

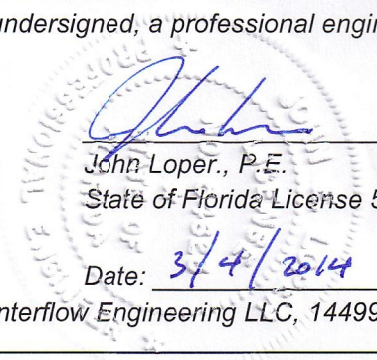
## MEMORANDUM

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**TO:** John Kenty (HW Lochner)  
**FROM:** John Loper and Daniel Parsons (Interflow)  
**DATE:** March 4, 2014  
**RE:** Hydrologic and Hydraulic Modeling Services, Sunset Point Road Bridge over Spring Branch and Related Improvements

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**Certification:** This technical memorandum was prepared by, or under the direct supervision of, the undersigned, a professional engineer registered in the State of Florida.

  
John Loper, P.E.  
State of Florida License 54623

Date: 3/4/2014

Interflow Engineering LLC, 14499 N Dale Mabry Hwy Suite 290, Tampa Florida, CA Lic. No. 26901

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Interflow Engineering, LLC (Interflow) was retained by HW Lochner to provide hydrologic and hydraulic modeling services related to the replacement of the Sunset Point Road Bridge over Spring Branch and related upstream and downstream hydraulic improvements. It is our understanding that the Sunset Point Road Bridge is scheduled to be replaced as part of the planned improvements to the intersection of Sunset Point Road and Betty Lane, within unincorporated Pinellas County. Interflow used the Interconnected Pond Routing model prepared for Stevenson Creek Watershed Management Plan to evaluate a number of alternative scenarios described hereafter.

### 1. Objectives

The objectives of this study are to develop recommendations for the following:

1. Proposed dimensions of a new bridge culvert under Sunset Point Road at Spring Branch. The new bridge culvert must have the capacity to convey ultimate flows resulting from current and future projects recommended in the 2001 Stevenson Creek Watershed Management Plan.
2. Dimensions of a temporary restriction to be placed over the proposed new bridge culvert under Sunset Point Road. The dimensions of the temporary restriction are to be based on the assumption that the private crossing immediately upstream of Sunset Point Road will be removed as part of this project. The removal of this crossing was recommended in the Stevenson Creek WMP.

3. Per a request by the City of Clearwater, proposed dimensions of potential future upsizing of the box culvert under Betty Lane at Spring Branch, in conjunction with raising the elevation of the Betty Lane. Betty Lane would be raised in order to meet the desired flood protection level of service for a 25-year design storm event.

## **2. Background**

Parsons Engineering Science (Parsons) completed the Stevenson Creek Watershed Management Plan (SCWMP) for the City of Clearwater in August of 2001. As part of the SCWMP, Parsons developed an ICPR model of the Stevenson Creek Watershed to analyze the existing conditions and to evaluate proposed improvements within the watershed to improve the flood protection level of service (FPLOS). Several of the proposed projects are within the Spring Branch Subwatershed. The SCWMP did not consider any improvements to the Sunset Point Road or Betty Lane crossings of Spring Branch. However, the SCWMP did recommend removal of a private culvert crossing immediately upstream of Sunset Point Road.

Recently, King Engineering Associates used the SCWMP ICPR model to compare existing and proposed conditions for the 'Idlewild and the Mall Sanitary Sewer System and Woodlawn Stormwater Improvements' and the 'Woodlawn Terrace Floodplain Storage Project' for the City of Clearwater. King updated the existing conditions model based on newer survey to establish a new baseline for their comparisons. King also developed a model representing the proposed conditions.

The proposed Woodlawn Stormwater Improvements and Woodlawn Terrace Floodplain Storage Projects are modified versions of projects recommended in the 2001 SCWMP. Because these two projects are upstream of the crossings at Sunset Point Road and Betty Lane, it was necessary to consider the effect these projects will have on proposed conditions within Spring Branch. The design recommendations for the crossings at Sunset Point Road and Betty Lane also considered the remaining potential future projects identified in the SCWMP that would have the potential for increasing flow rates within Spring Branch. Please refer to the Stevenson Creek Watershed Management Plan Final Report (Parsons Engineering Science, August 2001) for more information on the SCWMP.

## **3. Data Collection and Review**

Interflow obtained and reviewed the following relevant documents and information:

- Final Construction Plans for Idlewild and the Mall Sanitary Sewer System and Woodlawn Stormwater Improvements, prepared by King Engineering for the City of Clearwater
- 60% Design Drawings for Woodland Terrace Floodplain Storage, also prepared by King for the City of Clearwater

- Woodlawn Terrace Floodplain Storage Project - 60% Drainage Documentation (September 2012)
- Existing and proposed conditions ICPR models, reflecting the two improvements listed above, as prepared by King Engineering
- 2009 McKim&Creed Survey depicting Spring Branch from upstream of Betty Lane, downstream to include the Douglass Avenue crossing.

On May 14, 2013, Interflow conducted field reconnaissance of the project area to verify whether or not the existing conditions model was an accurate representation of current conditions. Interflow noted that the culvert under Betty Lane had an incorrect size in the model. Recent survey data from November, 2011 was evidently used in the existing conditions model; however, the 2011 measurement did not account for the skew angle of the box culvert, and therefore over-represented the effective width. **Figure 1** shows the box culvert under Betty Lane. **Figure 2** shows the existing concrete arch culvert under Sunset Point Road.

**Figure 3** shows the private crossing proposed to be removed. The private crossing was identified in the SCWMP as a major restriction to flow, which contributes to upstream flooding problems.



**Figure 1. Box Culvert under Betty Lane at Spring Branch**





**Figure 2. Concrete Arch under Sunset Point Road**



**Figure 3. Private Crossing Immediately Upstream of Sunset Point Road**

#### 4. Modeling Scenarios

Multiple scenarios were analyzed as part of this project described in **Table 1** below:

**Table 1 – Description of Model Runs**

<b>Model Run</b>	<b>Description of Model / Revisions</b>
Stevenson Creek Existing Conditions	Existing conditions when the Stevenson Creek Watershed Management Plan (SCWMP) was completed (2000-2001).
Stevenson Creek Alt-1	Proposed conditions based on the SCWMP
Woodlawn Terrace Projects 'Post' (King Engineering)	<p>Proposed Conditions provided to Interflow with the below updates.</p> <ul style="list-style-type: none"> <li>Revised span (P0600) based on field measurements to account for the skew angle of the box culvert.</li> <li>Revised the inverts (P0600) on the box culvert under Betty Lane; the inverts were reversed from the "Idlewild and the Mall Sanitary Sewer System and Woodlawn Stormwater Improvements" plan data.</li> </ul>
<b>Run 1</b> (revised existing conditions)	<p>Pre-conditions model provided by King Engineering with minor updates.</p> <ul style="list-style-type: none"> <li>Revised span (P0600) based on field measurements to account for the skew angle of the box culverts.</li> <li>Revised the inverts (P0600) on the box culverts under Betty Lane, the inverts were reversed from the "Idlewild and the Mall Sanitary Sewer System and Woodlawn Stormwater Improvements" plan data.</li> <li>Revised invert of the weir across Betty Lane based on the existing grade shown on the "Idlewild and the Mall Sanitary Sewer System and Woodlawn Stormwater Improvements". (Note that this weir is 50' compared to a 300' weir in Stevenson Creek Alt-1 model.)</li> <li>Revised weirs over Springtime Ave. and Douglas Ave. to reflect the guardrails restricting flow.</li> </ul>
<b>Run 2</b> (updated future conditions for Spring Branch, as contemplated in SCWMP; Sunset Point and Betty Lane crossings not included)	<p>Proposed conditions model provided by King Engineering that represents the "Idlewild and the Mall Sanitary Sewer System and Woodlawn Stormwater Improvements" and the Woodlawn Terrace Floodplain Storage (this represents project 1D and a portion of 1C from the SCWMP). Additional proposed conditions were added to the model described below.</p> <ul style="list-style-type: none"> <li>Made same changes mentioned above to Run1.</li> <li>Revised culverts under Springtime Avenue and Douglas</li> </ul>

	<p>Avenue to 9' x 9' twin box culverts. <u>Note:</u> Project 1B of the SCWMP specified 12' x 9' box culverts. Smaller culverts are possible because of the addition of the Woodlawn Terrace Floodplain Storage Project.</p> <ul style="list-style-type: none"> <li>Removed Private Drive culvert (P0580) and weir overtop (WOF0580). Re-routed subbasin B0580 to N0570 and changed downstream link of C0590 to N0570 and extended the channel length.</li> <li>Revised channel downstream of Kings Highway to reflect proposed conditions for project 1A in the SCWMP.</li> <li>Revised culverts and channel overflows upstream of Highland Ave. to represent the proposed conditions of 1A in the SCWMP.</li> <li>Added Glen Oaks Park</li> </ul>
<b>Run 3</b> (Sunset Point Crossing Ultimate Size)	Starting with Run 2, added proposed bridge/culvert under Sunset Point Road; upsized to twin 10'x10' box culverts
<b>Run 4</b> (Raise Betty Lane and Upsize Culverts)	Starting with Run 3, revised culvert under Betty Lane to twin 8' x 8' box culverts and raised the roadway weir overtopping elevation by 2'.
<b>Run 5</b> (Sunset Point Rd crossing, and removal of private drive, interim configuration)	<p>Starting with Run 1, revised to reflect interim configuration (no downstream improvements)</p> <ul style="list-style-type: none"> <li>Removed Private Drive (P0580) between Betty Lane and Sunset Point Road.</li> <li>Upsized the culvert under Sunset Point Road to 10'x10' twin box culvert but with restricting plates designed to avoid downstream impacts. The restriction would require blocking one 10' x 10' culvert off completely, and installing a steel plate (or equivalent) across the top 4.5 feet of the second culvert to leave an opening that is 10 feet wide and 5.5 feet high.</li> </ul>
<b>Run 6</b> (Sunset Point Rd crossing only)	<p>Starting with Run 1, revised to reflect interim configuration (no downstream improvements)</p> <ul style="list-style-type: none"> <li>Upsized the culvert under Sunset Point Road to 10'x10' twin box culvert (no restricting plate)</li> </ul>

Locations of the project features described in the table above are shown on the 11 x 17 map attachment at the end of this memorandum.

## 5. Results and Recommendations

Based on the results of our modeling analysis, the recommended design parameters of the proposed crossings at Sunset Point Road and Betty Lane over Spring Branch are as follows:

- Sunset Point Road Crossing over Spring Branch:
  - Dimensions: 10'x10' twin box culverts
  - Upstream invert: 2.5' NGVD29
  - Downstream invert: 1.5' NGVD29
  - Restriction plates required if private crossing upstream is also removed as part of current project (refer to 'Run 5' description in **Table 1**).
- Potential Future Betty Lane Crossing over Spring Branch:
  - Dimensions: 8' x 8' twin box culvert
  - Upstream invert: 3.41' NGVD 29
  - Downstream invert: 2.21' NGVD 29

Because the private culvert crossing immediately upstream of Sunset Point Road is a major flow restriction, upsizing only the Sunset Point Road crossing of Spring Branch would have minimal effect on downstream or upstream flood elevations (Run 6). However, if the private culvert crossing between Betty Lane and Sunset Point Road is also to be removed as part of the current project, the culvert under Sunset Point Road will need to be restricted in order to minimize impacts downstream (Run 5). At Sunset Point Road, the twin box culverts will need to be restricted to create a single opening at the upstream face of the culvert that is 10' wide by 5.5' high. The restriction would have to remain in place until downstream improvements in Spring Branch, including replacement of the bridges at Douglass Avenue and Springtime Avenue, are constructed.

**Tables 2 and 3** provide the results of Runs 1 through 6 for the 25- and 100-year storm events, respectively. Comparisons between Runs 2 through 6 and the updated existing conditions (Run 1) are also provided. Referenced model node locations are indicated on the map attachment.

**Table 2 – 25-year Peak Flood Levels and Comparisons**

Node	25-Year Peak Stages, Ft NGVD 29					Run6	Differences, Feet				
	Run1	Run2	Run3	Run4	Run5		Run2-Run1	Run3-Run1	Run4-Run1	Run5-Run1	Run6-Run1
N0500	6.22	6.22	6.22	6.31	6.23	6.21	0	0.01	0.1	0.01	0.00
N0510	6.75	7.02	7.02	7.23	6.79	6.74	0.29	0.29	0.5	0.04	0.00
N0520	6.79	7.14	7.14	7.35	6.84	6.79	0.36	0.36	0.57	0.05	0.00
N0530	9.43	7.34	7.34	7.73	9.68	9.41	-2.04	-2.04	-1.65	0.25	-0.02
N0540	10.65	7.87	7.87	8.61	11.00	10.63	-2.72	-2.72	-1.97	0.35	-0.02
N0550	10.76	8.26	8.26	8.95	11.10	10.73	-2.43	-2.43	-1.74	0.34	-0.02
N0560	10.81	8.67	8.67	9.26	11.14	10.78	-2.07	-2.07	-1.48	0.33	-0.02
N0570	10.94	9.42	8.8	9.34	12.16	10.82	-1.46	-2.07	-1.53	1.22	-0.11
N0590	13.06	10.74	10.7	11.01	12.39	12.76	-2.13	-2.16	-1.85	-0.67	-0.31
N0600	13.69	12.96	12.94	12.4	13.57	13.68	-0.77	-0.79	-1.33	-0.12	0.00
N0610	13.84	13.3	13.29	12.98	13.74	13.84	-0.58	-0.59	-0.9	-0.10	0.00
N0620	14.15	13.47	13.45	13.19	14.13	14.15	-0.71	-0.72	-0.98	-0.02	0.00
N0630	15.21	13.57	13.56	13.34	15.21	15.20	-1.64	-1.65	-1.86	0.00	0.00
N0680	13.85	13.35	13.34	13.05	13.75	13.84	-0.54	-0.55	-0.83	-0.10	0.00
N0690	13.85	13.35	13.34	13.05	13.75	13.84	-0.54	-0.55	-0.83	-0.10	0.00
N0740	13.86	13.37	13.36	13.08	13.77	13.86	-0.53	-0.54	-0.82	-0.09	0.00
N0750	13.86	13.37	13.36	13.08	13.77	13.86	-0.53	-0.54	-0.82	-0.09	0.00
N0760	14.21	14.12	14.11	14.06	14.18	14.21	-0.11	-0.11	-0.16	-0.03	0.00
N0765	14.30	14.23	14.23	14.18	14.27	14.30	-0.09	-0.09	-0.14	-0.03	0.00
N0768	14.21	14.06	14.05	14.01	14.18	14.20	-0.17	-0.17	-0.21	-0.03	0.00
N0770	14.38	14.33	14.33	14.29	14.35	14.37	-0.06	-0.06	-0.11	-0.03	0.00
N0775	15.60	15.38	15.38	15.36	15.59	15.59	-0.22	-0.22	-0.25	-0.01	-0.01
N0780	15.74	15.5	15.5	15.47	15.73	15.73	-0.24	-0.24	-0.27	-0.01	-0.01
N0790	15.90	15.67	15.67	15.64	15.89	15.89	-0.24	-0.24	-0.27	-0.01	-0.01
N0910	20.59	16.92	16.92	16.91	20.59	20.59	-3.67	-3.67	-3.69	0.00	0.00



**Table 3 – 100-year Peak Flood Levels and Comparisons**

Node	100-Year Peak Stages, Ft NGVD 29						Differences, Feet				
	Run1	Run2	Run3	Run4	Run5	Run6	Run2-Run1	Run3-Run1	Run4-Run1	Run5-Run1	Run6-Run1
N0500	7.35	7.44	7.44	7.46	7.35	7.35	0.1	0.1	0.11	0.00	0.00
N0510	8.32	9.67	9.66	9.64	8.28	8.31	1.36	1.36	1.33	-0.04	-0.01
N0520	8.33	9.7	9.7	9.67	8.29	8.32	1.38	1.38	1.36	-0.04	-0.01
N0530	11.12	10.65	10.65	10.59	10.96	11.11	-0.45	-0.45	-0.51	-0.16	-0.01
N0540	12.28	11.93	11.92	11.82	12.14	12.27	-0.34	-0.34	-0.44	-0.14	-0.01
N0550	12.35	12.08	12.08	11.97	12.21	12.34	-0.25	-0.25	-0.36	-0.14	-0.01
N0560	12.37	12.13	12.12	12.02	12.23	12.36	-0.22	-0.23	-0.33	-0.14	-0.01
N0570	12.47	12.28	12.25	12.14	15.13	12.43	-0.17	-0.2	-0.31	2.66	-0.04
N0590	15.28	12.62	12.59	12.49	15.18	15.23	-2.6	-2.62	-2.72	-0.10	-0.05
N0600	15.39	14.14	14.13	14.04	15.34	15.38	-1.22	-1.23	-1.33	-0.05	-0.01
N0610	15.47	14.42	14.41	14.31	15.42	15.45	-1.09	-1.11	-1.2	-0.05	-0.02
N0620	15.55	14.57	14.55	14.45	15.50	15.54	-1.03	-1.04	-1.14	-0.05	-0.01
N0630	16.34	14.65	14.64	14.54	16.35	16.34	-1.7	-1.71	-1.82	0.01	0.00
N0680	15.48	14.45	14.44	14.34	15.43	15.47	-1.08	-1.09	-1.19	-0.05	-0.01
N0690	15.48	14.45	14.44	14.34	15.43	15.47	-1.07	-1.09	-1.18	-0.05	-0.01
N0740	15.47	14.46	14.45	14.36	15.42	15.46	-1.05	-1.07	-1.16	-0.05	-0.01
N0750	15.47	14.47	14.45	14.36	15.42	15.46	-1.05	-1.06	-1.16	-0.05	-0.01
N0760	15.61	14.95	14.94	14.89	15.57	15.60	-0.7	-0.71	-0.77	-0.04	-0.01
N0770	15.75	15.21	15.2	15.14	15.71	15.74	-0.58	-0.59	-0.65	-0.04	-0.01
N0775	17.41	16.93	16.92	16.89	17.39	17.40	-0.5	-0.5	-0.54	-0.02	-0.01
N0780	17.63	17.11	17.11	17.08	17.62	17.62	-0.54	-0.54	-0.57	-0.01	-0.01
N0790	17.76	17.29	17.28	17.25	17.74	17.75	-0.49	-0.49	-0.52	-0.02	-0.02
N0910	21.18	19.82	19.82	19.81	21.17	21.18	-1.36	-1.36	-1.36	-0.01	0.00

Level of Service

Run 4, as described in Table 1, considers all of the planned and potential future conveyance improvements within Spring Branch. As shown in Table 4, the 25-year peak stages associated with the Sunset Point and Betty Lane crossings of Spring Branch are below the low edges of pavement. For the 100-year event, the peak stage is less than 0.5' above the low edge of pavement at Betty Lane, and well below the low edge of pavement at Sunset Point Road.

Roadway Location	Low Edge of Pavement (NGVD29)	Node ID	25-Year Peak Stage Run 4 (NGVD29)	100-Year Peak Stage Run 4 (NGVD29)
Sunset Point at Spring Branch	16.61'	N0570 (upstream)	9.34'	12.14'
Betty Lane at Spring Branch	13.61' *	N0600 (upstream)	12.4'	14.04'

\*As proposed in Run 4; approximately 2' higher than existing

**Recommendations for Future Study**

The SCWMP was completed in 2001. Since that time, several changes have occurred throughout the watershed; these include some of the projects recommended in the SCWMP, as well as unrelated municipal infrastructure and land re-development projects. Although significant efforts were made in this study to update the model in the vicinity of the area of interest, there is still considerable uncertainty in the model results regarding the future improvements that will ultimately be required within Spring Branch downstream of Sunset Point Road. Of particular concern is the reach between Douglass Avenue and the confluence with Stevenson Creek. The original SCWMP anticipated that some increases in flood elevation in this reach may be permissible, due to the fact that the regulatory base flood elevation (governed by storm surge) in this area is several feet higher than the riverine flood elevations. However, this assumption may have to be revisited in the context of more current permitting guidelines.

The proposed box culvert dimensions at the Sunset Point Road and Betty Lane crossings of Spring Branch, as determined herein, will have the capacity to convey the projected future flows as contemplated in the SCWMP. However, before the restriction plate is removed from the Sunset Point Road Crossing, a more comprehensive update to the SCWMP is recommended. This update should include all significant changes to the hydrology and hydraulics within the watershed that have occurred since 2001. In addition, a re-evaluation of the remaining future projects (those not implemented to date) to consider current watershed conditions, updated City of Clearwater and Pinellas County goals and policies, and the current regulatory environment is recommended.

