I. INTRODUCTION

This document contains information compiled from reviewing documents provided by the Lee County Natural Resources, South Florida Water Management District (SFWMD), United States Geological Survey (USGS) and other sources which address the specific permitting issues. All agencies involved were extremely helpful in the preparation of this report.

Project Goal

On May 2, 2008, Exceptional Engineering, Inc. provided to Lee County Natural Resources a scope of services (**att #1**) for the above referenced project. This scope of services provided for a detailed study of the permitting history and field verification of critical flow ways and structures within the Spring Creek Watershed boundaries. The purpose of the report was to provide a collection of data and permitting history to be used as a tool for determining the future needs and projects within the watershed boundary. The report was to specifically focus on direct discharge points to Spring Creek its tributaries and the major water control structures which control that discharge. The report does not include a detailed analysis of the hydraulic calculations or an engineering review of systems. It is assumed that this was conducted during the review of the information submitted for SFWMD permitting.

Means and Methods

Exceptional Engineering, Inc. was given access to SFWMD record permit files which were ordered from West Palm Beach, Compliance Department record files and detailed database reports. In addition to the SFWMD information, the South Lee County Watershed Plan, the Lee County Surface Water Management Master Plan and data gathered from the USGS and other agencies was utilized in the analysis. The files were reviewed in their entirety and catalogued in the attached spreadsheet database (**att #2**). After the initial data was collected, it was reviewed and specific permits were targeted for a more detailed review. The target permits are highlighted in blue on attached spreadsheet. The permits which were targeted from the initial review were chosen based on location, water control structures, discharge points and proposed improvements. Specific areas addressed were the Brooks, Three Oaks Parkway, San Carlos Estates, Old US-41, US-41, Bonita Bay and Pelican Landing. This focus area included discharge points and major water control structures included in the scope of work and will be addressed from the beginning of the watershed boundary to discharge at Estero Bay.

II. THE WATERSHED

Located in Southwest Lee County, the Spring Creek Watershed encompasses an area of approximately ten square miles. A watershed boundary and description is attached (**att #5**). It is located south of Halfway Creek Watershed and north and west of the Imperial River Watershed. The Lee County Surface Water Management Master Plan notes that the watershed had decreased in area by approximately two square miles from the original 1979 "Water Management in Lee County" report. The decrease in area occurred north and east of Coconut Road. The only flow crossing the watershed boundary occurs in Bonita Bay. This tidal salt water slough connects to the Imperial River at the southern boundary of the watershed. The main conveyance in the Spring Creek watershed is natural channel beginning at Estero Bay running approximately five miles to the railroad bridge. The creek is tidally controlled by Estero Bay to the FPL bridge crossing. The channel narrows at US-41 from approximately 100' to a width of 30' with an average bottom of -4.0' NGVD. At the railroad bridge it becomes a dug channel to Old US-41 with an approximate bottom of 5.0' NGVD. Attached are plan and profiles of Spring Creek taken from the Lee County Surface Water Management Master Plan showing five significant structures (**att #4**). These structures are the twin bridges at US-41, concrete bridge at the power line easement, corrugated metal pipes in Imperial Harbor, railroad bridge and a box culvert at Old US-41. The basin consists of residential, golf course, and commercial development as well as farm fields and vacant land areas. The creek contains no water control structures. Per SFWMD criteria the allowable discharge for new development in the watershed is limited to 81 csm for the 3 day – 25 year event.

III. THE HEADWATERS OF SPRING CREEK

The Spring Creek Watershed Basin begins just west of I-75 in south Lee County and includes a small portion of the Brooks adjacent to I-75. The South Florida Water Management District (SFWMD) permit (36-00288-S) for the Brooks is enclosed (**att #6**). The permit allowed discharge to the San Carlos Estates Drainage District for 220 acres of the Brooks Development known as Basin 3 in the approved permit. Per the approved permit, Basin 3 has a design discharge of 12.0 cfs and a control elevation of 14.00' NGVD. A review of the I-75 SFWMD permit (36-03802-P: I-75 Collier/Lee Co. Line North To Corkscrew Road Segment B) (**att** #7) shows that an additional discharge of 160 cfs is anticipated in this area from flows east of I-75. The permit states:

To direct the 160 cfs into the South Branch of The Estero River, the Lee County Department of Transportation and the Brooks of Bonita Springs/Sweetwater MPD provided conveyance for these flows along the Three Oaks Parkway right-of-way under Permit Nos. 36-002884 and 36-04007-P. Related to the 160 cfs into Spring Creek, Lee County Department of Transportation included this capacity in the Three Oaks Parkway project (Permit No. 36-04007-P)

This area separated from the other portions of San Carlos Estates by the recent construction of Three Oaks Parkway, is heavily vegetated and requires some maintenance and general grading.

Pic1. Original San Carlos Drainage District Canal at I-75 looking to Three Oaks.

The construction of Three Oaks Parkway provided a box culvert to convey flows from the area to the east into the San Carlos Estates Drainage District. The approved SFMW Permit 36-04007-P is attached (**att #8**). The alignment of Three Oaks Parkway is shown on the enclosed Spring Creek watershed aerial exhibit (**att #4**). Only Basin D of the approved permit discharges into the Spring Creek Basin and it is limited to 6.9 cfs with a peak stage of 16.8' NGVD for the 25 year – 3 day storm event. The control elevation for Basin D is 14.50' NGVD. The photo below shows this box culvert. The drainage ditch in this area is well maintained. The flow

continues through the box culvert into the San Carlos Estates Drainage District.

Pic2. Box Culvert at Three Oaks Parkway Extension east side.

Developed in 1962, San Carlos Estates consists of approximately 950 residential lots varying in size from one acre to one and half acres. The total development is approximately 1138 acres. The area is poorly drained with shallow rim canals around the development. Spoils from the excavation of the canals were used to form a low berm around the property boundary. The canals flow to the south end of the development were they discharge into two locations that flow under Old US-41 and into Spring Creek. At the time of the construction no SFWMD permits were required. However SFWMD did issue a permit on November 19, 2003 (36-04757-P) (**att #9**) for sealing and paving of the existing unpaved roadways and recontouring of existing roadside swales. No information concerning the control elevation could be found within SFWMD files. However, the plan of reclamation for the San Carlos Estates Drainage District did notate a discharge of 182 cfs from the development to Spring Creek. The field inspections conducted revealed a well defined perimeter ditch and berm system within San Carlos Estates. Although the canals did contain some vegetation it did not appear to impair flows. The picture below shows the general condition of the perimeter system within San Carlos Estates. The discharge to Spring Creek occurs at two points within the system. The location of these weirs is shown on the attached aerial exhibit. The field inspection conducted showed that erosion around the southern most weir (#4 on the aerial exhibit) has allowed flows to bypass

the weir. This erosion could lead to failure of the weir if not repaired and could lead to significant downstream impacts to Spring Creek.

Pic 3. San Carlos Estates berm and canal system

Pic 4. San Carlos Estates Weir (#5 on aerial exhibit)

Pic 5. San Carlos Estates southern most weir. Note: flow from erosion.

Pic 6. Erosion around the southern most weir at San Carlos Estates

The North Branch

Flows leave San Carlos Estates in two areas and create a north branch tributary and south branch tributary. The north branch runs in a man made canal adjacent to the Villages of Bonita subdivision. The canal in this area is heavily vegetated as shown in the picture below. Flows could

be increased in this by removing the vegetation and general maintenance grading of the canal.

Pic 19. North Branch adjacent to Villages of Bonita

The flow then crosses under Old US-41 through 2 – 8' x 4' box culverts and into the Bernwood Business Park. Inside Bernwood Business Park the tributary is moderately vegetated and the flow passes through another box culvert to the railroad right-of-way. At the railroad right-of-way the

Pic 20. Culvert in Bernwood Business Park – North Branch

Pic 21. North Branch entering railroad right-of-way.

Pic 22. 48” RCP at railroad crossing looking east

vegetation is very heavy as shown. There are several 48" RCP pipes along the railroad right of way which convey water from the east side ditch to the west side ditch that runs parallel to the tracks. Two of these pipes were located in the area of the north branch. In both instances the pipes were in poor condition and covered with vegetation and debris. Further analysis of the pipes and condition of the conveyance swales along the railroad right-of-way is recommended. Based on the size of the upstream box culverts at Old US-41 and inside Bernwood Business Park it is likely that the amount of vegetation and condition and spacing of the pipes at the railroad right of way is constricting the flow of the north branch. As flows pass the railroad right of way the north branch is almost completely covered by vegetation until it reaches the FPL right-of-way. The FPL right-of-way operates similar to the railroad with two adjacent ditches running parallel to the power poles with pipes spaced at intervals in the ditches. Again the pipes are in poor condition and covered with vegetation. Maintenance of the parallel ditches and inspections of the existing pipes is recommended in the area of the FPL easement.

Pic 23. 48" RCP at FPL easement

As flow exits the FPL easement it flows into the Cedar Creek Subdivision preserve area. This area is heavily vegetated and in some areas the flow is almost completely blocked. Removal of vegetation and maintenance in this area is necessary to restore flows in the north branch. As the north branch exists the subdivision it merges with the south branch.

Pic 24. restricted flow inside the Cedar Creek Subdivision

The South Branch

As flows leave San Carlos Estates in the south branch they are conveyed by a drainage canal to Old US-41. The photo below shows the intersection of the San Carlos Estates drainage canals and the offsite conveyance. As shown in the photo, as flows leave San Carlos Estates the conveyance is heavily vegetated and flows become restricted at this

Pic 7. Intersection of San Carlos Estates canals and offsite conveyance

point to the box culvert at Old US-41. On July 14, 2006, the SFWMD approved permit 36-05877-P (**att #10**) titled Old 41 Widening Project. This permit authorized the construction and operation of a surface water management system serving 35.01 acres of roadway improvements with discharges to the Imperial River and Spring Creek. The permit was issued to the City of Bonita Springs. Prior to issuance of the permit, there were no water control structures permitted for this section of Old US-41. The existing roadway drained to roadside ditches with discharge to Spring Creek in the area of existing box culverts. The permit delineated 7 basins with basins 1-2 discharging to the Imperial River and basins 3-7 discharging to Spring Creek. Basin 3 extends from Hope Lutheran Church to the existing 10'X6' box culverts. Runoff is directed to Hope Lutheran Church (36-03118-P) and additional improvements are provided for attenuation and discharge within that system with a permitted control elevation of 9.3'. Basins 4 & 5 include Bernwood Business Park and extend from the existing box culvert to the rail road crossing. This area has a direct impact on the headwaters of Spring Creek. Runoff in this area is directed to the surface water management system for Bernwood Business Park (36-02904-S) which discharges to the headwaters directly downstream of the box culverts at Old US-41. In order to provide water quality and attenuation two existing control structures within Bernwood Business Park were modified and a new control structure proposed to maintain the original peak design discharge for the Business Park. The permitted control elevation for this is 10.00' for Basin 5 and 9.3' for Basin 4. Basin 6 conveys runoff to the existing railroad ditch and provides for offsite flows from two commercial developments. Basin 7 extends from the railroad crossing to the intersection with US41. The runoff from this basin enters dry detention areas and is discharged to the existing ditch along the FPL powerline easement with a control elevation of 10.70' and an allowable discharge of 11.37 cfs. The Lee County Master Surface Water Management Plan lists an average elevation of the box culverts of 6.6'. A USGS monitoring station is located just upstream of the box culverts at Old US-41. Attached is monitoring data from that station (**att #11**). The monitoring data shows monthly mean gage height in feet and monthly mean flow data in cubic feet per second from 2002-2007.

Pic 8. Old US41 Box Culvert Upstream of Bernwood Business Park

After exiting the box culverts at Old US-41, the headwaters continue into Bernwood Business Park. Bernwood Business Park was permitted on March 9, 1995 (36-02904-S) (**att #12**) and subsequently modified on several occasions to permit individual lot development as well as modifications to the master storm water management system. The permit authorized construction and operation of a surface water management system to serve 110.41 acres of industrial development. The development was divided into five basins. Basin 1 flowed into Basin 2 then into the Spring Creek tributary. Basins 3-5 discharged directly to the tributary. The control elevation for all basins discharging to the tributary is 9.3'. The four proposed control structures limited discharge to the tributary to a total of 12.1 cfs. The conveyance in the area of Bernwood Business park is heavily vegetated causing flows to be restricted. It is suggested that the conveyance in this area be maintained by removing the vegetation to enhance flow. Also, the field inspection revealed that a cattle crossing had been constructed inside Bernwood Business Park. A picture of the cattle crossing is shown below. The cattle crossing does not appear to restrict flow in this area.

Pic 9. Bernwood Business Park upstream to Old US-41

Pic 10. Spring Creek Tributary inside Bernwood Business Park

Pic 11. Cattle Crossing inside Bernwood Business Park

The flow continues past Bernwood Business Park to the Seminole Gulf Railroad crossing. The crossing is shown in the picture below. The creek is shallow at the crossing and appears to widen at the crossing during maximum flows. During the field inspection an additional pipe was discovered at the south end of the crossing. This pipe is at a higher elevation and is intended to pass flows during high water events.

Pic 12. Seminole Gulf Railroad Crossing

Pic 13. Additional Pipe at Railroad Crossing

The pipe was clogged with debris and had eroded areas both upstream and downstream. Additional maintenance cleaning and removal of debris is required in this area as well as additional investigation during high flow events to evaluate flows at the bridge crossing. The Lee County Master Surface Water Management Plan details the crossing as a 51' bridge with road elevation of 14.1' NGVD. There is no mention of the additional pipe.
As the flow continues past the railroad bridge it again becomes constricted with vegetation until it reaches Imperial Harbor. Imperial Harbor is an existing mobile home development. The only permit issued by SFWMD is for unit 7 which discharges to the Imperial River and was issued on September 23, 1982. However, the Spring Creek tributary does run along the northern border of the development and is connected to the perimeter ditch of Imperial Harbor. There is a crossing inside Imperial Harbor consisting of four corrugated metal pipes. The Lee County Master Surface Water Management Plan shows 2-42" CMP's and 1-36" CMP with average inverts of 3.2'. The conveyance is very well maintained inside of the Imperial Harbor development. However, as flows continue past Imperial Harbor it again becomes densely vegetated to the point of causing a stagnate condition. Again general maintenance cleaning in this area will improve the flow conditions. This vegetation continues to the concrete bridge crossing for the FPL easement crossing. The Lee County Master Surface Water Management Plan shows the FPL crossing as a 40' concrete bridge crossing with a road elevation of 11.2'.

Pic 14. Imperial Harbor CMP pipe crossing.

Pic 15. Canal inside Imperial Harbor

Pic 16. Downstream of Imperial Harbor

There is vegetation in the conveyance both upstream and down stream at the FPL bridge crossing. It is at this point that Spring Creek becomes a natural waterway.

Pic 17. FPL Easement Bridge Crossing

IV. SPRING CREEK

At the FPL easement crossing, Spring Creek becomes a natural waterway and is controlled by tidal conditions according to the Lee County Master Surface Water Management Plan. From the FPL easement to the bridge at US-41 Spring Creek is moderately vegetated and begins to widen. According to the Lee County Master Surface Water Management Plan, the bridge is 148' with a road elevation of 9.4'. The area around the bridge is well maintained and no restrictions are noted. As the creek continues to Estero Bay, it varies greatly in width in excess of 100'. The creek is generally free of vegetation in the areas downstream of US-41. Downstream of US-41 the creek is bordered on the north by Pelican Landing (SFWMD Permit #36-01620-S)(**att #13**), Pelicans Nest (36-00433-S) and Spring Creek West (36-02469-S) (**att #14**).

Pic 18. Bridge crossing at US-41

Permitted on February 9, 1984 by SFWMD the Pelican's Nest Development included construction and operation for 187.2 acres of residential and recreational development. The project was divided into six drainage basins with basins 4-6 discharging directly into Spring Creek. The permit was modified several times to include a total development area of 397.5 acres with an allowable discharge of 55 cfs. The project discharge points to Spring Creek remain unchanged from the original construction and operating permit.

The Pelican Landing permit authorized construction and operation for 84.37 acres of residential development know as Pelican Landing Unit III and conceptual authorization for an additional 205.23 acres.. Unit III consisted of 5 drainage basins labeled 8A, 8B, 8C, 8D, and 8E. Only Basins 8C and 8E discharge to Spring Creek via and existing drainage ditch. The design discharge for Basin 8C is 39.32 cfs with a control elevation of 11.0'. The design discharge for Basin 8E is listed as 11.36 cfs, however the allowable listed in the permit is 1.55 cfs with a control elevation of 11.00'. The Pelican Landing permit has been modified on several occasions to permit additional development and modify the surface water management system. On August 15, 1991 a modification was issued for construction and operation of Unit 4 consisting of 118.96 acres and modifications to Unit III. An additional outfall to Spring Creek was added with a design discharge of 9.41 cfs at a control elevation of 11.5' within basin 8H. Basin 8C was modified to include two control structures with a design discharge of 86.91 cfs at control elevation 11.0". On July 15, 1993 the SFWMD approved another modification for conceptual approval for 879.87 acres of residential and golf course development was approved. This permit split Pelican Landing into two major drainage basins B and C and several sub-basins. Drainage basin B would discharge through previously permitted facilities in Basin 8 which were designed to accommodate the additional flows and basin C would discharge directly to Estero Bay and not impact Spring Creek.

Spring Creek West was approved on May 13, 1993 for conceptual approval for 315 acres of residential and golf course development and construction and operation approval of Phase 1 totaling 137.9 acres of golf course development. It was subsequently modified and granted construction and operation for 221.6 acres within Phase 1. The modification proposed 10 drainage basins with Basins 2,3,6,7 and 9 discharging to a tributary to Spring Creek and Basin 8 directly to Spring Creek. The control elevations and design discharges are shown in the table below:

Basin	**Contol Elevation (ft)**	**Design Discharge (cfs)**
2	9.0'	7.9
3	9.0'	8.2
6	6.0'	5.2
7	4.0'	5.7
8	5.0'	1.6
9	8.0'	5.0

On March 9, 1995 another modification was approved for construction and operation of 85.14 acres of residential development and added drainage

basins 11 and 12 with modifications to drainage basin 6 from the original permit. Basin 12 was approved with one structure that discharged directly to Spring Creek with a control elevation of 3.5' and a design discharge of 3.63 cfs. The modification also increased the Basin 6 design discharge to 6.45 cfs. On May 11, 1995 a modification was approved to place three weirs into the existing Spring Creek tributary that served 1345 acres of land comprised mostly of the three major developments of Pelican Landing, Pelican's Nest and Spring Creek West. The purpose of the modification was to stabilize water levels in the tributary and raise ground water elevations. The final weir discharged directly to Spring Creek with a design discharge rate of 185 cfs with a control elevation of 3.5'. Although this modification was issued under the Spring Creek West permit number it effectively limits all discharge to Spring Creek via the north/south tributary to 185 cfs.

On the south side Spring Creek is bordered by the Bonita Bay (36-00289-S) development (**att #15**). Bonita Bay was granted conceptual approval by SFWMD in October 1981. The conceptual approval included 2375 acres of total development including 277 acres of water management and 886.1 acres of impervious area. The conceptual permit also references 9,240 dwelling units and 1,410,000 sf of commercial area. The permit has been modified on several occasions to permit individual tract development. Most discharges within the development is directed to the north/south tidal slough that connects Spring Creek to the Imperial River. The establish discharge rate for the area east of the slough is 0.277 cfs/acre. The first construction and operation permit was issued on January 7, 1982 with discharging 129 cfs to the Imperial River and Spring Creek. The information contained within the SFWMD files did not specifically break the discharge into two separate watersheds. As show on the aerial exhibit the tidal slough becomes wide as it reaches Spring Creek where most of the discharges from Bonita Bay occur. Control elevations range from 6.0' to 2.5' within the Bonita Bay Development.

At this point Spring Creek discharges to Estero Bay and is well defined with mangrove wetland areas.

V. CONCLUSIONS AND RECOMMENDATIONS

From Estero Bay to US-41 Spring Creek is relatively free of vegetation with mangrove wetland areas. The creek in this area is relatively free of vegetation and flow restrictions. Past US-41 to the FPL easement the creek remains tidally controlled and becomes more vegetated. It is recommended that vegetation be removed in area. At the FPL bridge to the beginning of Imperial Harbor is severely restricted by vegetation. The flows in this area would benefit greatly if vegetation is removed from creek. Through Imperial Harbour the creek is a dug channel and well

maintained. The CMP pipes in Imperial Harbor should be inspected thoroughly and flows analyzed to determine the flow capacity. Upstream from Imperial Harbor through the Seminole Gulf crossing and into Bernwood Business Park is the channel is covered by dense vegetation. This vegetation should be removed to aid flows in this area. The box culverts at Old US-41 are well maintained but the channel from the box culverts to San Carlos Estates is moderately covered with vegetation. The erosion around the weir inside San Carlos Estates should be repaired immediately to prevent failure of the weir which could cause significant downstream impacts. The system within San Carlos Estates other than the weir is well maintained and functions according to the issued permit. The box culvert at Three Oaks Parkway is also well maintained, however upstream of the box culvert to I-75 and in the area of the Brooks outfall is heavily vegetated. This vegetation should be removed and some grading to define the channel banks should completed in the anticipation of additional flows to the system in the future.