCTION COST[1]	O&M COST (50YR)	RENEWAL COST[2]	REPLACEMENT COST[3]	SUBTOTAL
Elimination and 42" Relief Sewer for Kirkwood #3 LS with built out of Harvest Moon LS	$ 9,721,533	$ 88,000	$ -	$ -	$ 9,801,533
	$ 9,721,533	$ 88,000	$ -	$ -	
				Grand Total	$ 9,802,000

OPTION 3 - Route 3 Along COH ROW
Elimination of Kirkwood#3 and Built-out of Harvest Moon Lift Station.

	CONSTRUCTION COST[1]	O&M COST (50YR)	RENEWAL COST[2]	REPLACEMENT COST[3]	SUBTOTAL
Elimination and 42" Relief Sewer for Kirkwood #3 LS with built out of Harvest Moon LS	$ 14,518,851	$ 143,000	$ -	$ -	$ 14,662,851
	$ 14,518,851	$ 143,000	$ -	$ -	
				Grand Total	$ 14,663,000

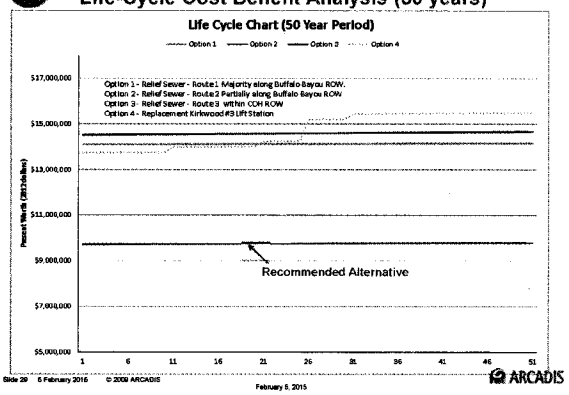
OPTION 4 - Status Quo continue operating Kirkwood#3 Lift Station
with new replacement lift station and 30-inch forcemain

	CONSTRUCTION COST[1]	O&M COST (50YR)	RENEWAL COST[2]	REPLACEMENT COST[3]	SUBTOTAL
New Replacement Kirkwood#3 Lift Station	$ 6,341,600	$ 6,352,000	$ 931,000	$ 906,000	$ 15,542,600
30" Forcemain @Kirkwood #3	$ 5,368,000	$ 88,000	$ -	$ -	$ 5,456,000
	$ 13,729,600	$ 5,460,000	$ 931,000	$ 906,000	
				Grand Total	$ 21,026,000

[illegible]

All figures represent present value (worth) and grand total values rounded up to nearest thousand.
(1) Construction Cost for Proposed item at year zero.
(2) Present Worth Cost of Lift Station Renewal/Rehab at every 25 years (non structural/ultra, wet well, mechanical and electrical items only). Pump replacement is separate calculation.
(3) Replacement cost [illegible]

Kirkwood #3 LS (FN 340)
Life-Cycle Cost Benefit Analysis (50 years)



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Ranking of Alternatives

- A comparative ranking technique was used that is specific to this project and only looks at the four alternatives.
- Each alternative was ranked based on the findings and assessments completed during the preliminary design phase.
- The maximum accumulative score possible from the ranking is 100 points (100%).
  - Construction Cost (20 points).
  - Life-Cycle Cost over 50-year period (50 points).
  - Constructability/Ease of installation (15 points).
  - Sustainability (5 points).
  - Community Impacts/Opposition (10 points)
- The higher the ranking the better the alternative is compared to its counterparts.
- As such for each category after ranking there can only be a 1st, 2nd, 3rd, and 4th ranked alternative.

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Kirkwood #3 LS (FN 340)
LCA Decision Matrix

	Alternatives			
	Sewer Route #1	Sewer Route #2	Sewer Route #3	LS Replacement #4
Life Cycle Cost	$14,157,700	$9,801,500	$14,662,800	$21,029,000
Probable Construction Costs	$14,098,700	$9,721,500	$14,519,800	$13,729,800
	Rankings Per Category			
Life-cycle Cost	2	1	3	4
Construction Cost	3	1	4	2
Constructability	4	1	3	2
Sustainability	2	1	3	4
Community Impacts/Opposition	4	2	3	1

Best=1, Worst =4

	Max Pts	Assigned Points			
Life-cycle Cost	50	37.5	50	25	12.5
Construction Cost	20	10	20	5	15
Constructability	15	3.75	15	7.5	11.25
Sustainability	5	3.75	5	2.5	1.25
Community Impacts/Opposition	10	2.5	7.5	5	10
Total	100	57.5	97.5	45	50
			Best		

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Kirkwood #3 LS (FN 340)
LCA Decision Matrix

Alternative #4 - Without Kirkwood #3 Force main Replacement Cost and discounting an additional $2,000,000.00

	Sewer Route #1	Sewer Route #2	Sewer Route #3	LS Replacement #4
Life Cycle Cost	$14,157,700	$9,801,500	$14,662,800	$13,641,000
Probable Construction Costs	$14,098,700	$9,721,500	$14,519,800	$6,341,800
	Rankings Per Category			
Life-cycle Cost	3	1	4	2
Construction Cost	3	2	4	1
Constructability	4	1	3	2
Sustainability	2	1	3	4
Community Impacts/Opposition	4	2	3	1

Best=1, Worst =4

	Max Pts	Assigned Points			
Life-cycle Cost	50	25	50	12.5	37.5
Construction Cost	20	10	15	5	20
Constructability	15	3.75	15	7.5	11.25
Sustainability	5	3.75	5	2.5	1.25
Community Impacts/Opposition	10	2.5	7.5	5	10
Total	100	45	92.5	32.5	80
			Best		

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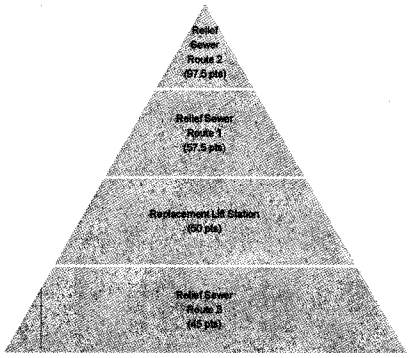
Kirkwood #3 LS (FN 340)
LCA Decision Matrix



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SUMMARY

From Life-cycle Cost Benefit Analysis (50 yr)

Estimated Replacement Cost ≈ $ 21,030,000

Estimated Elimination Cost ≈ $ 9,801,500

Cost difference in Alternatives ≈ $ (11,228,500)

Final Recommendation

Elimination of Kirkwood #3 Lift Station via Route 2
≈ $ 9,802,000.00

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Questions/Comments

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Recommended Alternative #2
Items For Relief Sewer

1) Install 5,200 linear feet of sanitary sewer under existing pavement.
   Sewer Size: 42-inch (ID) pipe.
   Method of Construction: Trenchless by Microtunneling.
   Sewer Material: FRP, Clay, and/or Concrete.

2) Minimum 6-foot diameter manholes.
   Sealed and vent manholes along Flood Plain as necessary.

3) 1,080 -feet of new easement (30-ft wide) from HCFCD.

4) 50-feet of new easement (30-ft wide) from private home owner.

5) Abandon 730-feet of existing easement within fence line of private homes.

6) Temporary construction easement from HCFCD.

7) Provide by-pass/diversion pumping for 18-inch sanitary sewer currently flowing into Harvest Moon lift station for duration of construction.

8) Provide CCTV inspection of existing 18-inch sanitary sewer for abandonment.

9) Divert flow, grout fill, and abandon in-place approximately 730 feet of 18-inch sanitary sewer.

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Recommended Alternative #2
Items For Harvest Moon Lift Station Site

1) Add pumps, piping and mechanical to spare side (unused side) of new Harvest Moon lift station to match existing.

2) Add associated electrical and VFDs for spare side (unused side) of new Harvest Moon lift station to match existing.

3) Add 12-inch surge protection valves to each valve vault at new Harvest Moon lift station.

4) Cut, plug and abandon 14-inch diameter force main from Harvest Moon lift station beneath Buffalo Bayou in place.

5) Tie-in proposed 42-inch sewer to new 8-ft diameter manhole at Harvest Moon lift station site.

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Recommended Alternative #2
Items For Kirkwood#3 Lift Station Site

1) Intercept and divert influent sanitary flows incoming to Kirkwood #3 lift station to proposed 42-inch sanitary relief sewer.
2) Demolish existing Kirkwood #3 lift station and all associated infrastructure to 4-feet below the ground surface.
3) Leave in-place perimeter fencing on the north, south, and east sides.
4) Demolish and remove fence along Kirkwood Drive.
5) Demolish and remove driveways to lift station site.
6) Restore curb and gutter and side walk along Kirkwood Drive.
7) Demolish and remove all pavements from site.
8) Sod entire site after construction and demolition activities.
9) Cut, plug, and abandon existing Kirkwood #3 14-inch diameter force main.
10) Cut, plug, and abandon existing Kirkwood #3 24-inch diameter force main.
11) Cut, plug, and abandon existing 30-inch diameter force main from junction of Harvest Moon and Kirkwood #3 force mains to Dairy Ashford lift station.
12) Cut and remove existing 14-inch diameter force main on Pipe Bridge crossing Buffalo Bayou along Kirkwood Drive.
13) Cut and remove existing 24-inch diameter force main on Pipe Bridge crossing Buffalo Bayou along Kirkwood Drive.
14) Cut and remove existing 30-inch diameter force main on Pipe Bridge crossing Buffalo Bayou along Dairy Ashford Drive.

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RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

ATTACHMENT F
SIGN-IN SHEET
(For TRC Meeting) RESPONSES TO COUNCILMAN INQUIRY

TRC MEETING SIGN IN SHEET
FOR

Diversion and Abandonment of Kirkwood #3 Lift Station to New Harvest Moon Lift Station

WBS NO. R-000536-0021-3

Thursday, February 5, 2015
3:00 to 4:30 p.m.
611 Walker, Conference Room 16A

	Name	Organization	Telephone	Email or Fax Number
1	Tanu Hiremath	COH-WWEng	832-395-2291	tanu.hiremath@houstontx.gov
2	Jeremy Austin	COH-WWEng	832-395-2340	jeremy.austin@houstontx.gov
3	JONATHAN HOWARD	ARCADIS	713-953-4703	jonathan.howard@arcadis-us.com
4	Ali Khawandish	COH/WWOPS	(832) 395-4971	ali.khawandish@houstontx.gov
5	FAZLE RABBI	COH/IPB	(832) 395-2687	FAZLE.RABBI@HOUSTONTX.GOV
6	PRATISTHA PRADHAN	COH/IPB	832-395-2697	Pratistha.pradhan@houstontx.gov
7	Ebi Nassiri	COH/WWE		
8	JoAnne Kammon	COH/Const.	832-395-2394	joanne.kammon@houstontx.gov
9	David Aguayo	ARCADIS	713-953-4734	david.aguayo@arcadis.us
10	Poolkeshi Patel	ARCADIS	713-953-4740	poolkeshi.patel@arcadis-us.com
11	MARK KIRSCHKE	COH	832 393 3267	Mark.Kirschke@houstontx.gov
12	EDWARD QUIROZ	ARCADIS	713-953-4814	edward.quiroz@arcadis-us.com
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RECORD OF DECISION AND ACTION ITEMS
WBS No. R-000536-0021-3

ATTACHMENT G
OTHER DATA
G.1 RESPONSES TO COUNCILMAN INQUIRY
G.2 PROFILE OF CONNECTION OF 42" SEWER @ HARVEST MOON LS SITE

1. **What steps are being taken to reduce wet flow rates? Cross over intrusion from storm water and private property drains should be investigated and minimized. This project data suggests an overbuilding at city expense and public inconvenience because of high intrusion rates.**

   This project is a consolidation project and the proposed sewer is a "relief sewer" whose sole purpose is to divert the incoming sanitary sewage flow away from the Kirkwood #3 lift station and to the new Harvest Moon Lift Station. As such, the "relief sewer" has no direct service connections to private users. The sanitary sewer was sized to match the existing incoming sewer into the Kirkwood #3 lift station site. As a rule sewers should always match or increase in size when compared to existing up gradient sewer.

2. **The preferred option was stated as option /route 2, yet the exhibit furnished (item 8) suggests Route 1. Preferred "option 2 routes says mostly along streets and 1000 ft. on bayou bank, yet last page map (item 8) shows route mostly along southern bank of Buffalo Bayou, corresponding to route. The documentation should agree with recommendation. Verify what route is actually recommended. (BFSNC opposes route 1).**

   The recommended route is Route 2. A written description of the recommended route is as follows. The proposed 42-inch relief sewer along Route 2 would begin at the Kirkwood #3 Lift Station site (1235 South Kirkwood Drive) and flow south along Kirkwood Drive for approximately 250 feet to the intersection of Carriage Hill Drive where it will then flow west along Carriage Hill Drive for approximately 2,730 feet to the intersection of Lashbrook Drive. From Lashbrook Drive, the proposed 42-inch relief sewer will then flow north along Lashbrook Drive for approximately 960 feet to the end of the cul-de-sac on Lashbrook Drive. The relief sewer would then continue to flow north along a proposed sanitary sewer easement on residential property (approximately 50 feet long) that would mate on the backside of the residential lot to a proposed sanitary sewer easement that run along the outer most edge of the buffalo bayou right-of way. From this point the proposed sewer would flow west approximately 1,030 feet to the existing Harvest Moon lift station site where it would ended at a proposed manhole currently under construction as part of the new harvest moon lift station project.

3. **Option 2 — Abandonment/elimination of Kirkwood #3 lift station to the new Harvest Moon lift station by proposed route 2 (see Exhibit 7). This route is along the streets Carriage Hill Drive and Lash brook Drive and approximately 1000 feet along the bank of buffalo bayou. Is this route feasible? Are relative elevations correct for this route; generally speaking the ground level elevations rises to the west?**

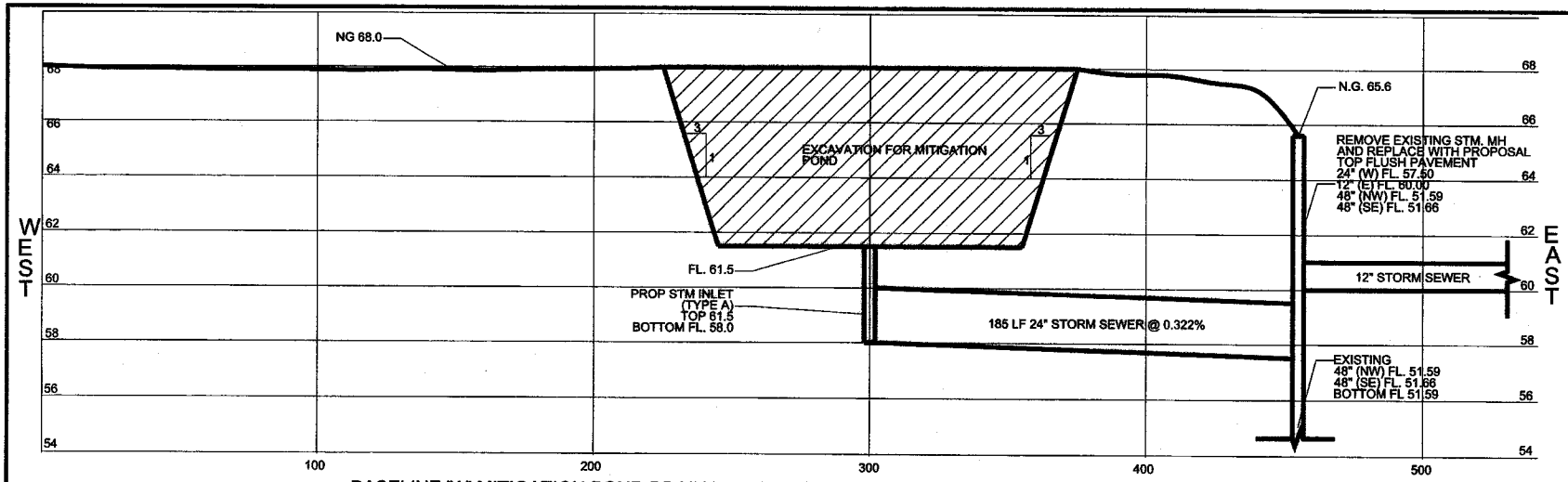
   Yes this route is feasible, the new harvest moon lift station and its support manholes are deep enough to allow for the installation of a new sewer from the Kirkwood lift station site to Harvest Moon lift station that will meet all of the design standards from the City of Houston Infrastructure Design Manual; as well as, all of the regulatory requirements of the Texas Commission on Environmental Quality (TCEQ).

4. **Tunneling is applauded as this minimized surface disturbance as well as minimizing damage to trees.**

   We are in agreement on this item. This installation method for pipe/sewer construction was specifically recommended for this area due to similar concerns. Trenchless construction allows for the least amount of disruption and/or disturbances to features on the ground surface. Trenchless construction refers to various techniques used to install piping below ground without having to excavate an open trench along the entire length of the sewer. Launch and receiving pits are constructed to the desire depths and then the sewer is constructed via horizontal tunneling techniques between both pits leave the ground surface in between undisturbed.

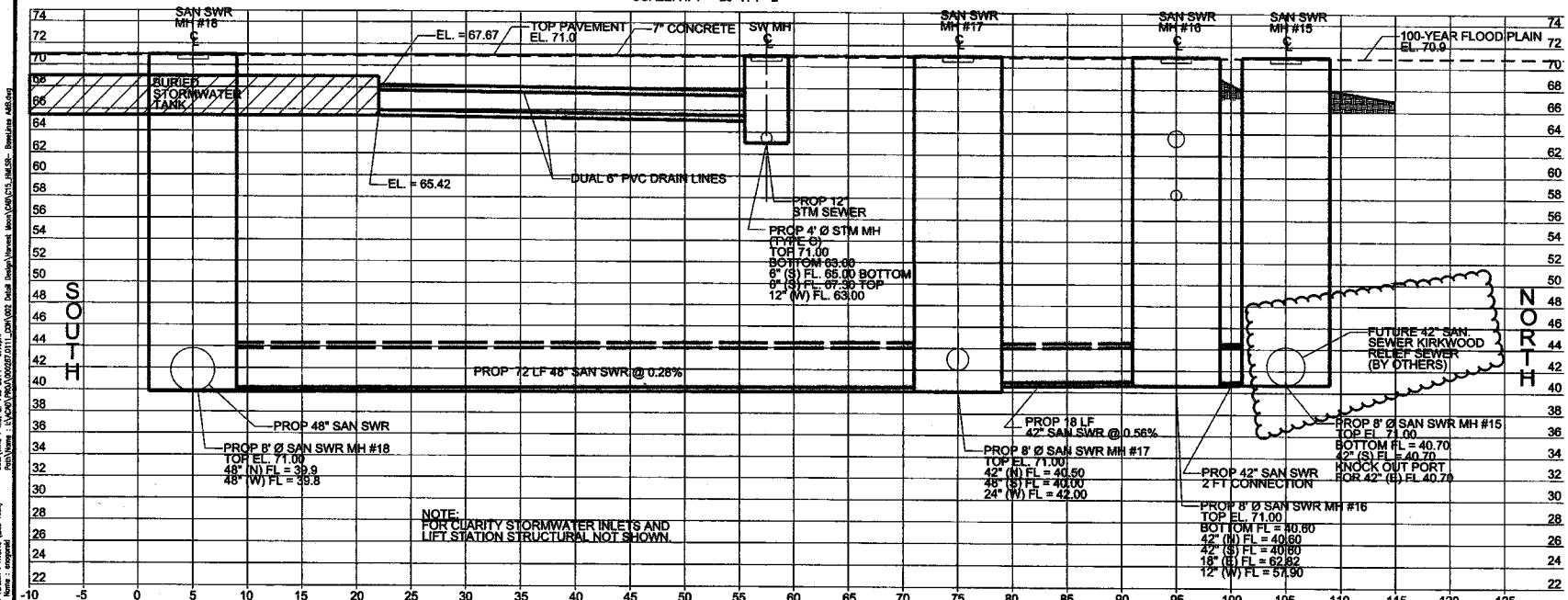
5. **Why an increase from 10-ft wide ROW easement required – line is only 3.5 ft. diameter? Since tunneling is stated as construction plan why increase/acquire ROW from HCFCD at 30 ft. width (from 10 ft.) along Buffalo Bayou required and why is 30 ft. easement required from home owner (instead of 10 ft.)?**

   The width of the easement is set by the City of Houston's Infrastructure Design manual which calls out requirements approved by the City Engineer and subject to Code Enforcement. The width of any easement is set by the design manual by the diameter of the sewer and the depth to the flow line of the sewer. The minimum width is the greater of either the depth or 20 feet; however, in this case the calculation calls for 26.80 feet. The Engineer of Record rounded up to a 30 foot wide easement.



BASELINE "A" MITIGATION POND DRAIN LINE (APPROX. WEST-EAST ALIGNMENT

SCALE: H: 1" = 20' V: 1"=2'



BASELINE "B" LIFT STATION INFLUENT MANHOLES (APPROX. SOUTH-NORTH ALIGNMENT

SCALE: H: 1" = 5' V: 1"=5'

NO	DATE	REVISIONS	APP

PRIVATE UTILITY LINES SHOWN

NA DATE:
CENTERPOINT ENERGY/ELECTRIC FACILITIES
(APPROVED ONLY FOR CROSSING UNDERGROUND DUCTLINES, UNLESS OTHERWISE NOTED) VALID AT TIME OF REVIEW ONLY.

NA DATE:
AT&T TEXAS/SWBT UTILITY LINES SHOWN
APPROVED AT&T TEXAS/SWBT FOR UNDERGROUND CONDUIT FACILITIES ONLY
SIGNATURE VALID FOR ONE YEAR.

NA DATE:
CENTERPOINT ENERGY/GAS FACILITIES
(GAS SERVICE LINES ARE NOT SHOWN)

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Texas Registered Engineering Firm F-533

DATE: FEBRUARY 2014
JOB NO. TX000967.0004

DESIGNED BY: EN
DRAWN BY: WW

STATE OF TEXAS
EDUARDO QUIROZ
65559
LICENSED
PROFESSIONAL ENGINEER
02/21/14

SURVEYED BY: RUO AND ASSOCIATES
FB NO.: P-5797

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

LIFT STATION
RENEWAL / REPLACEMENT
PROJECT

HARVEST MOON L.S.
BASELINES A&B

C15

WBS#: R-000267-0111-4

DRAWING SCALE:
AS SHOWN

CITY OF HOUSTON PM
TANU HIREMATH, P.E.

SHEET NO. 23 OF 222

ORIGINAL SCALE IN INCHES 0 1 2 3 FOR REDUCED PLANS

RDA1 Attachments A through B

Date\Time : Thu, 27 Feb 2014 - 5:13pm
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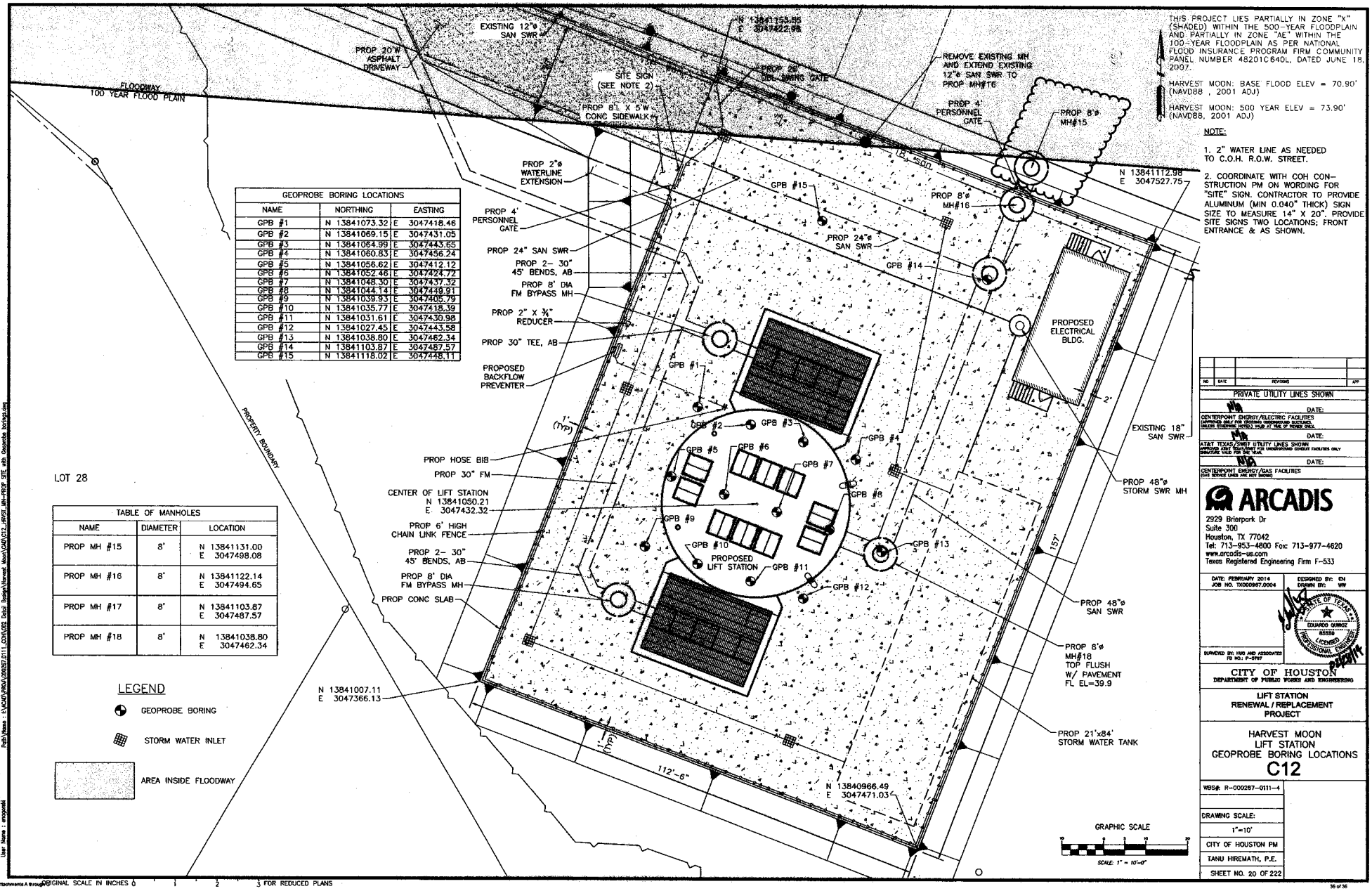
Acad Version : R18.1s (LMS Tech)
User Name : enogoreld



THIS PROJECT LIES PARTIALLY IN ZONE "X" (SHADED) WITHIN THE 500-YEAR FLOODPLAIN AND PARTIALLY IN ZONE "AE" WITHIN THE 100-YEAR FLOODPLAIN AS PER NATIONAL FLOOD INSURANCE PROGRAM FIRM COMMUNITY PANEL NUMBER 48201C640L, DATED JUNE 18, 2007.

HARVEST MOON: BASE FLOOD ELEV = 70.90' (NAVD88 , 2001 ADJ)

HARVEST MOON: 500 YEAR ELEV = 73.90' (NAVD88, 2001 ADJ)

NOTE:

1. 2" WATER LINE AS NEEDED TO C.O.H. R.O.W. STREET.
2. COORDINATE WITH COH CONSTRUCTION PM ON WORDING FOR "SITE" SIGN. CONTRACTOR TO PROVIDE ALUMINUM (MIN 0.040" THICK) SIGN SIZE TO MEASURE 14" X 20". PROVIDE SITE SIGNS TWO LOCATIONS; FRONT ENTRANCE & AS SHOWN.

GEOPROBE BORING LOCATIONS

NAME	NORTHING	EASTING
GPB #1	N 13841073.32	E 3047418.46
GPB #2	N 13841069.15	E 3047431.05
GPB #3	N 13841064.99	E 3047443.65
GPB #4	N 13841060.83	E 3047456.24
GPB #5	N 13841056.62	E 3047412.12
GPB #6	N 13841052.46	E 3047424.77
GPB #7	N 13841048.30	E 3047437.32
GPB #8	N 13841044.14	E 3047449.91
GPB #9	N 13841039.93	E 3047405.79
GPB #10	N 13841035.77	E 3047418.39
GPB #11	N 13841031.61	E 3047430.98
GPB #12	N 13841027.45	E 3047443.58
GPB #13	N 13841038.80	E 3047462.34
GPB #14	N 13841103.87	E 3047487.57
GPB #15	N 13841118.02	E 3047448.11

TABLE OF MANHOLES

NAME	DIAMETER	LOCATION
PROP MH #15	8'	N 13841131.00 E 3047498.08
PROP MH #16	8'	N 13841122.14 E 3047494.65
PROP MH #17	8'	N 13841103.87 E 3047487.57
PROP MH #18	8'	N 13841038.80 E 3047462.34

LEGEND

- GEOPROBE BORING
- STORM WATER INLET
- AREA INSIDE FLOODWAY

NO.	DATE	REVISIONS	APP

PRIVATE UTILITY LINES SHOWN

CENTERPOINT ENERGY/ELECTRIC FACILITIES — DATE:

AT&T TEXAS/SWBT UTILITY LINES SHOWN — DATE:

CENTERPOINT ENERGY/GAS FACILITIES — DATE:

ARCADIS
2929 Briarpark Dr
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Houston, TX 77042
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www.arcadis-us.com
Texas Registered Engineering Firm F-533

DATE: FEBRUARY 2014
JOB NO. TX000987.0004
DESIGNED BY: IDH
DRAWN BY: WW

EDUARDO QUIROZ 83589 LICENSED PROFESSIONAL ENGINEER

SURVEYED BY: HOU AND ASSOCIATES FB NO.: P-5747

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

LIFT STATION RENEWAL / REPLACEMENT PROJECT

HARVEST MOON
LIFT STATION
GEOPROBE BORING LOCATIONS
C12

WBS# R-000267-0111-4

DRAWING SCALE: 1"=10'

CITY OF HOUSTON PM
TANU HIREMATH, P.E.

SHEET NO. 20 OF 222

ORIGINAL SCALE IN INCHES 0 1 2 3 FOR REDUCED PLANS

RDAI Attachments A through B

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