MNS ENGINEERS INC

MNS Engineers, Inc.

Risk Assessment Study

on the Interceptor Sewerline System

in County Service Area 7A, Oak Shores

County of San Luis Obispo

10/1/2015

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Executive Summary

Purpose

This study has been conducted to examine and assess the potential risk of failure of the existing East & West Interceptor Sewer Lines , components of the Oak Shores Wastewater collection and treatment system also known as County Service Area 7A (CSA 7A) which serves the Oak Shores subdivision at Lake Nacimiento. Failure will result in potential health and safety issues, water supply issues and other human factor issues. Built in 1975, the interceptor lines, which are the lowest collector lines in the system and convey all of the subdivision wastewater to lift Station #3, are located beneath the high water level of Lake Nacimiento and serve the existing 632 homes.

The need to identify all risks to the interceptor portion of the system and prioritize them was brought to light in March of 2011. A breach occurred in one of the lines near its connection with the interceptor when the lake surface was high enough that the line was submerged. Sewage did not leak into the lake, but lake water infiltrated the pipe leading to lift station #3 and significantly increased flows and inundated the treatment plant. As a precaution, the Nacimiento community water supply was shut down until the leak could be located and repaired. This event demonstrated the risk for failure and potential effect on regional water supplies, recreation and other human factors posed by the location and configuration of this sewer collection system.

This risk assessment identifies potential weaknesses with the existing interceptors and lift-station (including operational and administrative controls), quantifies and prioritizes the risk, provides alternatives for improvements to the system, and makes recommendations for implementation.

Oak Shores Community Sewer System Summary

The ductile iron interceptor lines have become partially exposed due to wave action erosion, and are underwater when the lake water levels are near the high-water mark (Elevation 803 NAVD 1988). These lines with associated manholes and laterals were built in 1975 and operate under submerged conditions. They currently exist below the existing high-water level of the lake. Lift Station #3, while in good repair, has elements at risk due to access restrictions if inundated in

Exposed Interceptor Pipe IE-124 on the East Interceptor

Exposed Lateral Repairs along Eroded Bank

Manhole M93, Exposed Interceptor lower left

Exposed Interceptor IW-86 on the West Interceptor the event of a failure, and subsequent lake water intrusion. The adjacent photographs identify some of the key problems with the system.

Analysis

A basic hydraulic sewer system model of the interceptor lines was developed from as-built information and recent survey data. This model was used to determine capacity and adequacy of the interceptors, relate capacity to the history of flows (YR to YR), as well as to understand the operation of the interceptors. Various flows of interest are summarized in the table below.

Flow Component	Gallons Per Day (gpd)
Average Daily Base Flow	30,000
Average Peak Daily Flow	80,000
Highest Daily Flow Experienced	226,000
Est. Base Flow East Interceptor	11,250
Est. Base Flow West Interceptor	18,750
Max Est. Flow East Interceptor	84,600
Max Est. Flow West Interceptor	141,400
Design Capacity East Interceptor	1,900,000
Design Capacity West Interceptor	1,400,000

Definitions:
Average Daily Base Flow = Average Flow Experienced each day based on flow records available.
Maximum Estimated Flow = Based on actual highest peak flows measured between Oct 1993 & July 2012.
Estimated Design Capacity = Maximum flow that can be contained within the interceptors with the pipe flowing full.

Identification of Potential Risks

The risk assessment considers financial, operational, environmental, public health and CSA 7A impacts associated with the risk of failure and spill associated with the interceptor lines and lift station #3.

The risk of system failure was quantified considering the importance of the element to the system and the potential consequences should that element fail. The following are important impacts related to failure:

- Financial impacts including the cost of recovery, clean-up, repairs, public relations, regulatory fines from the Regional Water Quality Control Board, etc.
- Operational impacts such as degree of system failure, recovery operational issues, etc.
- General environmental impacts including water quality, and impacts on flora and fauna
- Potential public health impacts due to shut down or contamination of water supply.
- Recreational impacts due to closure of public swimming and lake recreation areas.
- CSA 7A impacts such as demand on staff and equipment resources, fiscal impacts, and impacts to CSA 7A and the County’s reputation with public & regulatory agencies

Risk was analyzed by looking at three areas of vulnerability of the system

1. Physical,
2. Operational, and
3. Administrative

Physical vulnerabilities included: manholes, interceptor pipes and connecting laterals. Issues such as location below the high water elevation of the lake, susceptibility to erosion, damage by boats, vandalism to exposed pipes &

manholes, lack of adequate pipe support where undermined, system age, accelerated corrosion, interior sediment accumulation, fat, oil, & grease accumulation as well as other physical factors. Various failure modes discussed include pipe breach by various external or internal causes, partial or full plugging, lift station overflow in the event of lake water intrusion following a failure, and impacts on the wastewater treatment plant.

Operational vulnerabilities were also evaluated. These included quantity and quality of operator training and certification, as well as funding and scheduling, of this training. These are policy and legal issues that need clarification.

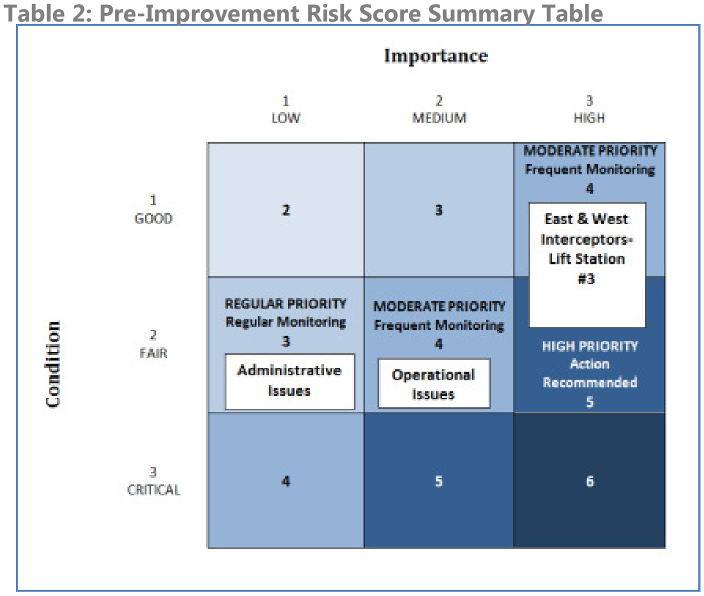
Administrative contributors to risk include adequate access easements, mapping of existing laterals with respect to existing easements . Also discussed is the need to adopt specific development requirements such as standard details for new construction and repair, and building permit conditions applicable to this location.

The physical vulnerabilities were further divided into three major components, east interceptor, west interceptor and lift station #3 as shown in Table 1. Each component was assessed a risk factor from 1 to 3 (with 3 being the highest) based on condition and importance. The two risk factors (condition & importance) were added together to establish a risk total associated with each vulnerability. Risk for the interceptor pipes and associated manholes was established by adding the risk from all components (pipes segments and manholes) and averaging the scores See Tables 4.5 & 4.6. The results are
displayed in Table 1 & 2.

Table 1: Pre-Improvement Risk Score Summary

Risk Element	Importance (Ave)	Condition (Ave)	Risk Based on Condition	Highest Possible Score
Physical Vulnerabilities:				
East Interceptor	3	1.7	4.7	6
West Interceptor	3	1.6	4.6	6
Lift Station #3	3	1.5	4.5	6
Operational Vulnerability	2	2	4	6
Administrative Vulnerability	1	2	3	6
		Total Average Risk	**4.26**	

Table 2: Pre-Improvement Risk Score Summary Table



The Physical vulnerabilities have average Risk Scores of 4.5 - 4.7, and are rated as “High Importance” with a “Moderate to High Priority” inferring corrective action is recommended as well as frequent monitoring until corrective action can be taken. Operational vulnerabilities were evaluated and assigned a risk score of 4, and are rated as “Medium Importance” with a moderate priority with frequent monitoring recommended until corrections can be made to lower the risk associated with this element. Administrative vulnerabilities were determined to have a risk score of 3, and are rated as “Low Importance” with a fair condition with regular monitoring recommended until corrections can be made to lower the risk associated with this element. The recommendations for improvement presented in the report focus on three areas:

1. Physical System (Lift station upgrades; interceptor repair or bypass
2. Operational and Emergency and
3. Administrative.

Recommended Improvements and Costs

A summary of the recommended improvements which have been identified that could reduce risk of failure for these risk elements and the TOTAL PROJECT COSTS are:

Table 3: Recommended Improvements with Total Project Costs

INTERCEPTOR PHYSICAL IMPROVEMENTS

1	***Provide additional flow monitoring devices, mechanical & electrical improvements.*** Enhance backup power, install automatic operating valves at the lift station, and consolidate some lateral lines. Clean and video pipe inspection.	$245,000
2	***Perform minor immediate repairs***: cover exposed interceptors, repair & replace laterals & supports, reduce erosion with rock rip-rap. Coord. With property owners.	$173,000
3a	***Improvement Option 3a*: *Interceptor Rehabilitation*** (Lining w/some replacement)	$1,024,000
3b	***Improvement Option 3b*: *Partial Interceptor Bypass*** (Eliminate >½ of Interceptors & reroute associated laterals)	$3,346,000
3c	***Improvement Option 3c*: *Interceptor Bypass*** (Eliminate all current Interceptors; East & West)	$4,452,000-$6,600,000
	Total Depends on Option Chosen	$1,442,000-$4,870,000

LIFT STATION #3

4	***Provide redundant equipment*** for backup in the event of a mechanical failure, including alarms. Have rental agreement for additional BU generator.	$32,000
5	***Provide Supervisory Control and Data Acquisition (SCADA) capability*** with recording, alarm systems, multiple stage sensors, additional flow monitors, and for the lift station monitoring system.	$94,000
6	***Provide a backup lift station pump on site***, and have accounts in place or methods for rental of backup equipment.	$13,000
7	***Consider a containment berm*** around the Lift Station.	$48,000
	Total	$187,000

OPERATIONAL (INCLUDING EMERGENCY) IMPROVEMENTS

8	***Schedule enhanced frequency of inspections*** for the interceptors and lift station systems as described in this report.	$9,000
9	***Develop a GIS system*** which correlates manhole and pipe line location, property ownership data, permits, repair logs, historical pictures etc.. Data should be made available to the operator and field crews. Also, a procedures and maintenance manual should be developed which allows for easy updating.	$32,000
10	***Develop a comprehensive set of emergency operation procedures***, provide training and make available to all operators and vital personnel.	$9,000
11	***Adopt enhanced system inspection procedures*** including a system component identification method, a cleaning and video inspection schedule, preparation of a monthly report of problem areas, and if needed, a photograph or sketch of the problem made and submitted to management for review. Other misc. recommendations as included in the report.	$6,000
12	***Enhance staff training*** by developing a staff work plan and position duties. Certification requirements and renewals should be actively discussed with all relevant personnel. Staff training and proficiency testing should be documented and recorded to ensure staff is current on all procedures.	$12,000
13	***Prepare enhanced standard operating procedures (SOPs)*** for the lift station and the interceptor lines addressing opening of manholes, line protection measures, lateral repairs, and emergency system operation procedures for various flooding or failure scenarios.	$9,000
14	***Implement operational improvements*** as recommended by the County	TBD
	Total	$77,000+

ADMINISTRATIVE IMPROVEMENTS

15	***Prepare development standards, standard plans, mapping of laterals and easements.***	$32,000

Because of the high cost associated with many of these items, implementation of recommended improvements would need to be accomplished in accordance with a multi-fiscal year budget plan.

A Ranking of Improvement Recommendations

All recommendations are important, and should be accomplished to the degree deemed feasible by CSA 7A according to priority. The improvements (shown in Table 3), in priority order of implementation are as follows:

1. Additional Flow Monitoring, BU Power, Automatic valves and some lateral consolidation(1.)
2. Minor Immediate Repairs(2)
3. Interceptor Improvements: Either (3a) Rehabilitate the interceptor lines, or (3b) bypass part of the existing interceptor or (3c) bypass all of the interceptor lines.
4. Lift Station #3 Upgrades (4-7)
5. Operational Improvements (8-14)
6. Administrative Improvements (15)

The reasons for this order are that Recommendations 1 and 2 are considered to be critical lines of defense that can reduce risk immediately, and the effectiveness of 3. Interceptor Improvements are dependent on implementation of these measures. The bigger project to bypass some or all of the interceptor lines (rerouting lateral flows) may need to be budgeted for in a phased approach over time, but should not delay implementation of the other measures.

A summary of risk reduction associated with these recommendations is shown in Table 4. They are listed in order of priority of implementation. This matrix represents the percent improvement that is expected through implementation of the recommendations. Note that under this system of assessment, the lowest possible risk value is 2, the largest is 6

Table 4. Recommendations By Priority & Pre/Post- Improvement Risk Summary

Improvement Recommendations (See Detailed Recommendation List Above)	Risk Range (Possible Score)	Pre-Improvement Risk	Post-Improvement Risk	Risk Improve-ment	Cost (Construction for Interceptor & Lift Station)	Priority
Interceptor Improvements (1-3c)	--	--	--	--	--	--
1. Add'l Flow Monitoring, BU Power, Automatic Valves & Lateral	**2-6**	4.65	4.5	3.2%	$200,000	**High**
2. Perform Minor Immediate Repairs	**2-6**	4.65	4.4	5.4%	$140,000	**High**
3. Option 3a: Interceptor Rehabilitation	**2-6**	4.65	4.3	7.5%	$1,200,000	**High (Choose One)**
Option 3b:Partial Interceptor Bypass	**2-6**	4.65	4.1	11.8%	$3,400,000	
Option 3c: Interceptor Bypass	**2-6**	4.65	3.2	31.2%	$6,600,000	
4-7. Lift Station #3	**2-6**	4.5	4 (with 3a/3b) 3 (with3c)	11.1% 33.3%	$355,000	**High**
8-14. Operational Improvements	**2-6**	4	3	25%	$74,000	Moderate
15. Administrative Improvements	**2-6**	3	2	33.3	$12,000	Regular

As would be expected, eliminating all or a major portion of the interceptors and replacing them with a by-pass system significantly reduces the risk. Rehabilitation reduces the risk to a predictably lesser extent.

It is highly recommended that improvements #1 and #2 be completed immediately. Prior to choosing one of the interceptor improvement alternatives 3a- 3c, it may be desirable to clean and video inspect each interceptor to determine the condition of the pipe. Because of their relatively low cost, even though they are a lower priority for implementation, it is recommended that the Operational and Administrative Improvements be considered for implementation as soon as possible. They are lower priority, but are still important lines of defense that can reduce risk immediately.

As all recommendations are accomplished, the condition of these risk elements improve from fair to good, and the level of monitoring or recommendations for action are reduced.

Table 5: Post-Improvement Risk Score Summary Table

Condition \ Importance	1 LOW	2 MEDIUM	3 HIGH
1 GOOD	REGULAR PRIORITY Infrequent Monitoring 2 Administrative Issues	MODERATE PRIORITY Regular Monitoring 3 East & West Interceptors- Full Bypass & Liftstation Operational Issues	MODERATE PRIORITY Frequent Monitoring 4 East & West Interceptors- Rehab or Part. Bypass & Liftstation
2 FAIR	REGULAR PRIORITY Regular Monitoring 3	MODERATE PRIORITY Frequent Monitoring 4	HIGH PRIORITY Action Recommended 5
3 CRITICAL	4	5	6

The importance of the interceptor pipes remains a “3” until they are removed from the lake. The importance of the lift station also remains a “3” until the interceptors and associated laterals are removed from the lake. Because it’s function is directly affected by failure of the interceptors, as long as they remain under water. Once a bypass is built, and the interceptors removed from the lake, the importance drops to a “2” and regular monitoring can be implemented.

As the recommendations are implemented, it can be seen that the risk of failure causing a spill into the lake is reduced sufficiently, and action is reduced to various levels of monitoring, maintenance and operational controls.

1.0 Introduction

1.1 Lake Nacimiento

The Nacimiento Dam and Reservoir are located in San Luis Obispo County. Nacimiento Dam was constructed in 1957 by the Monterey County Flood Control and Water Conservation District, which is now known as the Monterey County Water Resources Agency (MCWRA). The watershed that contributes to Lake Nacimiento is 324 square miles; this area consists mostly of wilderness and land used for grazing. The lake has a capacity of 377,900 acre feet and a surface area of 5,727 acres at the spillway crest elevation of el. 803.07 (NAVD88)[1]. This reservoir is owned and operated by the MCWRA. San Luis Obispo County Flood Control and Water Conservation (District) has an entitlement for 17,500 acre feet per year of water from the lake for use in San Luis Obispo County. [1.2]

Figure 1.1: Lake Nacimiento Satellite Image – Google Images

[1] 800 ft (NGVD 29)

[1.2] "Nacimiento Water Supply Project: Report on Recreational Use at Lake Nacimiento" prepared by San Luis Obispo County Flood Control and Water Conservation District June 2002

There are several additional agencies that have a stake in the happenings of the Oak Shores sewer system. Regulatory agencies include the Regional Water Quality Control Board, California Department of Public Health (CDPH), San Luis Obispo County Environmental Health Services, Army Corps of Engineers, and the California Department of Fish and Wildlife. Other organizations include the Oak Shores Community Association, Heritage Ranch Owner's Association, Monterey County Parks, Nacitone Watershed Steering Committee, and the Nacimiento Project Commission.

San Luis Obispo County Public Works Department operates the wastewater facilities as CSA 7A. CSA 7A is regulated by the Central Coast Regional Water Quality Control Board Waste Discharge Requirements (WDR) Order No. 01-130 and is governed by County Ordinance 2338 adopted by the Board of Supervisors on February 18, 1988 specifically for CSA 7A. The ordinance provides the rules and regulations for CSA 7A. The County Public Works Department also issued a Procedural Memorandum O-2 which further clarifies responsibilities for maintenance and operation of sewer laterals for all systems Public Works operates and maintains throughout the County.

1.2 Oak Shores Community

There are three main developments situated adjacent to Lake Nacimiento: Oak Shores, Heritage Ranch, and Lake Nacimiento Resort.

The Oak Shores Development is a gated lakefront community located on the north shore of Lake Nacimiento. This community is over 320 acres in size[1.3] and has a potential build-out of 1,750 homes[1.4]. However, the Regional Water Quality Control Board's WDR 01-130 only allows for 853 homes producing wastewater at build-out. Currently, there are a total of 632 homes[1.5] connected to the CSA 7A system. Many of the homes in this development are occupied seasonally, with the largest occupancy occurring in the summertime.

Oak Shores has the following utilities:

- **Water –** Nacimiento Water Company, a public utility. Water usage is metered and paid annually for part-time residents and quarterly for full-time residents.
- **Electricity** – Underground service to each lot provided by Pacific Gas & Electric.
- **Telephone** – Underground service to each lot provided by SBC.
- **Sewer** – Sewer system operated by San Luis Obispo County and owned by property owners.
- **Trash** – Weekly pickup (each Tuesday) provided by San Miguel Disposal Company.
- **Television & Internet –** Access is via satellite subscription service.

[1.3] http://www.oakshoresrealty.com/lake-information.php
[1.4] http://oakshores.us/
[1.5] Based on counts from supplied aerial mapping

Sewage interceptor lines gather flows from various mains and laterals in the system and convey this flow by gravity to a lift station (Lift Station #3). The interceptors are currently buried under the high water line (HWL) of the lake. [1.6] This lift station then pumps sewage to the wastewater treatment facility, constructed in 1975.

1.3 Risk Assessment Study

The County of San Luis Obispo acknowledges the potential risk of failure of the existing interceptor sewer system. Currently the East and West Interceptor Lines are located beneath the High Water level of Lake Nacimiento. The sewers were originally constructed in 1975 when the lake was used for recreation and water recharge. Currently the two interceptor's lines serve 632 homes.

In March of 2011, a joint in a sewer clean out line that was below the lake water elevation at the time became dislodged and lake water began to enter the sewer system inundating the downstream lift station #3 which then pumps to the treatment plant. No sewerage was reported leaking into the lake but many concerns were raised about the integrity of the interceptor system. As a precaution, the Nacimiento community water supply was shut down until the leak could be located and repaired. Prior to this incident there have been other leaks associated with the lines and the manholes. [1.7]

In 2004, an Interceptor Bypass Study[1.8] was performed to examine the extent of resources necessary to remove the interceptor from below the high water line of the reservoir. Due to high cost and limited County funds, the plan to remove the interceptor was not carried further. Built in 1975, the interceptor is aging and the risk involved in continuing to operate the current system must be examined.

The risk associated with this sewer needs to be assessed from every pertinent aspect, including assessment of alternatives for improvements to the system and operations while taking into consideration the following factors:

- Financial
- Operational
- Environmental
- Health and Safety
- Agency Impacts

The purpose of this study is to prepare a risk assessment of the Lift Station and the East and West Interceptor Lines of the Oak Shores Sanitary Sewer System. The study will also provide cost alternatives to reducing the risk level..

[1.6] "Nacimiento Water Supply Project: Report on Recreational Use at Lake Nacimiento" prepared by San Luis Obispo County Flood Control and Water Conservation District June 2002

[1.7] San Luis Obispo County Department of Public Works Request for Proposal- Risk Assessment Study on the Interceptor Sewer line System (Interceptor) in County Service Area 7A (CS7A) Oak Shores

[1.8] County Service Area 7A Oak Shores, California Interceptor Bypass Study 2004 – County of San Luis Obispo Public Works Department

This risk assessment examines existing conditions, identifies potential risks with the existing facilities, quantifies the risks, provides alternatives for the system, and makes recommendations for implementation. The tasks accomplished to address these goals are summarized below.

Initially, data was obtained and information gathered. In August 2012, a site visit was conducted with County staff and MNS. During this site visit, the condition of the existing system was assessed and documented with photos.

Following the site visit, the system was researched in depth. This included reviewing past studies, drawings, reports, and recorded data from the system. Operations staff were also interviewed and facilitated the gathering of information regarding historical work at the site. From this research, a hydraulic model was created, failure modes analyzed, and real and potential system weaknesses are identified. These are identified in more detail in Chapter 3 of this study.

A physical survey of the interceptors was also performed by professional land surveyors. This survey established a Network control and located the manholes, exposed mainlines, laterals and cleanouts on the east and west interceptor lines and provided a topographic survey of the existing ground over the east and west interceptor lines. A map was prepared showing the surveyed locations of the interceptor lines, manholes, laterals and cleanouts.

Once the information was gathered and the data organized, the system was assessed and a list of real and potential system “weaknesses” was developed. A priority list was developed based on the perceived severity. For each item identified as a weakness, the impacts of the item failing are discussed. These include the financial, operational, environmental, public health, recreational, and agency impacts.

A system for assigning a value for risk was developed for the recognized risks. Based on this system, priorities for the system were identified. Once the risks and severity of risks were identified, alternatives and solutions were provided to lead to the minimization of risk for the system. These solutions include infrastructure improvements, including creating “multiple lines of defense”, “hard improvements” and “soft improvements,” recommendations for repairs to the existing system, administrative alternatives, operational alternatives, emergency operation procedures, inspection procedures, emergency response, and staff training. These alternatives were then assessed and ranked based on their ability to remove risk from the system.

2.0 Existing Facilities

Sewage from the Oak Shores developed lots flow from lateral lines to the interceptor lines by gravity flow. The interceptor lines drain to Lift Station #3 where sewage is then pumped to the treatment plant. When constructed in 1975, the interceptors were buried below the high water line (HWL) of the lake EL 803.07 NAVD88[9]. [1.10] The East Branch Interceptor is approximately 4700 feet long and the entire length, with 24 manholes, are below the HWL. The West Branch Interceptor is 5050 feet long with 25 manholes, and is also buried below the HWL. Lift Station #3 wet well is approximately 60 feet deep, and the bottom of the wet well is located approximately 55 feet below the HWL[11]. The wastewater treatment facility is located approximately 1000 feet horizontally and 100 feet above the high water line of the reservoir.

CSA 7A's Ordinance 2338 defines the terms for the various components of the system. They are provided below to keep nomenclature consistent throughout this study.

Building Sewer - That portion of a sewer beginning two (2) feet from any building and extending to and including its connection to a public sewer.

Lateral Sewer –That portion of a public sewer lying within a public right-of-way or easement, which connects or is intended to connect, a building sewer to a main sewer.

Main Sewer - That portion of a public sewer, the purpose of which is to accept and convey to the wastewater treatment plant.

Public Sewer - That portion of a sewer lying within a public right-of-way or easement, and maintained by and subject to the jurisdiction of the County on behalf of the District.

Past reports and as-built construction drawings were examined to assemble information about the interceptor, laterals, the lift station, and the treatment plant. In order to better examine the condition of the existing facilities, a site visit was performed and documented with photos. The site visit was performed August 22, 2012 when reservoir levels were low. In addition, a survey of the system was completed October 25, 2012. This survey of the system involved surveying for location and elevation, as comprehensibly as possible, sewer interceptor lines,, laterals, and manholes.

Figure 2.1: Exposed Interceptor IW-86 on the West Interceptor

2.1 Interceptors

CSA 7A's sewage, flows from residences through laterals and

[9] EL 800.00 NGVD29

[1.10] "Nacimiento Water Supply Project: Report on Recreational Use at Lake Nacimiento" prepared by San Luis Obispo County Flood Control and Water Conservation District June 2002

[11] County Service Area 7A Oak Shores, California Interceptor Bypass Study 2004, County of San Luis Obispo

the collection system before being directed through the interceptor lines to lift station #3 and the treatment plant. The interceptor lines are referred to as the West interceptor and the East interceptor, and both terminate at the lift station. Both interceptors are located beneath the high water line of Lake Nacimiento. They operate by gravity flow and empty into Lift Station #3, where each line has a manual operation valve. Figures 2.2 and 2.3, on the following pages show overall layout of the West and East interceptors.

These sewer interceptors are made of ductile iron pipe (DIP) and range from 12 to 16-inches in diameter. From the as-built drawings and information, it appears that the interceptors are lined with concrete. The pipe segments are joined by use of a combination of bell and spigot and mechanical joints.

When originally constructed, the East and West interceptors were buried. However, over time, erosion has caused the interceptors to become exposed and undermined in several locations. Examples of this erosion can be seen in Figures 2.1, 2.4, and 2.5.

The West interceptor is approximately 5,050 feet in length and has 25 manholes located along it. There are 398 homes connected to this interceptor via sewer laterals. This interceptor is fed by 13 6-inch laterals and 21 4-inch laterals. A small exposed portion of the West interceptor may be seen in Figure 2.1. The East and West system layout showing areas of exposed pipes, laterals, and manholes is shown in Figures 2.2 and 2.3. An overall view of the system can be seen in Appendix C.

Figure 2.4: Exposed Interceptor Pipe IE-124 on the East Interceptor

The East interceptor may be seen in Figure 2.4. This interceptor is approximately 4,700 feet in length and has 24 manholes. There are 234 homes connected to this interceptor via laterals. This interceptor is fed by approximately 11 4-inch laterals and 16 6-inch lateral lines.

The District has tried several techniques to protect the interceptor against erosion. These techniques include concrete encasement, placing cement bags, and installing large rip rap. Placing concrete and placing cement bags have been difficult to install and eventually become undermined by wave erosion. Rip rap has proven to be the most successful method of supporting the main interceptor lines; however, erosion continues to occur.

2.2 Laterals

In addition to the main interceptor line, the sewer system is also comprised of ancillary

Figure 2.5: Exposed Feeder Composed of Different Materials

lines. These ancillary lines include laterals, and cleanout lines. Pipe material varies for these ancillary lines. Lateral lines are typically made of 4 inch PVC pipe that connect individual lines to 6 inch ductile iron laterals. These laterals have a cleanout at the upstream end and connect to the main sewer or interceptors line at the downstream end.

At the onset of this study, cleanouts identified by County staff as unnecessary or very difficult to access were scheduled to be removed. These cleanouts have since been cut and capped by County operators.

Many sections of laterals are exposed and unsupported due to bank erosion. Along the West interceptor 6 out of 12 laterals are exposed and 7 out of 21 laterals along the East interceptor are exposed. This erosion creates terrain that is very difficult to access in the event repairs need to be made to the system. Some precarious cleanouts and lateral pipes have been supported with District fabricated supports which consist of the following: two pipe supports, a metal saddle, a wooden or fabric spacer, and a strap across the top. Joint connections vary from compression fittings to flexible rubber connections.

2.3 Manholes

The manholes along the West and East Interceptors are beneath the high water line of the lake. These manholes were constructed using cast-in-place channels and benches with mortar and brick access.

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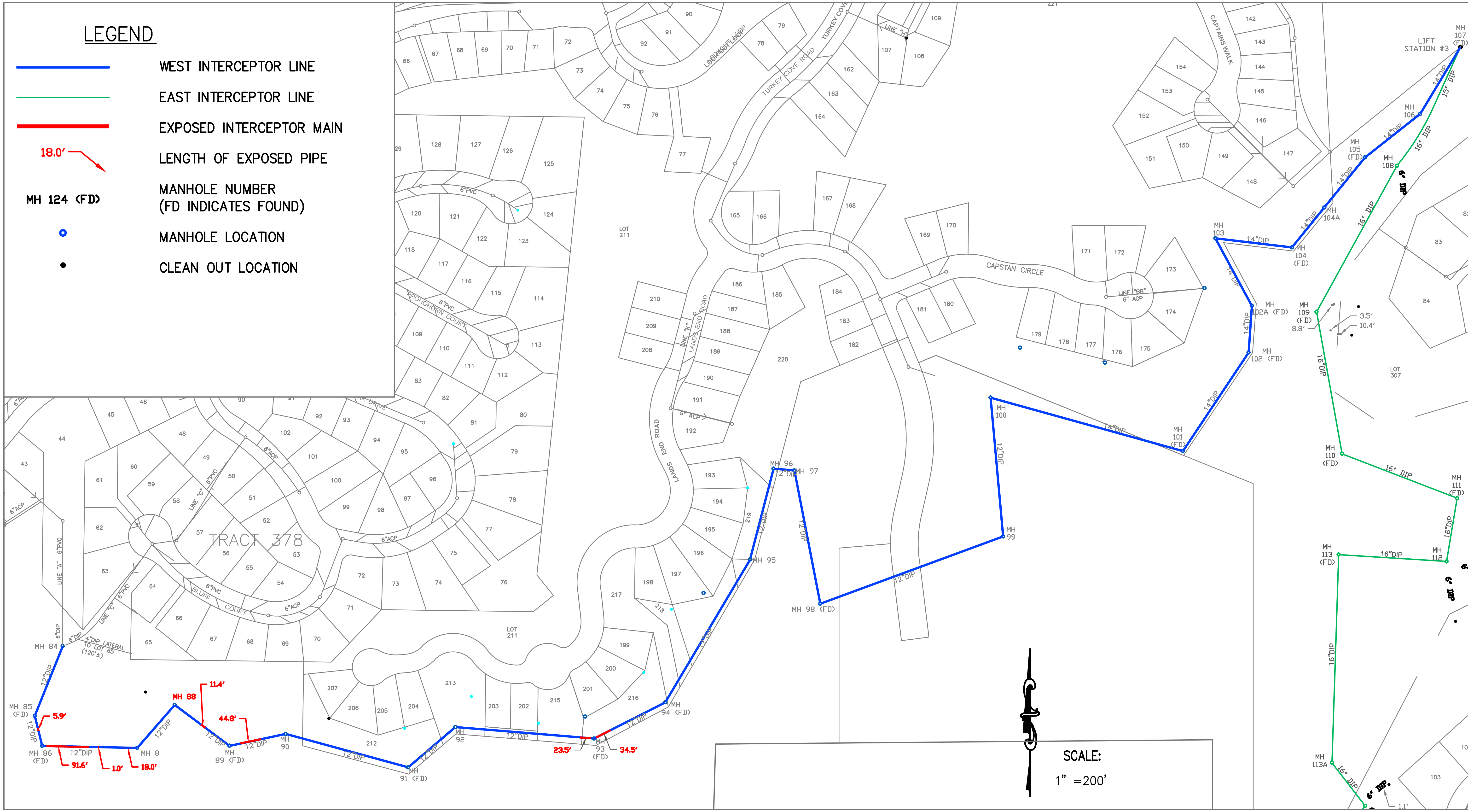


OAK SHORES SEWER RISK ANALYSIS
INTERCEPTOR SURVEY RESULTS

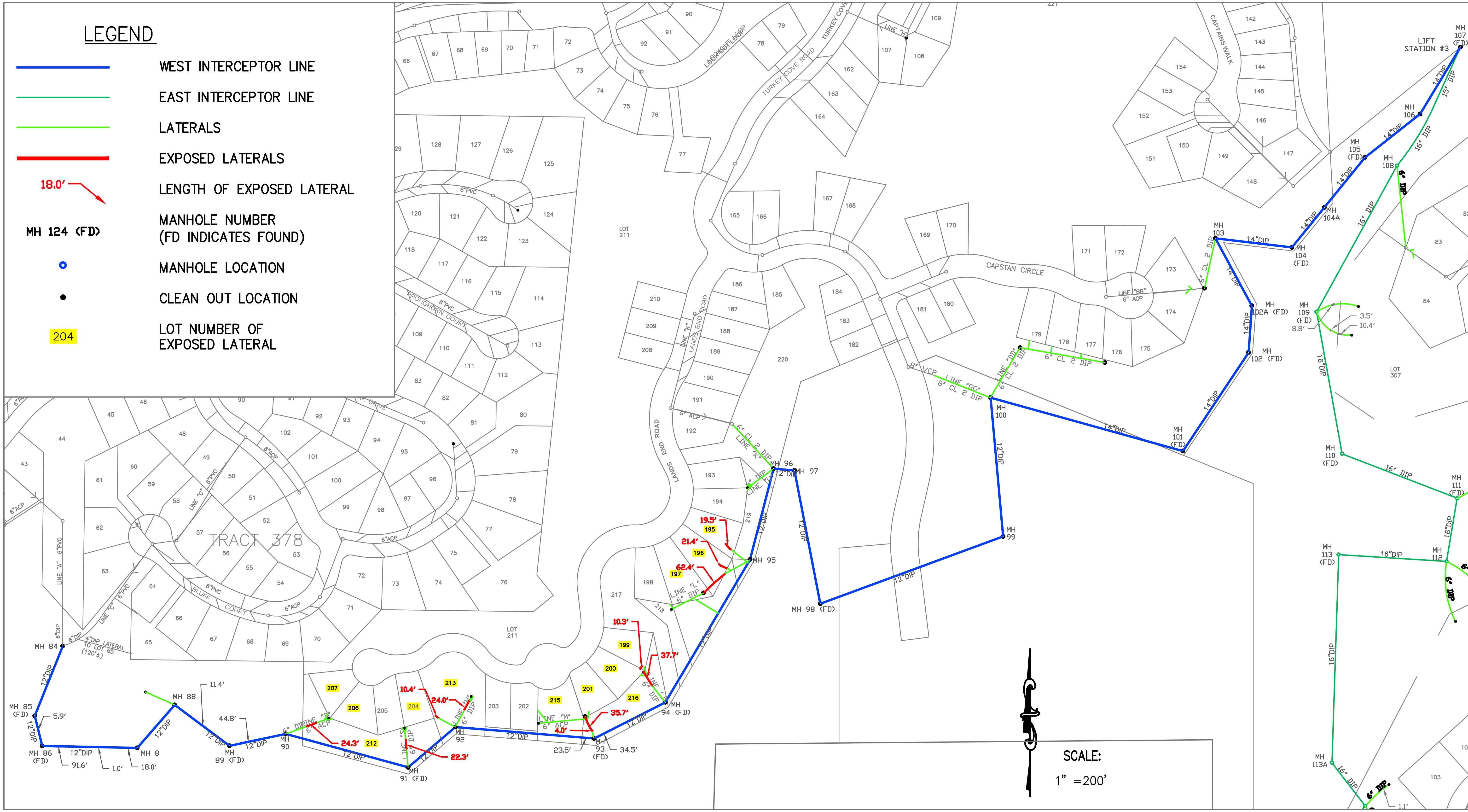
WEST INTERCEPTOR
EXHIBIT

WORK ORDER NO.
COSLO.110005

SHEET 1
OF 4 SHEETS

MNS ENGINEERS INC
201 Industrial Way
Buellton, CA 93427
805.688.5200 Phone
ENGINEERING
PLANNING
SURVEYING
CONSTRUCTION
MANAGEMENT

FIGURE 2.2a



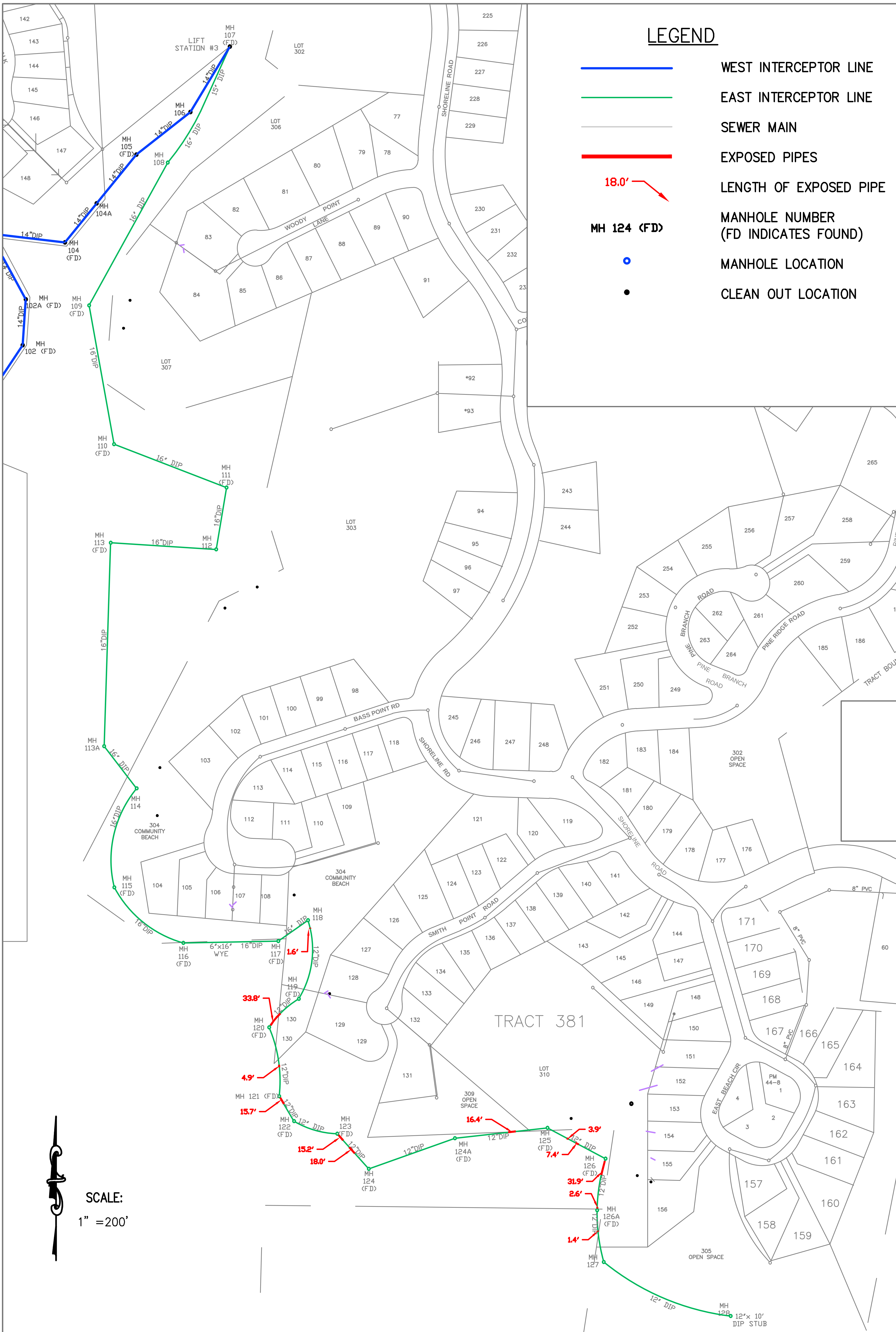
OAK SHORES SEWER RISK ANALYSIS
INTERCEPTOR SURVEY RESULTS
LATERAL EXHIBIT

MNS ENGINEERS INC
201 Industrial Way
Buellton, CA 93427
805.688.5200 Phone
ENGINEERING
PLANNING
SURVEYING
CONSTRUCTION
MANAGEMENT

WORK ORDER NO.
COSLO.110005

FIGURE 2.2b

Tue 29.Sep.15 02:36:19 PM \\mnsslo\Projects\COSLO County Of San Luis Obispo\COSLO.110005 Oak Shores Sewer Risk Study\Drawings\Civil\Exhibits\COSLO.110005 SEWER SURVEY EXHIBIT-3a_4-1 (NEW).dwg



OAK SHORES SEWER RISK ANALYSIS
INTERCEPTOR SURVEY RESULTS

EAST INTERCEPTOR EXHIBIT

MNS ENGINEERS INC
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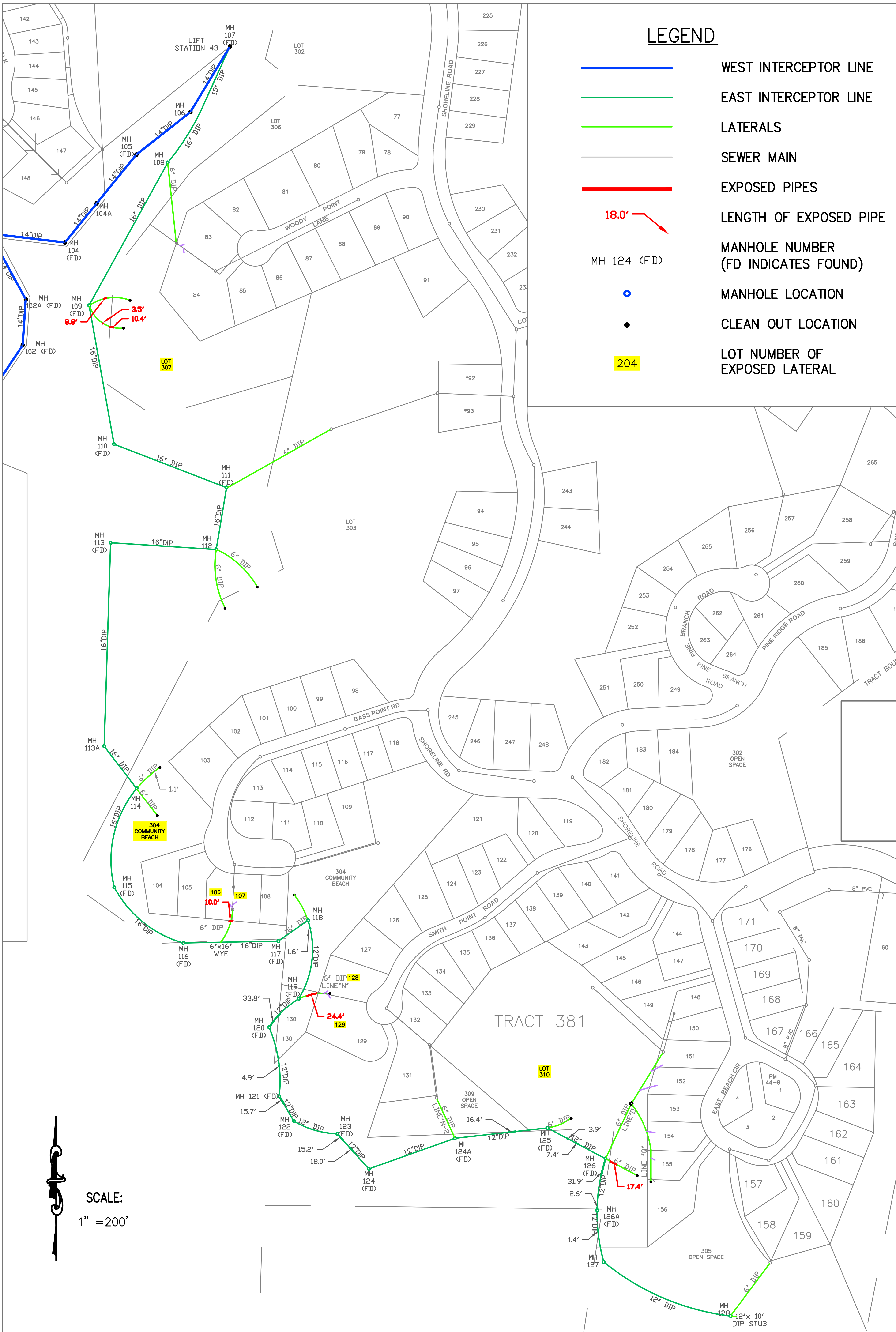
WORK ORDER NO.
COSLO.110005

SHEET 3
OF 4 SHEETS

FIGURE 2.3a



Tue 29.Sep.15 02:36:19 PM \\mnsslo\Projects\COSLO\COSLO.110005 County Of San Luis Obispo\COSLO.110005 Oak Shores Sewer Risk Study\Drawings\Civil\Exhibits\COSLO.110005 SEWER SURVEY EXHIBIT-3a_4-1 (NEW).dwg

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ENGINEERING
PLANNING
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MANAGEMENT

OAK SHORES SEWER RISK ANALYSIS
INTERCEPTOR SURVEY RESULTS

LATERAL EXHIBIT

WORK ORDER NO.
COSLO.110005
SHEET 4
OF 4 SHEETS

FIGURE 2.3b

The manholes are sealed with rubber gaskets and they are bolted and calked to lower the risk of leaking. Due to the level of difficulty of opening and sealing the manholes covers, manholes are not often accessed. In the last 20 years, approximately 10 of the 49 manholes have been opened. In the past, manholes have become unsealed while the water levels were above the manholes[2.12]. Several manholes are exposed and potentially vulnerable. 23 manholes were able to be located by survey. 26 manholes along the East and West interceptors are buried and could not be surveyed or accessed. Why they were installed this way is unknown.

Figure 2.6: Manhole M93, Exposed Interceptor, and Stabilization

2.4 Lift Station

The lift station conveys flows from the interceptors to the treatment plant. The station is approximately 60 feet deep with a 15 feet deep well. The bottom of the wetwell is 55 feet below the high water line. The lift station is enclosed by a chain link fence and the lid is secured with a chain and padlock. When designed, the lift station was designed as a duplex system; however, it was intended to meet demands by operating as a simplex system. This design allows for redundancy at the lift station.

This lift station was recently retrofitted with two removable submersible pumps mounted on rails and a new alarm system. The pumps at this lift station are 50 horsepower (HP) WEMCO Torque-Flow Model CE submersible pumps and they have a 12.5-inch impeller diameter. The rails extend to a platform located 15 feet above the floor of the lift station. The interceptor valves are only accessible from the platform. If the lift station floods above the platform, the interceptor valves will not be accessible. Transducer switches are used for primary alarming and traditional float switches are used for backup.

The lift station is equipped with a 24-hour emergency auto dialer alarm which has a battery backup. The backup power supply is an onsite, trailered diesel generator dedicated to the lift station. This generator is started and tested without a load every week for about 15 minutes and once a month it is tested with a load by simulating power failure at the lift station. Maintenance on the generator is performed every 6 months.

[2.12] San Luis Obispo County Department of Public Works Request for Proposal- Risk Assessment Study on the Interceptor Sewerline System (Interceptor) in County Service Area 7A (CS7A) Oak Shores.

Operations Staff has not indicated that there are any capacity or other operational issues with the lift station. There is, however the potential for it's capacity to be overwhelmed if there is a major break in a submerged interceptor line.

2.5 Treatment Plant

The wastewater facility was constructed in 1975 and is located approximately 1000 feet horizontally and 100 feet above the high water line of the reservoir. [2.13] The Waste Discharge Requirements (WDR) Order No. 01-130 for Oak Shores Development contains requirements set forth by the California Regional Water Quality Control Board.

This facility includes the following: a comminutor, a bar screen, two 400,000 gallon circular aerated ponds, a 1.6 million gallon settling basin, and an effluent pump station. WDR Order No. 01-130 permits the treatment plant for 100,000 gpd. Monitoring and Reporting program (MPR) No. 01-130 is part of the Order. In order to comply with the Order, the MPR requires routine water supply, groundwater, influent, disposal area, and effluent monitoring.

The effluent pump station pumps the treated effluent through a 12-inch force main to two storage ponds. From these storage ponds, reclaimed water is pumped to a spray irrigation disposal field.

Operations Staff have not indicated that there are any capacity or other operational issues with the treatment plant. There is, however the potential for it to be impacted or its capacity to be overwhelmed if there is a major break in a submerged interceptor line. See Section 4.1, "Physical Risks" for a description of this scenario.

[2.13] "Nacimiento Water Supply Project: Report on Recreational Use at Lake Nacimiento" prepared by San Luis Obispo County Flood Control and Water Conservation District June 2002.

3.0 System Model

3.1 Pipeline Profile

In order to gain an understanding of the operation of the interceptors, a basic hydraulic sewer system model was developed. This model was developed using the Autodesk Storm and Sanitary Sewer Analysis program using as-built information and survey data dated October 23, 2012. The model shows conditions under existing flows and can project future flows or potential flows based on future changes in the system. The results of the modeling were used to confirm the current hydraulic capacity of the interceptors and any capacity for minor breaches, breaks or infiltration flows. The flow data also assisted in understanding how the lift station may react to a break. Data obtained through modeling is integrated into the risk discussion of this report as appropriate.

Accessible manhole rims and exposed/accessible pipes were surveyed for location and elevation. The manholes are bolted shut, therefore access to the pipeline inverts were not available. Prior to the survey, MNS used the as-built plans to pre-calculate manhole locations. In general the located manholes were about 12 feet northwesterly of the pre-calculated manhole locations. The process of locating pre-calculated field components is termed “staking”, meaning placement of a stake where the component is expected to be. When manholes were not visible the manhole were “staked” and then searched for with a magnetic locater and shovels. A maximum of four feet of soil was removed in search of manholes.

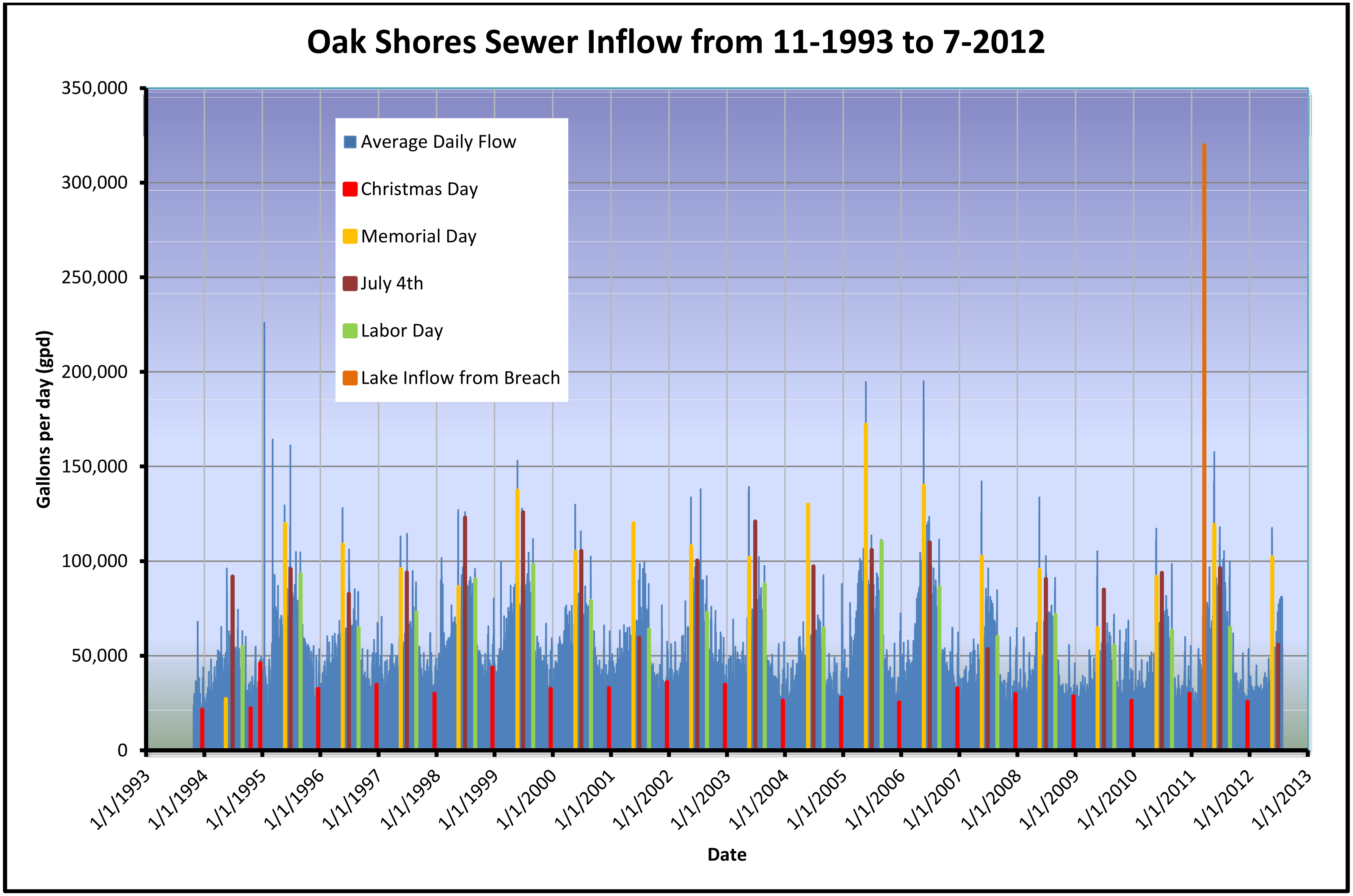
A survey of the ground profile over the mainline from manhole to manhole was performed and topographic information was established. The best available information was used to estimate the pipe locations. When consecutive manholes were found, a line of sight between the manholes was used. In some instances, a cut bench was used to approximate the pipeline location. The cut bench closely followed the as-built plans. A set of plan and profile drawings of the system was prepared and may be seen in Appendix A.

Using AutoCAD Civil 3D (version 2012), the surveyed manhole and exposed pipe data was mapped, and the best estimate was made for the location of inaccessible manholes. Separate pipe networks were created for the East and West Interceptor main lines. Pipe flow line elevations were estimated using the as-built slope, assuming a constant grade between manholes, the as-built drop of 0.2 feet per manhole, and by verifying depths with exposed surveyed pipelines. The pipes were exported from AutoCAD Civil 3D to the Autodesk Storm and Sanitary Sewer Analysis program.

3.2 Flow Data

Total Daily Average sewer plant inflows flows from October 25, 1993 to July 31, 2012 were supplied by the District. The data is presented in graph form in Figure 3.1. High usage days are graphed in separate colors and can be correlated to weekend holidays. Memorial Day which also coincides with the end of May and the end of the school year is generally the highest usage day. July 4 and Memorial Day holidays are also high usage days. Daily usage begins to fall after Labor Day and the Christmas Season marks the lowest usage.

Figure 3.1: Oak Shores Sewer Flows



The largest single day use recorded (other than the lateral breach) was on January 20, 1995 with a total daily flow of 226,100 gallons per day (gpd). The lowest recorded single day flow is 2,500 gpd on November 11, 2005.

Base Flow

Another method of viewing the flow data is to average the daily flow by months. By using this method, the average base flow is 30,000 gpd, and summer months are the peak months. The Daily Average for each month is shown in Figure 3.2.

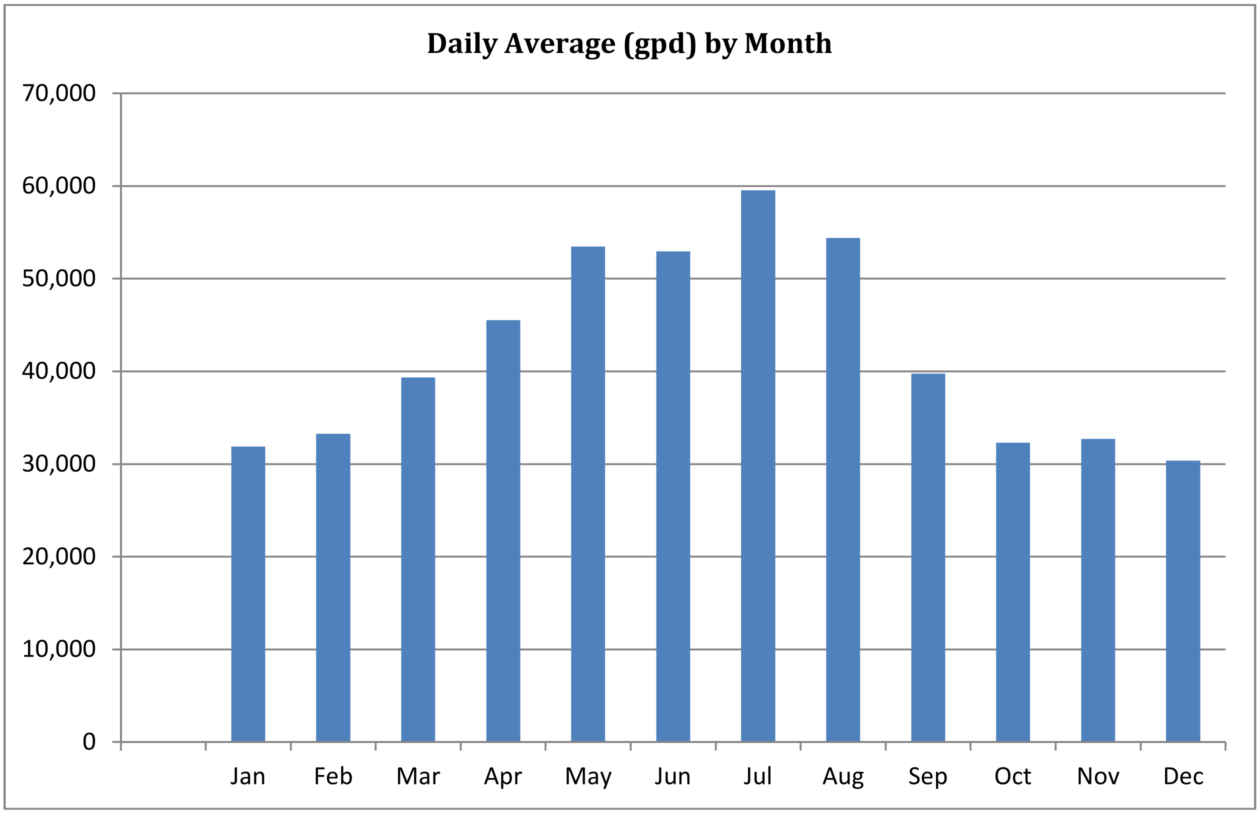


Figure 3.2: Daily Monthly Average

Peaking Factor

Sewage flows vary with human behavior. As such, typical sewage flows are high in the morning hours before 8:00 am while many people are preparing for their day. Flows will generally taper off during the mid-morning, increase again during the noon hour, decrease again during the afternoon, increase again in the early evening and diminish again in the late night. The times of heaviest flows, or peak flows, are the times which put the greatest load on the sewer system. However, low flows or base flows, are also important for keeping the system operational and free from clogging.

A typical sewer design will include an estimate of a base flow as well as peaking factors to ensure the system will perform during base flow times and peak flows. Peak flows are estimated by applying a “Peaking Factor” to the base flow.

As mentioned above, the Oak Shores Community is a weekend and holiday destination for many residences. Figure 3.3 is a graph of weekday flows grouped by months. It can be seen that Wednesdays are low flow days the weekends are high flow days. Figure 3.3 also demonstrates the cyclic characteristics of the sewer flow.

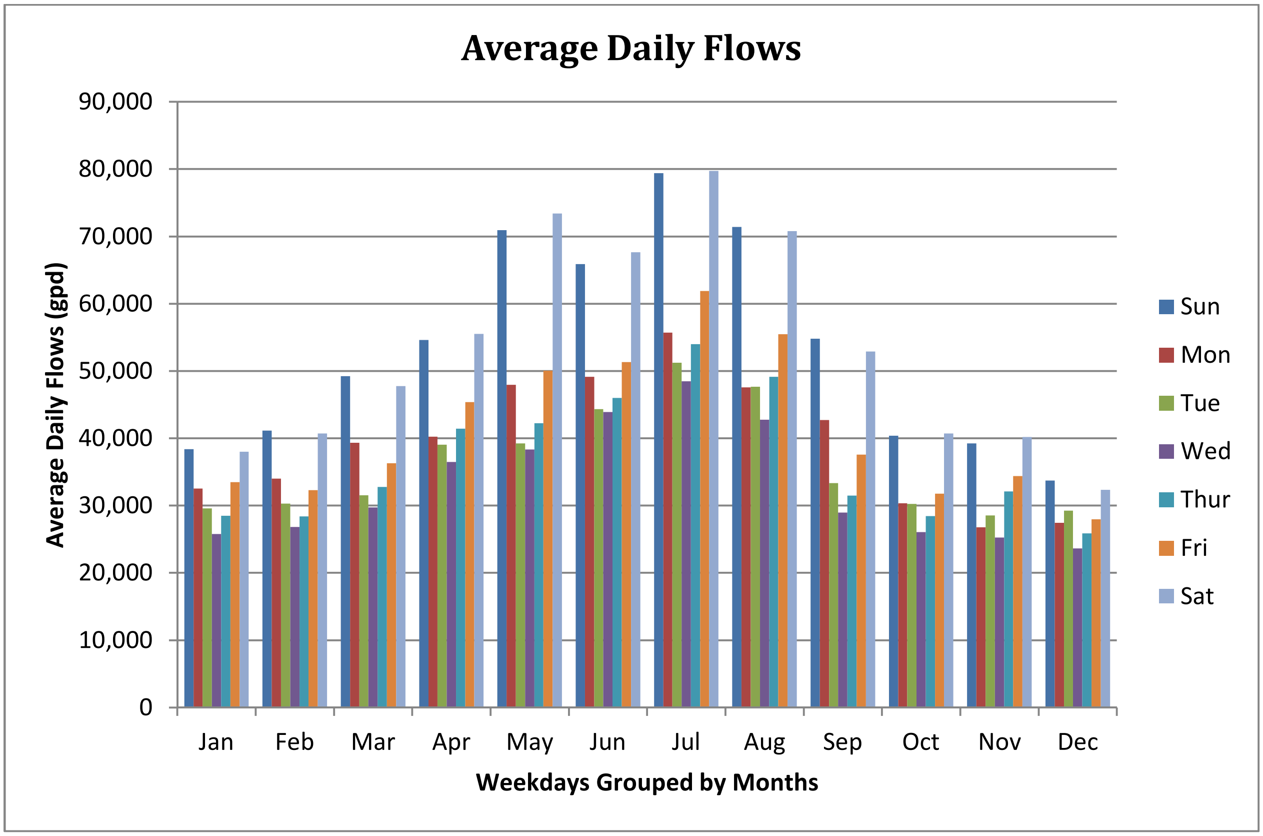


Figure 3.3 Average Daily Flows

A daily peaking factor for the Oak Shores sewer plant was established by dividing the maximum daily flows by the 30,000 gallon daily base flow. Monthly daily peaking factors are shown in Table 3.1.

Table 3.1: Average Daily Peaking Factors

Average Daily Peaking Factors Per Month							
Months	Sun	Mon	Tue	Wed	Thur	Fri	Sat
January	1.28	1.08	0.99	0.86	0.95	1.12	1.27
February	1.37	1.13	1.01	0.89	0.95	1.08	1.36
March	1.64	1.31	1.05	0.99	1.09	1.21	1.59
April	1.82	1.34	1.30	1.22	1.38	1.51	1.85
May	2.36	1.60	1.31	1.28	1.41	1.67	2.45
June	2.20	1.64	1.48	1.46	1.53	1.71	2.25
July	2.65	1.86	1.71	1.62	1.80	2.06	2.66
August	2.38	1.59	1.59	1.43	1.64	1.85	2.36
September	1.83	1.42	1.11	0.97	1.05	1.25	1.76
October	1.35	1.01	1.01	0.87	0.95	1.06	1.36
November	1.31	0.89	0.95	0.84	1.07	1.15	1.34
December	1.12	0.91	0.98	0.79	0.86	0.93	1.08

Estimating Base Flow Rates per Person

The data collected consists of total daily flows at the sewer treatment plant and is not divided based on the interceptors. To estimate flows in each interceptor the base flow was multiplied by the percent of built homes connected to each interceptor.

The Interceptor Bypass Study indicates as of July 2004 that 513 homes were connected to the sewer system; however, the study did not separate flows based on those eventually connected to the interceptor lines. Based on satellite imagery obtained from Google Earth dated September 17, 2011 and the base map supplied by the county it was estimated that 632 homes have been built in the community with 234 homes connected to the East Interceptor and 398 homes connected to the West Interceptor [3.14]. However, the Oak Shores community is

[3.14] Based on counts from aerial mapping supplied primarily a vacation community with 150[3.15] homes occupied on a permanent basis and the remaining homes occupied on a transient basis. The percent of permanently occupied homes is 23.8%.

The national census bureau estimates 2.6 persons per household. Therefore a constant number of people can be estimated at 2.6 times 150 permanent homes which equates to 390 permanent persons. In addition to the permanent people a total of 10 workers and support staff per day were assumed to be present. This makes the total estimated base Oak Shores capita at 400. A base per capita sewer rate of 75 gallons per capita per day (gpcd) can be obtained by dividing the base flow of 30,000 gpd by 400 persons. In 1996, the American Water Works Association (AWWA) estimated “Daily indoor per capita water use in the typical single family home with no water-conserving fixtures is 73 gallons.” [3.16] The estimated Oak Shores base usage of 75 gpcd is within 3% of the AWWA national estimate.

It is estimated that during peak holiday season 3,000 to 5,000 persons are in the Oak Shores Community[3.17]. Using average Peak flow of 80,000 gpd from Figure 3.3 and the lower estimate of 3,000 persons, one can derive a peak flow rate of 27 gpcd. This peak estimate is considerably less than the AWWA estimate of 75 gpcd. For this analysis, a rate of 75 gpcd will be used.

Flow Rates per Interceptor

The flows recorded at the plant are combined flows from both the East and West Interceptors. There are no flow meters in either interceptor to definitively separate flows. Therefore estimates of individual flows were calculated based on the number of homes connected to each line. The development of base flows for both interceptors is shown in Table 3.2.

Table 3.2 Base Flows per Interceptor

Interceptor	# of Homes Connected	# of permanent homes	Capita per Home	Assumed # of workers	Total Capita	Base Flow Rate		
						Per Capita	Total (gpd)	Total (gpm)
East	234	55	2.6	5	150	75	11,250	7.8
West	398	94	2.6	5	250	75	18,750	13.0
Totals	632	150		10	400		30,000	

3.3 Lift Station

As described in the Section 2.0 Existing Facilities of this report. The lift station consists of dual WEMCO pumps Model CE with 12.5” impellers and a 50 hp motor. The pump curve for this pump was listed as an input for the model at Manhole 107. The lifting head was estimated at 154.6 feet based on a 15 foot well below the lowest interceptor invert at Manhole 107 and a 70 foot lift to the plant head works.

[3.15] Data obtained from the Oak Shores Community Association
[3.16] Waterfacts website http://waterfacts.net/html/water_use.html
[3.17] Data obtained from the Oak Shores Community Association

3.4 System Model

Manhole names follow those presented by the County in the GIS information provided. Pipe numbering corresponds to the upstream manhole to which the pipe is connected and to the interceptor line to which it is connected. The East Interceptor was constructed with curved sections of pipe. The model program does not provide for curved pipes. To simulate curved sections of pipes, short tangent sections were used with junctions at each connection. These junction names correspond to the pipe section to which it is connected.

The interceptor lines are about 37 years old and, have never been cleaned except for flushing. Based on conversations with staff, the interceptor lines contain some grit. The modeling software has the ability to model pipe blockage; however there is no data to estimate the amount of blockage. Therefore, no blockage was modeled.

Max Flow Model

The single highest day use of 226,100 gpd was used to review the performance of the system under high flow conditions. The system was modeled using base flow rates as described in Table 3.2 and then applying a constant peaking factor of 7.45 to achieve a 157 gpm. Details of the of model are included in Attachment A Oak Shores Interceptor Model Max Flow of 226,100 gpd.

Monthly Average Model

The monthly average flow rates shown in figure 3.2 were modeled to demonstrate normal operation of the system. The peaking factors shown in Table 3.1 were applied to the base flows to achieve the average monthly flows. The timeline used in the model was from January 1 to December 31. Details of the model are included in Attachment B Oak Shores Interceptor Model Monthly Average Flows.

Model Summary

A summary of the Max and Monthly Average Model is shown in Table 3.3. The summary focuses on Velocity and the percent of Design Capacity.

Velocities

The general accepted philosophy in sewer design is that a minimum velocity of 2.0 feet per second (fps) is required to keep the system self-cleaning and maximum of 15 fps is required to prevent pipe scour and reduce momentum effects. A minimum velocity of 1.5 fps can be acceptable provided that occasional peak flows occur to flush the system. [3.18]

The estimated average monthly velocities for both East and West Interceptors are lower than the recommended minimum of 2.0 fps. The max average velocity is 1.35 fps in the East Interceptor and 1.46 fps in the West Interceptor. Both maximum velocities are less than what is required to flush the system. Due to the lack of cleaning it is anticipated that a large amount of sediment has accumulated in both interceptor lines.

The calculated maximum velocities of 2.03 fps in the East Interceptor and 2.09 fps in the West Interceptor from the Maximum Flow analysis meet the desired minimum velocities. However, for this flow, a higher velocity of 5 fps is desired to completely flush the system.

[3.18] Civil Engineering Reference Manual, Fifth Ed, by Michael R. Lindeburg, P.E.

Since the velocities in both interceptors are low, it is anticipated that pipe scouring of the system will not have issues.

Capacity

System capacity is important to know to prevent overloading a system and also to know the ability of system expansion.

The Average Monthly Flow model reveals that the East Interceptor reaches a maximum of 2.01% of the design capacity and the West Interceptor reaches 3.56% of the design capacity. During the Maximum Flow model the East Interceptor obtained a maximum of 7.59% of Design Capacity and the West Interceptor reached 13.41% of the design capacity.

Both the East and West Interceptors have room for expansion. Using the minimum design capacity of a series of pipes as the maximum design capacity of a system, the design capacity of the East Interceptor is 1,115,611 gpd and 1,051,877 gpd for the West Interceptor. Estimating 2.6 persons per home and 75 gallons per person per day, the total number of homes that can be connected the East Interceptor is 5,721 and 5,394 to the West Interceptor. The East Interceptor currently has 234 homes connected and therefore could expand by 5,487 homes. The West Interceptor currently has 398 homes connected and could expand by 4,996 homes.

These estimates are based on cleaned pipes and estimated invert elevations. Prior to use, these estimates need to be verified by verifying pipe inverts and grit levels.

Table 3.3 Model Results

Model	Base Flow (gpm)		Peaking Factor	Velocity (fps)						% of Design Capacity					
				Average		Min.		Max.		Average		Min.		Max.	
	East	West		East	West	East	West	East	West	East	West	East	West	East	West
Max Flow	7.8	13.0	7.533	1.49	1.59	1.25	1.44	2.03	2.09	5.03	10.3	2.16	7.97	7.59	13.41
Monthly Average	7.8	13.0	Varies[3.19]	1.00	1.08	0.83	0.94	1.35	1.46	1.33	2.75	0.57	2.15	2.01	3.56

[3.19] See values from Table 3.1

4.0 Risk Analysis

4.1 Identification of Potential Risks

In order to assess the Oak Shores sewage system, a wide array of information and potential impacts must be addressed. The risk of the system is quantified by determining the importance of the element to the system and the potential consequences should that element fail. The following are important impacts to consider as various risks are discussed:

- Financial impacts including the cost of recovery, clean-up, repairs, public relations, regulatory fines, etc.
- Operational impacts such as degree of system failure, recovery operational issues, etc.
- General environmental impacts including water quality, and impacts on flora and fauna
- Potential public health impacts
- CSA 7A impacts such as demand on staff and equipment resources, results should severe fiscal impacts occur, and impacts to agency reputation with public & regulatory agencies

Physical Risks

Exposed Interceptors

The interceptor has several sections where the line is exposed. Originally, the interceptor was completely covered by soil. Over time, erosion has led to the line being exposed and in some instances at risk of being undermined. This makes the interceptor vulnerable and exposed to the elements. In ideal conditions, ductile iron pipe is said to have a potential maximum lifespan of 100 years. However, unprotected, buried pipe can have a much shorter lifespan.

The interceptor line appears to be bowing due to the weight of the soil resting on it and the weight of the pipe itself in locations where the interceptor is exposed and undermined. This was seen at two locations identified on the site walk. Figure 4.1, to the right, shows an example of exposed pipe along the West Interceptor line which appears to be bowing.

Figure 4.1: Exposed pipe along the West Interceptor between Manholes M86 and M87

Interceptor lines and laterals which are exposed are at risk of damage from boats, with observations made by staff that on occasion boaters will tie their boats to the laterals.

The survey completed by MNS located sections of pipe where the main interceptor is exposed. On the East Interceptor, 11 locations are exposed totaling 102 linear feet of exposed pipeline. The West Interceptor has 8 locations exposed totaling approximately 231 linear feet of exposed pipeline. These exposed areas represent approximately 2% and 5% of the East and West Interceptors, respectively.

Interceptor Corrosion

The ductile iron pipe is exhibiting physical corrosion. Life expectancy for buried ductile iron pipe varies from source to source. Conditions of the soil can enhance the corrosion process. The exterior of the pipe seems to be undergoing a typical amount of corrosion and discoloration for its age.

Figure 4.2: Corrosion of Interceptor

Interceptor Pipe Interior

The pipe's interior condition is unknown. In its 37-year history,[4.20] the line has never been videoed. The line could be in any condition, from good to poor. The sewage and unvented H_2S may be causing corrosion of the interior of the pipe.

It is not likely that there is damage to the east and west interceptors from tree roots due to the lack of proximity of the trees. However, they may cause problems for the laterals.

Over time, fats, oils, and grease (FOG) can build up in a system. This can lead to blockages in the system. System operators have not experienced FOG issues in the past.

Aging sewer pipes can develop cracking and allow inflow and infiltration of water into the system. Based on the flows into the wastewater treatment plant, it does not appear that there is a problem with inflow and infiltration.

Figure 4.3: View of the Feeder Line at Parcel 201

Interceptor Accessibility

Access to the interceptor varies based on the time of year. During the summer months, the water levels are at their lowest. When the water levels are low, much of the interceptor can be accessed on foot. During high water levels, the East Interceptor and West Interceptor are submerged. If there were a breach during high water levels, then divers must be called in to examine the pipeline.

The terrain in this area poses a challenge as well. There are very rocky sections along the length of the interceptors, particularly along the East Interceptor. This makes access difficult for some sections even during low water levels.

[4.20] "Nacimiento Water Supply Project: Report on Recreational Use at Lake Nacimiento" prepared by San Luis Obispo County Flood Control and Water Conservation District June 2002

Exposed Laterals and Cleanouts

In many locations, the laterals (collectors that "feed" the interceptors)are exposed and lack support. Initially, the laterals and cleanouts were supported by the soil. However, erosion of the bank has caused the lines to become undermined and less supported. The erosion is caused by wave action resulting from wind and active boating activity, as well as rainwater run-off.

Temporary stabilization of some of the laterals and cleanouts to improve support has been accomplished by placing rock under the exposed pipe but has only been marginally effective. Figures 4.3 and 4.4 show the lateral line near Parcel 201. This line is situated along the West Interceptor. These figures show the eroded cliff and the precarious pipe position. The exposed root systems in the images further illustrate the erosion of the embankment. Figure 4.3, shows attempts by CSA1A to stabilize and provide support to the lateral pipe by importing rock and placing it beneath the pipe. Figure 4.4, to the right, gives a closer view of the feeder at the top of the embankment. The distance between the pipe and the soil level is more easily seen in Figure 4.4 compared to Figure 4.3. The transition of pipe materials from PVC to Ductile Iron Pipe (DIP) can also be seen here. Similar situations to this can be seen along both the West and East Interceptors.

Figure 4.4: Feeder Line at Parcel 201

Other feeder pipes and cleanouts have been supported with District fabricated supports. These supports typically consist of the following: two pipe supports, a metal saddle, a wooden or fabric spacer, and a strap across the top. Figure 4.5 shows the feeder line at Parcels 203 and 213. This feeder line is supported by the District fabricated supports described above.

Figure 4.5: Feeder Pipe at Parcels 203 and 213

Lateral Pipe Accessibility

Feeder lines and cleanouts are difficult to reach or completely inaccessible during the summer months when the water elevation is low. During the high water elevations, some are more reachable by water, but portions of these lines are submerged.

Lateral Pipe Breakage

Due to the aging pipes and lack of support due to erosion, breakage is a concern. The feeder lines of the system have a high risk of breaking and causing a breach.

When the lake elevation is above the system and there is a breach, like the one that occurred in 2011, lake water pours into the system and overwhelms the treatment plant. Divers were used to search for the breach in the system. Leaks have also occurred several times prior to the 2011 breach[4.21].

Lateral Pipes and Lake Use

The feeder pipes in this system are at risk of failing because of lake erosion and lake use activities. Many feeder pipes in the system are in danger of being undermined by erosion, being hit by boats, and simply deteriorating from age.

As the cliffs erode, the feeder pipes become more and more exposed. When the lake levels are high, the feeder pipes are partly submerged. They are not marked to warn boat operators of their location and run the risk of being struck by a boat. In the past, exposed feeder pipes have been used to tie-off boats.

Lateral Pipe

Lateral lines are typically 4 inch PVC pipe or 6 inch DIP that connect the building sewer lateral (house) to the main sewer or interceptor lines. Building sewer laterals are the responsibility of the homeowners. Maintenance, repair and upgrading of the laterals is inconsistent in that different methods, materials and quality of repair are evident. Not maintaining the laterals can lead to increased risk of breakage & failure.

Figure 4.6: Manhole M91

Manhole Access

Access to the manholes presents significant risk. The original manhole bolts break off when attempting to remove them. Lids weigh approximately 200 pounds and the original lifting rings and supports have broken off when attempting to access the manhole. When resealed, new rubber gaskets are used and a UV resistant sealer is used on the outside around the rim. There is currently no Standard Operating Procedure (SOP) in place for accessing the manholes. If the manhole is not sealed properly, a breach may occur, though it may not be noticed until the lake levels rise.

[4.21] San Luis Obispo County Department of Public Works Request for Proposal- Risk Assessment Study on the Interceptor Sewerline System (Interceptor) in County Service Area 7A (CS7A) Oak Shores

Due to the difficulty of access and the consequences of not re-sealing the manholes properly, many manholes have never been opened. By not opening the manholes, the interior condition is not known. Difficult access or lack of access prevents regular inspection and maintenance and higher risk of failure.

In addition to the difficulties of opening and sealing the manholes, there is also the issue of accessing the manholes when they are buried. During the survey performed, several manholes were deeply buried, greater than 4 feet, and their exact location is not known.

Figure 4.7: Manhole 126

Manholes and Lake Use

The manholes in this system are also at risk of failing because of lake erosion and public negligence. Manholes in the system are in danger of being undermined by erosion, being hit by boats, and simply deterioration from age.

Some manholes, like the one seen in Figure 4.7, are being exposed by erosion. Figure 4.7 shows a manhole along the east interceptor in a side view. The natural process of erosion is becoming enhanced by the fluctuating water elevations and the wave action of the lake. This side view shows the severity of erosion in some locations along the interceptor. Several feet of erosion have occurred at this location exposing the manhole.

When the manholes are below the waterline they are not visible to the public who drive boats on the water. They are not easily locatable and could very easily be struck by a boat. Near the Oak Shores area the boat speed limit is lower than in the more open areas of Lake Nacimiento. This reduces the speed at which boats can collide with the manholes; however, this impact is still detrimental to the condition and solidity of the manhole. Figure 4.8 shows a manhole located just below the lake's surface. This photo was taken in March of 2012.

When the water levels are low, manholes have been used to anchor boat docks. During the site visit in August 2012, a boat dock was seen tied to a manhole, see Figure 4.9, above. An attempt was made to remove the cord from around the manhole; however, it was pinned too tight to be removed because of the other dock tie.

Also, many manholes visible during the site visit had exterior cracking and some appeared as though they had

Figure 4.8: Underwater manhole.

Figure 4.9: Manhole M86

been repaired after being hit. Figure 4.10 shows cracking on the exterior of a manhole along the west interceptor.

Though the manholes are sealed, misuse by the public and natural deterioration could result in them becoming breached and allowing inflow and infiltration.

Lift Station Overflow

Lift station #3 which is the end collection point for the interceptor system before it is pumped to the treatment plant is approximately 60 feet deep. The bottom of the wetwell is 55 feet below the high water line. There are two removable and submersible pumps mounted on rails. The rails extend to a platform that is located 15 feet above the floor of the lift station. The interceptor valves are only accessible from the platform. If the lift station floods above the platform, the valves to the lift station would not be accessible except by diver.

Figure 4.10: Manhole M86

The wet well has approximately 3 days' worth of emergency storage based on average daily flows.[4.22] An overflow at the lift station would cause sewage to back into the interceptors to a point where the wastewater elevation equalizes.

The lift station is equipped with a 24-hour emergency auto dialer alarm which has a battery backup. This notification goes to the on-call operator. The backup power supply is an onsite, trailered diesel generator dedicated to the lift station.

Figure 4.11: View of Lift Station

Exceeding Wastewater Treatment Plant Capacity

A physical pipe break, if underwater, could result in excessive flows over a sustained period to the wastewater treatment plant. If these flows exceed the plant capacity, the potential for reduced levels of treatment, and/or spills is present.

[4.22] "Nacimiento Water Supply Project: Report on Recreational Use at Lake Nacimiento" prepared by San Luis Obispo County Flood Control and Water Conservation District June 2002

Operational Risks

Information Management and Staffing

Currently, the information regarding the Oak Shores system is found in several locations. System information can be found at the County Public Works Department Offices and can also be located by the operator.

Figure 4.12, below, shows the organizational structure for the County Staff involved with this project.

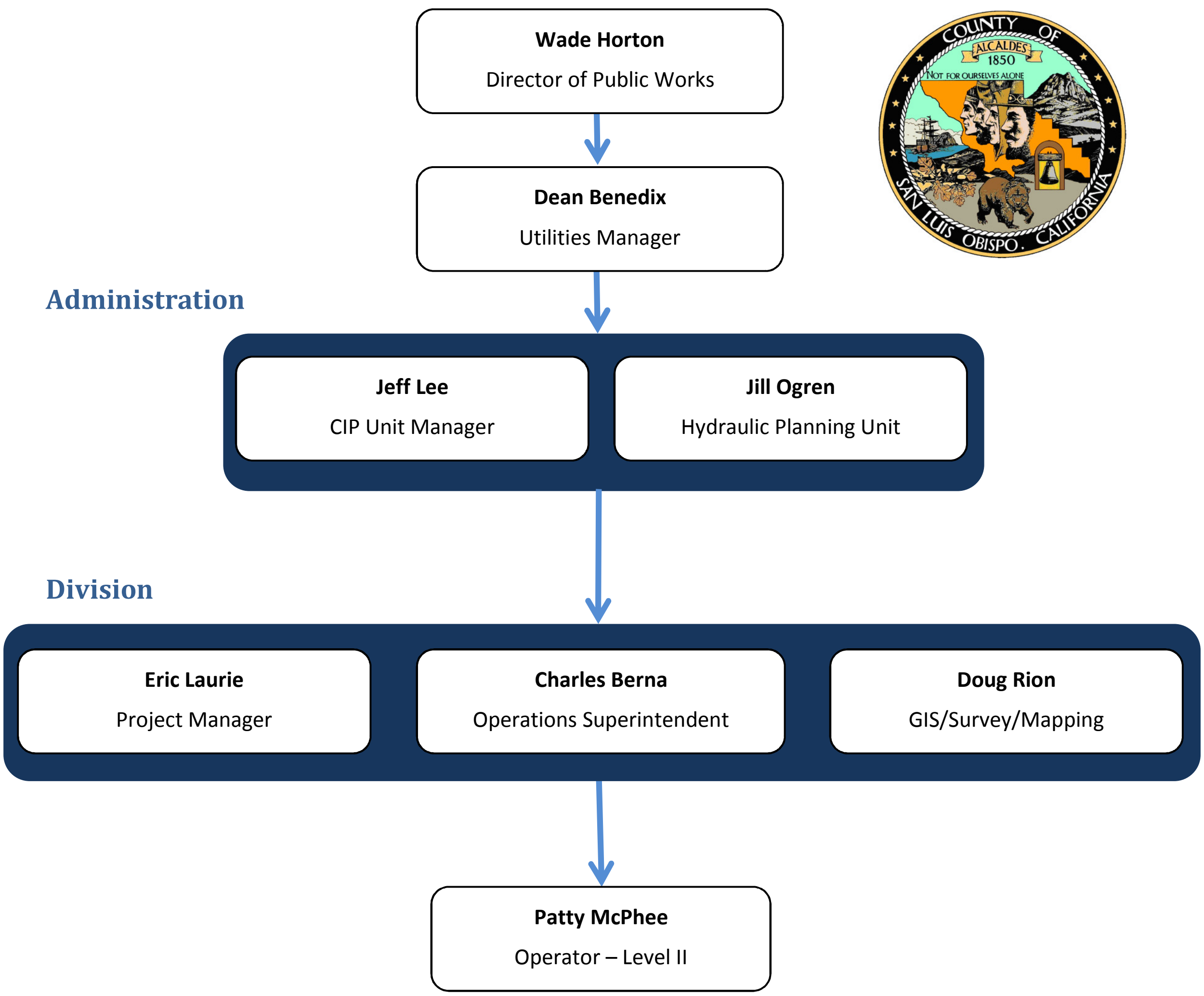


Figure 4.12: Organizational Chart

Sewer plant operations are governed by the California State Water Resources Control Board. There are five levels of operator certification, Grades I-V). Licenses are administered by the Office of Operator Certification. The law requires a person to have a certificate to work as an operator at a publicly owned wastewater or industrial treatment plant, or a privately owned wastewater or industrial plant if it is regulated by the California Public Utilities Commission (PUC). Positions such as a laboratory technician or a maintenance worker do not require a wastewater treatment plant operator. An operator certificate is not required for a privately owned industrial or manufacturing wastewater treatment plant that is not regulated by the PUC.

Training

The Oak Shores treatment plant is a Class II Wastewater Treatment Plant and requires a Level II Operator. The County has one Level II operator, who acts as Chief Plant Operator and two Level I operators for the facility. The current Chief Operator has been supervising the Oak Shores plant for almost 20 years and is a walking library of information regarding the sewer plant operations and the sewer collection system.

If there is an alarm, an automatic dialer calls the chief operator’s cell phone. Someone is on-call 24 hours a day 7 days a week. The on-call person must be able to reach the site within one hour. In the primary operator’s absence, the County must pull operators from its other locations to full fill the required duties.

Currently there is no plan in place for additional operator training. This is addressed under Section 5.9 “Recommended Solutions, Staff Training.” This poses a risk to the operation of the system, due to the minimal redundancy. Additional operator training facilitates knowledge transfer and provides redundancy for the system.

Operations and Maintenance

The daily plant operations and maintenance procedures appear adequate for the system. However, the plant needs an updated and comprehensive Operations and Maintenance (O&M) Manual. Currently, inquiries to plant and collections system are directed to the plant operator. Many inquiries require an investigation by the operator. Having an updated O&M annual available online would not only reduce the operators tasks but would also provide fast and easy response to questions or procedures.

Figure 4.13: Lateral L-95.3 shown coming through a retaining wall.

Administrative Risks

Some laterals traverse private property, presumably in public easements. The laterals have not been located with respect to easements created with the various tract maps. Without clarification of location of easements the reduction of risk is hampered by access uncertainty, as well as ownership uncertainty. The CSA 7A Sewer Use Ordinance speaks primarily to new connections and the associated permits and fees while the County Public Works Department’s Procedural Memorandum O-2 establishes maintenance and operation of building sewers(aka house laterals). As a matter of expediency, the County currently repairs pipes as needed even if they may be the responsibility of the homeowners or are not in a public easement. These are policy and legal issues that need clarification because they put the County at risk for clear rights to access for maintenance or in an emergency.

Building Permits

During the site visit it was noticed that several homes located on the water side of Lands End Road have been extensively redeveloped and enlarged; however, little or no upgrades to the sewer laterals were performed. In several instances, retaining walls have been constructed around lateral lines without what appears to be any consideration of existing easements; examples are shown in figures 4.13 and 4.14. Structural issues regarding wall or pipe integrity may not have been addressed, as well as adequacy of lateral capacity. Other considerations are:

1. These walls were built over and around the lateral lines without modification, lowering, or repair of these exposed lines.
2. The District's participation in the review process of these improvements should be considered.
3. Assessments or conditions of approval may apply, or current policy regarding building sewer connections to lateral sewers.
4. The County's current procedures regarding coordination between the Planning/Building Department and Public Works with respect to new or enlarged houses and installation of sewer laterals should have caught these inconsistencies..

Figure 4.14: Retaining wall built over Feeder F-95

Emergency Repairs

As mentioned previously the Oak Shore Community is primarily a vacation community, and only 23% of the homes are occupied as permanent residences. Therefore, during the winter months, the rainy season, when laterals fail along the eroding lake front property of unoccupied homes, the District is compelled to repair the line immediately to avoid a violation. In many cases the District is not compensated for these repairs. This creates an appearance of acceptance of maintenance responsibility for all future repairs, and discourages the property owners from taking any responsibility. This enhances the risk of delayed repairs due to owner complacency.

4.2 Quantifying Risks

Methodology

In order to quantify the risks, a Risk Assessment Matrix was developed to illustrate the range of risk exposure. This matrix uses the two parameters of "Importance" and "Condition" to rate the risk associated with main components of the sewer system. Components of the system are assessed and assigned a value based on their importance to the system and their condition. The

Table 4.1

Importance		Condition	
1	Low	1	Good
2	Medium	2	Fair
3	High	3	Critical

parameters have associated values ranging from 1 to 3 which can be seen in Table 4.1. A component of low importance to the system receives a ranking of 1 and high importance receives a 3. Something in good condition receives a 1 while a component of the system in critical condition receives a 3. This simple assignment of values gives a higher total or assignment of risk, and thus greater attention to important components in the worst condition.

The Risk Assessment Matrix uses these parameters to determine a visual picture of the level and hierarchy of risk among components in the system. This matrix is useful to compare various component risks and set priorities for corrective action. For example, Lift Station #3 is rated a "3", or "high" in importance, and after assessing condition, is given a rating of "1.5", between "good" and "fair". The total risk number is "4.5".

Table 4.2 Risk Assessment Matrix

Condition \ Importance	1	2	3
1	**2**	**3**	**4**
2	**3**	**4**	**5**
3	**4**	**5**	**6**

Table 4.3

Rank	Priority Level	Action
2	Lowest Priority	Monitor Periodically
3		Regular Monitoring
4	Moderate Priority	Frequent Monitoring
5		Action Recommended
6	Highest Priority	Immediate Action

System Risk

Table 4.4, below, provides a summary of the risk for the different elements of the system based on current conditions. The following pages provide more in depth tables of the elements of risk throughout the system.

Table 4.4

Risk Element	Importance (Ave)	Condition (Ave)	Risk Based on Condition	Highest Possible Score
East Interceptor	3	1.7	4.7	6
West Interceptor	3	1.6	4.6	6
Lift Station #3	3	1.5	4.5	6
Operational Issues	2	2	4	6
Administrative Issues	1	2	3	6
		Total Average Risk	**4.26**	

Tables 4.5 and 4.6, found later in this section, are provided for reference and provide a breakdown of each pipe segment. These tables for the West and East interceptors show the manholes, segment of interceptor, and laterals for each segment. In addition, the notes reflect observations made during the site visit.

Table 4.4.1 below provides a summary in table form of the risk assigned to the five elements identified in this risk assessment. We can see that action to correct is recommended to reduce the risk associated with the interceptor pipes and lift station. Operational issues are of a medium importance (priority), and the "frequent monitoring" should be understood to mean operational practices and procedures should be frequently reviewed and adjusted as needed to reduce the risk associated with the operations of the facilities. Administrative issues are of lower importance, but should be updated in the regular course of facility management. Improvements of all elements will reduce risk overall, and all should be addressed in order of priority, as allowed by funding and time to implement.

Table 4.4.1 Risk Assessment Summary Table-Existing Conditions

Condition \ Importance	1 LOW	2 MEDIUM	3 HIGH
1 GOOD	**2**	**3**	**MODERATE PRIORITY** **Frequent Monitoring** **4** **East & West Interceptors-Lift Station #3**
2 FAIR	**REGULAR PRIORITY** **Regular Monitoring** **3** **Administrative Issues**	**MODERATE PRIORITY** **Frequent Monitoring** **4** **Operational Issues**	**HIGH PRIORITY** **Action Recommended** **5**
3 CRITICAL	**4**	**5**	**6**

Table 4.5: West Interceptor (Sorted by Risk)

Risk Total	Manhole Number	Interceptor Name	Interceptor Length	Length of Exposed Interceptor	Lateral ID	Lateral Length	Length of Exposed Lateral	Importance (I)	Condition (C)	Total Risk (I + C)	Notes
6	MH #86	IW-86	196.71	110.6				3	3	6	Lengths of exposed and undermined interceptor
6	MH #90	IW-90	286.28		F-90	96.5	24.3	3	3	6	Lengths of exposed l
6	MH #91	IW-91	124.78		F-91	82.48	22.3	3	3	6	Manhole cracks and lengths of exposed laterals
6	MH #92	IW-92	305.3	23.5	F-92	72.26	24	3	3	6	Long lengths of exposed laterals. Additional support needed.
6	MH #93	IW-93	166.59	34.5	F-93	148.52	39.7	3	3	6	Long lengths of exposed laterals. Additional support needed.
6	MH #94	IW-94	353.86		F-94	77	37.7	3	3	6	High percentage of exposed lateral
6	MH #95	IW-95	199		F-95	200	62.4	3	3	6	Long lengths of exposed laterals. Additional support needed.
5	MH #89	IW-89	107.18	44.8	F-89			3	2	5	Lengths of exposed and undermined interceptor
4	MH #84	IW-84	160.36					3	1	4	
4	MH #85	IW-85	61.39	5.9				3	1	4	Lengths of exposed and undermined interceptor
4	MH #87	IW-87	121.51					3	1	4	Manhole at risk of being undermined
4	MH #88	IW-88	140.34	11.4	F-88	66.16		3	1	4	Lengths of exposed and undermined interceptor
4	MH #96	IW-96	40.96		F-96.1	126.53		3	1	4	
					F-96.2	67					
4	MH #97	IW-97	272.59					3	1	4	
4	MH #98	IW-98	416					3	1	4	
4	MH #99	IW-99	289.85					3	1	4	
4	MH #100	IW-100	431.18		F-100.1	127.16		3	1	4	
					F-100.2	301.58					
4	MH #101	IW-101	248.24					3	1	4	
4	MH #102	IW-102	101.62					3	1	4	
4	MH #102A	IW-102A	156.01					3	1	4	
4	MH #103	IW-103	159.71		F-103	104.73		3	1	4	
4	MH #104	IW-104	103.25					3	1	4	
4	MH #104A	IW-104A	143.04					3	1	4	
4	MH #105	IW-105	143.66					3	1	4	
4	MH #106	IW-106	172.04					3	1	4	
							Average	**3**	**1.6**	**4.6**	
								Importance	**Condition**	**Total Risk**	

Table 4.6: East Interceptor

Total Risk	Manhole Number	Interceptor Name	Interceptor Length	Length of Exposed Interceptor	Lateral Name	Lateral Length	Length of Exposed Feeder	Importance (I)	Condition (C)	Total Risk (I+C)	Notes
6	MH #126	IE-126	140.02	11.3	F-126.1	77	17.4	3	3	6	Lengths of exposed and undermined interceptor and feeder. Area surrounding manhole has been subject to major erosion.
					F-126.2	438					
6	MH #124	IE-124	98.67	33.2				3	3	6	Lengths of exposed and undermined interceptor
6	MH #119	IE-119	175.2	1.6	F-119	63.21	24.4	3	3	6	Lengths of exposed and undermined interceptor and feeder.
6	MH #117	IE-117	205		F-117	75.6	10	3	3	6	Exposed feeder
5	MH #125	IE-125	200.78	16.41	F-125	53		3	2	5	Lengths of exposed and undermined interceptor
5	MH #126A	IE-126A	110.47	34.5				3	2	5	Lengths of exposed and undermined interceptor
5	MH #127	IE-127	110.42	1.4				3	2	5	Lengths of exposed and undermined interceptor
5	MH #120	IE-120	266.31	33.8				3	2	5	Lengths of exposed and undermined interceptor. Major erosion occurring around manhole.
5	MH #121	IE-121	150.42	4.9				3	2	5	Lengths of exposed and undermined interceptor. Major erosion occurring around manhole.
5	MH #122	IE-122	58.57	15.7				3	2	5	Lengths of exposed and undermined interceptor.
5	MH #118	IE-118	74.51		F-118	61.37	1.8	3	2	5	Exposed feeder
5	MH #114	IE-114	112.18		F-114.1	72.92		3	2	5	Exposed feeder
					F-114.2	66.6	1.1				
4	MH #108	IE-108	287.5		F-108	172.92		3	1	4	
4	MH #109	IE-109	356.23		F-109.1	96	13.9	3	1	4	Exposed feeder
					F-109.2	92	8.8				
4	MH #110	IE-110	307.4					3	1	4	
4	MH #111	IE-111	262		F-111	260		3	1	4	
4	MH #112	IE-112	133.34		F-112.1	122.5		3	1	4	
					F-112.2	129.4					
4	MH #113	IE-113	228.96					3	1	4	
4	MH #113A	IE-113A	446.84					3	1	4	

Total Risk	Manhole Number	Interceptor Name	Interceptor Length	Length of Exposed Interceptor	Lateral Name	Lateral Length	Length of Exposed Feeder	Importance (I)	Condition (C)	Total Risk (I+C)	Notes
4	MH #124A	IE-124A	197.23		F-124A	92.73		3	1	4	
4	MH #115	IE-115	227.96					3	1	4	
4	MH #116	IE-116	196.48					3	1	4	
4	MH #123	IE-123	94.94					3	1	4	
4	MH #128	IE-128	304.6		F-128	141.23		3	1	4	
							AVERAGE	**3**	**1.7**	**4.7**	
								Importance	**Condition**	**Total Risk**	

Table 4.7 Summary of Risk Table – Existing Conditions

Risk Element	Importance	Condition	Risk	Max Possible	Notes
East Interceptor	3	1.7	4.7	6	Average risk for all elements of interceptor combined. Treated as a single Element for risk due to entire interceptor being under water.
West Interceptor	3	1.6	4.6	6	Average risk for all elements of interceptor combined. Treated as a single Element for risk due to entire interceptor being under water.
Lift Station #3	3	1.5	4.5	6	Risk of failure reduced based on the historical performance of the system. However, poor access to the element in emergency adds to the risk.
Operational	2	2	4	6	Most significant risk factor is that the Primary Operator is a crucial element of the system. Second is need for an Update to the O&M Manual, and staff training. These numbers represent an average of these factors.
Administrative	1	2	3	6	Administrative enhancements can keep the system as a whole running well. These numbers represent an average of the administrative factors defined in Section 5.

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5.0 Recommended Solutions and Costs

5.1 Improvements Addressing Physical, Operational and Administrative Risks

Before major repairs on the system are performed a long term plan needs to be established. The solutions below are addressed in four categories: Physical Improvements to the Interceptors, Lift Station #3 Improvements, Operational and Emergency Improvements, and Administrative Improvements. Note that there are some operational and administrative solutions that are being addressed separately by the County.

The recommended improvements are immediately followed with a description of benefits and why the recommendation reduces risk.

5.2 Physical Improvements to Interceptors

_Providing multiple lines of defense to prevent leaks is vital to reducing the overall risk of system failure. For the Oak Shores system several lines of defense are recommended as follows:

1. Provide Additional Flow Monitoring Devices, Mechanical & Electrical Improvements.

Recommendations:

- Provide additional flow monitoring devices throughout each interceptor line. Additional monitoring locations will aid in detecting blockages, infiltration leaks into the pipe or exfiltration leaks from the pipe into the ground or directly into the lake.
- In the event of a power outage, provide a method of automatic or remotely transferring power to the backup generator. As a minimum, provide additional contacts for backup generator startup. Having a second number on the auto dialer to someone local and trained to start the generator in case of a power failure.
- Automatic valve operation of the interceptor lines at the lift station. The interceptor lines enter the dry well 15 feet above the bottom of the lift station and 60 feet from the surface. During a previous breach in March 2011, lake water inundated the lift station and a diver was hired to enter the lift station and close the valves. Remote operating of the valves would allow the operator to close the valves partially or fully, regulate the flows into the lift station, and prevent an overflow from the lift station. With remote operation capability, this could be performed without entering the lift station, or having to go to the site. Entering the lift station under normal conditions is considered a confined space entry by OSHA and requires special training and equipment.
- Reduction of unusable lateral mains. The interceptor lines were originally constructed with lateral main connections that were capped and planned to be used as clean out lines. Due to erosion of the steep lake banks some of these are unusable and serve no purpose. Removing these will reduce the risk level for that section of interceptor. During the development of this report several of these lateral main connections were removed.
- Clean and videotape interceptors to determine and assess condition. Use this data to establish if any immediate or near-term improvements are needed.

Benefit to Risk Reduction:

- Early detection of blockages and leaks will allow timely resolution and repairs, reduce costs associated with leak related pumping and treatment of infiltrated flows, environmental concerns and regulatory agency consequences from exfiltration of wastewater into the ground or lake.
- Remote or automatic transfer of power to a back-up generator will reduce pump and treatment down-time and associated risk of overflow spills. Providing an additional emergency contact for emergency operations, including bringing the existing emergency generator online would also reduce the spill risk associated with delays in restoring power and downtime.
- Automatic valves on the interceptor pipes at the lift station would reduce the risk of overflow at the lift station. This would lessen the impacts of a severe leak or break in the interceptors, and reduce environmental concerns and regulatory agency consequences from overflow of wastewater onto the ground that may then flow into the lake and cause complete shutdown of the lake a public water supply.
- Removal of unusable lateral mains reduces risk by reducing the number of connections that can fail, which reduces the overall risk of leaks, and reduce environmental concerns and regulatory agency consequences from overflow of wastewater onto the ground that may then flow into the lake.
- A visual inspection and report on the full length of the interceptors will identify any immediate or near-term improvements needed.

2. Perform Minor Immediate Repairs to Lateral Mains

The most visible portions of the system requiring repair are the lateral mains. Many of the exposed laterals are located in active erosion areas. The erosion is being caused by wave action on the lake bank and by overland drainage flow down the steep slopes from above. The bank failure can be minimized by placing rock rip-rap along the lateral alignment. Diversion berms and culvert pipes can be installed to prevent storm runoff from flowing over the top of the bank. However, many of these laterals may be on private property and may not be within any easements. Coordination with and cooperation of landowners would be a necessity.

Recommendations:

- Physically protect the exposed sections of the interceptor mains by placing rock riprap over and around exposed sections.
- Improve and repair exposed lateral mains. Secure precarious lateral main lines by re-routing, burying and replacing as appropriate.
- For lateral mains that must remain above the surface, replace portions of these mains with pipe material, joint types, and supports appropriate for exposed pipes or sewer lines.

Benefit to Risk Reduction:

- Protection of exposed laterals, or otherwise Improving, repairing, securing, burying, and replacing laterals as appropriate in each instance, will reduce the rate of erosion and potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake.

- In the Post-Improvement Risk Score Summary Table in Section 7, it is assumed these recommendations will be adopted along with one of the options 3a, 3b, or 3c.

3a. Improvement Option: Interceptor Rehabilitation.

Recommendations:

- An option for rehabilitation would be to line the interceptors (entire length
-) with an in-situ structural liner. Some short sections may need replacement. This would aid in reducing the potential of leaks due to joint separation, or pipe failure. This option is recommended if the District chooses to leave the interceptors fully or partially in-place. Under normal conditions pipe lining can have up to a 50 year life span. A life span for use in the interceptor lines is estimated at a conservative 25 years. The reduced lifespan estimate is based on the exposed pipes and eroding ground conditions surrounding the pipe.
- Rehabilitate and line existing manholes.

Benefit to Risk Reduction:

- This alternative, in conjunction with improvement 2 (Minor immediate Repairs to lateral mains), does not eliminate risk for the system, but reduces risk by strengthening the interceptor pipes and supporting the laterals and sewer mains. This option will reduce the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake. This alternative will improve the east and west Interceptors by increasing their condition from Fair to Good, but preventative and enhanced administrative and maintenance procedures will still be needed to remain in effect and the interceptors will remain a high priority, because they will remain in a location where they will be subject to submersion during high water levels in the lake. This is seen in the Post-Improvement Risk Score Summary Table in Section 7.

3b. Improvement Option: Partial Interceptor Bypass

Recommendations:

- This alternative considers taking out of service portions of the interceptor lines where wastewater can be rerouted through new wastewater collection facilities built or modified at higher elevations, well above high water levels of the lake. This option could be considered as the first phase of the Option 3c: Interceptor Bypass alternative.
- For the East interceptor, this alternative is shown in the **Appendix D** Exhibit and includes:
  - Redirecting flows at the south end of Beach Street through a new easement to be located adjacent to lot 155. Flow will then be directed to a new lift station located in the common area between East Beach Circle and Smith Point Road.
  - The flow from the existing main which serves the lots on Smith Point Road, would be connected at its south end to the same new lift station by a new gravity feed line routed adjacent to lot 132. A discharge line from the new lift station would travel between lots 143 and 145, then along Shoreline Drive to the manhole located adjacent to lots 96 and 97. From there the flow would move by gravity into the existing system.

  - Flows along Bass Point Road would be collected in a second lift station located at the southerly end of Bass Point Road. Then flow would be pumped to the north following Bass Point Road, then along Shore Line Drive to the manhole in located adjacent to lots 96 and 97.
  - Lots 106 and 107 along Bass Point Road will require individual grinder pumps to lift effluent to Bass Point Road then flow by gravity into the second lift station. This portion of the alternative would eliminate Manholes 112 through 128 (3,533 feet of pipeline) or 74% of the East Interceptor line.
- The West interceptor components of this alternative would include:
  - Diverting gravity flows from Manhole on Saddle Way adjacent to lots 42 and 42 to a new manhole on Saddle Way adjacent to lot 44. Then flows would be routed through a new easement along lots 44 and 61 to the existing manhole at the west end of Bluff Court. The flows would follow the same alignment as Line "C" then turn East along the southerly side of lots 65 through 70 and then to a new manhole at the west end of Lands End Road.
  - The pipeline would continue northeasterly along Lands End Road and then turn south into the open space between lots 192 and 193. The pipeline would then connect to Manhole #96. Based on the limited topographic data available it appears this system could potentially operate as a gravity system. Additional topographic information will be required to verify the validity of this option.
  - Lots 194 through 207, lot 41, and lot 43 would require grinder pumps. This portion of the alternative would eliminate Manholes #84 through #95 (2,223 feet of pipeline) or 45% of the West interceptor line.
- Line the un-relocated portions of the interceptors with an in-situ structural liner. This would aid in reducing the potential of leaks due to joint separation, or pipe failure. Line and waterproof the manholes.

<u>Benefit to Risk Reduction:</u>

  - This alternative, in conjunction with improvement #2, does not eliminate risk for the system, but further reduces risk by strengthening the interceptor pipes and supporting the laterals and sewer mains. This option will reduce the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake. This alternative will reduce the risk in the east and west Interceptors by increasing the condition from Fair to Good, but preventative and enhanced administrative and maintenance procedures will need to remain in effect as the interceptors will remain a high priority. This is seen in the Post-Improvement Risk Score Summary Table in Section 7. This alternative is slightly superior to Option 3a: Interceptor Rehabilitation, but gets the system much closer to the far superior Option 3c: Interceptor Bypass, which represents the best that can be done.

3c. Improvement Option: Interceptor Bypass

Recommendations:

- This option for reducing risk associated with failure of the interceptors would remove and relocate them entirely to an elevation above the high water level of the lake. This concept was developed and studied by County staff and is described and shown in detail in "County Service Area 7A Oak Shores, California Interceptor Bypass Study 2004". An exhibit of this option is shown in **Appendix E**. This would be accomplished using existing access roads and existing lateral routes so far as possible. The complete bypass of both interceptor lines would remove most of the risk of failure associated with both the east and west interceptor lines.

Benefit to Risk Reduction:

- This option will reduce, to the maximum extent possible, the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake. This alternative will reduce the risk in the West Interceptor by increasing the condition from Fair to Good. The preventative and enhanced administrative and maintenance procedures can be reduced as the interceptors will be reduced from a high priority to a medium priority. This is seen in the Post-Improvement Risk Score Summary Table in Section 7.

5.3 Lift Station #3 Improvements

4. Provide Redundant Equipment & Alarms

Recommendations:

- Lift Station # 3 is a critical point in the sewer system. All flow to the wastewater treatment plant passes through the lift station. Replacing Lift Station #3 would be costly and is not recommended as it would necessitate a redesign of the wastewater treatment plant headworks. The lift station is designed as a circular shaft 60 feet deep. Alternating submersible pumps lift influent from the interceptor lines to the sewage treatment plant. Control systems and alarms are the primary defense to preventing or reducing the damage of a spill. Currently, the lift station is encompassed with three methods of protection. These include electronic monitoring for high flows, regular inspections, and a temporary shut down by manually closing valves. These are good defenses but they should be further strengthened.
    - The current mitigations to failure are the alarm system and the backup generator. It is recommended that the alarm system be enhanced as a backup to the system and routine inspection of the system included. The backup power source is a 100KW (Onan), diesel engine, trailer mounted generator. Providing enhanced inspection and testing of the generator would reduce the risk at the lift station. Should power outage occur the generator has to be manually started. Although the generator is tested monthly, should the generator fail during an emergency, the lift station would be at risk. A procedure needs to be in effect to acquire a

rental generator if necessary. An account with a rental supplier should be setup prior to an emergency to speed up the rental process.

- Alarm systems are crucial in the first line of defense. They constantly monitor a system, record the data, and can notify an operator when system parameters are not within usual operating specifications. Currently there are two sets of pump control switches in the lift station. The primary system is comprised of electronic transducers and the backup system is comprised of mechanical float switches. It is recommended that multiple stage sensors with Supervisory Control and Data Acquisition (SCADA) capability be installed to provide control redundancy.

Benefit to Risk Reduction:

- Providing enhanced inspection and testing procedures for the backup generator, and addition of remote monitoring capability are key to reducing risk of a failure and the amount of response time to a failure. These recommended improvements will reduce environmental concerns and regulatory agency consequences from overflow of wastewater onto the ground that may then flow into the lake. This alternative will reduce the risk in lift station #3 by increasing the condition from Fair to Good. The preventative and enhanced administrative and maintenance procedures can be reduced as the lift station will be reduced from a high priority to a medium priority. This is seen in the Post-Improvement Risk Score Summary Table in Section 7.

5. Provide Supervisory Control and Data Acquisition (SCADA) Capability

Recommendations:

- Add additional monitoring and control capability through an enhanced SCADA system that includes the collection, pump and treatment elements of the system. The existing alarm system notifies operators of a failure, but does not provide any insight as to the cause of failure. A more sophisticated electronic monitoring system would be able to continually collect data throughout the entire system, allow the operator to remotely view data and operate the system accordingly. SCADA provides the capability of graphic displays and user-friendly operation and monitoring. The level of sophistication, and determination of which functions to monitor and control should be discussed between the operations and engineering staff in order to provide the best tools for system management and reduction of risk.
- The SCADA system should be able to identify and trigger an alarm when lake levels are above the flow-line elevation of the interceptor. This will alert the staff to implement more careful and stringint monitoring protocols during this time of highest risk.
- The SCADA system should be able to identify and trigger an alarm when unusual increases in flow are experienced at the lift station, and as a backup, at the wastewater Treatment plant. Currently, only daily peak flows of both combined East and West interceptor flows into the plant are recorded. Specific hourly flows in each interceptor would be useful for future designs or repairs to the system.
- Additional flow monitoring devices with SCADA capability, should be installed at several locations in each interceptor line. The addition of a SCADA system to the recommended additional flow monitors throughout the system will allow the operator to create a baseline of flow data. Therefore, when debris begins to create a blockage the operator can detect the anomalies and perhaps prevent a blockage from moving into the interceptor system.

- Install remote operation of the interceptor valves at the lift station.
- The lift station monitoring system should be set to notify the operator when unusually reduced flows or no flow is detected. A no flow monitor would indicate a leak is occurring. The operator could be notified and the leak detected earlier than by routine inspection or public notification. A temporary malfunction does not directly result in a spill; however, it is a potential prelude to a spill. There is storage in the lift station storage in the interceptor pipe system. By providing remote access to operate the valves, the response time would be reduced. Remote access to transfer power to the backup generator will also reduce response time.
- Install SCADA and software to remotely transfer power to the backup generator In the event of a power outage.
- Provide software and training to the operator for remote system monitoring and operation.

Benefit to Risk Reduction:

- The SCADA system should allow remote access to levels in the lift station and provide a baseline graph of typical operations. By understanding baseline operations the operator can detect irregular anomalies in pump operations and prevent a complete pump failure.
- The above recommended actions reduce risk of failure by providing the earliest warnings of signs of failure; and help isolate the location of a failure. This capability will prevent or minimize the consequences of failure, and will reduce the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake.

6. Provide Back-up Lift Station Pump & Generator

Recommendations:

- Having backup equipment in place, on standby, or available for easy purchase reduces the risk of a leak due to failure of mechanical equipment. The Oak Shores system could benefit from redundant pumps on site which would allow them to be readily available for the lift station. The lift station currently has two alternating pumps. However should one of those pumps fail the entire system will rely on a single pump until the failed pump is replaced.

Benefit to Risk Reduction:

- Providing an on-site pump replacement will minimize the time the system is relying on a single pump. This recommended improvement will reduce environmental concerns and regulatory agency consequences from overflow of wastewater onto the ground that may then flow into the lake.

7. Provide a Containment Berm around the Lift Station

Recommendations:

- Providing a larger containment berm around the existing lift station #3 will reduce risk by providing for greater holding capacity in the event of a spill. A theoretical or analytical approach to sizing is not practical, as the types of failures are many. Rather, providing the largest protection capacity practical given physical construction and access constraints should be considered.

Benefit to Risk Reduction:

- Providing a larger containment berm will reduce risk of spills reaching the lake. This recommended improvement will reduce environmental concerns and regulatory agency consequences.

5.4 Operational & Emergency Improvements

8. Schedule Enhanced Frequency of Inspections

Recommendations:

- When practical, monthly inspections, at a minimum, are crucial to reducing the risk of equipment failure and ultimately a breach. Even with monitors and alarm systems, physical inspections are required to provide a backup to the monitoring system. An operator may find situations that the monitoring system was not designed to catch. Current inspection for the interceptors and lift station occur:
    - During low lake levels when the manholes and pipelines are exposed, the operator performs a monthly walk looking for signs of leakage. Inspections should remain monthly.
    - During high lake levels when the manholes and pipelines are submerged under the lake, the operator patrols the lake shore looking signs of sewage flows on the surface. Additionally, during this time the lift station is inspected for high flows which would indicate lake water intrusion. Inspections should remain monthly.
    - Annually, during the month of July, a dye test is performed. At first glance, one would think a dye plume would appear in the lake during a dye test on a submerged interceptor pipe with a leak, however this not the case. The sewer flow in the interceptor line is less than the pipe capacity therefore the pressure is greater outside the submerged pipe than inside the pipe. Therefore a leak in the interceptor pipe will result in water intrusion into the system. If the dye test is performed when the pipe is exposed then only the area of the pipe in contact with the dye will leak out dye, i.e. the bottom of the pipe. A low pressure leak test is recommended as an alternative.
    - Monthly test of the backup power generator system is performed for about 15 minutes. The generator is run weekly without a load for 15 minutes. The short duration of the runtime is governed by the Air Pollution Control Board (APCB) emissions requirements. A long duration such as 4 to 8 hours is recommended at least once a month. A solution to reducing emissions is to replace the diesel generator with a cleaner burning natural gas or propane generator. A natural gas or propane backup generator does not require an APCB permit. As an alternative, an exception could be obtained from the APCB.
    - Maintenance on the backup generator is performed every six months. This is probably adequate.
- Monthly opening and closing of the interceptor valves should be performed.

Benefit to Risk Reduction:

- Enhanced frequency and intensity of testing as recommended will reduce the risk of system failure by early detection of leaks or equipment maintenance issues or failures. This recommended improvement will reduce the potential for leaks, environmental concerns and regulatory agency consequences.

9. Develop a Geographical Information (GIS) System

Recommendations:

- GIS data consists of both spatial data and text data. Supplying the operator and field crew with a GIS system which correlates line location, property ownership data, permits, repair logs, historical pictures etc. of the wastewater collection system will give them a useful tool to prevent spills or reduce reaction time during a spill. It is imperative that accurate and up-to-date information is kept on file. The best type of data for this system is GIS data. It is recommended that a GIS data base be developed for the wastewater collection system.
- It is recommended that the operator have a portable computing device capable of taking pictures, typing report notes, GPS tracking, viewing GIS files, and the capacity for wireless internet access. Inspection and Maintenance Reports, SOP's, SMP's, training logs etc. can then be immediately uploaded to a central server and the data base updated accordingly.

Benefit to Risk Reduction:

- A GIS system will be a useful tool to prevent spills or reduce reaction time during a spill. . This recommended improvement will reduce the potential for leaks, environmental concerns and regulatory agency consequences.

10. Develop a Comprehensive Set of Emergency Operation Procedures

Recommendations:

- Adopt existing County emergency procedures as applicable. The procedures outlined in the San Luis Obispo County Department of Public Works Procedural Memorandum O-8 dated October 4, 2011, are followed for Sewage Spill Handling and Reporting, and should be retained for CSA 7a.
- Staff has currently been trained for emergency response. The operator is primary emergency response contact. Other field crew has been instructed by the operator on restoring power to the lift station using the onsite backup generator. A record should be kept of all formal and informal personnel training including emergency response procedures. As the system is improved through other recommendations in this report, training should be adjusted accordingly.
- Currently, there are no regularly practiced emergency drills. It is recommended that emergency drills be performed at least annually. A drill performance report including results, successes and failures of the drill should be recorded along with the list of participants and discussions on how response techniques can be improved. The report should be submitted to management for review.
- Emergency equipment is routinely tested and inspected. The backup generator is tested monthly and inspected every six months. It is recommended that test and inspection reports should be submitted to management for review. At a minimum the test report should include date, time and length of the test, the load carried by the generator, personnel performing the test and notes regarding any issues. The inspection report should include the numbers of hours on the generator, a list of inspected items, fluids changed, and the operator or field technician performing the inspection.

Benefit to Risk Reduction:

- Development and implementation of CSA 7a specific emergency operations procedures will facilitate the timely and professional resolution of system problems and emergencies as they arise. Additional management review of these procedures will heighten awareness, potentially catch weaknesses and allow for earliest corrective action as needed. These procedures will lessen the risk of extended spills and associated environmental concerns and regulatory agency consequences.

11. Adopt Enhanced System Inspection Procedures

Recommendations:

- A system component identification method is needed. A graphical (map) identification system such as presented in the attached maps and exhibits should be adopted for quick and clear communication regarding individual components. This identification system or another system should be adopted by both the field and office personnel. The adopted system would also be incorporated into the GIS data bases to maintain consistency.
- A Fats, Oils and Grease (FOG) program is in place. At this time there does not appear to be any issue with FOG in the system. However, this information is directly from the operator who has only been able to observe the lower reaches of the interceptor lines near the lift station and at various locations when manholes have been opened. Once a cleaning and video inspection is performed additional recommendations may be made.
- Problem areas have been identified by staff and through this report development and are receiving additional monitoring. Due to ongoing toe and bank erosion as well as wave erosion, new problem areas are consistently being discovered. The principal problem areas on the East interceptor are from Manhole (MH) #114 to MH # 128, and on the West interceptor from (MH) #84 to MH #96. These areas are checked monthly by the operator. A simple monthly report indicating the system component, the previous condition, the current condition and if needed a photograph or sketch of the problem should be made and submitted to management for review.
- A method of infiltration or leakage identification is currently in place and should be maintained. During high lake levels the lift station is monitored for excessive flows. The monthly inspection of the interceptor lines during low lake levels is a visual inspection for leaks. Leak tests are performed on an annual basis in July. These inspections are not precise in determining minor infiltration flows that may develop into larger leaks. As mentioned earlier, additional flow sensors and level monitors combined with a SCADA system will assist the operator in early detection of leaks.
- Areas vulnerable to root intrusion, age, settling etc. have been identified and are monitored. The location of the interceptor lines is generally not in a root prone area. However, many of the laterals and feeder pipes are located near the top of the lake bank which is a root zone area. Although there are no known issues of root intrusion, this should be monitored.
- Additional trained staff should be available during inclement weather.
- Areas of excessive hydrogen sulfide corrosion need to be identified and controlled. Most of the interceptor manholes have not been opened since they were constructed 35 years ago. For the manholes that have been opened, there have not been any reports of hydrogen sulfide corrosion, but inspection for this corrosion would be a prudent preventative practice.

Benefit to Risk Reduction:

- Inspection and maintenance procedures are preventative methods of protection from failure. Risk of system failure and leaks are reduced by earlier detection of issues and problems before they develop into failures. This enhancement will prevent or minimize the consequences of failure, and will reduce the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake.

12. Enhance Staff Training

Recommendations:

- The district should establish a plan for operator training and backup support training support for the plant staff. Training should include general operator training as well as specific daily plant procedures and emergency response procedures. Staff training and proficiency testing should be documented and recorded to ensure staff is current on all procedures.
- Field crew as well the operators should receive training and participate in emergency drills to practice and develop emergency skills and backup procedures. Necessary core competencies to operate, maintain and perform emergency operations on the system have been identified and should be incorporated. For example, the lift station is critical component of the system. Should the lift station go off line, sewage will begin to backup. The greater the sewage backup, the more problematic the situation becomes. The lift station is equipped with twin alternating pumps. However, a standby pump should be available and ready for replacement in case one pump goes out. The procedures for changing a pump should be practiced once a month.
- A staff work plan and position duties & requirements should be created and maintained by management. Certifications, skill & knowledge requirements and renewals should be actively discussed with all relevant personnel.

Benefit to Risk Reduction:

- Staff Training is another preventative method of protection from failure. Risk of system failure and leaks are reduced by more competent inspection, maintenance and repair. This results in earlier detection of issues and problems before they develop into failures. This enhancement will prevent or minimize the consequences of failure, and will reduce the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake.

13. Prepare Enhanced Standard Operating Procedures, SOPs

Recommendations:

- The current interceptor and lift station operating procedures are working well. However, the current operator has been the primary operator for 20 years and has developed many practices and procedures. It is recommended that a procedures manual be created, verified for conformity with County procedures and kept up-to-date. The district operates under the San Luis Obispo County Public Works Department Sanitary Sewer System Management Plan dated March 15, 2010.

- The following operating procedures for the lift station and the interceptor lines need to be compiled as SOPs:
  - Opening of manholes
  - Rock rip rap cover placement
  - Lateral and Feeder line supporting
  - Lift station valve operation
  - Backup power initiation
- Additionally a Standard Maintenance Procedures (SMP) Manual should be developed for documentation. This SMP manual should include check lists and reporting requirements.
- A comprehensive set of Emergency Operation Procedures (EOPs) should be comprised and made available to all operators and vital personnel. Accurate and readily accessible maps should be made available to the operator and field crews. The field crews should mark changes or corrections on the maps so the GIS data base can be updated. Accurate maps and data base information will not only provide field crew with a useful tool but will also provide management with a better understanding of the system conditions.

Benefit to Risk Reduction:

- Updating and enhancing SOPs for CSA 7a will assure uniformity and consistency in maintenance and operations of the system, reducing risk of failure from procedural errors. This enhancement will prevent or minimize the consequences of failure, and will reduce the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake.

14. Implement Operational Improvements as Recommended by the County

- The County staff is constantly, through experience, developing operational improvements. They also currently follow existing County operational guidelines. This includes guidelines found in the County Sanitary Sewer Management Plan (SSMP) and include consideration of :
  - Rules
  - Regulations
  - Procedures
  - Supervision
  - Sign off procedures
  - Permit to work systems

  The County recommends the continued adaptation of county guidelines including the SSMP and its subsequent updates.

Benefit to Risk Reduction:

- Developing operational improvements through experience while following existing County operational guidelines for CSA 7a will assure state-of-the-art in maintenance and operations of the system, reducing risk of failure from procedural errors. This will prevent or minimize the consequences of failure, and will reduce the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake.

5.5 Administrative Improvements

15. Development Standards, Standard Plans, Mapping of Laterals & Easements

Recommendations:

- Clear, specific delineation of ownership, cleaning, normal and emergency maintenance responsibility should be added to the existing ordinance CSA 7A Ordinance 2338.
- County design standards and standard details should be cited for CSA 7A. Based on daily flow criteria, the existing East and West interceptors do not meet the generally accepted minimum velocity criteria of 2.0 fps. The average maximum velocity achieved in either interceptor is 1.49 fps in the East interceptor and 1.59 fps in the West interceptor. A new design would make attempts to achieve an average daily self-cleaning velocity of 2.0 fps.
- Construction requirements. Policies and procedures established in the ordinance need to be enforced to prevent construction from adversely affecting the existing collection system. Coordination between the building department and the Public Works Department on behalf of CSA 7A needs to occur. Additionally the County should consider assessing fees for upgrading or protecting the sewer collection systems.
- Access to manholes and pipelines. Any work on the laterals or on the mainline will require vehicular access to the pipelines and manholes. A few access locations are available but additional access may be required across private property. This will involve grading roads to the lake and acquiring access easements. Environmental permits will be required from various agencies to perform the work.
- Clean and inspect the remaining portions of the interceptor to determine the pipe condition. If needed install a semi-flexible fiberglass liner. This would aid in reducing the risk of a leak due to joint separation or pipe failure. The cost and effort to access and inspect may warrant lining the pipe at the same time.

Benefit to Risk Reduction:

- Development Standards, Standard Plans, and mapping of laterals and easements for CSA 7a will assure consistency in future additions to, or improvements of the system, reducing risk of failure from substandard design and construction.
- Easement maps will reduce the risk associated with access during routine and emergency maintenance and repairs
- These items will all prevent or minimize the consequences of failure, and will reduce the potential for frequent breaks and leaks, and reduce environmental concerns and regulatory agency consequences from exfiltration or leakage from failures of wastewater onto the ground that may then flow into the lake.

6.0 Risk Analysis of Solutions

The risk associated with recommendations are presented in the following categories, as presented in Section 5 of this report: Interceptor physical improvements, Lift Station #3 Improvements, Operational (including emergency) improvements, and Administrative Improvements

Note that there are three alternatives or options presented for reducing risk for the interceptor lines. These alternatives are: 3a. Rehabilitation of the existing pipeline, 3b. Partial pipeline relocation, or 3c. Complete pipeline relocation as outlined in the 2004 Interceptor Bypass Study. Each of these alternatives reduces overall risk by improving, reinforcing or taking the higher risk sections out of service.

Operational and administrative alternatives are lines of defense that minimize and or prevent mechanical failures, downtime, spills and increases response times. Providing operators and field crews with accurate tools and written procedures will reduce the risk of failures.

6.1 Prioritization of Solutions

Table 6.3 below contains a list of recommended improvements including estimated improvement costs. These recommended improvements are described in detail in Section 5 of this report. These recommended actions reduce the risk of failure for the main elements of the Oak Shores interceptor pipe system. Referencing Table 6.3:

A. It is recommended that improvements 1&2 be implemented immediately.
B. It is recommended that the lift station and the administrative alternatives be implemented as soon as possible. Risk associated with these system components will always be present due to their inherent nature; however, they may be minimalized by implementing these recommendations.
C. Selecting an alternative to reduce risk associated with the interceptors (Options 3a, 3b, or 3c) may be deferred until a video inspection of the lines can be made and an up-to-date aerial survey can be performed. The video inspection will determine the condition of the pipes and the topographic survey will give more information about new sewer line routes and components. With these tools a more logical and accurate cost benefit analysis can be performed.
D. Other improvements may be adopted as soon as practical, as determined by budget and time to implement.

6.2 Summary of Costs

A summary Total Project cost is provided in Table 6.3 below. A tabulated detail of estimated costs can be found in spreadsheets comprising Appendix B. Because of the high cost associated with many of these items, Implementation of recommended improvements would need to be accomplished in accordance with a multi-fiscal year budget plan.

Table 6.3 Recommended Improvements with Total Project Costs

	INTERCEPTOR PHYSICAL IMPROVEMENTS	COST (x1000)
1	***Provide additional flow monitoring devices, mechanical & electrical improvements.*** Enhance backup power, install automatic operating valves at the lift station, and consolidate some lateral lines. Clean and video pipe inspection.	$245
2	***Perform minor immediate repairs***: cover exposed interceptors, repair & replace laterals & supports, reduce erosion with rock rip-rap. Coord. With property owners.	$173
3a	***Improvement Option 3a: Interceptor Rehabilitation*** (Lining w/some replacement)	$1,024
3b	***Improvement Option 3b: Partial Interceptor Bypass*** (Eliminate over ½ of current Interceptors)	$3,346
3c	***Improvement Option 3c: Interceptor Bypass*** (Eliminate current Interceptors)	$4,452
	Total Depends on Option Chosen	$1,442-$4,870
	LIFT STATION #3	
4	***Provide redundant equipment*** for backup in the event of a mechanical failure, including alarms. Have rental agreement for additional BU generator.	$32
5	***Provide Supervisory Control and Data Acquisition (SCADA) capability*** with recording, alarm systems, multiple stage sensors, additional flow monitors, and for the lift station monitoring system.	$94
6	***Provide a backup lift station pump on site***, and have accounts in place or methods for rental of backup equipment.	$13
7	***Consider a containment berm*** around the Lift Station.	$48
	Total	$187
	OPERATIONAL (INCLUDING EMERGENCY) IMPROVEMENTS	
8	***Schedule enhanced frequency of inspections*** for the interceptors and lift station systems as described in this report.	$9
9	***Develop a GIS system*** which correlates manhole and pipe line location, property ownership data, permits, repair logs, historical pictures etc.. Data should be made available to the operator and field crews. Also, a procedures and maintenance manual should be developed which allows for easy updating.	$32
10	***Develop a comprehensive set of emergency operation procedures***, provide training and make available to all operators and vital personnel.	$9
11	***Adopt enhanced system inspection procedures*** including a system component identification method, a cleaning and video inspection schedule, preparation of a monthly report of problem areas, and if needed, a photograph or sketch of the problem made and submitted to management for review. Othermisc. recommendations as included in the report.	$6
12	***Enhance staff training*** by developing a staff work plan and position duties. Certification requirements and renewals should be actively discussed with all relevant personnel. Staff training and proficiency testing should be documented and recorded to ensure staff is current on all procedures.	$12
13	***Prepare enhanced standard operating procedures (SOPs)*** for the lift station and the interceptor lines addressing opening of manholes, line protection measures, lateral repairs, and emergency system operation procedures for various flooding or failure scenarios.	$9
14	***Implement operational improvements*** as recommended by the County	TBD
	Total	$77+
	ADMINISTRATIVE IMPROVEMENTS	
15	***Prepare development standards, standard plans, mapping of laterals and easements.***	$32

6.3 A Ranking of Improvement Recommendations

All recommendations are important, and it is recommended that all be accomplished to the degree deemed feasible by the agency according to priority. The recommended priority order of implementation of improvement recommendations is as follows:

1. Additional Flow Monitoring, BU Power, Automatic valves and some lateral consolidation

2. Minor Immediate Repairs

3. Interceptor Improvements: Either (a) Rehabilitate or (b) bypass part of the existing interceptor lines or (c) bypass all of the existing interceptor lines

4.-7. Lift Station Upgrades

8.-14. Operational Improvements

15. Administrative Improvements

The reasons for this order are that Recommendations 1 and 2 are considered to be critical lines of defense that can reduce risk immediately, and the effectiveness of 3. Interceptor Improvements is dependent on implementation of these measures. The bigger project to make changes to the interceptor lines may need to be budgeted for future years, but should not delay implementation of the other measures.

A summary of risk reduction associated with these recommendations is shown in the table 6.4 below. They are listed in order of priority of implementation. This matrix represents the percent improvement that is expected through implementation of the recommendations.

Table 6.4 Summary of Risk Reduction

Improvement Recommendations (See Detailed Recommendation List Above)	Risk Range (Possible Score)	Pre-Improvement Risk	Post-Improvement Risk	Risk Improve-ment	Cost (Construction for Interceptor & Lift Station)	Priority
Interceptor Improvements (1-3c)	--	--	--	--	--	--
1. Add'l Flow Monitoring, BU Power, Automatic Valves & Lateral Consol.	**2-6**	4.65	4.5	3.2%	$200,000	**High**
2. Perform Minor Immediate Repairs	**2-6**	4.65	4.4	5.4%	$140,000	**High**
3. Option 3a: Interceptor Rehabilitation	**2-6**	4.65	4.3	7.5%	$1,200,000	**High (Choose One)**
Option 3b:Partial Interceptor Bypass	**2-6**	4.65	4.1	11.8%	$3,400,000	
Option 3c: Interceptor Bypass	**2-6**	4.65	3.2	31.2%	$6,600,000	
4-7. Lift Station #3	**2-6**	4.5	4 (with 3a/3b) 3 (with3c)	11.1% 33.3%	$355,000	**High**
8-14. Operational Improvements	**2-6**	4	3	25%	$74,000	Moderate
15. Administrative Improvements	**2-6**	3	2	33.3	$12,000	Regular

As would be expected, eliminating all or a major portion of the interceptors and replacing them with a by-pass system significantly reduces the risk. Rehabilitation reduces the risk to a predictably lesser extent.

Exhibits for the Lift Station and Operational and Administrative Alternatives are not required however Appendices D & E illustrate alternatives 3b partial By-pass of the interceptor system and; 3c By-pass of all the interceptors. Alternative 3c was proposed and described conceptually in the 2004 Interceptor Bypass Study. Appendix E is copied from this study.

6.4 Conclusions

The interceptor system, (the East and West Interceptor along with the Lift Station), has a 4.5-4.65 (Out of 6) risk of failure. This translates to a high priority for action. The risk is due to exposed pipes and the need for multiple lines of defense at the lift station. The alternatives presented in this report focus on three areas physical, operational, and administrative

15 recommendations have been made in table 6.3 in the order of recommended priority. In summary form these recommendations are as follows:

- Items 1-3 are considered equal in priority.
  1. Additional Flow Monitoring, BU Power, Automatic valves and some lateral consolidation. These are important items, that taken together provide great benefit in terms of reduced risk of spill.

  2. Minor Immediate Repairs. These small measures are easily implemented and should be high priority because they can be accomplished quickly.

  3. Interceptor Improvements: Either (a) Rehabilitate or (b) bypass part of the existing interceptor lines or (c) bypass all of the existing interceptor lines. These are the most important of all physical improvements, and one of these options should be implemented concurrent with items 1& 2 above.

     This interceptor system is more complicated than a normal sewer due to its location in the lake. The age of the system and difficulties associated with opening manholes also contribute risk to the system. As the life of the interceptor system increases these issue continue to increase. Under normal conditions the anticipated life of ductile iron pipe is 100 years. In acidic or corrosive conditions Ductile iron pipe can have an expected life span of 50 years. Therefore with the interceptor lines being 37 years old it is safe to estimate the DIP has reached or exceeded half of the service life.

- Items 4-7. Lift Station Upgrades: These improvements should be considered next in importance after after 1-3, and should be implemented in turn as soon as practical.

- Items 8-14. Operational Improvements. Although lower in priority than physical improvements and other priorities as listed above, these improvements could be partially or wholly implemented as soon as practical.

- Item 15. Administrative Improvements. Although lower in priority than physical improvements and other priorities as listed above, these improvements could be partially or wholly implemented as soon as practical.

It is highly recommended that Recommendations 1 and 2 be completed immediately. Prior to choosing one of the interceptor improvement alternatives 3a- 3c, it may be desirable to clean and video inspect each interceptor to determine the condition of the pipe. Because of their relatively low cost, even though they are a lower priority for implementation, it is recommended that the Operational and Administrative Improvements be considered for implementation as soon as possible. They are lower priority, but are still important lines of defense that can reduce risk immediately.

Table 6.5 Post-Improvement Risk Score Summary Table

Condition	Importance: 1 LOW	Importance: 2 MEDIUM	Importance: 3 HIGH
1 GOOD	**REGULAR PRIORITY** Infrequent Monitoring 2 Administrative Issues	**MODERATE PRIORITY** Regular Monitoring 3 East & West Interceptors- Full Bypass & Liftstation Operational Issues	**MODERATE PRIORITY** Frequent Monitoring 4 East & West Interceptors- Rehab or Part. Bypass & Liftstation
2 FAIR	**REGULAR PRIORITY** Regular Monitoring 3	**MODERATE PRIORITY** Frequent Monitoring 4	**HIGH PRIORITY** Action Recommended 5
3 CRITICAL	4	5	6

As all recommendations are accomplished, the condition of these risk elements improve from fair to good, and the level of monitoring or recommendations for action and risk will be reduced. This is illustrated in Table 6.5.

The importance of the interceptor pipes remains a “3” until they are removed from the lake. The importance of the lift station also remains a “3” until the interceptors are removed from the lake. Its function is directly affected by failure of the interceptors, as long as they remain under water. Once a bypass is built, and the interceptors removed from the lake, the importance drops to a “2” and regular monitoring can be implemented.

As the recommendations are implemented, it can be seen that the risk of failure causing a spill into the lake is reduced accordingly, and action is reduced to various levels of monitoring, maintenance and operational controls.

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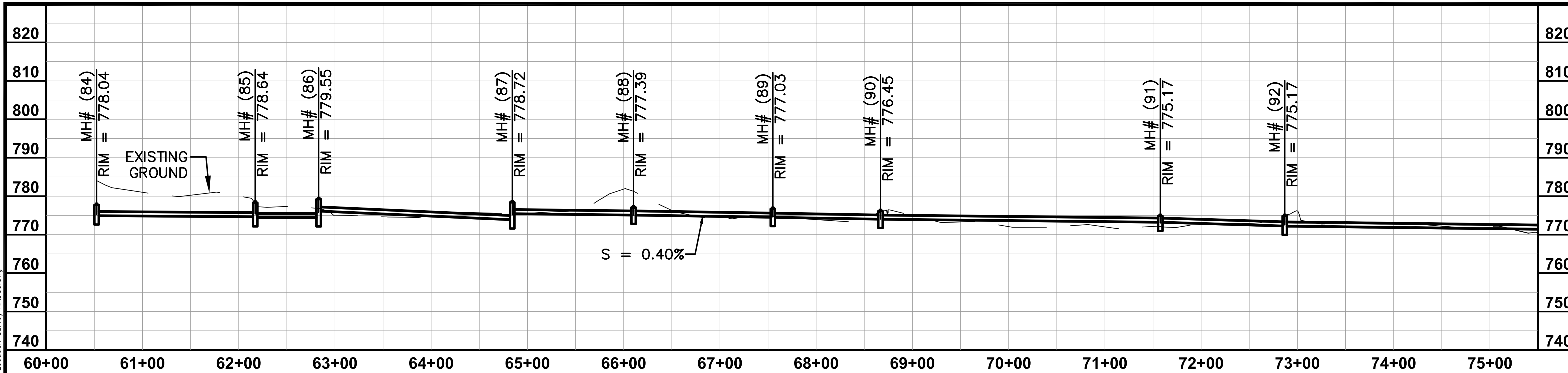
Appendix A Plan and Profile Exhibits



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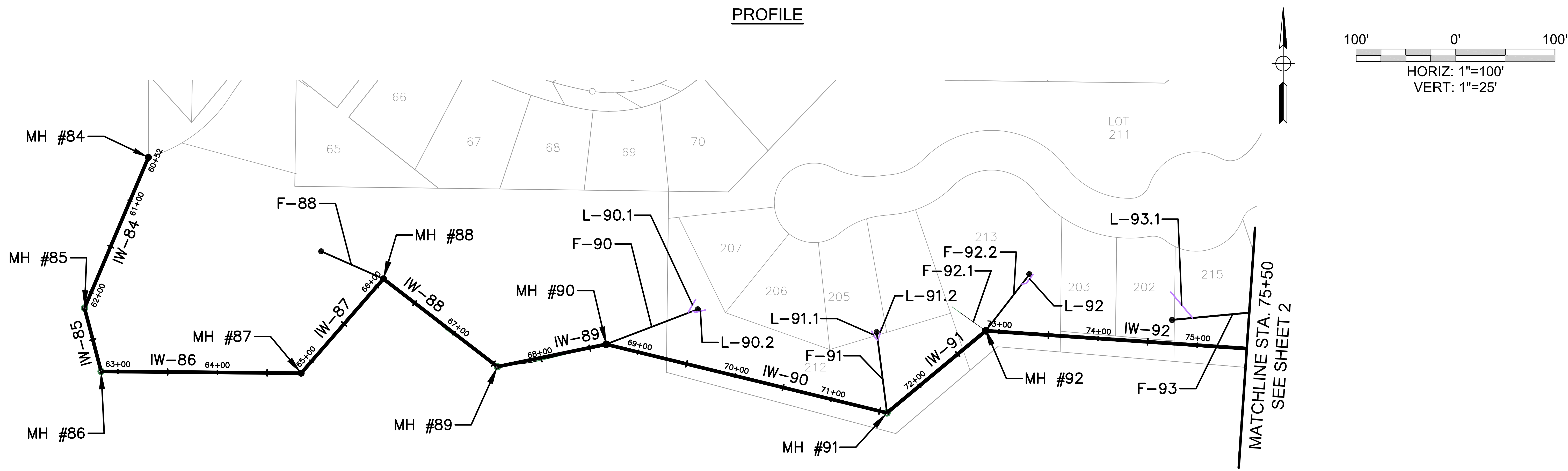

PLAN

COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS
OAK SHORES RISK ASSESSMENT

WEST INTERCEPTOR SEWERLINE LOCATION & PROFILE

STA: 60+00 TO 75+50

SCALE: AS SHOWN

MNS ENGINEERS INC
2231 Broad Street
San Luis Obispo, CA 93401
805.787.0326 Phone
ENGINEERING
PLANNING
SURVEYING
CONSTRUCTION MANAGEMENT

WORK ORDER NO.
COSLO.110005
SHEET 1
OF 8 SHEETS

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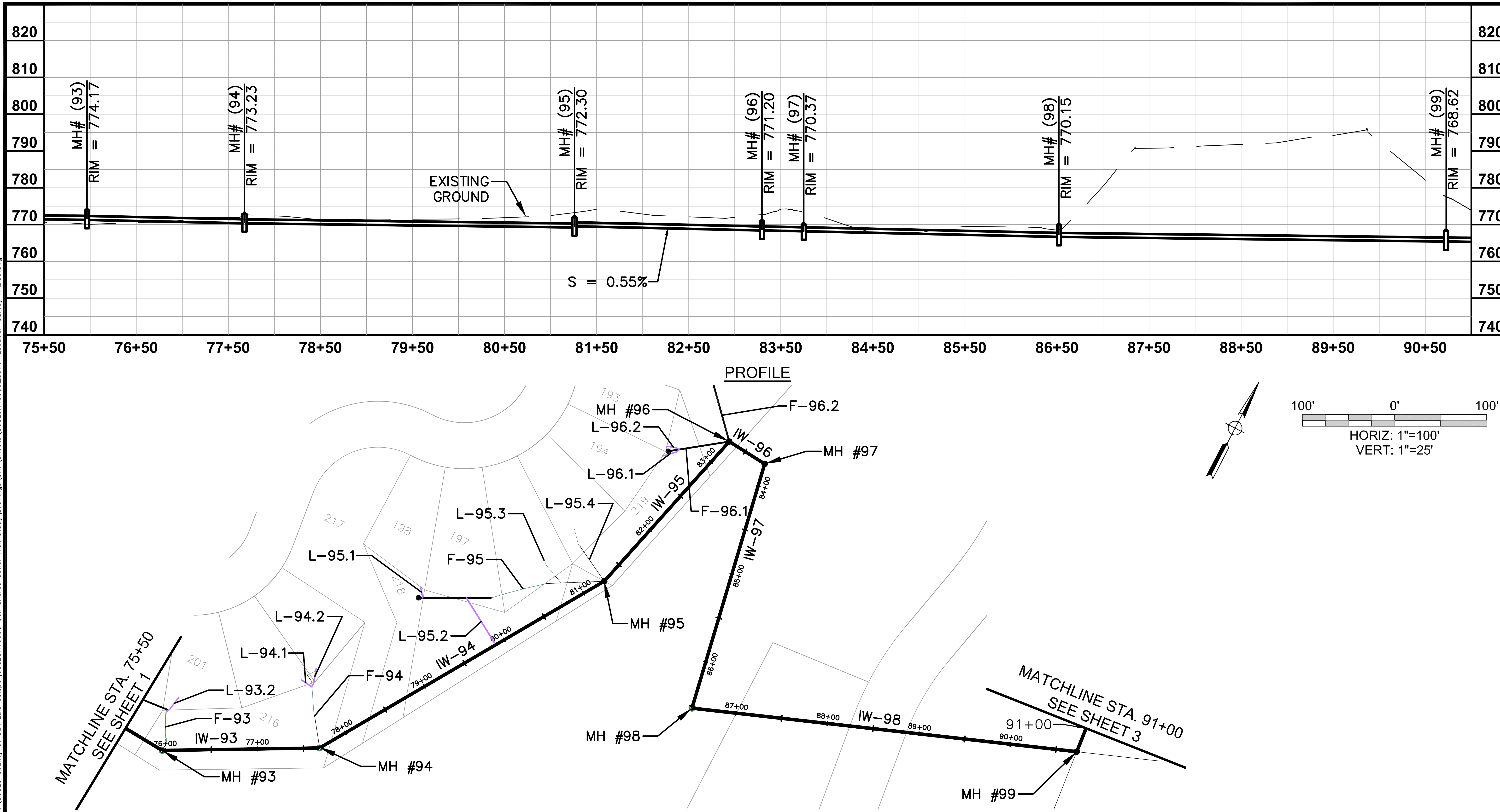

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MNS ENGINEERS INC
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San Luis Obispo, CA 93401
805.787.0326 Phone

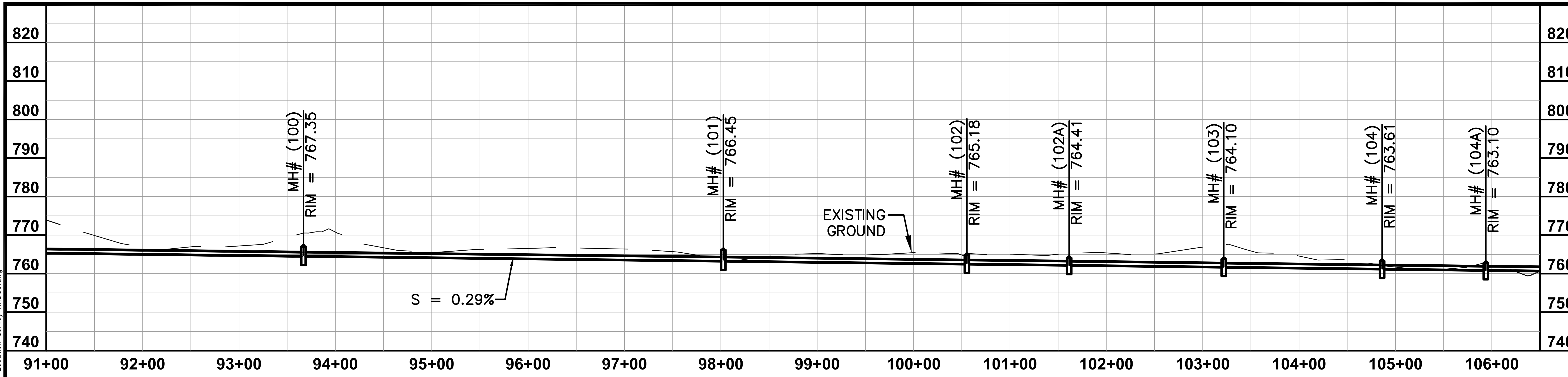
ENGINEERING
PLANNING
SURVEYING
CONSTRUCTION MANAGEMENT

SCALE:
AS SHOWN

COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS
OAK SHORES RISK ASSESSMENT

WEST INTERCEPTOR SEWERLINE LOCATION & PROFILE
STA: 75+50 TO 91+00

WORK ORDER NO.
COSLO.110005



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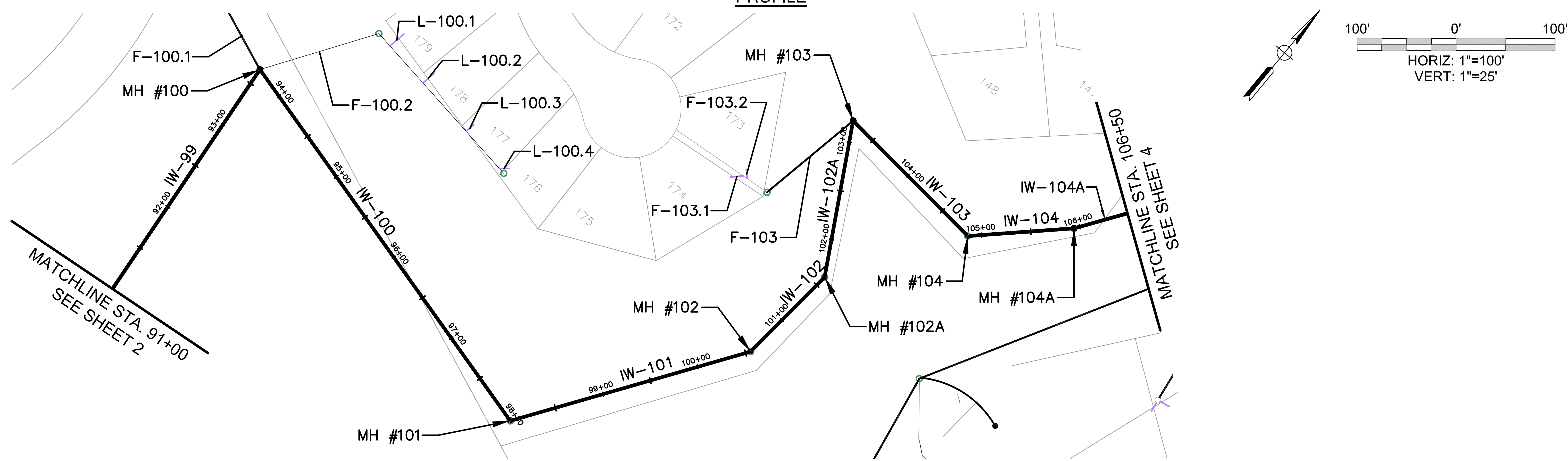


PLAN

60% PRELIMINARY SUBMITTAL

COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS
OAK SHORES RISK ASSESSMENT

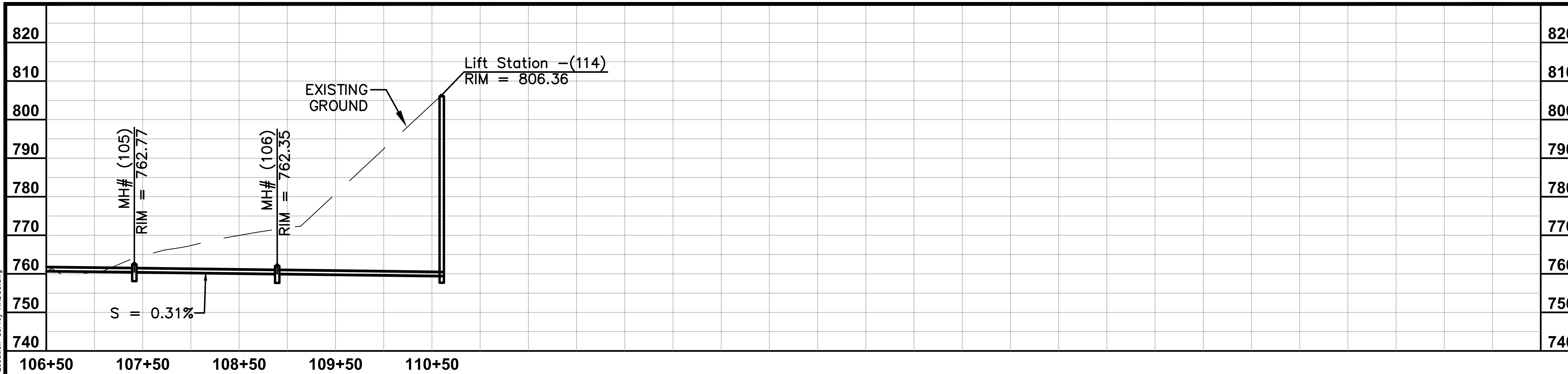
WEST INTERCEPTOR SEWERLINE LOCATION & PROFILE
STA: 91+00 TO 106+50

SCALE: AS SHOWN

WORK ORDER NO. COSLO.110005

SHEET 3 OF 8 SHEETS

MNS ENGINEERS INC
2231 Broad Street
San Luis Obispo, CA 93401
805.787.0326 Phone
ENGINEERING
PLANNING
SURVEYING
CONSTRUCTION MANAGEMENT



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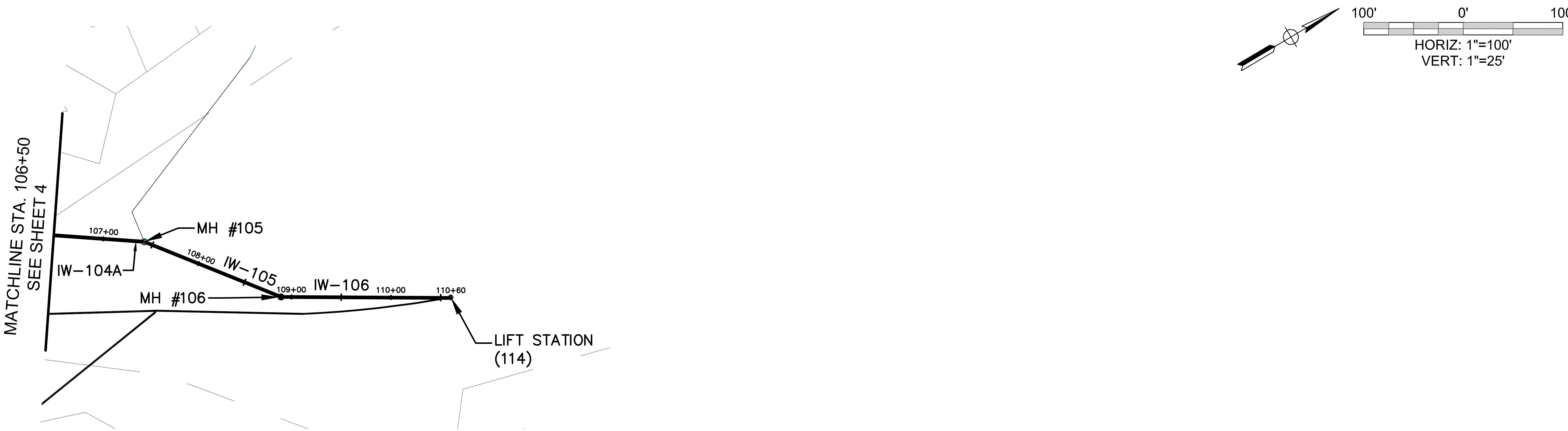

PLAN

COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS
OAK SHORES RISK ASSESSMENT
WEST INTERCEPTOR SEWERLINE LOCATION & PROFILE
STA: 106+50 TO 110+60

SCALE: AS SHOWN

WORK ORDER NO. COSLO.110005

SHEET 4 OF 8 SHEETS

MNS ENGINEERS INC
2231 Broad Street
San Luis Obispo, CA 93401
805.787.0326 Phone
ENGINEERING
PLANNING
SURVEYING
CONSTRUCTION MANAGEMENT

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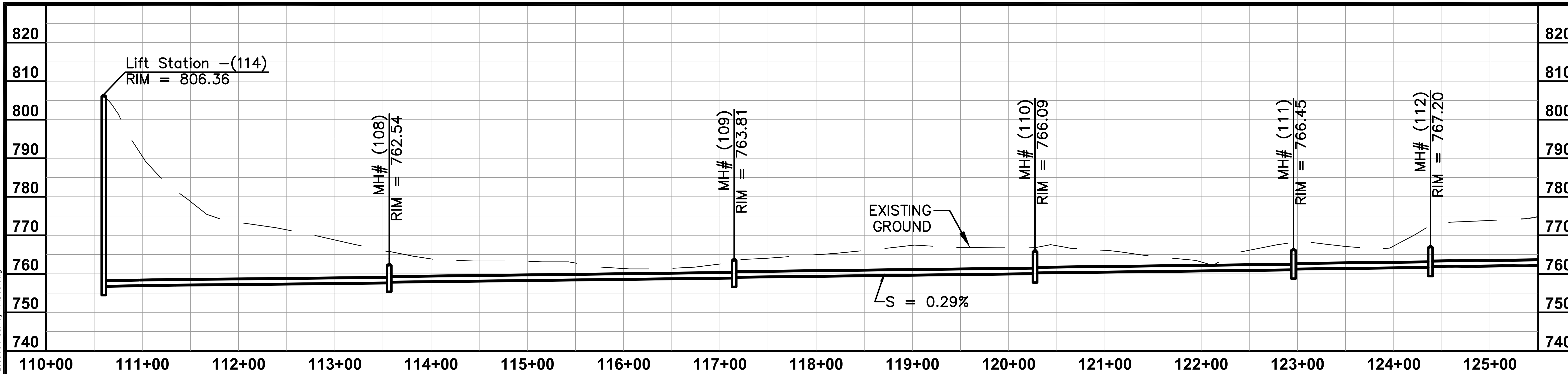

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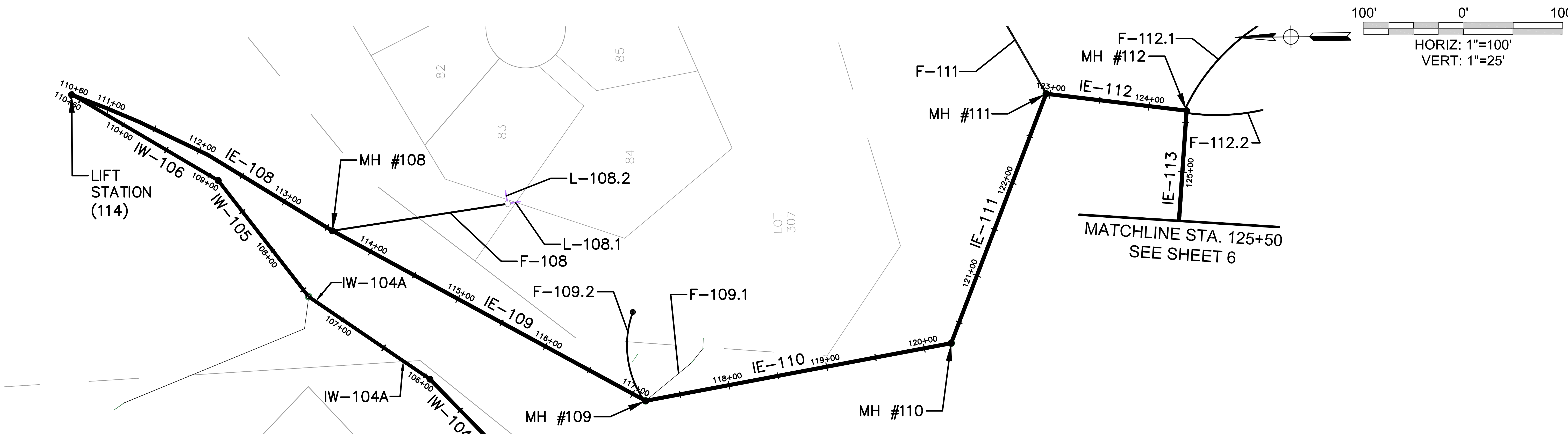

PLAN

COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS
OAK SHORES RISK ASSESSMENT

EAST INTERCEPTOR SEWERLINE LOCATION & PROFILE

STA: 110+60 TO 125+50

SCALE: AS SHOWN

WORK ORDER NO. COSLO.110005

SHEET 5 OF 8 SHEETS

MNS ENGINEERS INC
2231 Broad Street
San Luis Obispo, CA 93401
805.787.0326 Phone
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CONSTRUCTION MANAGEMENT

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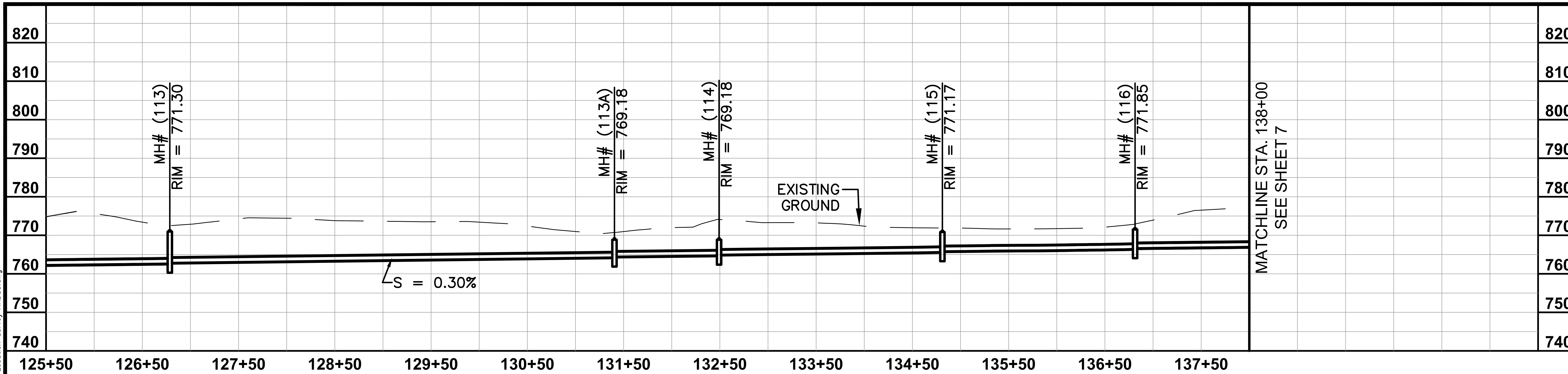

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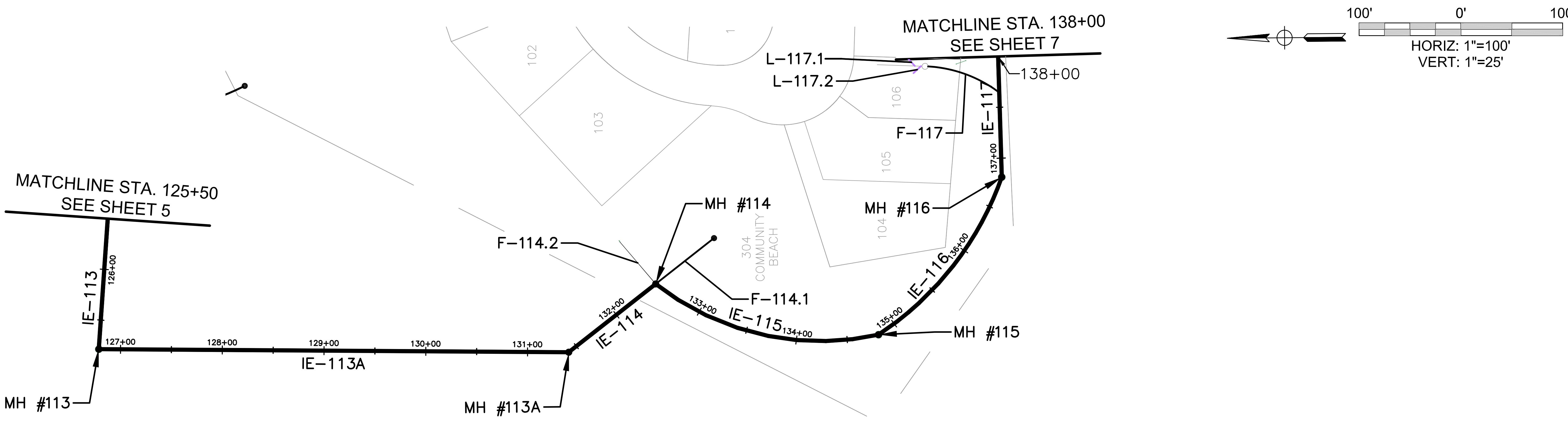

PLAN

COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS
OAK SHORES RISK ASSESSMENT

EAST INTERCEPTOR SEWERLINE LOCATION & PROFILE

STA: 125+50 TO 138+00

SCALE:
AS SHOWN

WORK ORDER NO.
COSLO.110005

SHEET 6 OF 8 SHEETS

MNS ENGINEERS INC
2231 Broad Street
San Luis Obispo, CA 93401
805.787.0326 Phone
ENGINEERING
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SURVEYING
CONSTRUCTION MANAGEMENT

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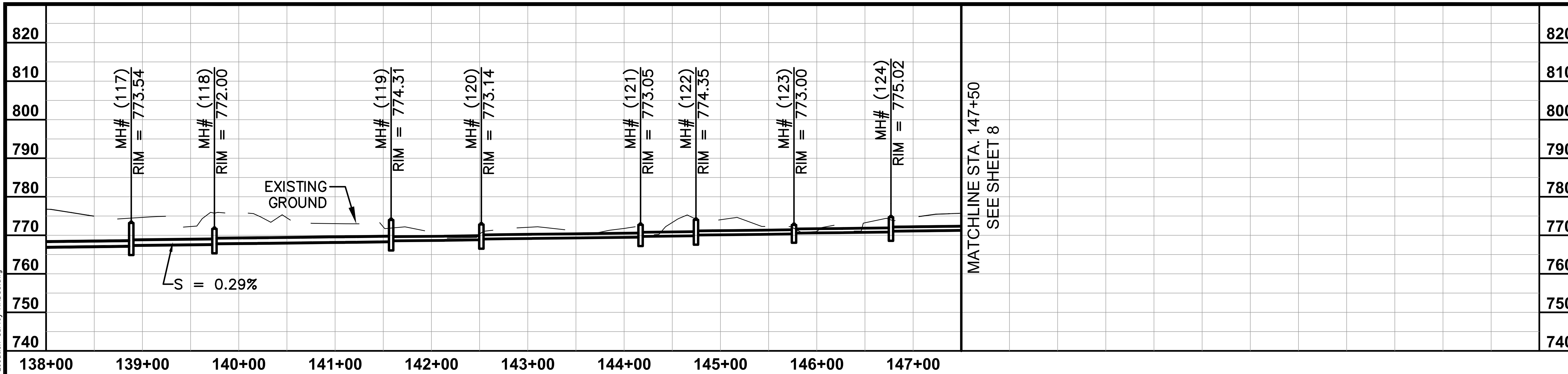

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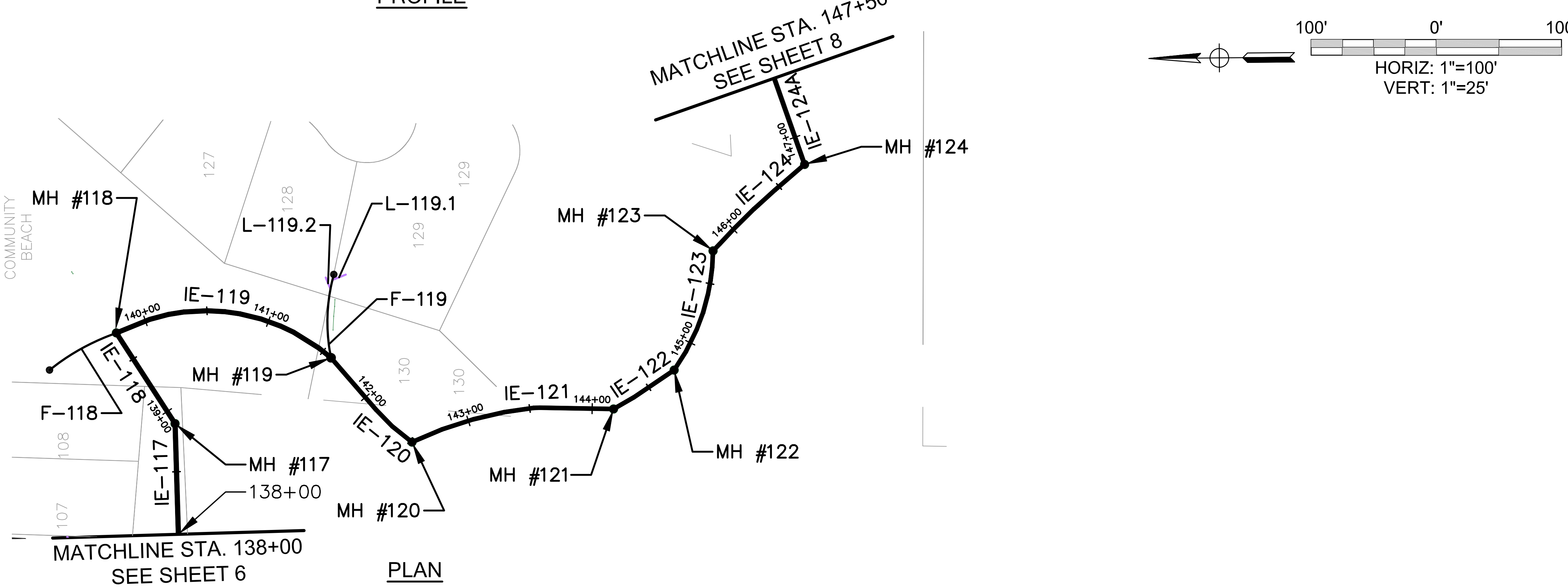

PLAN

COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS
OAK SHORES RISK ASSESSMENT

EAST INTERCEPTOR SEWERLINE LOCATION & PROFILE

STA: 138+00 TO 147+50

SCALE: AS SHOWN

WORK ORDER NO. COSLO.110005

SHEET 7 OF 8 SHEETS

MNS ENGINEERS INC
2231 Broad Street
San Luis Obispo, CA 93401
805.787.0326 Phone
ENGINEERING
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SURVEYING
CONSTRUCTION MANAGEMENT

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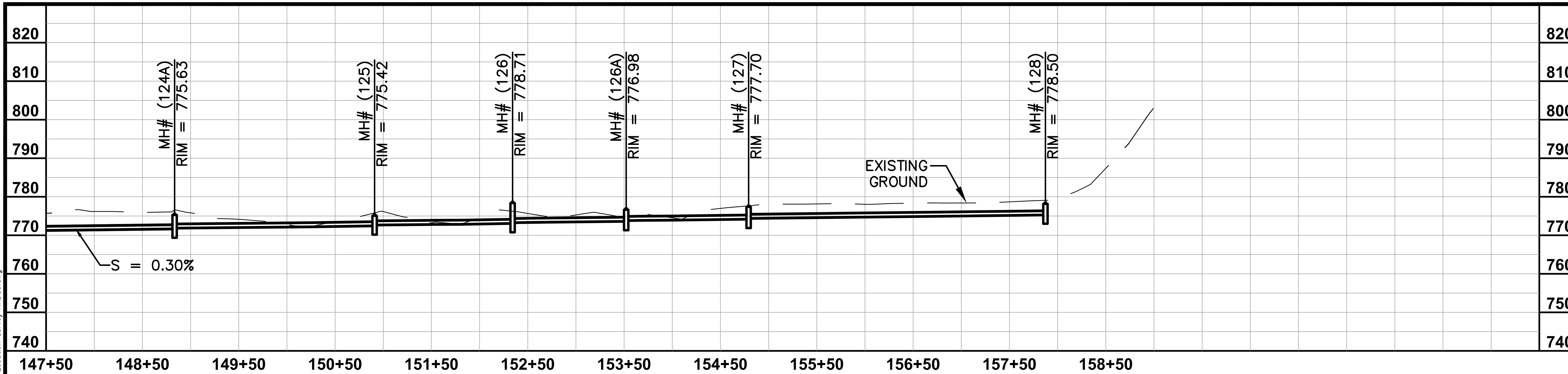

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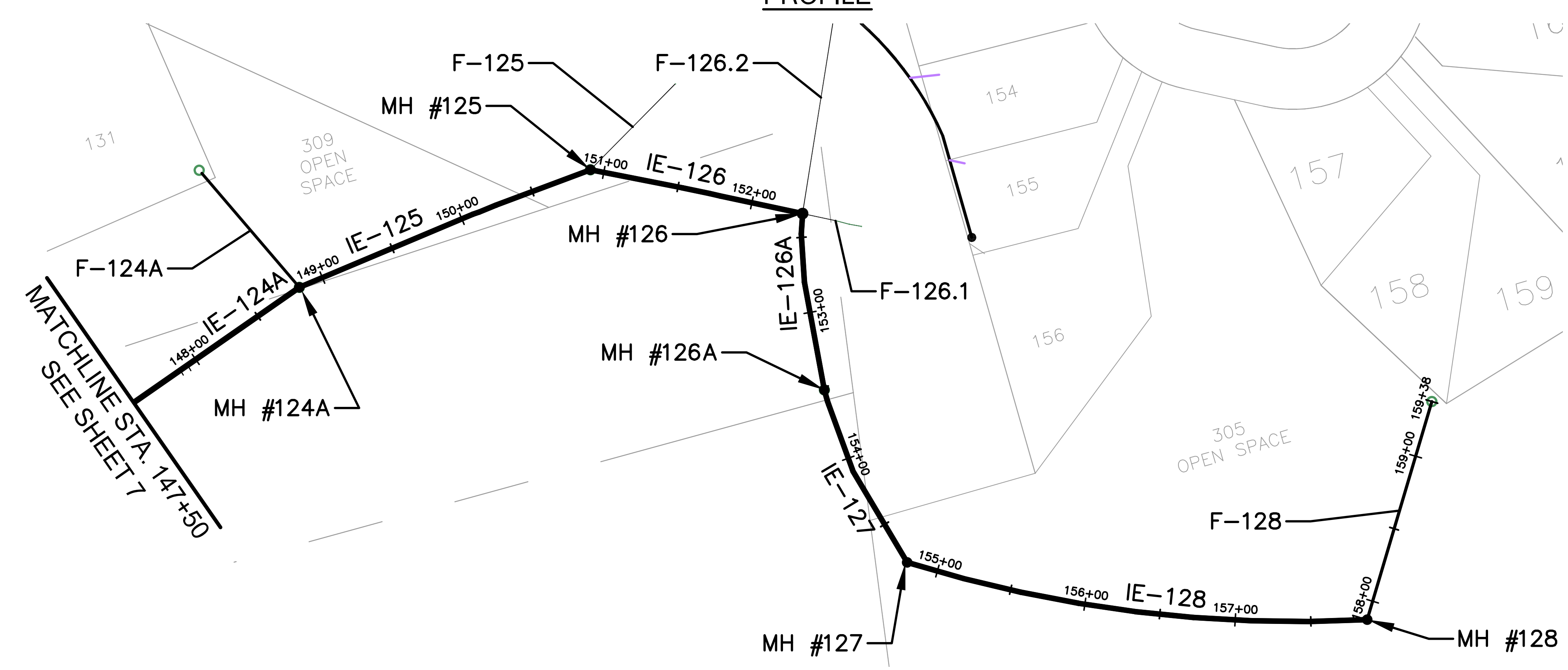

100' 0' 100'

HORIZ: 1"=100'
VERT: 1"=25'

PLAN

60% PRELIMINARY SUBMITTAL

COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS
OAK SHORES RISK ASSESSMENT

INTERCEPTOR SEWERLINE LOCATION & PROFILE
STA: 147+50 TO 158+00

SCALE:
AS SHOWN

WORK ORDER NO.
COSLO.110005
SHEET 8
OF 8 SHEETS

MNS ENGINEERS INC
2231 Broad Street
San Luis Obispo, CA 93401
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ENGINEERING
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SURVEYING
CONSTRUCTION MANAGEMENT

MNS ENGINEERS INC
1962 50TH ANNIVERSARY 2012

Appendix B System Model Tables & Estimates

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Project Description

File Name	East and West Interceptor-4.SPF

Project Options

Flow Units	GPM
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jan 01, 2013	00:00:00
End Analysis On	Jan 01, 2013	23:59:59
Start Reporting On	Jan 01, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	0
Nodes	124
Junctions	123
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	123
Channels	0
Pipes	122
Pumps	1
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Node Summary

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Surcharge Elevation (ft)	Peak Inflow (gpm)	Max HGL Elevation Attained (ft)
1	E MH-108	757.70	762.54	762.54	8.29	757.96
2	E MH-109	758.98	763.81	763.81	8.29	759.24
3	E MH-110	760.10	766.09	766.09	8.29	760.36
4	E MH-111	761.10	766.45	766.45	8.29	761.36
5	E MH-112	761.72	767.20	767.20	8.29	761.98
6	E MH-113	762.63	771.30	771.30	8.29	762.89
7	E MH-113A	764.22	769.18	769.18	8.29	764.48
8	E MH-114	764.73	769.18	769.18	8.29	764.99
9	E MH-115	765.62	771.17	771.17	8.29	765.89
10	E MH-116	766.41	771.85	771.85	8.29	766.67
11	E MH-117	767.22	773.54	773.54	8.29	767.48
12	E MH-118	767.67	772.00	772.00	8.29	767.94
13	E MH-119	768.40	774.31	774.31	8.29	768.67
14	E MH-120	768.87	773.14	773.14	8.29	769.14
15	E MH-121	769.55	773.05	773.05	8.29	769.82
16	E MH-122	769.91	774.35	774.35	8.29	770.18
17	E MH-123	770.41	773.00	773.00	8.29	770.68
18	E MH-124	770.90	775.02	775.02	8.29	771.17
19	E MH-124A	771.71	775.63	775.63	8.29	771.98
20	E MH-125	772.51	775.42	775.42	8.29	772.78
21	E MH-126	773.12	778.71	778.71	8.29	773.38
22	E MH-126A	773.66	776.98	776.98	8.29	773.92
23	E MH-127	774.23	777.70	777.70	8.29	774.50
24	E MH-128	775.34	778.50	778.50	8.29	775.40
25	IE-123.1	770.37	771.51	771.51	8.29	770.44
26	J-108.1	757.00	758.54	758.54	8.29	757.06
27	J-108.2	757.15	758.69	758.69	8.29	757.22
28	J-108.3	757.30	758.84	758.84	8.29	757.37
29	J-115.1	765.01	766.55	766.55	8.29	765.07
30	J-115.2	765.10	766.64	766.64	8.29	765.16
31	J-115.3	765.18	766.72	766.72	8.29	765.24
32	J-115.4	765.27	766.81	766.81	8.29	765.33
33	J-115.5	765.35	766.89	766.89	8.29	765.41
34	J-115.6	765.43	766.97	766.97	8.29	765.49
35	J-115.7	765.52	767.06	767.06	8.29	765.58
36	J-116.1	765.87	767.41	767.41	8.29	765.94
37	J-116.10	766.25	767.79	767.79	8.29	766.31
38	J-116.11	766.30	767.84	767.84	8.29	766.36
39	J-116.12	766.35	767.89	767.89	8.29	766.41
40	J-116.2	765.91	767.45	767.45	8.29	765.97
41	J-116.3	765.96	767.50	767.50	8.29	766.03
42	J-116.4	766.01	767.55	767.55	8.29	766.08
43	J-116.5	766.04	767.58	767.58	8.29	766.11
44	J-116.6	766.08	767.62	767.62	8.29	766.14
45	J-116.7	766.12	767.66	767.66	8.29	766.18
46	J-116.8	766.17	767.71	767.71	8.29	766.23
47	J-116.9	766.21	767.75	767.75	8.29	766.27
48	J-119.1	767.92	769.46	769.46	8.29	767.99
49	J-119.10	768.34	769.88	769.88	8.29	768.41
50	J-119.2	767.96	769.50	769.50	8.29	768.03
51	J-119.3	768.00	769.54	769.54	8.29	768.07
52	J-119.4	768.05	769.59	769.59	8.29	768.12
53	J-119.5	768.09	769.63	769.63	8.29	768.16
54	J-119.6	768.14	769.68	769.68	8.29	768.21
55	J-119.7	768.19	769.73	769.73	8.29	768.26
56	J-119.8	768.23	769.77	769.77	8.29	768.30
57	J-119.9	768.27	769.81	769.81	8.29	768.34
58	J-120.1	768.73	769.87	769.87	8.29	768.80
59	J-120.2	768.80	769.94	769.94	8.29	768.86
60	J-120.3	768.86	770.00	770.00	8.29	768.93
61	J-121.1	769.15	770.29	770.29	8.29	769.22
62	J-121.2	769.23	770.37	770.37	8.29	769.30
63	J-121.3	769.30	770.44	770.44	8.29	769.37
64	J-121.4	769.37	770.51	770.51	8.29	769.44
65	J-121.5	769.39	770.53	770.53	8.29	769.46
66	J-122.1	769.76	770.90	770.90	8.29	769.83
67	J-122.2	769.81	770.95	770.95	8.29	769.88
68	J-123.1	770.15	771.29	771.29	8.29	770.22
69	J-123.2	770.20	771.34	771.34	8.29	770.27
70	J-123.3	770.24	771.38	771.38	8.29	770.31
71	J-123.4	770.28	771.42	771.42	8.29	770.35
72	J-123.5	770.32	771.46	771.46	8.29	770.38
73	J-124.1	770.63	771.77	771.77	8.29	770.70
74	J-124.2	770.67	771.81	771.81	8.29	770.74
75	J-124.3	770.71	771.85	771.85	8.29	770.78
76	J-124.4	770.73	771.87	771.87	8.29	770.79
77	J-124.5	770.80	771.94	771.94	8.29	770.87
78	J-125.	772.20	773.34	773.34	8.29	772.27
79	J-125.2	772.22	773.36	773.36	8.29	772.29
80	J-125.3	772.25	773.39	773.39	8.29	772.32
81	J-126.1	772.86	774.00	774.00	8.29	772.93

Node Summary

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Surcharge Elevation (ft)	Peak Inflow (gpm)	Max HGL Elevation Attained (ft)
82	J-126.2	772.87	774.01	774.01	8.29	772.94
83	J-126.3	772.89	774.03	774.03	8.29	772.96
84	J-126.4	772.90	774.04	774.04	8.29	772.97
85	J-126A.1	773.38	774.52	774.52	8.29	773.45
86	J-126A.2	773.48	774.62	774.62	8.29	773.55
87	J-127.1	773.90	775.04	775.04	8.29	773.96
88	J-127.2	773.91	775.05	775.05	8.29	773.98
89	J-127.3	774.00	775.14	775.14	8.29	774.07
90	J-127.4	774.01	775.15	775.15	8.29	774.08
91	J-128.1	774.54	774.54	774.54	8.29	774.61
92	J-128.2	774.65	774.65	774.65	8.29	774.72
93	J-128.3	774.87	774.87	774.87	8.29	774.94
94	J-128.4	774.87	774.87	774.87	8.29	774.94
95	J-128.5	774.98	774.98	774.98	8.29	775.05
96	J-128.6	775.09	775.09	775.09	8.29	775.16
97	J-128.7	775.20	775.20	775.20	8.29	775.27
98	LS MH-107	739.40	806.36	0.00	22.11	756.87
99	W MH-100	760.61	765.16	765.16	13.82	760.90
100	W MH-101	759.16	764.44	764.44	13.82	759.45
101	W MH-102	758.21	763.72	763.72	13.82	758.50
102	W MH-102A	757.70	762.99	762.99	13.82	757.99
103	W MH-103	757.03	761.95	761.95	13.82	757.32
104	W MH-104	756.35	761.85	761.85	13.82	756.64
105	W MH-104A	755.84	760.87	760.87	13.82	756.13
106	W MH-105	755.21	761.16	761.16	13.82	755.50
107	W MH-106	754.58	759.83	759.83	13.82	754.87
108	W MH-84	776.94	778.86	778.86	13.82	777.04
109	W MH-85	776.26	778.72	778.72	13.82	776.55
110	W MH-86	775.57	778.15	778.15	13.82	775.85
111	W MH-87	773.79	775.91	775.91	13.82	774.06
112	W MH-88	773.24	775.36	775.36	13.82	773.53
113	W MH-89	772.46	775.66	775.66	13.82	772.75
114	W MH-90	771.83	773.97	773.97	13.82	772.12
115	W MH-91	770.76	774.02	774.02	13.82	771.05
116	W MH-92	769.68	772.24	772.24	13.82	769.96
117	W MH-93	768.52	772.15	772.15	13.82	768.81
118	W MH-94	767.41	771.31	771.31	13.82	767.69
119	W MH-95	766.13	769.53	769.53	13.82	766.42
120	W MH-96	765.13	768.53	768.53	13.82	765.42
121	W MH-97	764.73	768.16	768.16	13.82	765.01
122	W MH-98	763.10	767.64	767.64	13.82	763.38
123	W MH-99	761.67	772.31	772.31	13.82	761.96
124	Out-1Pipe - (270)	894.04			575.00	894.04

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (gpm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
1	IE-108.1	Pipe	J-108.1	LS MH-107	37.09	757.00	756.81	0.5100	15.000	0.0120	8.29	2248.09	0.00	0.96	0.06	0.04
2	IE-108.2	Pipe	J-108.2	J-108.1	37.35	757.15	757.00	0.4000	16.000	0.0120	8.29	2364.18	0.00	0.87	0.06	0.04
3	IE-108.3	Pipe	J-108.3	J-108.2	75.38	757.30	757.15	0.2000	16.000	0.0120	8.29	1668.48	0.00	0.68	0.07	0.05
4	IE-108.4	Pipe	E MH-108	J-108.3	146.66	757.70	757.30	0.2700	16.000	0.0120	8.29	1948.38	0.00	0.76	0.06	0.05
5	IE-109	Pipe	E MH-109	E MH-108	358.32	758.98	757.90	0.3000	16.000	0.0120	8.29	2048.25	0.00	0.79	0.06	0.05
6	IE-110	Pipe	E MH-110	E MH-109	312.58	760.10	759.18	0.2900	16.000	0.0120	8.29	2024.04	0.00	0.78	0.06	0.05
7	IE-111	Pipe	E MH-111	E MH-110	268.51	761.10	760.30	0.3000	16.000	0.0120	8.29	2036.45	0.00	0.78	0.06	0.05
8	IE-112	Pipe	E MH-112	E MH-111	142.21	761.72	761.30	0.3000	16.000	0.0120	8.29	2027.55	0.00	0.78	0.06	0.05
9	IE-113	Pipe	E MH-113	E MH-112	240.52	762.63	761.92	0.3000	16.000	0.0120	8.29	2027.03	0.00	0.78	0.06	0.05
10	IE-113A	Pipe	E MH-113A	E MH-113	461.82	764.22	762.83	0.3000	16.000	0.0120	8.29	2046.81	0.00	0.79	0.06	0.05
11	IE-114	Pipe	E MH-114	E MH-113A	108.68	764.73	764.42	0.2900	16.000	0.0120	8.29	1992.60	0.00	0.77	0.06	0.05
12	IE-115.1	Pipe	J-115.1	E MH-114	27.13	765.01	764.93	0.2900	16.000	0.0120	8.29	2025.87	0.00	0.78	0.06	0.05
13	IE-115.2	Pipe	J-115.2	J-115.1	30.98	765.10	765.01	0.2900	16.000	0.0120	8.29	2010.89	0.00	0.78	0.06	0.05
14	IE-115.3	Pipe	J-115.3	J-115.2	33.39	765.18	765.10	0.2400	16.000	0.0120	8.29	1826.15	0.00	0.73	0.06	0.05
15	IE-115.4	Pipe	J-115.4	J-115.3	31.30	765.27	765.18	0.2900	16.000	0.0120	8.29	2000.45	0.00	0.77	0.06	0.05
16	IE-115.5	Pipe	J-115.5	J-115.4	28.56	765.35	765.27	0.2800	16.000	0.0120	8.29	1974.74	0.00	0.77	0.06	0.05
17	IE-115.6	Pipe	J-115.6	J-115.5	28.59	765.43	765.35	0.2800	16.000	0.0120	8.29	1973.42	0.00	0.77	0.06	0.05
18	IE-115.7	Pipe	J-115.7	J-115.6	26.25	765.52	765.43	0.3400	16.000	0.0120	8.29	2184.37	0.00	0.82	0.06	0.04
19	IE-115.8	Pipe	E MH-115	J-115.7	25.83	765.62	765.52	0.3900	16.000	0.0120	8.29	2321.48	0.00	0.86	0.06	0.04
20	IE-116.1	Pipe	J-116.1	E MH-115	22.81	765.87	765.82	0.2200	16.000	0.0120	8.29	1746.81	0.00	0.70	0.07	0.05
21	IE-116.10	Pipe	J-116.10	J-116.9	13.35	766.25	766.21	0.3000	16.000	0.0120	8.29	2042.48	0.00	0.79	0.06	0.05
22	IE-116.11	Pipe	J-116.11	J-116.10	12.67	766.30	766.25	0.3900	16.000	0.0120	8.29	2343.91	0.00	0.87	0.06	0.04
23	IE-116.12	Pipe	J-116.12	J-116.11	11.46	766.35	766.30	0.4400	16.000	0.0120	8.29	2464.49	0.00	0.90	0.06	0.04
24	IE-116.13	Pipe	E MH-116	J-116.12	11.31	766.41	766.35	0.5300	16.000	0.0120	8.29	2717.18	0.00	0.97	0.05	0.04
25	IE-116.2	Pipe	J-116.2	J-116.1	13.94	765.91	765.87	0.2900	16.000	0.0120	8.29	1998.48	0.00	0.77	0.06	0.05
26	IE-116.3	Pipe	J-116.3	J-116.2	13.64	765.96	765.91	0.3700	16.000	0.0120	8.29	2258.67	0.00	0.84	0.06	0.04
27	IE-116.4	Pipe	J-116.4	J-116.3	27.15	766.01	765.96	0.1800	16.000	0.0120	8.29	1668.48	0.00	0.68	0.07	0.05
28	IE-116.5	Pipe	J-116.5	J-116.4	22.75	766.04	766.01	0.1300	16.000	0.0120	8.29	1668.48	0.00	0.68	0.07	0.05
29	IE-116.6	Pipe	J-116.6	J-116.5	13.38	766.08	766.04	0.3000	16.000	0.0120	8.29	2039.80	0.00	0.79	0.06	0.05
30	IE-116.7	Pipe	J-116.7	J-116.6	13.14	766.12	766.08	0.3000	16.000	0.0120	8.29	2058.77	0.00	0.79	0.06	0.05
31	IE-116.8	Pipe	J-116.8	J-116.7	12.54	766.17	766.12	0.4000	16.000	0.0120	8.29	2356.02	0.00	0.87	0.06	0.04
32	IE-116.9	Pipe	J-116.9	J-116.8	11.96	766.21	766.17	0.3300	16.000	0.0120	8.29	2157.62	0.00	0.82	0.06	0.05
33	IE-117	Pipe	E MH-117	E MH-116	207.20	767.22	766.61	0.2900	16.000	0.0120	8.29	2024.29	0.00	0.78	0.06	0.05
34	IE-118	Pipe	E MH-118	E MH-117	86.29	767.67	767.42	0.2900	16.000	0.0120	8.29	2008.14	0.00	0.78	0.06	0.05
35	IE-119.1	Pipe	J-119.1	E MH-118	28.83	767.92	767.87	0.1700	12.000	0.0120	8.29	774.73	0.01	0.72	0.07	0.07
36	IE-119.10	Pipe	J-119.10	J-119.9	23.64	768.34	768.27	0.3000	12.000	0.0120	8.29	942.61	0.01	0.82	0.07	0.07
37	IE-119.11	Pipe	E MH-119	J-119.10	12.53	768.40	768.34	0.4800	12.000	0.0120	8.29	1198.93	0.01	0.98	0.06	0.06
38	IE-119.2	Pipe	J-119.2	J-119.1	15.49	767.96	767.92	0.2600	12.000	0.0120	8.29	880.37	0.01	0.78	0.07	0.07
39	IE-119.3	Pipe	J-119.3	J-119.2	12.27	768.00	767.96	0.3300	12.000	0.0120	8.29	989.26	0.01	0.85	0.06	0.06
40	IE-119.4	Pipe	J-119.4	J-119.3	18.94	768.05	768.00	0.2600	12.000	0.0120	8.29	890.03	0.01	0.79	0.07	0.07
41	IE-119.5	Pipe	J-119.5	J-119.4	14.17	768.09	768.05	0.2800	12.000	0.0120	8.29	920.25	0.01	0.81	0.07	0.07
42	IE-119.6	Pipe	J-119.6	J-119.5	11.96	768.14	768.09	0.4200	12.000	0.0120	8.29	1119.99	0.01	0.93	0.06	0.06
43	IE-119.7	Pipe	J-119.7	J-119.6	17.29	768.19	768.14	0.2900	12.000	0.0120	8.29	931.47	0.01	0.82	0.07	0.07
44	IE-119.8	Pipe	J-119.8	J-119.7	16.52	768.23	768.19	0.2400	12.000	0.0120	8.29	852.36	0.01	0.77	0.07	0.07
45	IE-119.9	Pipe	J-119.9	J-119.8	11.72	768.27	768.23	0.3400	12.000	0.0120	8.29	1012.04	0.01	0.86	0.06	0.06
46	IE-120.1	Pipe	J-120.1	E MH-119	55.21	768.73	768.60	0.2400	12.000	0.0120	8.29	840.62	0.01	0.76	0.07	0.07
47	IE-120.2	Pipe	J-120.2	J-120.1	18.32	768.80	768.73	0.3800	12.000	0.0120	8.29	1070.96	0.01	0.90	0.06	0.06
48	IE-120.3	Pipe	J-120.3	J-120.2	15.49	768.86	768.80	0.3900	12.000	0.0120	8.29	1078.30	0.01	0.91	0.06	0.06
49	IE-120.4	Pipe	E MH-120	J-120.3	4.65	768.87	768.86	0.2200	12.000	0.0120	8.29	803.78	0.01	0.74	0.07	0.07
50	IE-121.1	Pipe	J-121.1	E MH-120	25.89	769.15	769.07	0.3100	12.000	0.0120	8.29	962.97	0.01	0.83	0.07	0.07
51	IE-121.2	Pipe	J-121.2	J-121.1	26.54	769.23	769.15	0.3000	12.000	0.0120	8.29	951.10	0.01	0.83	0.07	0.07
52	IE-121.3	Pipe	J-121.3	J-121.2	25.05	769.30	769.23	0.2800	12.000	0.0120	8.29	915.78	0.01	0.81	0.07	0.07
53	IE-121.4	Pipe	J-121.4	J-121.3	23.82	769.37	769.30	0.2900	12.000	0.0120	8.29	939.03	0.01	0.82	0.07	0.07
54	IE-121.5	Pipe	J-121.5	J-121.4	4.92	769.39	769.37	0.4100	12.000	0.0120	8.29	1104.26	0.01	0.92	0.06	0.06
55	IE-121.6	Pipe	E MH-121	J-121.5	58.97	769.55	769.39	0.2700	12.000	0.0120	8.29	902.35	0.01	0.80	0.07	0.07
56	IE-122.1	Pipe	J-122.1	E MH-121	3.12	769.76	769.75	0.3200	12.000	0.0120	8.29	981.46	0.01	0.85	0.07	0.07
57	IE-122.2	Pipe	J-122.2	J-122.1	15.67	769.81	769.76	0.3200	12.000	0.0120	8.29	978.69	0.01	0.84	0.07	0.07
58	IE-122.3	Pipe	E MH-122	J-122.2	38.77	769.91	769.81	0.2600	12.000	0.0120	8.29	879.78	0.01	0.78	0.07	0.07

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio
					(ft)	(ft)	(ft)	(%)	(in)		(gpm)	(gpm)		(ft/sec)	(ft)	
59	IE-123.1	Pipe	J-123.1	E MH-122	17.34	770.15	770.11	0.2300	12.000	0.0120	8.29	832.02	0.01	0.75	0.07	0.07
60	IE-123.2	Pipe	J-123.2	J-123.1	19.94	770.20	770.15	0.2500	12.000	0.0120	8.29	867.44	0.01	0.78	0.07	0.07
61	IE-123.3	Pipe	J-123.3	J-123.2	14.24	770.24	770.20	0.2800	12.000	0.0120	8.29	918.16	0.01	0.81	0.07	0.07
62	IE-123.4	Pipe	J-123.4	J-123.3	14.97	770.28	770.24	0.2700	12.000	0.0120	8.29	895.46	0.01	0.79	0.07	0.07
63	IE-123.5	Pipe	J-123.5	J-123.4	11.63	770.32	770.28	0.3400	12.000	0.0120	8.29	1015.95	0.01	0.87	0.06	0.06
64	IE-123.6	Pipe	IE-123.1	J-123.5	10.75	770.37	770.32	0.4600	12.000	0.0120	8.29	1181.19	0.01	0.97	0.06	0.06
65	IE-123.7	Pipe	E MH-123	IE-123.1	12.85	770.41	770.37	0.3100	12.000	0.0120	8.29	966.66	0.01	0.84	0.07	0.07
66	IE-124.1	Pipe	J-124.1	E MH-123	7.94	770.63	770.61	0.2500	12.000	0.0120	8.29	869.63	0.01	0.78	0.07	0.07
67	IE-124.2	Pipe	J-124.2	J-124.1	15.23	770.67	770.63	0.2600	12.000	0.0120	8.29	887.70	0.01	0.79	0.07	0.07
68	IE-124.3	Pipe	J-124.3	J-124.2	23.51	770.71	770.67	0.1700	12.000	0.0120	8.29	774.73	0.01	0.72	0.07	0.07
69	IE-124.4	Pipe	J-124.4	J-124.3	4.50	770.73	770.71	0.4400	12.000	0.0120	8.29	1155.11	0.01	0.95	0.06	0.06
70	IE-124.5	Pipe	J-124.5	J-124.4	18.01	770.80	770.73	0.3900	12.000	0.0120	8.29	1080.13	0.01	0.91	0.06	0.06
71	IE-124.6	Pipe	E MH-124	J-124.5	31.48	770.90	770.80	0.3200	12.000	0.0120	8.29	976.38	0.01	0.84	0.07	0.07
72	IE-124A	Pipe	E MH-124A	E MH-124	206.44	771.71	771.10	0.3000	12.000	0.0120	8.29	941.68	0.01	0.82	0.07	0.07
73	IE-125.1	Pipe	J-125.	E MH-124A	124.29	772.20	771.91	0.2300	12.000	0.0120	8.29	836.79	0.01	0.76	0.07	0.07
74	IE-125.2	Pipe	J-125.2	J-125.	4.58	772.22	772.20	0.4400	12.000	0.0120	8.29	1144.21	0.01	0.95	0.06	0.06
75	IE-125.3	Pipe	J-125.3	J-125.2	12.07	772.25	772.22	0.2500	12.000	0.0120	8.29	863.64	0.01	0.77	0.07	0.07
76	IE-125.4	Pipe	E MH-125	J-125.3	66.64	772.51	772.25	0.3900	12.000	0.0120	8.29	1082.05	0.01	0.91	0.06	0.06
77	IE-126.1	Pipe	J-126.1	E MH-125	58.71	772.86	772.71	0.2600	12.000	0.0120	8.29	875.62	0.01	0.78	0.07	0.07
78	IE-126.2	Pipe	J-126.2	J-126.1	3.46	772.87	772.86	0.2900	12.000	0.0120	8.29	931.16	0.01	0.81	0.07	0.07
79	IE-126.3	Pipe	J-126.3	J-126.2	18.10	772.89	772.87	0.1100	12.000	0.0120	8.29	774.73	0.01	0.72	0.07	0.07
80	IE-126.4	Pipe	J-126.4	J-126.3	7.35	772.90	772.89	0.1400	12.000	0.0120	8.29	774.73	0.01	0.72	0.07	0.07
81	IE-126.5	Pipe	E MH-126	J-126.4	55.60	773.12	772.90	0.4000	12.000	0.0120	8.29	1089.75	0.01	0.91	0.06	0.06
82	IE-126A.1	Pipe	J-126A.1	E MH-126	13.55	773.38	773.32	0.4400	12.000	0.0120	8.29	1152.91	0.01	0.95	0.06	0.06
83	IE-126A.2	Pipe	J-126A.2	J-126A.1	31.85	773.48	773.38	0.3100	12.000	0.0120	8.29	970.69	0.01	0.84	0.07	0.07
84	IE-126A.3	Pipe	E MH-126A	J-126A.2	72.49	773.66	773.48	0.2500	12.000	0.0120	8.29	863.25	0.01	0.77	0.07	0.07
85	IE-127.1	Pipe	J-127.1	E MH-126A	7.73	773.90	773.86	0.5200	12.000	0.0120	8.29	1246.54	0.01	1.00	0.06	0.06
86	IE-127.2	Pipe	J-127.2	J-127.1	2.64	773.91	773.90	0.3800	12.000	0.0120	8.29	1066.90	0.01	0.90	0.06	0.06
87	IE-127.3	Pipe	J-127.3	J-127.2	45.38	774.00	773.91	0.2000	12.000	0.0120	8.29	774.73	0.01	0.72	0.07	0.07
88	IE-127.4	Pipe	J-127.4	J-127.3	1.40	774.01	774.00	0.7100	12.000	0.0120	8.29	1464.28	0.01	1.11	0.05	0.05
89	IE-127.5	Pipe	E MH-127	J-127.4	69.97	774.23	774.01	0.3100	12.000	0.0120	8.29	971.41	0.01	0.84	0.07	0.07
90	IE-128.1	Pipe	J-128.1	E MH-127	38.85	774.54	774.43	0.2800	12.000	0.0120	8.29	921.77	0.01	0.81	0.07	0.07
91	IE-128.2	Pipe	J-128.2	J-128.1	38.66	774.65	774.54	0.2800	12.000	0.0120	8.29	924.01	0.01	0.81	0.07	0.07
92	IE-128.3	Pipe	J-128.3	J-128.2	39.02	774.76	774.65	0.2800	12.000	0.0120	8.29	1300.76	0.01	1.03	0.06	0.06
93	IE-128.4	Pipe	J-128.4	J-128.3	38.10	774.87	774.76	0.2900	12.000	0.0120	8.29	774.73	0.01	0.72	0.07	0.07
94	IE-128.5	Pipe	J-128.5	J-128.4	38.55	774.98	774.87	0.2900	12.000	0.0120	8.29	925.41	0.01	0.81	0.07	0.07
95	IE-128.6	Pipe	J-128.6	J-128.5	38.44	775.09	774.98	0.2900	12.000	0.0120	8.29	926.71	0.01	0.81	0.07	0.07
96	IE-128.7	Pipe	J-128.7	J-128.6	37.92	775.20	775.09	0.2900	12.000	0.0120	8.29	933.07	0.01	0.82	0.07	0.07
97	IE-128.8	Pipe	E MH-128	J-128.7	38.52	775.34	775.20	0.3600	12.000	0.0120	8.29	1044.36	0.01	0.88	0.06	0.06
98	IW-100	Pipe	W MH-100	W MH-101	435.67	760.61	759.36	0.2900	14.000	0.0150	13.82	1119.76	0.01	0.80	0.09	0.08
99	IW-101	Pipe	W MH-101	W MH-102	252.71	759.16	758.41	0.3000	14.000	0.0150	13.82	1138.85	0.01	0.81	0.09	0.08
100	IW-102	Pipe	W MH-102	W MH-102A	106.09	758.21	757.90	0.2900	14.000	0.0150	13.82	1130.03	0.01	0.80	0.09	0.08
101	IW-102A	Pipe	W MH-102A	W MH-103	160.50	757.70	757.23	0.2900	14.000	0.0150	13.82	1131.27	0.01	0.80	0.09	0.08
102	IW-103	Pipe	W MH-103	W MH-104	164.19	757.03	756.55	0.2900	14.000	0.0150	13.82	1130.32	0.01	0.80	0.09	0.08
103	IW-104	Pipe	W MH-104	W MH-104A	107.70	756.35	756.04	0.2900	14.000	0.0150	13.82	1121.55	0.01	0.80	0.09	0.08
104	IW-104A	Pipe	W MH-104A	W MH-105	147.50	755.84	755.41	0.2900	14.000	0.0150	13.82	1128.74	0.01	0.80	0.09	0.08
105	IW-105	Pipe	W MH-105	W MH-106	148.11	755.21	754.78	0.2900	14.000	0.0150	13.82	1126.41	0.01	0.80	0.09	0.08
106	IW-106	Pipe	W MH-106	LS MH-107	170.65	754.58	754.04	0.3200	14.000	0.0150	13.82	1175.98	0.01	0.82	0.09	0.08
107	IW-84	Pipe	W MH-84	W MH-85	164.84	776.94	776.46	0.2900	12.000	0.0150	13.82	747.85	0.02	0.81	0.09	0.09
108	IW-85	Pipe	W MH-85	W MH-86	65.86	776.26	775.77	0.7400	12.000	0.0150	13.82	1195.40	0.01	1.14	0.08	0.08
109	IW-86	Pipe	W MH-86	W MH-87	201.17	775.57	773.99	0.7900	12.000	0.0150	13.82	1228.22	0.01	1.16	0.07	0.07
110	IW-87	Pipe	W MH-87	W MH-88	125.98	773.79	773.44	0.2800	12.000	0.0150	13.82	730.47	0.02	0.80	0.10	0.10
111	IW-88	Pipe	W MH-88	W MH-89	144.79	773.24	772.66	0.4000	12.000	0.0150	13.82	877.13	0.02	0.91	0.09	0.09
112	IW-89	Pipe	W MH-89	W MH-90	111.66	772.46	772.03	0.3900	12.000	0.0150	13.82	860.03	0.02	0.90	0.09	0.09
113	IW-90	Pipe	W MH-90	W MH-91	290.72	771.83	770.96	0.3000	12.000	0.0150	13.82	758.14	0.02	0.82	0.09	0.09
114	IW-91	Pipe	W MH-91	W MH-92	129.24	770.76	769.88	0.6800	12.000	0.0150	13.82	1143.61	0.01	1.10	0.08	0.08
115	IW-92	Pipe	W MH-92	W MH-93	309.74	769.68	768.72	0.3100	12.000	0.0150	13.82	771.55	0.02	0.83	0.09	0.09
116	IW-93	Pipe	W MH-93	W MH-94	171.03	768.52	767.61	0.5300	12.000	0.0150	13.82	1010.91	0.01	1.01	0.08	0.08

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (gpm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
117 IW-94	Pipe	W MH-94	W MH-95	358.35	767.41	766.33	0.3000	12.000	0.0150	13.82	760.83	0.02	0.82	0.09	0.09
118 IW-95	Pipe	W MH-95	W MH-96	203.67	766.13	765.33	0.3900	12.000	0.0150	13.82	868.57	0.02	0.91	0.09	0.09
119 IW-96	Pipe	W MH-96	W MH-97	45.43	765.13	764.93	0.4400	12.000	0.0150	13.82	921.88	0.01	0.95	0.09	0.09
120 IW-97	Pipe	W MH-97	W MH-98	277.05	764.73	763.30	0.5200	12.000	0.0150	13.82	995.32	0.01	1.00	0.08	0.08
121 IW-98	Pipe	W MH-98	W MH-99	420.55	763.10	761.87	0.2900	12.000	0.0150	13.82	749.50	0.02	0.81	0.09	0.09
122 IW-99	Pipe	W MH-99	W MH-100	294.33	761.67	760.81	0.2900	12.000	0.0150	13.82	749.13	0.02	0.81	0.09	0.09
123 LS-3	Pump	LS MH-107	Out-1Pipe - (270)		739.40	894.04				575.00					

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)
1	E MH-108	757.70	762.54	4.84	757.70	0.00	762.54
2	E MH-109	758.98	763.81	4.83	758.98	0.00	763.81
3	E MH-110	760.10	766.09	5.99	760.10	0.00	766.09
4	E MH-111	761.10	766.45	5.35	761.10	0.00	766.45
5	E MH-112	761.72	767.20	5.48	761.72	0.00	767.20
6	E MH-113	762.63	771.30	8.67	762.63	0.00	771.30
7	E MH-113A	764.22	769.18	4.96	764.22	0.00	769.18
8	E MH-114	764.73	769.18	4.45	764.73	0.00	769.18
9	E MH-115	765.62	771.17	5.55	765.62	0.00	771.17
10	E MH-116	766.41	771.85	5.44	766.41	0.00	771.85
11	E MH-117	767.22	773.54	6.32	767.22	0.00	773.54
12	E MH-118	767.67	772.00	4.33	767.67	0.00	772.00
13	E MH-119	768.40	774.31	5.91	768.40	0.00	774.31
14	E MH-120	768.87	773.14	4.27	768.87	0.00	773.14
15	E MH-121	769.55	773.05	3.50	769.55	0.00	773.05
16	E MH-122	769.91	774.35	4.44	769.91	0.00	774.35
17	E MH-123	770.41	773.00	2.59	770.41	0.00	773.00
18	E MH-124	770.90	775.02	4.12	770.90	0.00	775.02
19	E MH-124A	771.71	775.63	3.92	771.71	0.00	775.63
20	E MH-125	772.51	775.42	2.91	772.51	0.00	775.42
21	E MH-126	773.12	778.71	5.59	773.12	0.00	778.71
22	E MH-126A	773.66	776.98	3.32	773.66	0.00	776.98
23	E MH-127	774.23	777.70	3.47	774.23	0.00	777.70
24	E MH-128	775.34	778.50	3.16	775.34	0.00	778.50
25	IE-123.1	770.37	771.51	1.14	770.37	0.00	771.51
26	J-108.1	757.00	758.54	1.54	757.00	0.00	758.54
27	J-108.2	757.15	758.69	1.54	757.15	0.00	758.69
28	J-108.3	757.30	758.84	1.54	757.30	0.00	758.84
29	J-115.1	765.01	766.55	1.54	765.01	0.00	766.55
30	J-115.2	765.10	766.64	1.54	765.10	0.00	766.64
31	J-115.3	765.18	766.72	1.54	765.18	0.00	766.72
32	J-115.4	765.27	766.81	1.54	765.27	0.00	766.81
33	J-115.5	765.35	766.89	1.54	765.35	0.00	766.89
34	J-115.6	765.43	766.97	1.54	765.43	0.00	766.97
35	J-115.7	765.52	767.06	1.54	765.52	0.00	767.06
36	J-116.1	765.87	767.41	1.54	765.87	0.00	767.41
37	J-116.10	766.25	767.79	1.54	766.25	0.00	767.79
38	J-116.11	766.30	767.84	1.54	766.30	0.00	767.84
39	J-116.12	766.35	767.89	1.54	766.35	0.00	767.89
40	J-116.2	765.91	767.45	1.54	765.91	0.00	767.45
41	J-116.3	765.96	767.50	1.54	765.96	0.00	767.50
42	J-116.4	766.01	767.55	1.54	766.01	0.00	767.55
43	J-116.5	766.04	767.58	1.54	766.04	0.00	767.58
44	J-116.6	766.08	767.62	1.54	766.08	0.00	767.62
45	J-116.7	766.12	767.66	1.54	766.12	0.00	767.66
46	J-116.8	766.17	767.71	1.54	766.17	0.00	767.71
47	J-116.9	766.21	767.75	1.54	766.21	0.00	767.75
48	J-119.1	767.92	769.46	1.54	767.92	0.00	769.46
49	J-119.10	768.34	769.88	1.54	768.34	0.00	769.88
50	J-119.2	767.96	769.50	1.54	767.96	0.00	769.50
51	J-119.3	768.00	769.54	1.54	768.00	0.00	769.54
52	J-119.4	768.05	769.59	1.54	768.05	0.00	769.59
53	J-119.5	768.09	769.63	1.54	768.09	0.00	769.63
54	J-119.6	768.14	769.68	1.54	768.14	0.00	769.68
55	J-119.7	768.19	769.73	1.54	768.19	0.00	769.73
56	J-119.8	768.23	769.77	1.54	768.23	0.00	769.77
57	J-119.9	768.27	769.81	1.54	768.27	0.00	769.81
58	J-120.1	768.73	769.87	1.14	768.73	0.00	769.87
59	J-120.2	768.80	769.94	1.14	768.80	0.00	769.94
60	J-120.3	768.86	770.00	1.14	768.86	0.00	770.00
61	J-121.1	769.15	770.29	1.14	769.15	0.00	770.29
62	J-121.2	769.23	770.37	1.14	769.23	0.00	770.37
63	J-121.3	769.30	770.44	1.14	769.30	0.00	770.44
64	J-121.4	769.37	770.51	1.14	769.37	0.00	770.51
65	J-121.5	769.39	770.53	1.14	769.39	0.00	770.53
66	J-122.1	769.76	770.90	1.14	769.76	0.00	770.90
67	J-122.2	769.81	770.95	1.14	769.81	0.00	770.95
68	J-123.1	770.15	771.29	1.14	770.15	0.00	771.29
69	J-123.2	770.20	771.34	1.14	770.20	0.00	771.34
70	J-123.3	770.24	771.38	1.14	770.24	0.00	771.38
71	J-123.4	770.28	771.42	1.14	770.28	0.00	771.42
72	J-123.5	770.32	771.46	1.14	770.32	0.00	771.46
73	J-124.1	770.63	771.77	1.14	770.63	0.00	771.77
74	J-124.2	770.67	771.81	1.14	770.67	0.00	771.81
75	J-124.3	770.71	771.85	1.14	770.71	0.00	771.85
76	J-124.4	770.73	771.87	1.14	770.73	0.00	771.87
77	J-124.5	770.80	771.94	1.14	770.80	0.00	771.94
78	J-125.	772.20	773.34	1.14	772.20	0.00	773.34
79	J-125.2	772.22	773.36	1.14	772.22	0.00	773.36
80	J-125.3	772.25	773.39	1.14	772.25	0.00	773.39
81	J-126.1	772.86	774.00	1.14	772.86	0.00	774.00
82	J-126.2	772.87	774.01	1.14	772.87	0.00	774.01

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)
83	J-126.3	772.89	774.03	1.14	772.89	0.00	774.03
84	J-126.4	772.90	774.04	1.14	772.90	0.00	774.04
85	J-126A.1	773.38	774.52	1.14	773.38	0.00	774.52
86	J-126A.2	773.48	774.62	1.14	773.48	0.00	774.62
87	J-127.1	773.90	775.04	1.14	773.90	0.00	775.04
88	J-127.2	773.91	775.05	1.14	773.91	0.00	775.05
89	J-127.3	774.00	775.14	1.14	774.00	0.00	775.14
90	J-127.4	774.01	775.15	1.14	774.01	0.00	775.15
91	J-128.1	774.54	774.54	0.00	774.54	0.00	774.54
92	J-128.2	774.65	774.65	0.00	774.65	0.00	774.65
93	J-128.3	774.87	774.87	0.00	774.76	-0.11	774.87
94	J-128.4	774.87	774.87	0.00	774.87	0.00	774.87
95	J-128.5	774.98	774.98	0.00	774.98	0.00	774.98
96	J-128.6	775.09	775.09	0.00	775.09	0.00	775.09
97	J-128.7	775.20	775.20	0.00	775.20	0.00	775.20
98	LS MH-107	739.40	806.36	66.96	754.04	14.64	0.00
99	W MH-100	760.61	765.16	4.55	761.61	1.00	765.16
100	W MH-101	759.16	764.44	5.28	759.16	0.00	764.44
101	W MH-102	758.21	763.72	5.51	758.21	0.00	763.72
102	W MH-102A	757.70	762.99	5.29	757.70	0.00	762.99
103	W MH-103	757.03	761.95	4.92	757.03	0.00	761.95
104	W MH-104	756.35	761.85	5.50	756.35	0.00	761.85
105	W MH-104A	755.84	760.87	5.03	755.84	0.00	760.87
106	W MH-105	755.21	761.16	5.95	755.21	0.00	761.16
107	W MH-106	754.58	759.83	5.25	754.58	0.00	759.83
108	W MH-84	776.94	778.86	1.92	776.94	0.00	778.86
109	W MH-85	776.26	778.72	2.46	776.26	0.00	778.72
110	W MH-86	775.57	778.15	2.58	775.57	0.00	778.15
111	W MH-87	773.79	775.91	2.12	773.79	0.00	775.91
112	W MH-88	773.24	775.36	2.12	773.24	0.00	775.36
113	W MH-89	772.46	775.66	3.20	772.46	0.00	775.66
114	W MH-90	771.83	773.97	2.14	771.83	0.00	773.97
115	W MH-91	770.76	774.02	3.26	770.76	0.00	774.02
116	W MH-92	769.68	772.24	2.56	769.68	0.00	772.24
117	W MH-93	768.52	772.15	3.63	768.52	0.00	772.15
118	W MH-94	767.41	771.31	3.90	767.41	0.00	771.31
119	W MH-95	766.13	769.53	3.40	766.13	0.00	769.53
120	W MH-96	765.13	768.53	3.40	765.13	0.00	768.53
121	W MH-97	764.73	768.16	3.43	764.73	0.00	768.16
122	W MH-98	763.10	767.64	4.54	763.10	0.00	767.64
123	W MH-99	761.67	772.31	10.64	761.67	0.00	772.31

Junction Results

SN	Element ID	Peak Lateral Inflow (gpm)	Max HGL Elevation Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)
1	E MH-108	0.00	757.96	4.58	757.96	0.26
2	E MH-109	0.00	759.24	4.57	759.24	0.26
3	E MH-110	0.00	760.36	5.73	760.36	0.26
4	E MH-111	0.00	761.36	5.09	761.36	0.26
5	E MH-112	0.00	761.98	5.22	761.98	0.26
6	E MH-113	0.00	762.89	8.41	762.89	0.26
7	E MH-113A	0.00	764.48	4.70	764.48	0.26
8	E MH-114	0.00	764.99	4.19	764.99	0.26
9	E MH-115	0.00	765.89	5.28	765.88	0.26
10	E MH-116	0.00	766.67	5.18	766.67	0.26
11	E MH-117	0.00	767.48	6.06	767.48	0.26
12	E MH-118	0.00	767.94	4.06	767.94	0.27
13	E MH-119	0.00	768.67	5.64	768.67	0.27
14	E MH-120	0.00	769.14	4.00	769.13	0.26
15	E MH-121	0.00	769.82	3.23	769.81	0.26
16	E MH-122	0.00	770.18	4.17	770.18	0.27
17	E MH-123	0.00	770.68	2.32	770.68	0.27
18	E MH-124	0.00	771.17	3.85	771.17	0.27
19	E MH-124A	0.00	771.98	3.65	771.98	0.27
20	E MH-125	0.00	772.78	2.64	772.78	0.27
21	E MH-126	0.00	773.38	5.33	773.38	0.26
22	E MH-126A	0.00	773.92	3.06	773.92	0.26
23	E MH-127	0.00	774.50	3.20	774.50	0.27
24	E MH-128	8.29	775.40	3.10	775.40	0.06
25	IE-123.1	0.00	770.44	1.08	770.43	0.06
26	J-108.1	0.00	757.06	1.48	757.05	0.05
27	J-108.2	0.00	757.22	1.47	757.21	0.06
28	J-108.3	0.00	757.37	1.47	757.36	0.06
29	J-115.1	0.00	765.07	1.48	765.07	0.06
30	J-115.2	0.00	765.16	1.47	765.16	0.06
31	J-115.3	0.00	765.24	1.47	765.24	0.06
32	J-115.4	0.00	765.33	1.47	765.33	0.06
33	J-115.5	0.00	765.41	1.47	765.41	0.06
34	J-115.6	0.00	765.49	1.47	765.49	0.06
35	J-115.7	0.00	765.58	1.48	765.58	0.06
36	J-116.1	0.00	765.94	1.47	765.93	0.06
37	J-116.10	0.00	766.31	1.48	766.31	0.06
38	J-116.11	0.00	766.36	1.48	766.36	0.06
39	J-116.12	0.00	766.41	1.48	766.40	0.05
40	J-116.2	0.00	765.97	1.48	765.97	0.06
41	J-116.3	0.00	766.03	1.47	766.03	0.07
42	J-116.4	0.00	766.08	1.47	766.08	0.07
43	J-116.5	0.00	766.11	1.47	766.11	0.07
44	J-116.6	0.00	766.14	1.48	766.14	0.06
45	J-116.7	0.00	766.18	1.48	766.18	0.06
46	J-116.8	0.00	766.23	1.48	766.23	0.06
47	J-116.9	0.00	766.27	1.48	766.27	0.06
48	J-119.1	0.00	767.99	1.46	767.99	0.07
49	J-119.10	0.00	768.41	1.47	768.41	0.07
50	J-119.2	0.00	768.03	1.47	768.03	0.07
51	J-119.3	0.00	768.07	1.47	768.07	0.07
52	J-119.4	0.00	768.12	1.47	768.12	0.07
53	J-119.5	0.00	768.16	1.47	768.16	0.07
54	J-119.6	0.00	768.21	1.47	768.21	0.07
55	J-119.7	0.00	768.26	1.47	768.26	0.07
56	J-119.8	0.00	768.30	1.47	768.30	0.07
57	J-119.9	0.00	768.34	1.47	768.33	0.06
58	J-120.1	0.00	768.80	1.07	768.80	0.07
59	J-120.2	0.00	768.86	1.08	768.86	0.06
60	J-120.3	0.00	768.93	1.07	768.93	0.07
61	J-121.1	0.00	769.22	1.08	769.21	0.06
62	J-121.2	0.00	769.30	1.07	769.30	0.07
63	J-121.3	0.00	769.37	1.07	769.37	0.07
64	J-121.4	0.00	769.44	1.08	769.44	0.07
65	J-121.5	0.00	769.46	1.07	769.46	0.07
66	J-122.1	0.00	769.83	1.08	769.82	0.06
67	J-122.2	0.00	769.88	1.07	769.88	0.07
68	J-123.1	0.00	770.22	1.07	770.22	0.07
69	J-123.2	0.00	770.27	1.07	770.27	0.07
70	J-123.3	0.00	770.31	1.07	770.31	0.07
71	J-123.4	0.00	770.35	1.07	770.35	0.07
72	J-123.5	0.00	770.38	1.08	770.38	0.06
73	J-124.1	0.00	770.70	1.07	770.70	0.07
74	J-124.2	0.00	770.74	1.07	770.74	0.07
75	J-124.3	0.00	770.78	1.07	770.78	0.07
76	J-124.4	0.00	770.79	1.08	770.79	0.06
77	J-124.5	0.00	770.87	1.08	770.86	0.06
78	J-125.	0.00	772.27	1.07	772.27	0.07
79	J-125.2	0.00	772.29	1.07	772.29	0.07
80	J-125.3	0.00	772.32	1.07	772.32	0.07
81	J-126.1	0.00	772.93	1.07	772.93	0.07

Junction Results

SN	Element ID	Peak Lateral Inflow (gpm)	Max HGL Elevation Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)
82	J-126.2	0.00	772.94	1.07	772.94	0.07
83	J-126.3	0.00	772.96	1.07	772.96	0.07
84	J-126.4	0.00	772.97	1.07	772.97	0.07
85	J-126A.1	0.00	773.45	1.08	773.45	0.07
86	J-126A.2	0.00	773.55	1.07	773.55	0.07
87	J-127.1	0.00	773.96	1.08	773.96	0.06
88	J-127.2	0.00	773.98	1.07	773.98	0.07
89	J-127.3	0.00	774.07	1.07	774.07	0.07
90	J-127.4	0.00	774.08	1.08	774.08	0.07
91	J-128.1	0.00	774.61	0.93	774.61	0.07
92	J-128.2	0.00	774.72	0.93	774.72	0.07
93	J-128.3	0.00	774.94	0.93	774.94	0.07
94	J-128.4	0.00	774.94	0.93	774.94	0.07
95	J-128.5	0.00	775.05	0.93	775.05	0.07
96	J-128.6	0.00	775.16	0.93	775.16	0.07
97	J-128.7	0.00	775.27	0.93	775.27	0.07
98	LS MH-107	0.00	756.87	49.49	756.86	17.46
99	W MH-100	0.00	760.90	4.26	760.90	0.29
100	W MH-101	0.00	759.45	4.99	759.45	0.29
101	W MH-102	0.00	758.50	5.22	758.50	0.29
102	W MH-102A	0.00	757.99	5.00	757.99	0.29
103	W MH-103	0.00	757.32	4.63	757.32	0.29
104	W MH-104	0.00	756.64	5.21	756.64	0.29
105	W MH-104A	0.00	756.13	4.74	756.13	0.29
106	W MH-105	0.00	755.50	5.66	755.50	0.29
107	W MH-106	0.00	754.87	4.96	754.87	0.29
108	W MH-84	13.82	777.04	1.82	777.04	0.10
109	W MH-85	0.00	776.55	2.17	776.55	0.29
110	W MH-86	0.00	775.85	2.30	775.85	0.28
111	W MH-87	0.00	774.06	1.84	774.06	0.27
112	W MH-88	0.00	773.53	1.82	773.53	0.29
113	W MH-89	0.00	772.75	2.91	772.75	0.29
114	W MH-90	0.00	772.12	1.85	772.12	0.29
115	W MH-91	0.00	771.05	2.97	771.05	0.29
116	W MH-92	0.00	769.96	2.28	769.96	0.28
117	W MH-93	0.00	768.81	3.34	768.81	0.29
118	W MH-94	0.00	767.69	3.62	767.69	0.28
119	W MH-95	0.00	766.42	3.11	766.42	0.29
120	W MH-96	0.00	765.42	3.11	765.42	0.29
121	W MH-97	0.00	765.01	3.15	765.01	0.28
122	W MH-98	0.00	763.38	4.26	763.38	0.28
123	W MH-99	0.00	761.96	10.35	761.96	0.29

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Diameter or Height (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses
1	IE-108.1	37.09	757.00	756.81	17.41	0.19	0.5100	15.000	0.0120	0.5000	0.5000
2	IE-108.2	37.35	757.15	757.00	0.00	0.15	0.4000	15.960	0.0120	0.5000	0.5000
3	IE-108.3	75.38	757.30	757.15	0.00	0.15	0.2000	15.960	0.0120	0.5000	0.5000
4	IE-108.4	146.66	757.70	757.30	0.00	0.40	0.2700	15.960	0.0120	0.5000	0.5000
5	IE-109	358.32	758.98	757.90	0.20	1.08	0.3000	15.960	0.0120	0.5000	0.5000
6	IE-110	312.58	760.10	759.18	0.20	0.92	0.2900	15.960	0.0120	0.5000	0.5000
7	IE-111	268.51	761.10	760.30	0.20	0.80	0.3000	15.960	0.0120	0.5000	0.5000
8	IE-112	142.21	761.72	761.30	0.20	0.42	0.3000	15.960	0.0120	0.5000	0.5000
9	IE-113	240.52	762.63	761.92	0.20	0.71	0.3000	15.960	0.0120	0.5000	0.5000
10	IE-113A	461.82	764.22	762.83	0.20	1.39	0.3000	15.960	0.0120	0.5000	0.5000
11	IE-114	108.68	764.73	764.42	0.20	0.31	0.2900	15.960	0.0120	0.5000	0.5000
12	IE-115.1	27.13	765.01	764.93	0.20	0.08	0.2900	15.960	0.0120	0.5000	0.5000
13	IE-115.2	30.98	765.10	765.01	0.00	0.09	0.2900	15.960	0.0120	0.5000	0.5000
14	IE-115.3	33.39	765.18	765.10	0.00	0.08	0.2400	15.960	0.0120	0.5000	0.5000
15	IE-115.4	31.30	765.27	765.18	0.00	0.09	0.2900	15.960	0.0120	0.5000	0.5000
16	IE-115.5	28.56	765.35	765.27	0.00	0.08	0.2800	15.960	0.0120	0.5000	0.5000
17	IE-115.6	28.59	765.43	765.35	0.00	0.08	0.2800	15.960	0.0120	0.5000	0.5000
18	IE-115.7	26.25	765.52	765.43	0.00	0.09	0.3400	15.960	0.0120	0.5000	0.5000
19	IE-115.8	25.83	765.62	765.52	0.00	0.10	0.3900	15.960	0.0120	0.5000	0.5000
20	IE-116.1	22.81	765.87	765.82	0.20	0.05	0.2200	15.960	0.0120	0.5000	0.5000
21	IE-116.10	13.35	766.25	766.21	0.00	0.04	0.3000	15.960	0.0120	0.5000	0.5000
22	IE-116.11	12.67	766.30	766.25	0.00	0.05	0.3900	15.960	0.0120	0.5000	0.5000
23	IE-116.12	11.46	766.35	766.30	0.00	0.05	0.4400	15.960	0.0120	0.5000	0.5000
24	IE-116.13	11.31	766.41	766.35	0.00	0.06	0.5300	15.960	0.0120	0.5000	0.5000
25	IE-116.2	13.94	765.91	765.87	0.00	0.04	0.2900	15.960	0.0120	0.5000	0.5000
26	IE-116.3	13.64	765.96	765.91	0.00	0.05	0.3700	15.960	0.0120	0.5000	0.5000
27	IE-116.4	27.15	766.01	765.96	0.00	0.05	0.1800	15.960	0.0120	0.5000	0.5000
28	IE-116.5	22.75	766.04	766.01	0.00	0.03	0.1300	15.960	0.0120	0.5000	0.5000
29	IE-116.6	13.38	766.08	766.04	0.00	0.04	0.3000	15.960	0.0120	0.5000	0.5000
30	IE-116.7	13.14	766.12	766.08	0.00	0.04	0.3000	15.960	0.0120	0.5000	0.5000
31	IE-116.8	12.54	766.17	766.12	0.00	0.05	0.4000	15.960	0.0120	0.5000	0.5000
32	IE-116.9	11.96	766.21	766.17	0.00	0.04	0.3300	15.960	0.0120	0.5000	0.5000
33	IE-117	207.20	767.22	766.61	0.20	0.61	0.2900	15.960	0.0120	0.5000	0.5000
34	IE-118	86.29	767.67	767.42	0.20	0.25	0.2900	15.960	0.0120	0.5000	0.5000
35	IE-119.1	28.83	767.92	767.87	0.20	0.05	0.1700	12.000	0.0120	0.5000	0.5000
36	IE-119.10	23.64	768.34	768.27	0.00	0.07	0.3000	12.000	0.0120	0.5000	0.5000
37	IE-119.11	12.53	768.40	768.34	0.00	0.06	0.4800	12.000	0.0120	0.5000	0.5000
38	IE-119.2	15.49	767.96	767.92	0.00	0.04	0.2600	12.000	0.0120	0.5000	0.5000
39	IE-119.3	12.27	768.00	767.96	0.00	0.04	0.3300	12.000	0.0120	0.5000	0.5000
40	IE-119.4	18.94	768.05	768.00	0.00	0.05	0.2600	12.000	0.0120	0.5000	0.5000
41	IE-119.5	14.17	768.09	768.05	0.00	0.04	0.2800	12.000	0.0120	0.5000	0.5000
42	IE-119.6	11.96	768.14	768.09	0.00	0.05	0.4200	12.000	0.0120	0.5000	0.5000
43	IE-119.7	17.29	768.19	768.14	0.00	0.05	0.2900	12.000	0.0120	0.5000	0.5000
44	IE-119.8	16.52	768.23	768.19	0.00	0.04	0.2400	12.000	0.0120	0.5000	0.5000
45	IE-119.9	11.72	768.27	768.23	0.00	0.04	0.3400	12.000	0.0120	0.5000	0.5000
46	IE-120.1	55.21	768.73	768.60	0.20	0.13	0.2400	12.000	0.0120	0.5000	0.5000
47	IE-120.2	18.32	768.80	768.73	0.00	0.07	0.3800	12.000	0.0120	0.5000	0.5000
48	IE-120.3	15.49	768.86	768.80	0.00	0.06	0.3900	12.000	0.0120	0.5000	0.5000
49	IE-120.4	4.65	768.87	768.86	0.00	0.01	0.2200	12.000	0.0120	0.5000	0.5000
50	IE-121.1	25.89	769.15	769.07	0.20	0.08	0.3100	12.000	0.0120	0.5000	0.5000
51	IE-121.2	26.54	769.23	769.15	0.00	0.08	0.3000	12.000	0.0120	0.5000	0.5000
52	IE-121.3	25.05	769.30	769.23	0.00	0.07	0.2800	12.000	0.0120	0.5000	0.5000
53	IE-121.4	23.82	769.37	769.30	0.00	0.07	0.2900	12.000	0.0120	0.5000	0.5000
54	IE-121.5	4.92	769.39	769.37	0.00	0.02	0.4100	12.000	0.0120	0.5000	0.5000
55	IE-121.6	58.97	769.55	769.39	0.00	0.16	0.2700	12.000	0.0120	0.5000	0.5000
56	IE-122.1	3.12	769.76	769.75	0.20	0.01	0.3200	12.000	0.0120	0.5000	0.5000
57	IE-122.2	15.67	769.81	769.76	0.00	0.05	0.3200	12.000	0.0120	0.5000	0.5000
58	IE-122.3	38.77	769.91	769.81	0.00	0.10	0.2600	12.000	0.0120	0.5000	0.5000
59	IE-123.1	17.34	770.15	770.11	0.20	0.04	0.2300	12.000	0.0120	0.5000	0.5000
60	IE-123.2	19.94	770.20	770.15	0.00	0.05	0.2500	12.000	0.0120	0.5000	0.5000
61	IE-123.3	14.24	770.24	770.20	0.00	0.04	0.2800	12.000	0.0120	0.5000	0.5000
62	IE-123.4	14.97	770.28	770.24	0.00	0.04	0.2700	12.000	0.0120	0.5000	0.5000
63	IE-123.5	11.63	770.32	770.28	0.00	0.04	0.3400	12.000	0.0120	0.5000	0.5000
64	IE-123.6	10.75	770.37	770.32	0.00	0.05	0.4600	12.000	0.0120	0.5000	0.5000
65	IE-123.7	12.85	770.41	770.37	0.00	0.04	0.3100	12.000	0.0120	0.5000	0.5000
66	IE-124.1	7.94	770.63	770.61	0.20	0.02	0.2500	12.000	0.0120	0.5000	0.5000
67	IE-124.2	15.23	770.67	770.63	0.00	0.04	0.2600	12.000	0.0120	0.5000	0.5000
68	IE-124.3	23.51	770.71	770.67	0.00	0.04	0.1700	12.000	0.0120	0.5000	0.5000
69	IE-124.4	4.50	770.73	770.71	0.00	0.02	0.4400	12.000	0.0120	0.5000	0.5000
70	IE-124.5	18.01	770.80	770.73	0.00	0.07	0.3900	12.000	0.0120	0.5000	0.5000
71	IE-124.6	31.48	770.90	770.80	0.00	0.10	0.3200	12.000	0.0120	0.5000	0.5000
72	IE-124A	206.44	771.71	771.10	0.20	0.61	0.3000	12.000	0.0120	0.5000	0.5000
73	IE-125.1	124.29	772.20	771.91	0.20	0.29	0.2300	12.000	0.0120	0.5000	0.5000
74	IE-125.2	4.58	772.22	772.20	0.00	0.02	0.4400	12.000	0.0120	0.5000	0.5000
75	IE-125.3	12.07	772.25	772.22	0.00	0.03	0.2500	12.000	0.0120	0.5000	0.5000
76	IE-125.4	66.64	772.51	772.25	0.00	0.26	0.3900	12.000	0.0120	0.5000	0.5000
77	IE-126.1	58.71	772.86	772.71	0.20	0.15	0.2600	12.000	0.0120	0.5000	0.5000
78	IE-126.2	3.46	772.87	772.86	0.00	0.01	0.2900	12.000	0.0120	0.5000	0.5000
79	IE-126.3	18.10	772.89	772.87	0.00	0.02	0.1100	12.000	0.0120	0.5000	0.5000
80	IE-126.4	7.35	772.90	772.89	0.00	0.01	0.1400	12.000	0.0120	0.5000	0.5000
81	IE-126.5	55.60	773.12	772.90	0.00	0.22	0.4000	12.000	0.0120	0.5000	0.5000
82	IE-126A.1	13.55	773.38	773.32	0.20	0.06	0.4400	12.000	0.0120	0.5000	0.5000

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Diameter or Height (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses
83	IE-126A.2	31.85	773.48	773.38	0.00	0.10	0.3100	12.000	0.0120	0.5000	0.5000
84	IE-126A.3	72.49	773.66	773.48	0.00	0.18	0.2500	12.000	0.0120	0.5000	0.5000
85	IE-127.1	7.73	773.90	773.86	0.20	0.04	0.5200	12.000	0.0120	0.5000	0.5000
86	IE-127.2	2.64	773.91	773.90	0.00	0.01	0.3800	12.000	0.0120	0.5000	0.5000
87	IE-127.3	45.38	774.00	773.91	0.00	0.09	0.2000	12.000	0.0120	0.5000	0.5000
88	IE-127.4	1.40	774.01	774.00	0.00	0.01	0.7100	12.000	0.0120	0.5000	0.5000
89	IE-127.5	69.97	774.23	774.01	0.00	0.22	0.3100	12.000	0.0120	0.5000	0.5000
90	IE-128.1	38.85	774.54	774.43	0.20	0.11	0.2800	12.000	0.0120	0.5000	0.5000
91	IE-128.2	38.66	774.65	774.54	0.00	0.11	0.2800	12.000	0.0120	0.5000	0.5000
92	IE-128.3	39.02	774.76	774.65	0.00	0.11	0.2800	12.000	0.0120	0.5000	0.5000
93	IE-128.4	38.10	774.87	774.76	-0.11	0.11	0.2900	12.000	0.0120	0.5000	0.5000
94	IE-128.5	38.55	774.98	774.87	0.00	0.11	0.2900	12.000	0.0120	0.5000	0.5000
95	IE-128.6	38.44	775.09	774.98	0.00	0.11	0.2900	12.000	0.0120	0.5000	0.5000
96	IE-128.7	37.92	775.20	775.09	0.00	0.11	0.2900	12.000	0.0120	0.5000	0.5000
97	IE-128.8	38.52	775.34	775.20	0.00	0.14	0.3600	12.000	0.0120	0.5000	0.5000
98	IW-100	435.67	760.61	759.36	0.20	1.25	0.2900	14.040	0.0150	0.5000	0.5000
99	IW-101	252.71	759.16	758.41	0.20	0.75	0.3000	14.040	0.0150	0.5000	0.5000
100	IW-102	106.09	758.21	757.90	0.20	0.31	0.2900	14.040	0.0150	0.5000	0.5000
101	IW-102A	160.50	757.70	757.23	0.20	0.47	0.2900	14.040	0.0150	0.5000	0.5000
102	IW-103	164.19	757.03	756.55	0.20	0.48	0.2900	14.040	0.0150	0.5000	0.5000
103	IW-104	107.70	756.35	756.04	0.20	0.31	0.2900	14.040	0.0150	0.5000	0.5000
104	IW-104A	147.50	755.84	755.41	0.20	0.43	0.2900	14.040	0.0150	0.5000	0.5000
105	IW-105	148.11	755.21	754.78	0.20	0.43	0.2900	14.040	0.0150	0.5000	0.5000
106	IW-106	170.65	754.58	754.04	14.64	0.54	0.3200	14.040	0.0150	0.5000	0.5000
107	IW-84	164.84	776.94	776.46	0.20	0.48	0.2900	12.000	0.0150	0.5000	0.5000
108	IW-85	65.86	776.26	775.77	0.20	0.49	0.7400	12.000	0.0150	0.5000	0.5000
109	IW-86	201.17	775.57	773.99	0.20	1.58	0.7900	12.000	0.0150	0.5000	0.5000
110	IW-87	125.98	773.79	773.44	0.20	0.35	0.2800	12.000	0.0150	0.5000	0.5000
111	IW-88	144.79	773.24	772.66	0.20	0.58	0.4000	12.000	0.0150	0.5000	0.5000
112	IW-89	111.66	772.46	772.03	0.20	0.43	0.3900	12.000	0.0150	0.5000	0.5000
113	IW-90	290.72	771.83	770.96	0.20	0.87	0.3000	12.000	0.0150	0.5000	0.5000
114	IW-91	129.24	770.76	769.88	0.20	0.88	0.6800	12.000	0.0150	0.5000	0.5000
115	IW-92	309.74	769.68	768.72	0.20	0.96	0.3100	12.000	0.0150	0.5000	0.5000
116	IW-93	171.03	768.52	767.61	0.20	0.91	0.5300	12.000	0.0150	0.5000	0.5000
117	IW-94	358.35	767.41	766.33	0.20	1.08	0.3000	12.000	0.0150	0.5000	0.5000
118	IW-95	203.67	766.13	765.33	0.20	0.80	0.3900	12.000	0.0150	0.5000	0.5000
119	IW-96	45.43	765.13	764.93	0.20	0.20	0.4400	12.000	0.0150	0.5000	0.5000
120	IW-97	277.05	764.73	763.30	0.20	1.43	0.5200	12.000	0.0150	0.5000	0.5000
121	IW-98	420.55	763.10	761.87	0.20	1.23	0.2900	12.000	0.0150	0.5000	0.5000
122	IW-99	294.33	761.67	760.81	0.20	0.86	0.2900	12.000	0.0150	0.5000	0.5000

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Pipe Results

SN	Element ID	Peak Flow (gpm)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	IE-108.1	8.29	0 03:40	2248.09	0.00	0.96	0.64	0.06	0.04	0.00		Calculated
2	IE-108.2	8.29	0 03:38	2364.18	0.00	0.87	0.72	0.06	0.04	0.00		Calculated
3	IE-108.3	8.29	0 03:38	1668.48	0.00	0.68	1.85	0.07	0.05	0.00		Calculated
4	IE-108.4	8.29	0 03:37	1948.38	0.00	0.76	3.22	0.06	0.05	0.00		Calculated
5	IE-109	8.29	0 03:35	2048.25	0.00	0.79	7.56	0.06	0.05	0.00		Calculated
6	IE-110	8.29	0 03:31	2024.04	0.00	0.78	6.68	0.06	0.05	0.00		Calculated
7	IE-111	8.29	0 03:26	2036.45	0.00	0.78	5.74	0.06	0.05	0.00		Calculated
8	IE-112	8.29	0 03:24	2027.55	0.00	0.78	3.04	0.06	0.05	0.00		Calculated
9	IE-113	8.29	0 03:23	2027.03	0.00	0.78	5.14	0.06	0.05	0.00		Calculated
10	IE-113A	8.29	0 03:21	2046.81	0.00	0.79	9.74	0.06	0.05	0.00		Calculated
11	IE-114	8.29	0 01:57	1992.60	0.00	0.77	2.35	0.06	0.05	0.00		Calculated
12	IE-115.1	8.29	0 01:56	2025.87	0.00	0.78	0.58	0.06	0.05	0.00		Calculated
13	IE-115.2	8.29	0 02:21	2010.89	0.00	0.78	0.66	0.06	0.05	0.00		Calculated
14	IE-115.3	8.29	0 02:11	1826.15	0.00	0.73	0.76	0.06	0.05	0.00		Calculated
15	IE-115.4	8.29	0 02:11	2000.45	0.00	0.77	0.68	0.06	0.05	0.00		Calculated
16	IE-115.5	8.29	0 02:10	1974.74	0.00	0.77	0.62	0.06	0.05	0.00		Calculated
17	IE-115.6	8.29	0 02:10	1973.42	0.00	0.77	0.62	0.06	0.05	0.00		Calculated
18	IE-115.7	8.29	0 02:19	2184.37	0.00	0.82	0.53	0.06	0.04	0.00		Calculated
19	IE-115.8	8.29	0 01:50	2321.48	0.00	0.86	0.50	0.06	0.04	0.00		Calculated
20	IE-116.1	8.29	0 02:52	1746.81	0.00	0.70	0.54	0.07	0.05	0.00		Calculated
21	IE-116.10	8.29	0 02:16	2042.48	0.00	0.79	0.28	0.06	0.05	0.00		Calculated
22	IE-116.11	8.29	0 01:53	2343.91	0.00	0.87	0.24	0.06	0.04	0.00		Calculated
23	IE-116.12	8.29	0 01:49	2464.49	0.00	0.90	0.21	0.06	0.04	0.00		Calculated
24	IE-116.13	8.29	0 01:47	2717.18	0.00	0.97	0.19	0.05	0.04	0.00		Calculated
25	IE-116.2	8.29	0 02:52	1998.48	0.00	0.77	0.30	0.06	0.05	0.00		Calculated
26	IE-116.3	8.29	0 01:53	2258.67	0.00	0.84	0.27	0.06	0.04	0.00		Calculated
27	IE-116.4	8.29	0 02:05	1668.48	0.00	0.68	0.67	0.07	0.05	0.00		Calculated
28	IE-116.5	8.29	0 02:02	1668.48	0.00	0.68	0.56	0.07	0.05	0.00		Calculated
29	IE-116.6	8.29	0 02:08	2039.80	0.00	0.79	0.28	0.06	0.05	0.00		Calculated
30	IE-116.7	8.29	0 02:39	2058.77	0.00	0.79	0.28	0.06	0.05	0.00		Calculated
31	IE-116.8	8.29	0 01:56	2356.02	0.00	0.87	0.24	0.06	0.04	0.00		Calculated
32	IE-116.9	8.29	0 02:08	2157.62	0.00	0.82	0.24	0.06	0.05	0.00		Calculated
33	IE-117	8.29	0 01:45	2024.29	0.00	0.78	4.43	0.06	0.05	0.00		Calculated
34	IE-118	8.29	0 01:32	2008.14	0.00	0.78	1.84	0.06	0.05	0.00		Calculated
35	IE-119.1	8.29	0 01:31	774.73	0.01	0.72	0.67	0.07	0.07	0.00		Calculated
36	IE-119.10	8.29	0 02:01	942.61	0.01	0.82	0.48	0.07	0.07	0.00		Calculated
37	IE-119.11	8.29	0 01:31	1198.93	0.01	0.98	0.21	0.06	0.06	0.00		Calculated
38	IE-119.2	8.29	0 02:02	880.37	0.01	0.78	0.33	0.07	0.07	0.00		Calculated
39	IE-119.3	8.29	0 01:32	989.26	0.01	0.85	0.24	0.06	0.06	0.00		Calculated
40	IE-119.4	8.29	0 01:32	890.03	0.01	0.79	0.40	0.07	0.07	0.00		Calculated
41	IE-119.5	8.29	0 01:31	920.25	0.01	0.81	0.29	0.07	0.07	0.00		Calculated
42	IE-119.6	8.29	0 02:09	1119.99	0.01	0.93	0.21	0.06	0.06	0.00		Calculated
43	IE-119.7	8.29	0 01:31	931.47	0.01	0.82	0.35	0.07	0.07	0.00		Calculated
44	IE-119.8	8.29	0 01:31	852.36	0.01	0.77	0.36	0.07	0.07	0.00		Calculated
45	IE-119.9	8.29	0 01:31	1012.04	0.01	0.86	0.23	0.06	0.06	0.00		Calculated
46	IE-120.1	8.29	0 02:01	840.62	0.01	0.76	1.21	0.07	0.07	0.00		Calculated
47	IE-120.2	8.29	0 01:29	1070.96	0.01	0.90	0.34	0.06	0.06	0.00		Calculated
48	IE-120.3	8.29	0 01:29	1078.30	0.01	0.91	0.28	0.06	0.06	0.00		Calculated
49	IE-120.4	8.29	0 01:29	803.78	0.01	0.74	0.10	0.07	0.07	0.00		Calculated
50	IE-121.1	8.29	0 01:29	962.97	0.01	0.83	0.52	0.07	0.07	0.00		Calculated
51	IE-121.2	8.29	0 01:28	951.10	0.01	0.83	0.53	0.07	0.07	0.00		Calculated
52	IE-121.3	8.29	0 01:28	915.78	0.01	0.81	0.52	0.07	0.07	0.00		Calculated
53	IE-121.4	8.29	0 01:28	939.03	0.01	0.82	0.48	0.07	0.07	0.00		Calculated
54	IE-121.5	8.29	0 01:27	1104.26	0.01	0.92	0.09	0.06	0.06	0.00		Calculated
55	IE-121.6	8.29	0 01:28	902.35	0.01	0.80	1.23	0.07	0.07	0.00		Calculated
56	IE-122.1	8.29	0 01:26	981.46	0.01	0.85	0.06	0.07	0.07	0.00		Calculated
57	IE-122.2	8.29	0 01:27	978.69	0.01	0.84	0.31	0.07	0.07	0.00		Calculated
58	IE-122.3	8.29	0 01:26	879.78	0.01	0.78	0.83	0.07	0.07	0.00		Calculated
59	IE-123.1	8.29	0 01:32	832.02	0.01	0.75	0.39	0.07	0.07	0.00		Calculated
60	IE-123.2	8.29	0 01:31	867.44	0.01	0.78	0.43	0.07	0.07	0.00		Calculated
61	IE-123.3	8.29	0 01:31	918.16	0.01	0.81	0.29	0.07	0.07	0.00		Calculated
62	IE-123.4	8.29	0 01:31	895.46	0.01	0.79	0.32	0.07	0.07	0.00		Calculated
63	IE-123.5	8.29	0 01:25	1015.95	0.01	0.87	0.22	0.06	0.06	0.00		Calculated
64	IE-123.6	8.29	0 01:31	1181.19	0.01	0.97	0.18	0.06	0.06	0.00		Calculated
65	IE-123.7	8.29	0 01:25	966.66	0.01	0.84	0.25	0.07	0.07	0.00		Calculated
66	IE-124.1	8.29	0 01:24	869.63	0.01	0.78	0.17	0.07	0.07	0.00		Calculated
67	IE-124.2	8.29	0 01:24	887.70	0.01	0.79	0.32	0.07	0.07	0.00		Calculated
68	IE-124.3	8.29	0 01:24	774.73	0.01	0.72	0.54	0.07	0.07	0.00		Calculated
69	IE-124.4	8.29	0 01:24	1155.11	0.01	0.95	0.08	0.06	0.06	0.00		Calculated
70	IE-124.5	8.29	0 01:24	1080.13	0.01	0.91	0.33	0.06	0.06	0.00		Calculated
71	IE-124.6	8.29	0 01:23	976.38	0.01	0.84	0.62	0.07	0.07	0.00		Calculated
72	IE-124A	8.29	0 01:23	941.68	0.01	0.82	4.20	0.07	0.07	0.00		Calculated
73	IE-125.1	8.29	0 01:04	836.79	0.01	0.76	2.73	0.07	0.07	0.00		Calculated
74	IE-125.2	8.29	0 00:42	1144.21	0.01	0.95	0.08	0.06	0.06	0.00		Calculated
75	IE-125.3	8.29	0 00:40	863.64	0.01	0.77	0.26	0.07	0.07	0.00		Calculated
76	IE-125.4	8.29	0 00:40	1082.05	0.01	0.91	1.22	0.06	0.06	0.00		Calculated
77	IE-126.1	8.29	0 00:49	875.62	0.01	0.78	1.25	0.07	0.07	0.00		Calculated
78	IE-126.2	8.29	0 00:37	931.16	0.01	0.81	0.07	0.07	0.07	0.00		Calculated
79	IE-126.3	8.29	0 00:37	774.73	0.01	0.72	0.42	0.07	0.07	0.00		Calculated
80	IE-126.4	8.29	0 00:47	774.73	0.01	0.72	0.17	0.07	0.07	0.00		Calculated
81	IE-126.5	8.29	0 00:36	1089.75	0.01	0.91	1.02	0.06	0.06	0.00		Calculated

Oak Shores Interceptor Model
Max Flow of 226,000gpd

Pipe Results

SN	Element ID	Peak Flow (gpm)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
82	IE-126A.1	8.29	0 00:32	1152.91	0.01	0.95	0.24	0.06	0.06	0.00		Calculated
83	IE-126A.2	8.29	0 00:30	970.69	0.01	0.84	0.63	0.07	0.07	0.00		Calculated
84	IE-126A.3	8.29	0 00:29	863.25	0.01	0.77	1.57	0.07	0.07	0.00		Calculated
85	IE-127.1	8.29	0 00:20	1246.54	0.01	1.00	0.13	0.06	0.06	0.00		Calculated
86	IE-127.2	8.29	0 00:20	1066.90	0.01	0.90	0.05	0.06	0.06	0.00		Calculated
87	IE-127.3	8.29	0 00:19	774.73	0.01	0.72	1.05	0.07	0.07	0.00		Calculated
88	IE-127.4	8.29	0 00:17	1464.28	0.01	1.11	0.02	0.05	0.05	0.00		Calculated
89	IE-127.5	8.29	0 00:30	971.41	0.01	0.84	1.39	0.07	0.07	0.00		Calculated
90	IE-128.1	8.29	0 00:20	921.77	0.01	0.81	0.80	0.07	0.07	0.00		Calculated
91	IE-128.2	8.29	0 00:19	924.01	0.01	0.81	0.80	0.07	0.07	0.00		Calculated
92	IE-128.3	8.29	0 00:18	1300.76	0.01	1.03	0.63	0.06	0.06	0.00		Calculated
93	IE-128.4	8.29	0 00:18	774.73	0.01	0.72	0.88	0.07	0.07	0.00		Calculated
94	IE-128.5	8.29	0 00:16	925.41	0.01	0.81	0.79	0.07	0.07	0.00		Calculated
95	IE-128.6	8.29	0 00:15	926.71	0.01	0.81	0.79	0.07	0.07	0.00		Calculated
96	IE-128.7	8.29	0 00:13	933.07	0.01	0.82	0.77	0.07	0.07	0.00		Calculated
97	IE-128.8	8.29	0 00:11	1044.36	0.01	0.88	0.73	0.06	0.06	0.00		Calculated
98	IW-100	13.82	0 03:19	1119.76	0.01	0.80	9.08	0.09	0.08	0.00		Calculated
99	IW-101	13.82	0 03:22	1138.85	0.01	0.81	5.20	0.09	0.08	0.00		Calculated
100	IW-102	13.82	0 03:23	1130.03	0.01	0.80	2.21	0.09	0.08	0.00		Calculated
101	IW-102A	13.82	0 03:25	1131.27	0.01	0.80	3.34	0.09	0.08	0.00		Calculated
102	IW-103	13.82	0 03:28	1130.32	0.01	0.80	3.42	0.09	0.08	0.00		Calculated
103	IW-104	13.82	0 03:31	1121.55	0.01	0.80	2.24	0.09	0.08	0.00		Calculated
104	IW-104A	13.82	0 03:32	1128.74	0.01	0.80	3.07	0.09	0.08	0.00		Calculated
105	IW-105	13.82	0 03:35	1126.41	0.01	0.80	3.09	0.09	0.08	0.00		Calculated
106	IW-106	13.82	0 03:36	1175.98	0.01	0.82	3.47	0.09	0.08	0.00		Calculated
107	IW-84	13.82	0 00:52	747.85	0.02	0.81	3.39	0.09	0.09	0.00		Calculated
108	IW-85	13.82	0 00:52	1195.40	0.01	1.14	0.96	0.08	0.08	0.00		Calculated
109	IW-86	13.82	0 00:55	1228.22	0.01	1.16	2.89	0.07	0.07	0.00		Calculated
110	IW-87	13.82	0 00:59	730.47	0.02	0.80	2.62	0.10	0.10	0.00		Calculated
111	IW-88	13.82	0 01:02	877.13	0.02	0.91	2.65	0.09	0.09	0.00		Calculated
112	IW-89	13.82	0 01:03	860.03	0.02	0.90	2.07	0.09	0.09	0.00		Calculated
113	IW-90	13.82	0 01:39	758.14	0.02	0.82	5.91	0.09	0.09	0.00		Calculated
114	IW-91	13.82	0 01:41	1143.61	0.01	1.10	1.96	0.08	0.08	0.00		Calculated
115	IW-92	13.82	0 01:54	771.55	0.02	0.83	6.22	0.09	0.09	0.00		Calculated
116	IW-93	13.82	0 01:55	1010.91	0.01	1.01	2.82	0.08	0.08	0.00		Calculated
117	IW-94	13.82	0 02:17	760.83	0.02	0.82	7.28	0.09	0.09	0.00		Calculated
118	IW-95	13.82	0 02:19	868.57	0.02	0.91	3.73	0.09	0.09	0.00		Calculated
119	IW-96	13.82	0 02:20	921.88	0.01	0.95	0.80	0.09	0.09	0.00		Calculated
120	IW-97	13.82	0 02:23	995.32	0.01	1.00	4.62	0.08	0.08	0.00		Calculated
121	IW-98	13.82	0 02:52	749.50	0.02	0.81	8.65	0.09	0.09	0.00		Calculated
122	IW-99	13.82	0 02:57	749.13	0.02	0.81	6.06	0.09	0.09	0.00		Calculated

Project Description

File Name	East and West Interceptor-4.SPF

Project Options

Flow Units	GPM
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Kinematic Wave
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Jan 01, 2013	00:00:00
End Analysis On	Dec 31, 2013	23:59:59
Start Reporting On	Jan 01, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	0
Nodes	124
Junctions	123
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	123
Channels	0
Pipes	122
Pumps	1
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Oak Shores Interceptor Model
Monthly Average Flow

Node Summary

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Surcharge Elevation (ft)	Peak Inflow (gpm)	Max HGL Elevation Attained (ft)
1	E MH-108	757.70	762.54	762.54	15.56	757.98
2	E MH-109	758.98	763.81	763.81	15.56	759.26
3	E MH-110	760.10	766.09	766.09	15.56	760.38
4	E MH-111	761.10	766.45	766.45	15.56	761.38
5	E MH-112	761.72	767.20	767.20	15.57	762.00
6	E MH-113	762.63	771.30	771.30	15.57	762.91
7	E MH-113A	764.22	769.18	769.18	15.51	764.50
8	E MH-114	764.73	769.18	769.18	15.51	765.01
9	E MH-115	765.62	771.17	771.17	15.52	765.91
10	E MH-116	766.41	771.85	771.85	15.53	766.69
11	E MH-117	767.22	773.54	773.54	15.51	767.50
12	E MH-118	767.67	772.00	772.00	15.52	767.97
13	E MH-119	768.40	774.31	774.31	15.53	768.69
14	E MH-120	768.87	773.14	773.14	15.53	769.16
15	E MH-121	769.55	773.05	773.05	15.55	769.84
16	E MH-122	769.91	774.35	774.35	15.55	770.20
17	E MH-123	770.41	773.00	773.00	15.57	770.70
18	E MH-124	770.90	775.02	775.02	15.58	771.19
19	E MH-124A	771.71	775.63	775.63	15.51	772.00
20	E MH-125	772.51	775.42	775.42	15.48	772.80
21	E MH-126	773.12	778.71	778.71	15.48	773.40
22	E MH-126A	773.66	776.98	776.98	15.48	773.94
23	E MH-127	774.23	777.70	777.70	15.48	774.52
24	E MH-128	775.34	778.50	778.50	15.48	775.42
25	IE-123.1	770.37	771.51	771.51	15.57	770.46
26	J-108.1	757.00	758.54	758.54	15.55	757.08
27	J-108.2	757.15	758.69	758.69	15.55	757.24
28	J-108.3	757.30	758.84	758.84	15.55	757.39
29	J-115.1	765.01	766.55	766.55	15.51	765.09
30	J-115.2	765.10	766.64	766.64	15.51	765.19
31	J-115.3	765.18	766.72	766.72	15.51	765.27
32	J-115.4	765.27	766.81	766.81	15.51	765.35
33	J-115.5	765.35	766.89	766.89	15.51	765.43
34	J-115.6	765.43	766.97	766.97	15.52	765.51
35	J-115.7	765.52	767.06	767.06	15.52	765.60
36	J-116.1	765.87	767.41	767.41	15.52	765.96
37	J-116.10	766.25	767.79	767.79	15.53	766.33
38	J-116.11	766.30	767.84	767.84	15.53	766.38
39	J-116.12	766.35	767.89	767.89	15.53	766.43
40	J-116.2	765.91	767.45	767.45	15.52	765.99
41	J-116.3	765.96	767.50	767.50	15.52	766.05
42	J-116.4	766.01	767.55	767.55	15.52	766.10
43	J-116.5	766.04	767.58	767.58	15.52	766.13
44	J-116.6	766.08	767.62	767.62	15.52	766.16
45	J-116.7	766.12	767.66	767.66	15.53	766.20
46	J-116.8	766.17	767.71	767.71	15.52	766.25
47	J-116.9	766.21	767.75	767.75	15.53	766.29
48	J-119.1	767.92	769.46	769.46	15.52	768.02
49	J-119.10	768.34	769.88	769.88	15.53	768.43
50	J-119.2	767.96	769.50	769.50	15.52	768.05
51	J-119.3	768.00	769.54	769.54	15.52	768.09
52	J-119.4	768.05	769.59	769.59	15.52	768.14
53	J-119.5	768.09	769.63	769.63	15.52	768.18
54	J-119.6	768.14	769.68	769.68	15.52	768.23
55	J-119.7	768.19	769.73	769.73	15.52	768.28
56	J-119.8	768.23	769.77	769.77	15.52	768.33
57	J-119.9	768.27	769.81	769.81	15.53	768.36
58	J-120.1	768.73	769.87	769.87	15.53	768.83
59	J-120.2	768.80	769.94	769.94	15.53	768.88
60	J-120.3	768.86	770.00	770.00	15.53	768.96
61	J-121.1	769.15	770.29	770.29	15.54	769.24
62	J-121.2	769.23	770.37	770.37	15.54	769.32
63	J-121.3	769.30	770.44	770.44	15.54	769.39
64	J-121.4	769.37	770.51	770.51	15.54	769.46
65	J-121.5	769.39	770.53	770.53	15.54	769.48
66	J-122.1	769.76	770.90	770.90	15.55	769.85
67	J-122.2	769.81	770.95	770.95	15.55	769.90
68	J-123.1	770.15	771.29	771.29	15.56	770.25
69	J-123.2	770.20	771.34	771.34	15.56	770.29
70	J-123.3	770.24	771.38	771.38	15.56	770.33
71	J-123.4	770.28	771.42	771.42	15.56	770.37
72	J-123.5	770.32	771.46	771.46	15.56	770.41
73	J-124.1	770.63	771.77	771.77	15.57	770.72
74	J-124.2	770.67	771.81	771.81	15.57	770.77
75	J-124.3	770.71	771.85	771.85	15.58	770.81
76	J-124.4	770.73	771.87	771.87	15.58	770.81
77	J-124.5	770.80	771.94	771.94	15.58	770.89
78	J-125.	772.20	773.34	773.34	15.48	772.30
79	J-125.2	772.22	773.36	773.36	15.48	772.31
80	J-125.3	772.25	773.39	773.39	15.48	772.34
81	J-126.1	772.86	774.00	774.00	15.48	772.95

Node Summary

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Surcharge Elevation (ft)	Peak Inflow (gpm)	Max HGL Elevation Attained (ft)
82	J-126.2	772.87	774.01	774.01	15.48	772.97
83	J-126.3	772.89	774.03	774.03	15.48	772.99
84	J-126.4	772.90	774.04	774.04	15.48	773.00
85	J-126A.1	773.38	774.52	774.52	15.48	773.47
86	J-126A.2	773.48	774.62	774.62	15.48	773.57
87	J-127.1	773.90	775.04	775.04	15.48	773.98
88	J-127.2	773.91	775.05	775.05	15.48	774.01
89	J-127.3	774.00	775.14	775.14	15.48	774.10
90	J-127.4	774.01	775.15	775.15	15.48	774.10
91	J-128.1	774.54	774.54	774.54	15.48	774.63
92	J-128.2	774.65	774.65	774.65	15.48	774.74
93	J-128.3	774.87	774.87	774.87	15.48	774.97
94	J-128.4	774.87	774.87	774.87	15.48	774.97
95	J-128.5	774.98	774.98	774.98	15.48	775.07
96	J-128.6	775.09	775.09	775.09	15.48	775.18
97	J-128.7	775.20	775.20	775.20	15.48	775.29
98	LS MH-107	739.40	806.36	0.00	41.35	756.88
99	W MH-100	760.61	765.16	765.16	26.28	760.94
100	W MH-101	759.16	764.44	764.44	26.00	759.48
101	W MH-102	758.21	763.72	763.72	26.08	758.53
102	W MH-102A	757.70	762.99	762.99	25.96	758.02
103	W MH-103	757.03	761.95	761.95	25.91	757.35
104	W MH-104	756.35	761.85	761.85	25.92	756.67
105	W MH-104A	755.84	760.87	760.87	25.92	756.16
106	W MH-105	755.21	761.16	761.16	25.91	755.53
107	W MH-106	754.58	759.83	759.83	25.89	754.90
108	W MH-84	776.94	778.86	778.86	25.80	777.07
109	W MH-85	776.26	778.72	778.72	26.26	776.59
110	W MH-86	775.57	778.15	778.15	26.14	775.87
111	W MH-87	773.79	775.91	775.91	26.44	774.09
112	W MH-88	773.24	775.36	775.36	25.97	773.57
113	W MH-89	772.46	775.66	775.66	25.93	772.78
114	W MH-90	771.83	773.97	773.97	25.90	772.15
115	W MH-91	770.76	774.02	774.02	25.95	771.09
116	W MH-92	769.68	772.24	772.24	25.94	769.98
117	W MH-93	768.52	772.15	772.15	25.96	768.85
118	W MH-94	767.41	771.31	771.31	27.40	767.72
119	W MH-95	766.13	769.53	769.53	26.92	766.46
120	W MH-96	765.13	768.53	768.53	26.20	765.45
121	W MH-97	764.73	768.16	768.16	26.07	765.04
122	W MH-98	763.10	767.64	767.64	26.78	763.41
123	W MH-99	761.67	772.31	772.31	26.57	762.00
124	Out-1Pipe - (270)	894.04			575.00	894.04

Oak Shores Interceptor Model
Monthly Average Flow

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (gpm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
1	IE-108.1	Pipe	J-108.1	LS MH-107	37.09	757.00	756.81	0.5100	15.000	0.0120	15.55	2248.09	0.01	1.17	0.07	0.06
2	IE-108.2	Pipe	J-108.2	J-108.1	37.35	757.15	757.00	0.4000	16.000	0.0120	15.55	2364.18	0.01	1.06	0.08	0.06
3	IE-108.3	Pipe	J-108.3	J-108.2	75.38	757.30	757.15	0.2000	16.000	0.0120	15.55	1668.48	0.01	0.83	0.09	0.07
4	IE-108.4	Pipe	E MH-108	J-108.3	146.66	757.70	757.30	0.2700	16.000	0.0120	15.55	1948.38	0.01	0.93	0.08	0.06
5	IE-109	Pipe	E MH-109	E MH-108	358.32	758.98	757.90	0.3000	16.000	0.0120	15.56	2048.25	0.01	0.97	0.08	0.06
6	IE-110	Pipe	E MH-110	E MH-109	312.58	760.10	759.18	0.2900	16.000	0.0120	15.56	2024.04	0.01	0.96	0.08	0.06
7	IE-111	Pipe	E MH-111	E MH-110	268.51	761.10	760.30	0.3000	16.000	0.0120	15.56	2036.45	0.01	0.97	0.08	0.06
8	IE-112	Pipe	E MH-112	E MH-111	142.21	761.72	761.30	0.3000	16.000	0.0120	15.56	2027.55	0.01	0.96	0.08	0.06
9	IE-113	Pipe	E MH-113	E MH-112	240.52	762.63	761.92	0.3000	16.000	0.0120	15.57	2027.03	0.01	0.96	0.08	0.06
10	IE-113A	Pipe	E MH-113A	E MH-113	461.82	764.22	762.83	0.3000	16.000	0.0120	15.57	2046.81	0.01	0.98	0.08	0.06
11	IE-114	Pipe	E MH-114	E MH-113A	108.68	764.73	764.42	0.2900	16.000	0.0120	15.51	1992.60	0.01	0.95	0.08	0.06
12	IE-115.1	Pipe	J-115.1	E MH-114	27.13	765.01	764.93	0.2900	16.000	0.0120	15.51	2025.87	0.01	0.96	0.08	0.06
13	IE-115.2	Pipe	J-115.2	J-115.1	30.98	765.10	765.01	0.2900	16.000	0.0120	15.51	2010.89	0.01	0.95	0.08	0.06
14	IE-115.3	Pipe	J-115.3	J-115.2	33.39	765.18	765.10	0.2400	16.000	0.0120	15.51	1826.15	0.01	0.89	0.09	0.07
15	IE-115.4	Pipe	J-115.4	J-115.3	31.30	765.27	765.18	0.2900	16.000	0.0120	15.51	2000.45	0.01	0.95	0.08	0.06
16	IE-115.5	Pipe	J-115.5	J-115.4	28.56	765.35	765.27	0.2800	16.000	0.0120	15.51	1974.74	0.01	0.94	0.08	0.06
17	IE-115.6	Pipe	J-115.6	J-115.5	28.59	765.43	765.35	0.2800	16.000	0.0120	15.51	1973.42	0.01	0.94	0.08	0.06
18	IE-115.7	Pipe	J-115.7	J-115.6	26.25	765.52	765.43	0.3400	16.000	0.0120	15.52	2184.37	0.01	1.01	0.08	0.06
19	IE-115.8	Pipe	E MH-115	J-115.7	25.83	765.62	765.52	0.3900	16.000	0.0120	15.52	2321.48	0.01	1.05	0.08	0.06
20	IE-116.1	Pipe	J-116.1	E MH-115	22.81	765.87	765.82	0.2200	16.000	0.0120	15.52	1746.81	0.01	0.86	0.09	0.07
21	IE-116.10	Pipe	J-116.10	J-116.9	13.35	766.25	766.21	0.3000	16.000	0.0120	15.53	2042.48	0.01	0.96	0.08	0.06
22	IE-116.11	Pipe	J-116.11	J-116.10	12.67	766.30	766.25	0.3900	16.000	0.0120	15.53	2343.91	0.01	1.06	0.08	0.06
23	IE-116.12	Pipe	J-116.12	J-116.11	11.46	766.35	766.30	0.4400	16.000	0.0120	15.53	2464.49	0.01	1.09	0.08	0.06
24	IE-116.13	Pipe	E MH-116	J-116.12	11.31	766.41	766.35	0.5300	16.000	0.0120	15.53	2717.18	0.01	1.16	0.07	0.05
25	IE-116.2	Pipe	J-116.2	J-116.1	13.94	765.91	765.87	0.2900	16.000	0.0120	15.52	1998.48	0.01	0.95	0.08	0.06
26	IE-116.3	Pipe	J-116.3	J-116.2	13.64	765.96	765.91	0.3700	16.000	0.0120	15.52	2258.67	0.01	1.03	0.08	0.06
27	IE-116.4	Pipe	J-116.4	J-116.3	27.15	766.01	765.96	0.1800	16.000	0.0120	15.52	1668.48	0.01	0.83	0.09	0.07
28	IE-116.5	Pipe	J-116.5	J-116.4	22.75	766.04	766.01	0.1300	16.000	0.0120	15.52	1668.48	0.01	0.83	0.09	0.07
29	IE-116.6	Pipe	J-116.6	J-116.5	13.38	766.08	766.04	0.3000	16.000	0.0120	15.52	2039.80	0.01	0.96	0.08	0.06
30	IE-116.7	Pipe	J-116.7	J-116.6	13.14	766.12	766.08	0.3000	16.000	0.0120	15.52	2058.77	0.01	0.97	0.08	0.06
31	IE-116.8	Pipe	J-116.8	J-116.7	12.54	766.17	766.12	0.4000	16.000	0.0120	15.53	2356.02	0.01	1.06	0.08	0.06
32	IE-116.9	Pipe	J-116.9	J-116.8	11.96	766.21	766.17	0.3300	16.000	0.0120	15.52	2157.62	0.01	1.00	0.08	0.06
33	IE-117	Pipe	E MH-117	E MH-116	207.20	767.22	766.61	0.2900	16.000	0.0120	15.53	2024.29	0.01	0.97	0.08	0.06
34	IE-118	Pipe	E MH-118	E MH-117	86.29	767.67	767.42	0.2900	16.000	0.0120	15.51	2008.14	0.01	0.95	0.08	0.06
35	IE-119.1	Pipe	J-119.1	E MH-118	28.83	767.92	767.87	0.1700	12.000	0.0120	15.52	774.73	0.02	0.86	0.10	0.10
36	IE-119.10	Pipe	J-119.10	J-119.9	23.64	768.34	768.27	0.3000	12.000	0.0120	15.53	942.61	0.02	0.99	0.09	0.09
37	IE-119.11	Pipe	E MH-119	J-119.10	12.53	768.40	768.34	0.4800	12.000	0.0120	15.53	1198.93	0.01	1.18	0.08	0.08
38	IE-119.2	Pipe	J-119.2	J-119.1	15.49	767.96	767.92	0.2600	12.000	0.0120	15.52	880.37	0.02	0.95	0.09	0.09
39	IE-119.3	Pipe	J-119.3	J-119.2	12.27	768.00	767.96	0.3300	12.000	0.0120	15.52	989.26	0.02	1.03	0.09	0.09
40	IE-119.4	Pipe	J-119.4	J-119.3	18.94	768.05	768.00	0.2600	12.000	0.0120	15.52	890.03	0.02	0.95	0.09	0.09
41	IE-119.5	Pipe	J-119.5	J-119.4	14.17	768.09	768.05	0.2800	12.000	0.0120	15.52	920.25	0.02	0.98	0.09	0.09
42	IE-119.6	Pipe	J-119.6	J-119.5	11.96	768.14	768.09	0.4200	12.000	0.0120	15.52	1119.99	0.01	1.13	0.08	0.08
43	IE-119.7	Pipe	J-119.7	J-119.6	17.29	768.19	768.14	0.2900	12.000	0.0120	15.52	931.47	0.02	0.99	0.09	0.09
44	IE-119.8	Pipe	J-119.8	J-119.7	16.52	768.23	768.19	0.2400	12.000	0.0120	15.52	852.36	0.02	0.92	0.09	0.09
45	IE-119.9	Pipe	J-119.9	J-119.8	11.72	768.27	768.23	0.3400	12.000	0.0120	15.52	1012.04	0.02	1.05	0.09	0.09
46	IE-120.1	Pipe	J-120.1	E MH-119	55.21	768.73	768.60	0.2400	12.000	0.0120	15.53	840.62	0.02	0.92	0.09	0.09
47	IE-120.2	Pipe	J-120.2	J-120.1	18.32	768.80	768.73	0.3800	12.000	0.0120	15.53	1070.96	0.01	1.09	0.08	0.08
48	IE-120.3	Pipe	J-120.3	J-120.2	15.49	768.86	768.80	0.3900	12.000	0.0120	15.53	1078.30	0.01	1.09	0.08	0.08
49	IE-120.4	Pipe	E MH-120	J-120.3	4.65	768.87	768.86	0.2200	12.000	0.0120	15.53	803.78	0.02	0.88	0.10	0.10
50	IE-121.1	Pipe	J-121.1	E MH-120	25.89	769.15	769.07	0.3100	12.000	0.0120	15.53	962.97	0.02	1.01	0.09	0.09
51	IE-121.2	Pipe	J-121.2	J-121.1	26.54	769.23	769.15	0.3000	12.000	0.0120	15.54	951.10	0.02	1.00	0.09	0.09
52	IE-121.3	Pipe	J-121.3	J-121.2	25.05	769.30	769.23	0.2800	12.000	0.0120	15.54	915.78	0.02	0.97	0.09	0.09
53	IE-121.4	Pipe	J-121.4	J-121.3	23.82	769.37	769.30	0.2900	12.000	0.0120	15.54	939.03	0.02	0.99	0.09	0.09
54	IE-121.5	Pipe	J-121.5	J-121.4	4.92	769.39	769.37	0.4100	12.000	0.0120	15.54	1104.26	0.01	1.11	0.08	0.08
55	IE-121.6	Pipe	E MH-121	J-121.5	58.97	769.55	769.39	0.2700	12.000	0.0120	15.54	902.35	0.02	0.97	0.09	0.09
56	IE-122.1	Pipe	J-122.1	E MH-121	3.12	769.76	769.75	0.3200	12.000	0.0120	15.55	981.46	0.02	1.02	0.09	0.09
57	IE-122.2	Pipe	J-122.2	J-122.1	15.67	769.81	769.76	0.3200	12.000	0.0120	15.55	978.69	0.02	1.02	0.09	0.09
58	IE-122.3	Pipe	E MH-122	J-122.2	38.77	769.91	769.81	0.2600	12.000	0.0120	15.55	879.78	0.02	0.95	0.09	0.09

Oak Shores Interceptor Model
Monthly Average Flow

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (gpm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
59	IE-123.1	Pipe	J-123.1	E MH-122	17.34	770.15	770.11	0.2300	12.000	0.0120	15.55	832.02	0.02	0.91	0.10	0.10
60	IE-123.2	Pipe	J-123.2	J-123.1	19.94	770.20	770.15	0.2500	12.000	0.0120	15.56	867.44	0.02	0.94	0.09	0.09
61	IE-123.3	Pipe	J-123.3	J-123.2	14.24	770.24	770.20	0.2800	12.000	0.0120	15.56	918.16	0.02	0.98	0.09	0.09
62	IE-123.4	Pipe	J-123.4	J-123.3	14.97	770.28	770.24	0.2700	12.000	0.0120	15.56	895.46	0.02	0.96	0.09	0.09
63	IE-123.5	Pipe	J-123.5	J-123.4	11.63	770.32	770.28	0.3400	12.000	0.0120	15.56	1015.95	0.02	1.05	0.09	0.09
64	IE-123.6	Pipe	IE-123.1	J-123.5	10.75	770.37	770.32	0.4600	12.000	0.0120	15.56	1181.19	0.01	1.17	0.08	0.08
65	IE-123.7	Pipe	E MH-123	IE-123.1	12.85	770.41	770.37	0.3100	12.000	0.0120	15.57	966.66	0.02	1.01	0.09	0.09
66	IE-124.1	Pipe	J-124.1	E MH-123	7.94	770.63	770.61	0.2500	12.000	0.0120	15.57	869.63	0.02	0.94	0.09	0.09
67	IE-124.2	Pipe	J-124.2	J-124.1	15.23	770.67	770.63	0.2600	12.000	0.0120	15.57	887.70	0.02	0.95	0.09	0.09
68	IE-124.3	Pipe	J-124.3	J-124.2	23.51	770.71	770.67	0.1700	12.000	0.0120	15.57	774.73	0.02	0.86	0.10	0.10
69	IE-124.4	Pipe	J-124.4	J-124.3	4.50	770.73	770.71	0.4400	12.000	0.0120	15.58	1155.11	0.01	1.15	0.08	0.08
70	IE-124.5	Pipe	J-124.5	J-124.4	18.01	770.80	770.73	0.3900	12.000	0.0120	15.58	1080.13	0.01	1.10	0.08	0.08
71	IE-124.6	Pipe	E MH-124	J-124.5	31.48	770.90	770.80	0.3200	12.000	0.0120	15.58	976.38	0.02	1.02	0.09	0.09
72	IE-124A	Pipe	E MH-124A	E MH-124	206.44	771.71	771.10	0.3000	12.000	0.0120	15.58	941.68	0.02	1.01	0.09	0.09
73	IE-125.1	Pipe	J-125.	E MH-124A	124.29	772.20	771.91	0.2300	12.000	0.0120	15.51	836.79	0.02	0.93	0.09	0.09
74	IE-125.2	Pipe	J-125.2	J-125.	4.58	772.22	772.20	0.4400	12.000	0.0120	15.48	1144.21	0.01	1.14	0.08	0.08
75	IE-125.3	Pipe	J-125.3	J-125.2	12.07	772.25	772.22	0.2500	12.000	0.0120	15.48	863.64	0.02	0.93	0.09	0.09
76	IE-125.4	Pipe	E MH-125	J-125.3	66.64	772.51	772.25	0.3900	12.000	0.0120	15.48	1082.05	0.01	1.10	0.08	0.08
77	IE-126.1	Pipe	J-126.1	E MH-125	58.71	772.86	772.71	0.2600	12.000	0.0120	15.48	875.62	0.02	0.95	0.09	0.09
78	IE-126.2	Pipe	J-126.2	J-126.1	3.46	772.87	772.86	0.2900	12.000	0.0120	15.48	931.16	0.02	0.98	0.09	0.09
79	IE-126.3	Pipe	J-126.3	J-126.2	18.10	772.89	772.87	0.1100	12.000	0.0120	15.48	774.73	0.02	0.86	0.10	0.10
80	IE-126.4	Pipe	J-126.4	J-126.3	7.35	772.90	772.89	0.1400	12.000	0.0120	15.48	774.73	0.02	0.86	0.10	0.10
81	IE-126.5	Pipe	E MH-126	J-126.4	55.60	773.12	772.90	0.4000	12.000	0.0120	15.48	1089.75	0.01	1.11	0.08	0.08
82	IE-126A.1	Pipe	J-126A.1	E MH-126	13.55	773.38	773.32	0.4400	12.000	0.0120	15.48	1152.91	0.01	1.15	0.08	0.08
83	IE-126A.2	Pipe	J-126A.2	J-126A.1	31.85	773.48	773.38	0.3100	12.000	0.0120	15.48	970.69	0.02	1.02	0.09	0.09
84	IE-126A.3	Pipe	E MH-126A	J-126A.2	72.49	773.66	773.48	0.2500	12.000	0.0120	15.48	863.25	0.02	0.94	0.09	0.09
85	IE-127.1	Pipe	J-127.1	E MH-126A	7.73	773.90	773.86	0.5200	12.000	0.0120	15.48	1246.54	0.01	1.21	0.08	0.08
86	IE-127.2	Pipe	J-127.2	J-127.1	2.64	773.91	773.90	0.3800	12.000	0.0120	15.48	1066.90	0.01	1.09	0.08	0.08
87	IE-127.3	Pipe	J-127.3	J-127.2	45.38	774.00	773.91	0.2000	12.000	0.0120	15.48	774.73	0.02	0.87	0.10	0.10
88	IE-127.4	Pipe	J-127.4	J-127.3	1.40	774.01	774.00	0.7100	12.000	0.0120	15.48	1464.28	0.01	1.35	0.07	0.07
89	IE-127.5	Pipe	E MH-127	J-127.4	69.97	774.23	774.01	0.3100	12.000	0.0120	15.48	971.41	0.02	1.03	0.09	0.09
90	IE-128.1	Pipe	J-128.1	E MH-127	38.85	774.54	774.43	0.2800	12.000	0.0120	15.48	921.77	0.02	0.98	0.09	0.09
91	IE-128.2	Pipe	J-128.2	J-128.1	38.66	774.65	774.54	0.2800	12.000	0.0120	15.48	924.01	0.02	0.99	0.09	0.09
92	IE-128.3	Pipe	J-128.3	J-128.2	39.02	774.76	774.65	0.2800	12.000	0.0120	15.48	1300.76	0.01	1.25	0.08	0.08
93	IE-128.4	Pipe	J-128.4	J-128.3	38.10	774.87	774.76	0.2900	12.000	0.0120	15.48	774.73	0.02	0.88	0.10	0.10
94	IE-128.5	Pipe	J-128.5	J-128.4	38.55	774.98	774.87	0.2900	12.000	0.0120	15.48	925.41	0.02	0.99	0.09	0.09
95	IE-128.6	Pipe	J-128.6	J-128.5	38.44	775.09	774.98	0.2900	12.000	0.0120	15.48	926.71	0.02	0.99	0.09	0.09
96	IE-128.7	Pipe	J-128.7	J-128.6	37.92	775.20	775.09	0.2900	12.000	0.0120	15.48	933.07	0.02	1.00	0.09	0.09
97	IE-128.8	Pipe	E MH-128	J-128.7	38.52	775.34	775.20	0.3600	12.000	0.0120	15.48	1044.36	0.01	1.11	0.08	0.08
98	IW-100	Pipe	W MH-100	W MH-101	435.67	760.61	759.36	0.2900	14.000	0.0150	26.00	1119.76	0.02	0.99	0.12	0.11
99	IW-101	Pipe	W MH-101	W MH-102	252.71	759.16	758.41	0.3000	14.000	0.0150	26.08	1138.85	0.02	0.97	0.12	0.11
100	IW-102	Pipe	W MH-102	W MH-102A	106.09	758.21	757.90	0.2900	14.000	0.0150	25.96	1130.03	0.02	0.95	0.12	0.11
101	IW-102A	Pipe	W MH-102A	W MH-103	160.50	757.70	757.23	0.2900	14.000	0.0150	25.91	1131.27	0.02	0.95	0.12	0.11
102	IW-103	Pipe	W MH-103	W MH-104	164.19	757.03	756.55	0.2900	14.000	0.0150	25.92	1130.32	0.02	0.95	0.12	0.11
103	IW-104	Pipe	W MH-104	W MH-104A	107.70	756.35	756.04	0.2900	14.000	0.0150	25.92	1121.55	0.02	0.94	0.12	0.11
104	IW-104A	Pipe	W MH-104A	W MH-105	147.50	755.84	755.41	0.2900	14.000	0.0150	25.91	1128.74	0.02	0.94	0.12	0.11
105	IW-105	Pipe	W MH-105	W MH-106	148.11	755.21	754.78	0.2900	14.000	0.0150	25.89	1126.41	0.02	0.94	0.12	0.11
106	IW-106	Pipe	W MH-106	LS MH-107	170.65	754.58	754.04	0.3200	14.000	0.0150	25.87	1175.98	0.02	0.98	0.12	0.10
107	IW-84	Pipe	W MH-84	W MH-85	164.84	776.94	776.46	0.2900	12.000	0.0150	26.26	747.85	0.04	1.07	0.13	0.13
108	IW-85	Pipe	W MH-85	W MH-86	65.86	776.26	775.77	0.7400	12.000	0.0150	26.14	1195.40	0.02	1.38	0.10	0.10
109	IW-86	Pipe	W MH-86	W MH-87	201.17	775.57	773.99	0.7900	12.000	0.0150	26.44	1228.22	0.02	1.46	0.10	0.10
110	IW-87	Pipe	W MH-87	W MH-88	125.98	773.79	773.44	0.2800	12.000	0.0150	25.97	730.47	0.04	1.00	0.13	0.13
111	IW-88	Pipe	W MH-88	W MH-89	144.79	773.24	772.66	0.4000	12.000	0.0150	25.93	877.13	0.03	1.12	0.12	0.12
112	IW-89	Pipe	W MH-89	W MH-90	111.66	772.46	772.03	0.3900	12.000	0.0150	25.90	860.03	0.03	1.10	0.12	0.12
113	IW-90	Pipe	W MH-90	W MH-91	290.72	771.83	770.96	0.3000	12.000	0.0150	25.95	758.14	0.03	1.02	0.13	0.13
114	IW-91	Pipe	W MH-91	W MH-92	129.24	770.76	769.88	0.6800	12.000	0.0150	25.94	1143.61	0.02	1.35	0.11	0.11
115	IW-92	Pipe	W MH-92	W MH-93	309.74	769.68	768.72	0.3100	12.000	0.0150	25.96	771.55	0.03	1.05	0.12	0.12
116	IW-93	Pipe	W MH-93	W MH-94	171.03	768.52	767.61	0.5300	12.000	0.0150	27.40	1010.91	0.03	1.27	0.11	0.11

Oak Shores Interceptor Model
Monthly Average Flow

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (gpm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio
117	IW-94	Pipe	W MH-94	W MH-95	358.35	767.41	766.33	0.3000	12.000	0.0150	26.92	760.83	0.04	1.05	0.13	0.13
118	IW-95	Pipe	W MH-95	W MH-96	203.67	766.13	765.33	0.3900	12.000	0.0150	26.20	868.57	0.03	1.13	0.12	0.12
119	IW-96	Pipe	W MH-96	W MH-97	45.43	765.13	764.93	0.4400	12.000	0.0150	26.07	921.88	0.03	1.16	0.11	0.12
120	IW-97	Pipe	W MH-97	W MH-98	277.05	764.73	763.30	0.5200	12.000	0.0150	26.78	995.32	0.03	1.24	0.11	0.11
121	IW-98	Pipe	W MH-98	W MH-99	420.55	763.10	761.87	0.2900	12.000	0.0150	26.57	749.50	0.04	1.04	0.13	0.13
122	IW-99	Pipe	W MH-99	W MH-100	294.33	761.67	760.81	0.2900	12.000	0.0150	26.28	749.13	0.04	1.02	0.13	0.13
123	LS-3	Pump	LS MH-107	Out-1Pipe - (270)		739.40	894.04				575.00					

Oak Shores Interceptor Model
Monthly Average Flow

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)
1	E MH-108	757.70	762.54	4.84	757.70	0.00	762.54
2	E MH-109	758.98	763.81	4.83	758.98	0.00	763.81
3	E MH-110	760.10	766.09	5.99	760.10	0.00	766.09
4	E MH-111	761.10	766.45	5.35	761.10	0.00	766.45
5	E MH-112	761.72	767.20	5.48	761.72	0.00	767.20
6	E MH-113	762.63	771.30	8.67	762.63	0.00	771.30
7	E MH-113A	764.22	769.18	4.96	764.22	0.00	769.18
8	E MH-114	764.73	769.18	4.45	764.73	0.00	769.18
9	E MH-115	765.62	771.17	5.55	765.62	0.00	771.17
10	E MH-116	766.41	771.85	5.44	766.41	0.00	771.85
11	E MH-117	767.22	773.54	6.32	767.22	0.00	773.54
12	E MH-118	767.67	772.00	4.33	767.67	0.00	772.00
13	E MH-119	768.40	774.31	5.91	768.40	0.00	774.31
14	E MH-120	768.87	773.14	4.27	768.87	0.00	773.14
15	E MH-121	769.55	773.05	3.50	769.55	0.00	773.05
16	E MH-122	769.91	774.35	4.44	769.91	0.00	774.35
17	E MH-123	770.41	773.00	2.59	770.41	0.00	773.00
18	E MH-124	770.90	775.02	4.12	770.90	0.00	775.02
19	E MH-124A	771.71	775.63	3.92	771.71	0.00	775.63
20	E MH-125	772.51	775.42	2.91	772.51	0.00	775.42
21	E MH-126	773.12	778.71	5.59	773.12	0.00	778.71
22	E MH-126A	773.66	776.98	3.32	773.66	0.00	776.98
23	E MH-127	774.23	777.70	3.47	774.23	0.00	777.70
24	E MH-128	775.34	778.50	3.16	775.34	0.00	778.50
25	IE-123.1	770.37	771.51	1.14	770.37	0.00	771.51
26	J-108.1	757.00	758.54	1.54	757.00	0.00	758.54
27	J-108.2	757.15	758.69	1.54	757.15	0.00	758.69
28	J-108.3	757.30	758.84	1.54	757.30	0.00	758.84
29	J-115.1	765.01	766.55	1.54	765.01	0.00	766.55
30	J-115.2	765.10	766.64	1.54	765.10	0.00	766.64
31	J-115.3	765.18	766.72	1.54	765.18	0.00	766.72
32	J-115.4	765.27	766.81	1.54	765.27	0.00	766.81
33	J-115.5	765.35	766.89	1.54	765.35	0.00	766.89
34	J-115.6	765.43	766.97	1.54	765.43	0.00	766.97
35	J-115.7	765.52	767.06	1.54	765.52	0.00	767.06
36	J-116.1	765.87	767.41	1.54	765.87	0.00	767.41
37	J-116.10	766.25	767.79	1.54	766.25	0.00	767.79
38	J-116.11	766.30	767.84	1.54	766.30	0.00	767.84
39	J-116.12	766.35	767.89	1.54	766.35	0.00	767.89
40	J-116.2	765.91	767.45	1.54	765.91	0.00	767.45
41	J-116.3	765.96	767.50	1.54	765.96	0.00	767.50
42	J-116.4	766.01	767.55	1.54	766.01	0.00	767.55
43	J-116.5	766.04	767.58	1.54	766.04	0.00	767.58
44	J-116.6	766.08	767.62	1.54	766.08	0.00	767.62
45	J-116.7	766.12	767.66	1.54	766.12	0.00	767.66
46	J-116.8	766.17	767.71	1.54	766.17	0.00	767.71
47	J-116.9	766.21	767.75	1.54	766.21	0.00	767.75
48	J-119.1	767.92	769.46	1.54	767.92	0.00	769.46
49	J-119.10	768.34	769.88	1.54	768.34	0.00	769.88
50	J-119.2	767.96	769.50	1.54	767.96	0.00	769.50
51	J-119.3	768.00	769.54	1.54	768.00	0.00	769.54
52	J-119.4	768.05	769.59	1.54	768.05	0.00	769.59
53	J-119.5	768.09	769.63	1.54	768.09	0.00	769.63
54	J-119.6	768.14	769.68	1.54	768.14	0.00	769.68
55	J-119.7	768.19	769.73	1.54	768.19	0.00	769.73
56	J-119.8	768.23	769.77	1.54	768.23	0.00	769.77
57	J-119.9	768.27	769.81	1.54	768.27	0.00	769.81
58	J-120.1	768.73	769.87	1.14	768.73	0.00	769.87
59	J-120.2	768.80	769.94	1.14	768.80	0.00	769.94
60	J-120.3	768.86	770.00	1.14	768.86	0.00	770.00
61	J-121.1	769.15	770.29	1.14	769.15	0.00	770.29
62	J-121.2	769.23	770.37	1.14	769.23	0.00	770.37
63	J-121.3	769.30	770.44	1.14	769.30	0.00	770.44
64	J-121.4	769.37	770.51	1.14	769.37	0.00	770.51
65	J-121.5	769.39	770.53	1.14	769.39	0.00	770.53
66	J-122.1	769.76	770.90	1.14	769.76	0.00	770.90
67	J-122.2	769.81	770.95	1.14	769.81	0.00	770.95
68	J-123.1	770.15	771.29	1.14	770.15	0.00	771.29
69	J-123.2	770.20	771.34	1.14	770.20	0.00	771.34
70	J-123.3	770.24	771.38	1.14	770.24	0.00	771.38
71	J-123.4	770.28	771.42	1.14	770.28	0.00	771.42
72	J-123.5	770.32	771.46	1.14	770.32	0.00	771.46
73	J-124.1	770.63	771.77	1.14	770.63	0.00	771.77
74	J-124.2	770.67	771.81	1.14	770.67	0.00	771.81
75	J-124.3	770.71	771.85	1.14	770.71	0.00	771.85
76	J-124.4	770.73	771.87	1.14	770.73	0.00	771.87
77	J-124.5	770.80	771.94	1.14	770.80	0.00	771.94
78	J-125.	772.20	773.34	1.14	772.20	0.00	773.34
79	J-125.2	772.22	773.36	1.14	772.22	0.00	773.36
80	J-125.3	772.25	773.39	1.14	772.25	0.00	773.39
81	J-126.1	772.86	774.00	1.14	772.86	0.00	774.00
82	J-126.2	772.87	774.01	1.14	772.87	0.00	774.01

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)
83	J-126.3	772.89	774.03	1.14	772.89	0.00	774.03
84	J-126.4	772.90	774.04	1.14	772.90	0.00	774.04
85	J-126A.1	773.38	774.52	1.14	773.38	0.00	774.52
86	J-126A.2	773.48	774.62	1.14	773.48	0.00	774.62
87	J-127.1	773.90	775.04	1.14	773.90	0.00	775.04
88	J-127.2	773.91	775.05	1.14	773.91	0.00	775.05
89	J-127.3	774.00	775.14	1.14	774.00	0.00	775.14
90	J-127.4	774.01	775.15	1.14	774.01	0.00	775.15
91	J-128.1	774.54	774.54	0.00	774.54	0.00	774.54
92	J-128.2	774.65	774.65	0.00	774.65	0.00	774.65
93	J-128.3	774.87	774.87	0.00	774.76	-0.11	774.87
94	J-128.4	774.87	774.87	0.00	774.87	0.00	774.87
95	J-128.5	774.98	774.98	0.00	774.98	0.00	774.98
96	J-128.6	775.09	775.09	0.00	775.09	0.00	775.09
97	J-128.7	775.20	775.20	0.00	775.20	0.00	775.20
98	LS MH-107	739.40	806.36	66.96	754.04	14.64	0.00
99	W MH-100	760.61	765.16	4.55	761.61	1.00	765.16
100	W MH-101	759.16	764.44	5.28	759.16	0.00	764.44
101	W MH-102	758.21	763.72	5.51	758.21	0.00	763.72
102	W MH-102A	757.70	762.99	5.29	757.70	0.00	762.99
103	W MH-103	757.03	761.95	4.92	757.03	0.00	761.95
104	W MH-104	756.35	761.85	5.50	756.35	0.00	761.85
105	W MH-104A	755.84	760.87	5.03	755.84	0.00	760.87
106	W MH-105	755.21	761.16	5.95	755.21	0.00	761.16
107	W MH-106	754.58	759.83	5.25	754.58	0.00	759.83
108	W MH-84	776.94	778.86	1.92	776.94	0.00	778.86
109	W MH-85	776.26	778.72	2.46	776.26	0.00	778.72
110	W MH-86	775.57	778.15	2.58	775.57	0.00	778.15
111	W MH-87	773.79	775.91	2.12	773.79	0.00	775.91
112	W MH-88	773.24	775.36	2.12	773.24	0.00	775.36
113	W MH-89	772.46	775.66	3.20	772.46	0.00	775.66
114	W MH-90	771.83	773.97	2.14	771.83	0.00	773.97
115	W MH-91	770.76	774.02	3.26	770.76	0.00	774.02
116	W MH-92	769.68	772.24	2.56	769.68	0.00	772.24
117	W MH-93	768.52	772.15	3.63	768.52	0.00	772.15
118	W MH-94	767.41	771.31	3.90	767.41	0.00	771.31
119	W MH-95	766.13	769.53	3.40	766.13	0.00	769.53
120	W MH-96	765.13	768.53	3.40	765.13	0.00	768.53
121	W MH-97	764.73	768.16	3.43	764.73	0.00	768.16
122	W MH-98	763.10	767.64	4.54	763.10	0.00	767.64
123	W MH-99	761.67	772.31	10.64	761.67	0.00	772.31

Oak Shores Interceptor Model
Monthly Average Flow

Junction Results

SN	Element ID	Peak Lateral Inflow (gpm)	Max HGL Elevation Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)
1	E MH-108	0.00	757.98	4.56	757.97	0.27
2	E MH-109	0.00	759.26	4.55	759.25	0.27
3	E MH-110	0.00	760.38	5.71	760.37	0.27
4	E MH-111	0.00	761.38	5.07	761.37	0.27
5	E MH-112	0.00	762.00	5.20	761.99	0.27
6	E MH-113	0.00	762.91	8.39	762.90	0.27
7	E MH-113A	0.00	764.50	4.68	764.49	0.27
8	E MH-114	0.00	765.01	4.17	765.00	0.27
9	E MH-115	0.00	765.91	5.26	765.90	0.28
10	E MH-116	0.00	766.69	5.16	766.68	0.27
11	E MH-117	0.00	767.50	6.04	767.49	0.27
12	E MH-118	0.00	767.97	4.03	767.95	0.28
13	E MH-119	0.00	768.69	5.62	768.68	0.28
14	E MH-120	0.00	769.16	3.98	769.14	0.27
15	E MH-121	0.00	769.84	3.21	769.82	0.27
16	E MH-122	0.00	770.20	4.15	770.19	0.28
17	E MH-123	0.00	770.70	2.30	770.69	0.28
18	E MH-124	0.00	771.19	3.83	771.18	0.28
19	E MH-124A	0.00	772.00	3.62	771.99	0.28
20	E MH-125	0.00	772.80	2.62	772.79	0.28
21	E MH-126	0.00	773.40	5.31	773.39	0.27
22	E MH-126A	0.00	773.94	3.04	773.93	0.27
23	E MH-127	0.00	774.52	3.18	774.51	0.28
24	E MH-128	15.48	775.42	3.08	775.41	0.07
25	IE-123.1	0.00	770.46	1.05	770.44	0.07
26	J-108.1	0.00	757.08	1.46	757.07	0.07
27	J-108.2	0.00	757.24	1.45	757.23	0.08
28	J-108.3	0.00	757.39	1.45	757.38	0.08
29	J-115.1	0.00	765.09	1.45	765.08	0.07
30	J-115.2	0.00	765.19	1.45	765.17	0.07
31	J-115.3	0.00	765.27	1.45	765.25	0.07
32	J-115.4	0.00	765.35	1.45	765.34	0.07
33	J-115.5	0.00	765.43	1.45	765.42	0.07
34	J-115.6	0.00	765.51	1.45	765.50	0.07
35	J-115.7	0.00	765.60	1.46	765.59	0.07
36	J-116.1	0.00	765.96	1.45	765.95	0.08
37	J-116.10	0.00	766.33	1.45	766.32	0.07
38	J-116.11	0.00	766.38	1.46	766.37	0.07
39	J-116.12	0.00	766.43	1.46	766.41	0.06
40	J-116.2	0.00	765.99	1.45	765.98	0.07
41	J-116.3	0.00	766.05	1.45	766.04	0.08
42	J-116.4	0.00	766.10	1.45	766.09	0.08
43	J-116.5	0.00	766.13	1.45	766.12	0.08
44	J-116.6	0.00	766.16	1.45	766.15	0.07
45	J-116.7	0.00	766.20	1.46	766.19	0.07
46	J-116.8	0.00	766.25	1.46	766.24	0.07
47	J-116.9	0.00	766.29	1.45	766.28	0.07
48	J-119.1	0.00	768.02	1.44	768.00	0.08
49	J-119.10	0.00	768.43	1.45	768.42	0.08
50	J-119.2	0.00	768.05	1.44	768.04	0.08
51	J-119.3	0.00	768.09	1.45	768.08	0.08
52	J-119.4	0.00	768.14	1.44	768.13	0.08
53	J-119.5	0.00	768.18	1.45	768.17	0.08
54	J-119.6	0.00	768.23	1.45	768.22	0.08
55	J-119.7	0.00	768.28	1.44	768.27	0.08
56	J-119.8	0.00	768.33	1.44	768.31	0.08
57	J-119.9	0.00	768.36	1.45	768.35	0.08
58	J-120.1	0.00	768.83	1.05	768.81	0.08
59	J-120.2	0.00	768.88	1.06	768.87	0.07
60	J-120.3	0.00	768.96	1.05	768.94	0.08
61	J-121.1	0.00	769.24	1.05	769.22	0.07
62	J-121.2	0.00	769.32	1.05	769.31	0.08
63	J-121.3	0.00	769.39	1.05	769.38	0.08
64	J-121.4	0.00	769.46	1.05	769.45	0.08
65	J-121.5	0.00	769.48	1.05	769.47	0.08
66	J-122.1	0.00	769.85	1.05	769.83	0.07
67	J-122.2	0.00	769.90	1.05	769.89	0.08
68	J-123.1	0.00	770.25	1.05	770.23	0.08
69	J-123.2	0.00	770.29	1.05	770.28	0.08
70	J-123.3	0.00	770.33	1.05	770.32	0.08
71	J-123.4	0.00	770.37	1.05	770.36	0.08
72	J-123.5	0.00	770.41	1.06	770.39	0.07
73	J-124.1	0.00	770.72	1.05	770.71	0.08
74	J-124.2	0.00	770.77	1.04	770.75	0.08
75	J-124.3	0.00	770.81	1.04	770.79	0.08
76	J-124.4	0.00	770.81	1.06	770.80	0.07
77	J-124.5	0.00	770.89	1.05	770.87	0.07
78	J-125.	0.00	772.30	1.05	772.28	0.08
79	J-125.2	0.00	772.31	1.05	772.30	0.08
80	J-125.3	0.00	772.34	1.05	772.33	0.08
81	J-126.1	0.00	772.95	1.05	772.94	0.08

Junction Results

SN	Element ID	Peak Lateral Inflow (gpm)	Max HGL Elevation Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)
82	J-126.2	0.00	772.97	1.04	772.95	0.08
83	J-126.3	0.00	772.99	1.04	772.97	0.08
84	J-126.4	0.00	773.00	1.04	772.98	0.08
85	J-126A.1	0.00	773.47	1.05	773.45	0.07
86	J-126A.2	0.00	773.57	1.05	773.56	0.08
87	J-127.1	0.00	773.98	1.06	773.97	0.07
88	J-127.2	0.00	774.01	1.04	773.99	0.08
89	J-127.3	0.00	774.10	1.04	774.08	0.08
90	J-127.4	0.00	774.10	1.05	774.08	0.07
91	J-128.1	0.00	774.63	0.91	774.62	0.08
92	J-128.2	0.00	774.74	0.91	774.73	0.08
93	J-128.3	0.00	774.97	0.90	774.95	0.08
94	J-128.4	0.00	774.97	0.90	774.95	0.08
95	J-128.5	0.00	775.07	0.91	775.06	0.08
96	J-128.6	0.00	775.18	0.91	775.17	0.08
97	J-128.7	0.00	775.29	0.91	775.28	0.08
98	LS MH-107	0.00	756.88	49.48	756.87	17.47
99	W MH-100	0.00	760.94	4.22	760.92	0.31
100	W MH-101	0.00	759.48	4.96	759.46	0.30
101	W MH-102	0.00	758.53	5.19	758.51	0.30
102	W MH-102A	0.00	758.02	4.97	758.00	0.30
103	W MH-103	0.00	757.35	4.60	757.33	0.30
104	W MH-104	0.00	756.67	5.18	756.65	0.30
105	W MH-104A	0.00	756.16	4.71	756.14	0.30
106	W MH-105	0.00	755.53	5.63	755.51	0.30
107	W MH-106	0.00	754.90	4.93	754.88	0.30
108	W MH-84	25.80	777.07	1.79	777.05	0.11
109	W MH-85	0.00	776.59	2.13	776.57	0.31
110	W MH-86	0.00	775.87	2.28	775.86	0.29
111	W MH-87	0.00	774.09	1.82	774.07	0.28
112	W MH-88	0.00	773.57	1.79	773.55	0.31
113	W MH-89	0.00	772.78	2.88	772.76	0.30
114	W MH-90	0.00	772.15	1.82	772.13	0.30
115	W MH-91	0.00	771.09	2.93	771.07	0.31
116	W MH-92	0.00	769.98	2.26	769.97	0.29
117	W MH-93	0.00	768.85	3.30	768.82	0.30
118	W MH-94	0.00	767.72	3.59	767.70	0.29
119	W MH-95	0.00	766.46	3.07	766.44	0.31
120	W MH-96	0.00	765.45	3.08	765.43	0.30
121	W MH-97	0.00	765.04	3.12	765.03	0.30
122	W MH-98	0.00	763.41	4.23	763.39	0.29
123	W MH-99	0.00	762.00	10.31	761.98	0.31

Oak Shores Interceptor Model
Monthly Average Flow

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Diameter or Height (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses
1	IE-108.1	37.09	757.00	756.81	17.41	0.19	0.5100	15.000	0.0120	0.5000	0.5000
2	IE-108.2	37.35	757.15	757.00	0.00	0.15	0.4000	15.960	0.0120	0.5000	0.5000
3	IE-108.3	75.38	757.30	757.15	0.00	0.15	0.2000	15.960	0.0120	0.5000	0.5000
4	IE-108.4	146.66	757.70	757.30	0.00	0.40	0.2700	15.960	0.0120	0.5000	0.5000
5	IE-109	358.32	758.98	757.90	0.20	1.08	0.3000	15.960	0.0120	0.5000	0.5000
6	IE-110	312.58	760.10	759.18	0.20	0.92	0.2900	15.960	0.0120	0.5000	0.5000
7	IE-111	268.51	761.10	760.30	0.20	0.80	0.3000	15.960	0.0120	0.5000	0.5000
8	IE-112	142.21	761.72	761.30	0.20	0.42	0.3000	15.960	0.0120	0.5000	0.5000
9	IE-113	240.52	762.63	761.92	0.20	0.71	0.3000	15.960	0.0120	0.5000	0.5000
10	IE-113A	461.82	764.22	762.83	0.20	1.39	0.3000	15.960	0.0120	0.5000	0.5000
11	IE-114	108.68	764.73	764.42	0.20	0.31	0.2900	15.960	0.0120	0.5000	0.5000
12	IE-115.1	27.13	765.01	764.93	0.20	0.08	0.2900	15.960	0.0120	0.5000	0.5000
13	IE-115.2	30.98	765.10	765.01	0.00	0.09	0.2900	15.960	0.0120	0.5000	0.5000
14	IE-115.3	33.39	765.18	765.10	0.00	0.08	0.2400	15.960	0.0120	0.5000	0.5000
15	IE-115.4	31.30	765.27	765.18	0.00	0.09	0.2900	15.960	0.0120	0.5000	0.5000
16	IE-115.5	28.56	765.35	765.27	0.00	0.08	0.2800	15.960	0.0120	0.5000	0.5000
17	IE-115.6	28.59	765.43	765.35	0.00	0.08	0.2800	15.960	0.0120	0.5000	0.5000
18	IE-115.7	26.25	765.52	765.43	0.00	0.09	0.3400	15.960	0.0120	0.5000	0.5000
19	IE-115.8	25.83	765.62	765.52	0.00	0.10	0.3900	15.960	0.0120	0.5000	0.5000
20	IE-116.1	22.81	765.87	765.82	0.20	0.05	0.2200	15.960	0.0120	0.5000	0.5000
21	IE-116.10	13.35	766.25	766.21	0.00	0.04	0.3000	15.960	0.0120	0.5000	0.5000
22	IE-116.11	12.67	766.30	766.25	0.00	0.05	0.3900	15.960	0.0120	0.5000	0.5000
23	IE-116.12	11.46	766.35	766.30	0.00	0.05	0.4400	15.960	0.0120	0.5000	0.5000
24	IE-116.13	11.31	766.41	766.35	0.00	0.06	0.5300	15.960	0.0120	0.5000	0.5000
25	IE-116.2	13.94	765.91	765.87	0.00	0.04	0.2900	15.960	0.0120	0.5000	0.5000
26	IE-116.3	13.64	765.96	765.91	0.00	0.05	0.3700	15.960	0.0120	0.5000	0.5000
27	IE-116.4	27.15	766.01	765.96	0.00	0.05	0.1800	15.960	0.0120	0.5000	0.5000
28	IE-116.5	22.75	766.04	766.01	0.00	0.03	0.1300	15.960	0.0120	0.5000	0.5000
29	IE-116.6	13.38	766.08	766.04	0.00	0.04	0.3000	15.960	0.0120	0.5000	0.5000
30	IE-116.7	13.14	766.12	766.08	0.00	0.04	0.3000	15.960	0.0120	0.5000	0.5000
31	IE-116.8	12.54	766.17	766.12	0.00	0.05	0.4000	15.960	0.0120	0.5000	0.5000
32	IE-116.9	11.96	766.21	766.17	0.00	0.04	0.3300	15.960	0.0120	0.5000	0.5000
33	IE-117	207.20	767.22	766.61	0.20	0.61	0.2900	15.960	0.0120	0.5000	0.5000
34	IE-118	86.29	767.67	767.42	0.20	0.25	0.2900	15.960	0.0120	0.5000	0.5000
35	IE-119.1	28.83	767.92	767.87	0.20	0.05	0.1700	12.000	0.0120	0.5000	0.5000
36	IE-119.10	23.64	768.34	768.27	0.00	0.07	0.3000	12.000	0.0120	0.5000	0.5000
37	IE-119.11	12.53	768.40	768.34	0.00	0.06	0.4800	12.000	0.0120	0.5000	0.5000
38	IE-119.2	15.49	767.96	767.92	0.00	0.04	0.2600	12.000	0.0120	0.5000	0.5000
39	IE-119.3	12.27	768.00	767.96	0.00	0.04	0.3300	12.000	0.0120	0.5000	0.5000
40	IE-119.4	18.94	768.05	768.00	0.00	0.05	0.2600	12.000	0.0120	0.5000	0.5000
41	IE-119.5	14.17	768.09	768.05	0.00	0.04	0.2800	12.000	0.0120	0.5000	0.5000
42	IE-119.6	11.96	768.14	768.09	0.00	0.05	0.4200	12.000	0.0120	0.5000	0.5000
43	IE-119.7	17.29	768.19	768.14	0.00	0.05	0.2900	12.000	0.0120	0.5000	0.5000
44	IE-119.8	16.52	768.23	768.19	0.00	0.04	0.2400	12.000	0.0120	0.5000	0.5000
45	IE-119.9	11.72	768.27	768.23	0.00	0.04	0.3400	12.000	0.0120	0.5000	0.5000
46	IE-120.1	55.21	768.73	768.60	0.20	0.13	0.2400	12.000	0.0120	0.5000	0.5000
47	IE-120.2	18.32	768.80	768.73	0.00	0.07	0.3800	12.000	0.0120	0.5000	0.5000
48	IE-120.3	15.49	768.86	768.80	0.00	0.06	0.3900	12.000	0.0120	0.5000	0.5000
49	IE-120.4	4.65	768.87	768.86	0.00	0.01	0.2200	12.000	0.0120	0.5000	0.5000
50	IE-121.1	25.89	769.15	769.07	0.20	0.08	0.3100	12.000	0.0120	0.5000	0.5000
51	IE-121.2	26.54	769.23	769.15	0.00	0.08	0.3000	12.000	0.0120	0.5000	0.5000
52	IE-121.3	25.05	769.30	769.23	0.00	0.07	0.2800	12.000	0.0120	0.5000	0.5000
53	IE-121.4	23.82	769.37	769.30	0.00	0.07	0.2900	12.000	0.0120	0.5000	0.5000
54	IE-121.5	4.92	769.39	769.37	0.00	0.02	0.4100	12.000	0.0120	0.5000	0.5000
55	IE-121.6	58.97	769.55	769.39	0.00	0.16	0.2700	12.000	0.0120	0.5000	0.5000
56	IE-122.1	3.12	769.76	769.75	0.20	0.01	0.3200	12.000	0.0120	0.5000	0.5000
57	IE-122.2	15.67	769.81	769.76	0.00	0.05	0.3200	12.000	0.0120	0.5000	0.5000
58	IE-122.3	38.77	769.91	769.81	0.00	0.10	0.2600	12.000	0.0120	0.5000	0.5000
59	IE-123.1	17.34	770.15	770.11	0.20	0.04	0.2300	12.000	0.0120	0.5000	0.5000
60	IE-123.2	19.94	770.20	770.15	0.00	0.05	0.2500	12.000	0.0120	0.5000	0.5000
61	IE-123.3	14.24	770.24	770.20	0.00	0.04	0.2800	12.000	0.0120	0.5000	0.5000
62	IE-123.4	14.97	770.28	770.24	0.00	0.04	0.2700	12.000	0.0120	0.5000	0.5000
63	IE-123.5	11.63	770.32	770.28	0.00	0.04	0.3400	12.000	0.0120	0.5000	0.5000
64	IE-123.6	10.75	770.37	770.32	0.00	0.05	0.4600	12.000	0.0120	0.5000	0.5000
65	IE-123.7	12.85	770.41	770.37	0.00	0.04	0.3100	12.000	0.0120	0.5000	0.5000
66	IE-124.1	7.94	770.63	770.61	0.20	0.02	0.2500	12.000	0.0120	0.5000	0.5000
67	IE-124.2	15.23	770.67	770.63	0.00	0.04	0.2600	12.000	0.0120	0.5000	0.5000
68	IE-124.3	23.51	770.71	770.67	0.00	0.04	0.1700	12.000	0.0120	0.5000	0.5000
69	IE-124.4	4.50	770.73	770.71	0.00	0.02	0.4400	12.000	0.0120	0.5000	0.5000
70	IE-124.5	18.01	770.80	770.73	0.00	0.07	0.3900	12.000	0.0120	0.5000	0.5000
71	IE-124.6	31.48	770.90	770.80	0.00	0.10	0.3200	12.000	0.0120	0.5000	0.5000
72	IE-124A	206.44	771.71	771.10	0.20	0.61	0.3000	12.000	0.0120	0.5000	0.5000
73	IE-125.1	124.29	772.20	771.91	0.20	0.29	0.2300	12.000	0.0120	0.5000	0.5000
74	IE-125.2	4.58	772.22	772.20	0.00	0.02	0.4400	12.000	0.0120	0.5000	0.5000
75	IE-125.3	12.07	772.25	772.22	0.00	0.03	0.2500	12.000	0.0120	0.5000	0.5000
76	IE-125.4	66.64	772.51	772.25	0.00	0.26	0.3900	12.000	0.0120	0.5000	0.5000
77	IE-126.1	58.71	772.86	772.71	0.20	0.15	0.2600	12.000	0.0120	0.5000	0.5000
78	IE-126.2	3.46	772.87	772.86	0.00	0.01	0.2900	12.000	0.0120	0.5000	0.5000
79	IE-126.3	18.10	772.89	772.87	0.00	0.02	0.1100	12.000	0.0120	0.5000	0.5000
80	IE-126.4	7.35	772.90	772.89	0.00	0.01	0.1400	12.000	0.0120	0.5000	0.5000
81	IE-126.5	55.60	773.12	772.90	0.00	0.22	0.4000	12.000	0.0120	0.5000	0.5000
82	IE-126A.1	13.55	773.38	773.32	0.20	0.06	0.4400	12.000	0.0120	0.5000	0.5000

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Diameter or Height (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses
83	IE-126A.2	31.85	773.48	773.38	0.00	0.10	0.3100	12.000	0.0120	0.5000	0.5000
84	IE-126A.3	72.49	773.66	773.48	0.00	0.18	0.2500	12.000	0.0120	0.5000	0.5000
85	IE-127.1	7.73	773.90	773.86	0.20	0.04	0.5200	12.000	0.0120	0.5000	0.5000
86	IE-127.2	2.64	773.91	773.90	0.00	0.01	0.3800	12.000	0.0120	0.5000	0.5000
87	IE-127.3	45.38	774.00	773.91	0.00	0.09	0.2000	12.000	0.0120	0.5000	0.5000
88	IE-127.4	1.40	774.01	774.00	0.00	0.01	0.7100	12.000	0.0120	0.5000	0.5000
89	IE-127.5	69.97	774.23	774.01	0.00	0.22	0.3100	12.000	0.0120	0.5000	0.5000
90	IE-128.1	38.85	774.54	774.43	0.20	0.11	0.2800	12.000	0.0120	0.5000	0.5000
91	IE-128.2	38.66	774.65	774.54	0.00	0.11	0.2800	12.000	0.0120	0.5000	0.5000
92	IE-128.3	39.02	774.76	774.65	0.00	0.11	0.2800	12.000	0.0120	0.5000	0.5000
93	IE-128.4	38.10	774.87	774.76	-0.11	0.11	0.2900	12.000	0.0120	0.5000	0.5000
94	IE-128.5	38.55	774.98	774.87	0.00	0.11	0.2900	12.000	0.0120	0.5000	0.5000
95	IE-128.6	38.44	775.09	774.98	0.00	0.11	0.2900	12.000	0.0120	0.5000	0.5000
96	IE-128.7	37.92	775.20	775.09	0.00	0.11	0.2900	12.000	0.0120	0.5000	0.5000
97	IE-128.8	38.52	775.34	775.20	0.00	0.14	0.3600	12.000	0.0120	0.5000	0.5000
98	IW-100	435.67	760.61	759.36	0.20	1.25	0.2900	14.040	0.0150	0.5000	0.5000
99	IW-101	252.71	759.16	758.41	0.20	0.75	0.3000	14.040	0.0150	0.5000	0.5000
100	IW-102	106.09	758.21	757.90	0.20	0.31	0.2900	14.040	0.0150	0.5000	0.5000
101	IW-102A	160.50	757.70	757.23	0.20	0.47	0.2900	14.040	0.0150	0.5000	0.5000
102	IW-103	164.19	757.03	756.55	0.20	0.48	0.2900	14.040	0.0150	0.5000	0.5000
103	IW-104	107.70	756.35	756.04	0.20	0.31	0.2900	14.040	0.0150	0.5000	0.5000
104	IW-104A	147.50	755.84	755.41	0.20	0.43	0.2900	14.040	0.0150	0.5000	0.5000
105	IW-105	148.11	755.21	754.78	0.20	0.43	0.2900	14.040	0.0150	0.5000	0.5000
106	IW-106	170.65	754.58	754.04	14.64	0.54	0.3200	14.040	0.0150	0.5000	0.5000
107	IW-84	164.84	776.94	776.46	0.20	0.48	0.2900	12.000	0.0150	0.5000	0.5000
108	IW-85	65.86	776.26	775.77	0.20	0.49	0.7400	12.000	0.0150	0.5000	0.5000
109	IW-86	201.17	775.57	773.99	0.20	1.58	0.7900	12.000	0.0150	0.5000	0.5000
110	IW-87	125.98	773.79	773.44	0.20	0.35	0.2800	12.000	0.0150	0.5000	0.5000
111	IW-88	144.79	773.24	772.66	0.20	0.58	0.4000	12.000	0.0150	0.5000	0.5000
112	IW-89	111.66	772.46	772.03	0.20	0.43	0.3900	12.000	0.0150	0.5000	0.5000
113	IW-90	290.72	771.83	770.96	0.20	0.87	0.3000	12.000	0.0150	0.5000	0.5000
114	IW-91	129.24	770.76	769.88	0.20	0.88	0.6800	12.000	0.0150	0.5000	0.5000
115	IW-92	309.74	769.68	768.72	0.20	0.96	0.3100	12.000	0.0150	0.5000	0.5000
116	IW-93	171.03	768.52	767.61	0.20	0.91	0.5300	12.000	0.0150	0.5000	0.5000
117	IW-94	358.35	767.41	766.33	0.20	1.08	0.3000	12.000	0.0150	0.5000	0.5000
118	IW-95	203.67	766.13	765.33	0.20	0.80	0.3900	12.000	0.0150	0.5000	0.5000
119	IW-96	45.43	765.13	764.93	0.20	0.20	0.4400	12.000	0.0150	0.5000	0.5000
120	IW-97	277.05	764.73	763.30	0.20	1.43	0.5200	12.000	0.0150	0.5000	0.5000
121	IW-98	420.55	763.10	761.87	0.20	1.23	0.2900	12.000	0.0150	0.5000	0.5000
122	IW-99	294.33	761.67	760.81	0.20	0.86	0.2900	12.000	0.0150	0.5000	0.5000

Oak Shores Interceptor Model
Monthly Average Flow

Pipe Results

SN	Element ID	Peak Flow (gpm)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	IE-108.1	15.55	212 00:46	2248.09	0.01	1.17	0.53	0.07	0.06	0.00		Calculated
2	IE-108.2	15.55	212 00:46	2364.18	0.01	1.06	0.59	0.08	0.06	0.00		Calculated
3	IE-108.3	15.55	212 00:45	1668.48	0.01	0.83	1.51	0.09	0.07	0.00		Calculated
4	IE-108.4	15.55	212 00:44	1948.38	0.01	0.93	2.63	0.08	0.06	0.00		Calculated
5	IE-109	15.56	212 00:43	2048.25	0.01	0.97	6.16	0.08	0.06	0.00		Calculated
6	IE-110	15.56	212 00:39	2024.04	0.01	0.96	5.43	0.08	0.06	0.00		Calculated
7	IE-111	15.56	212 00:36	2036.45	0.01	0.97	4.61	0.08	0.06	0.00		Calculated
8	IE-112	15.56	212 00:34	2027.55	0.01	0.96	2.47	0.08	0.06	0.00		Calculated
9	IE-113	15.57	212 00:32	2027.03	0.01	0.96	4.18	0.08	0.06	0.00		Calculated
10	IE-113A	15.57	212 00:30	2046.81	0.01	0.98	7.85	0.08	0.06	0.00		Calculated
11	IE-114	15.51	212 00:26	1992.60	0.01	0.95	1.91	0.08	0.06	0.00		Calculated
12	IE-115.1	15.51	212 00:25	2025.87	0.01	0.96	0.47	0.08	0.06	0.00		Calculated
13	IE-115.2	15.51	212 00:25	2010.89	0.01	0.95	0.54	0.08	0.06	0.00		Calculated
14	IE-115.3	15.51	212 00:25	1826.15	0.01	0.89	0.63	0.09	0.07	0.00		Calculated
15	IE-115.4	15.51	212 00:24	2000.45	0.01	0.95	0.55	0.08	0.06	0.00		Calculated
16	IE-115.5	15.51	212 00:24	1974.74	0.01	0.94	0.51	0.08	0.06	0.00		Calculated
17	IE-115.6	15.51	212 00:23	1973.42	0.01	0.94	0.51	0.08	0.06	0.00		Calculated
18	IE-115.7	15.52	212 00:23	2184.37	0.01	1.01	0.43	0.08	0.06	0.00		Calculated
19	IE-115.8	15.52	212 00:23	2321.48	0.01	1.05	0.41	0.08	0.06	0.00		Calculated
20	IE-116.1	15.52	212 00:23	1746.81	0.01	0.86	0.44	0.09	0.07	0.00		Calculated
21	IE-116.10	15.53	212 00:21	2042.48	0.01	0.96	0.23	0.08	0.06	0.00		Calculated
22	IE-116.11	15.53	212 00:21	2343.91	0.01	1.06	0.20	0.08	0.06	0.00		Calculated
23	IE-116.12	15.53	212 00:21	2464.49	0.01	1.09	0.18	0.08	0.06	0.00		Calculated
24	IE-116.13	15.53	212 00:20	2717.18	0.01	1.16	0.16	0.07	0.05	0.00		Calculated
25	IE-116.2	15.52	212 00:22	1998.48	0.01	0.95	0.24	0.08	0.06	0.00		Calculated
26	IE-116.3	15.52	212 00:22	2258.67	0.01	1.03	0.22	0.08	0.06	0.00		Calculated
27	IE-116.4	15.52	212 00:22	1668.48	0.01	0.83	0.55	0.09	0.07	0.00		Calculated
28	IE-116.5	15.52	212 00:22	1668.48	0.01	0.83	0.46	0.09	0.07	0.00		Calculated
29	IE-116.6	15.52	212 00:21	2039.80	0.01	0.96	0.23	0.08	0.06	0.00		Calculated
30	IE-116.7	15.52	212 00:21	2058.77	0.01	0.97	0.23	0.08	0.06	0.00		Calculated
31	IE-116.8	15.53	212 00:21	2356.02	0.01	1.06	0.20	0.08	0.06	0.00		Calculated
32	IE-116.9	15.52	212 00:21	2157.62	0.01	1.00	0.20	0.08	0.06	0.00		Calculated
33	IE-117	15.53	212 00:20	2024.29	0.01	0.97	3.56	0.08	0.06	0.00		Calculated
34	IE-118	15.51	212 00:18	2008.14	0.01	0.95	1.51	0.08	0.06	0.00		Calculated
35	IE-119.1	15.52	212 00:18	774.73	0.02	0.86	0.56	0.10	0.10	0.00		Calculated
36	IE-119.10	15.53	212 00:16	942.61	0.02	0.99	0.40	0.09	0.09	0.00		Calculated
37	IE-119.11	15.53	212 00:16	1198.93	0.01	1.18	0.18	0.08	0.08	0.00		Calculated
38	IE-119.2	15.52	212 00:17	880.37	0.02	0.95	0.27	0.09	0.09	0.00		Calculated
39	IE-119.3	15.52	212 00:17	989.26	0.02	1.03	0.20	0.09	0.09	0.00		Calculated
40	IE-119.4	15.52	212 00:17	890.03	0.02	0.95	0.33	0.09	0.09	0.00		Calculated
41	IE-119.5	15.52	212 00:17	920.25	0.02	0.98	0.24	0.09	0.09	0.00		Calculated
42	IE-119.6	15.52	212 00:16	1119.99	0.01	1.13	0.18	0.08	0.08	0.00		Calculated
43	IE-119.7	15.52	212 00:16	931.47	0.02	0.99	0.29	0.09	0.09	0.00		Calculated
44	IE-119.8	15.52	212 00:16	852.36	0.02	0.92	0.30	0.09	0.09	0.00		Calculated
45	IE-119.9	15.52	212 00:16	1012.04	0.02	1.05	0.19	0.09	0.09	0.00		Calculated
46	IE-120.1	15.53	212 00:15	840.62	0.02	0.92	1.00	0.09	0.09	0.00		Calculated
47	IE-120.2	15.53	212 00:15	1070.96	0.01	1.09	0.28	0.08	0.08	0.00		Calculated
48	IE-120.3	15.53	212 00:15	1078.30	0.01	1.09	0.24	0.08	0.08	0.00		Calculated
49	IE-120.4	15.53	212 00:14	803.78	0.02	0.88	0.09	0.10	0.10	0.00		Calculated
50	IE-121.1	15.53	212 00:14	962.97	0.02	1.01	0.43	0.09	0.09	0.00		Calculated
51	IE-121.2	15.54	212 00:14	951.10	0.02	1.00	0.44	0.09	0.09	0.00		Calculated
52	IE-121.3	15.54	212 00:14	915.78	0.02	0.97	0.43	0.09	0.09	0.00		Calculated
53	IE-121.4	15.54	212 00:14	939.03	0.02	0.99	0.40	0.09	0.09	0.00		Calculated
54	IE-121.5	15.54	212 00:13	1104.26	0.01	1.11	0.07	0.08	0.08	0.00		Calculated
55	IE-121.6	15.54	212 00:13	902.35	0.02	0.97	1.01	0.09	0.09	0.00		Calculated
56	IE-122.1	15.55	212 00:13	981.46	0.02	1.02	0.05	0.09	0.09	0.00		Calculated
57	IE-122.2	15.55	212 00:13	978.69	0.02	1.02	0.26	0.09	0.09	0.00		Calculated
58	IE-122.3	15.55	212 00:12	879.78	0.02	0.95	0.68	0.09	0.09	0.00		Calculated
59	IE-123.1	15.55	212 00:12	832.02	0.02	0.91	0.32	0.10	0.10	0.00		Calculated
60	IE-123.2	15.56	212 00:12	867.44	0.02	0.94	0.35	0.09	0.09	0.00		Calculated
61	IE-123.3	15.56	212 00:11	918.16	0.02	0.98	0.24	0.09	0.09	0.00		Calculated
62	IE-123.4	15.56	212 00:11	895.46	0.02	0.96	0.26	0.09	0.09	0.00		Calculated
63	IE-123.5	15.56	212 00:11	1015.95	0.02	1.05	0.18	0.09	0.09	0.00		Calculated
64	IE-123.6	15.56	212 00:11	1181.19	0.01	1.17	0.15	0.08	0.08	0.00		Calculated
65	IE-123.7	15.57	212 00:11	966.66	0.02	1.01	0.21	0.09	0.09	0.00		Calculated
66	IE-124.1	15.57	212 00:11	869.63	0.02	0.94	0.14	0.09	0.09	0.00		Calculated
67	IE-124.2	15.57	212 00:11	887.70	0.02	0.95	0.27	0.09	0.09	0.00		Calculated
68	IE-124.3	15.57	212 00:10	774.73	0.02	0.86	0.46	0.10	0.10	0.00		Calculated
69	IE-124.4	15.58	212 00:10	1155.11	0.01	1.15	0.07	0.08	0.08	0.00		Calculated
70	IE-124.5	15.58	212 00:10	1080.13	0.01	1.10	0.27	0.08	0.08	0.00		Calculated
71	IE-124.6	15.58	212 00:10	976.38	0.02	1.02	0.51	0.09	0.09	0.00		Calculated
72	IE-124A	15.58	212 00:10	941.68	0.02	1.01	3.41	0.09	0.09	0.00		Calculated
73	IE-125.1	15.51	212 00:08	836.79	0.02	0.93	2.23	0.09	0.09	0.00		Calculated
74	IE-125.2	15.48	212 00:05	1144.21	0.01	1.14	0.07	0.08	0.08	0.00		Calculated
75	IE-125.3	15.48	212 00:05	863.64	0.02	0.93	0.22	0.09	0.09	0.00		Calculated
76	IE-125.4	15.48	212 00:05	1082.05	0.01	1.10	1.01	0.08	0.08	0.00		Calculated
77	IE-126.1	15.48	212 00:05	875.62	0.02	0.95	1.03	0.09	0.09	0.00		Calculated
78	IE-126.2	15.48	212 00:04	931.16	0.02	0.98	0.06	0.09	0.09	0.00		Calculated
79	IE-126.3	15.48	212 00:04	774.73	0.02	0.86	0.35	0.10	0.10	0.00		Calculated
80	IE-126.4	15.48	212 00:04	774.73	0.02	0.86	0.14	0.10	0.10	0.00		Calculated
81	IE-126.5	15.48	212 00:04	1089.75	0.01	1.11	0.83	0.08	0.08	0.00		Calculated

Oak Shores Interceptor Model
Monthly Average Flow

Pipe Results

SN	Element ID	Peak Flow (gpm)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (gpm)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
82	IE-126A.1	15.48	212 00:04	1152.91	0.01	1.15	0.20	0.08	0.08	0.00		Calculated
83	IE-126A.2	15.48	212 00:04	970.69	0.02	1.02	0.52	0.09	0.09	0.00		Calculated
84	IE-126A.3	15.48	212 00:03	863.25	0.02	0.94	1.29	0.09	0.09	0.00		Calculated
85	IE-127.1	15.48	181 00:10	1246.54	0.01	1.21	0.11	0.08	0.08	0.00		Calculated
86	IE-127.2	15.48	181 00:11	1066.90	0.01	1.09	0.04	0.08	0.08	0.00		Calculated
87	IE-127.3	15.48	212 00:02	774.73	0.02	0.87	0.87	0.10	0.10	0.00		Calculated
88	IE-127.4	15.48	212 00:01	1464.28	0.01	1.35	0.02	0.07	0.07	0.00		Calculated
89	IE-127.5	15.48	212 00:01	971.41	0.02	1.03	1.13	0.09	0.09	0.00		Calculated
90	IE-128.1	15.48	181 00:15	921.77	0.02	0.98	0.66	0.09	0.09	0.00		Calculated
91	IE-128.2	15.48	181 00:14	924.01	0.02	0.99	0.65	0.09	0.09	0.00		Calculated
92	IE-128.3	15.48	181 00:13	1300.76	0.01	1.25	0.52	0.08	0.08	0.00		Calculated
93	IE-128.4	15.48	181 00:13	774.73	0.02	0.88	0.72	0.10	0.10	0.00		Calculated
94	IE-128.5	15.48	181 00:10	925.41	0.02	0.99	0.65	0.09	0.09	0.00		Calculated
95	IE-128.6	15.48	181 00:09	926.71	0.02	0.99	0.65	0.09	0.09	0.00		Calculated
96	IE-128.7	15.48	181 00:08	933.07	0.02	1.00	0.63	0.09	0.09	0.00		Calculated
97	IE-128.8	15.48	181 00:06	1044.36	0.01	1.11	0.58	0.08	0.08	0.00		Calculated
98	IW-100	26.00	212 00:10	1119.76	0.02	0.99	7.33	0.12	0.11	0.00		Calculated
99	IW-101	26.08	212 00:10	1138.85	0.02	0.97	4.34	0.12	0.11	0.00		Calculated
100	IW-102	25.96	212 00:11	1130.03	0.02	0.95	1.86	0.12	0.11	0.00		Calculated
101	IW-102A	25.91	212 00:10	1131.27	0.02	0.95	2.82	0.12	0.11	0.00		Calculated
102	IW-103	25.92	212 00:21	1130.32	0.02	0.95	2.88	0.12	0.11	0.00		Calculated
103	IW-104	25.92	212 00:22	1121.55	0.02	0.94	1.91	0.12	0.11	0.00		Calculated
104	IW-104A	25.91	212 00:23	1128.74	0.02	0.94	2.62	0.12	0.11	0.00		Calculated
105	IW-105	25.89	212 00:24	1126.41	0.02	0.94	2.63	0.12	0.11	0.00		Calculated
106	IW-106	25.87	212 00:26	1175.98	0.02	0.98	2.90	0.12	0.10	0.00		Calculated
107	IW-84	26.26	212 00:00	747.85	0.04	1.07	2.57	0.13	0.13	0.00		Calculated
108	IW-85	26.14	212 00:00	1195.40	0.02	1.38	0.80	0.10	0.10	0.00		Calculated
109	IW-86	26.44	212 00:01	1228.22	0.02	1.46	2.30	0.10	0.10	0.00		Calculated
110	IW-87	25.97	212 00:02	730.47	0.04	1.00	2.10	0.13	0.13	0.00		Calculated
111	IW-88	25.93	212 00:03	877.13	0.03	1.12	2.15	0.12	0.12	0.00		Calculated
112	IW-89	25.90	212 00:04	860.03	0.03	1.10	1.69	0.12	0.12	0.00		Calculated
113	IW-90	25.95	212 00:06	758.14	0.03	1.02	4.75	0.13	0.13	0.00		Calculated
114	IW-91	25.94	212 00:07	1143.61	0.02	1.35	1.60	0.11	0.11	0.00		Calculated
115	IW-92	25.96	212 00:09	771.55	0.03	1.05	4.92	0.12	0.12	0.00		Calculated
116	IW-93	27.40	212 00:08	1010.91	0.03	1.27	2.24	0.11	0.11	0.00		Calculated
117	IW-94	26.92	212 00:11	760.83	0.04	1.05	5.69	0.13	0.13	0.00		Calculated
118	IW-95	26.20	212 00:08	868.57	0.03	1.13	3.00	0.12	0.12	0.00		Calculated
119	IW-96	26.07	212 00:12	921.88	0.03	1.16	0.65	0.11	0.12	0.00		Calculated
120	IW-97	26.78	181 00:31	995.32	0.03	1.24	3.72	0.11	0.11	0.00		Calculated
121	IW-98	26.57	212 00:20	749.50	0.04	1.04	6.74	0.13	0.13	0.00		Calculated
122	IW-99	26.28	212 00:10	749.13	0.04	1.02	4.81	0.13	0.13	0.00		Calculated

Date: 10/1/2015
Revised:
By: D.Pike

Oak Shores (CSA 7a) Risk Assessment Study
Recommended Improvements Estimate of Cost

Recommendation No.: 1
Name: Provide add'l flow monitoring devices, mech. & electrical improvements.

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Interceptor Line Flow Meters	EA	$3,500	6	$21,000	
Remote Reading Device Interface	EA	$650	6	$3,900	
Emergency Generator Transfer Switch	EA	$20,000	1	$20,000	
Interceptor Auto. Valve Placement	EA	$15,000	2	$30,000	
Remove Unused Lateral Connections	EA	$850	10	$8,500	
Clean & Video Interceptor	LS	$55,000	1	$55,000	
			Construction Subtotal:	**$138,400**	
OH & Const. Contingency:	37%			$51,208	
			With Contingency Adjustment:	**$189,608**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	3%			$5,688	Reduce from 5%
Environmental	10%	N/A		$0	
Design	12%			$22,753	Reduce from 20%
Right of Way	2%			$3,792	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	12%			$22,753	Reduce from 20%
			Total Project Cost:	**$244,594**	

Notes

1. PM, Design & CM reduced (Vendor participation)

Date: 10/1/2015
Revised:
By: D.Pike

Oak Shores (CSA 7a) Risk Assessment Study
Recommended Improvements Estimate of Cost

Recommendation No.: 2
Name: Perform Minor Immediate Repairs

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Rock Rip-Rap & Erosion Repair	LS	$20,000	1	$20,000	
Repair Laterals	LF	$15	1400	$21,000	
Replace laterals	LF	$30	1400	$42,000	
			Construction Subtotal:	**$83,000**	
OH & Const. Contingency:	37%			$30,710	
			With Contingency Adjustment:	**$113,710**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		0	
Project Management	5%			5,686	
Environmental	10%	N/A		0	
Design	20%			22,742	
Right of Way	2%			1,660	
Flagging	2%	N/A		0	
SWPPP	5%			5,686	
Construction Management & Inspect	20%			22,742	
			Total Project Cost:	**$172,225**	

Notes

1. Design+ Field Assessment and detailed Scope of Work
2. CM & Inspect = field supervision and redundant crews

Date: 10/1/2015
Revised:
By: D.Pike

Oak Shores (CSA 7a) Risk Assessment Study
Recommended Improvements Estimate of Cost

Recommendation No.: 3a
Name: Rehabilitate Manholes and Inceptors

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Clean,Repair,Line East Interceptor	LF	$40	4745	$189,800	
Rehab East Interceptor Manholes	EA	$2,500	24	$60,000	
Clean,Repair,Line West Interceptor	LF	$40	4905	$196,200	
Rehab West Interceptor Manholes	EA	$2,500	25	$62,500	
			Construction Subtotal:	**$508,500**	
OH & Const. Contingency:	37%			$188,145	
			With Contingency Adjustment:	**$696,645**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	5%			34,832	
Environmental	10%	N/A		0	
Design	20%			139,329	
Right of Way	2%			13,933	
Flagging	2%	N/A		0	
SWPPP	5%	N/A		0	
Construction Management & Inspect	20%			139,329	
			Total Project Cost:	**$1,024,068**	

Notes

1. Rehab Interceptors= Insitu Lining
2. Rehab Manholes= Spray liner in manholes & new gaskets

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study Revised: ______

Recommended Improvements Estimate of Cost By: D.Pike

Recommendation No.: 3b

Name: Rehabilitate some Manholes and relocate Portion of Interceptors

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Clean,Repair,Rehab East Interceptor	LF	$40	1212	$48,480	
Rehab East Interceptor Manholes	EA	$2,500	3	$7,500	
Clean,Repair,Rehab West Interceptor	LF	$40	2682	$107,280	
Rehab West Interceptor Manholes	EA	$2,500	15	$37,500	
Relocate Portion East Interceptor	LF	$150	3533	$529,950	
Relocate Portion West Interceptor	LF	$150	2223	$333,450	
New Manholes, East Interceptor	EA	$5,000	22	$110,000	
New Manholes, West Interceptor	EA	$5,000	12	$60,000	
New Lift Stations	EA	$45,000	3	$135,000	
Easement Acquisition	LS	$30,000	1	$30,000	
New Grinder pumps	EA	$4,500	16	$72,000	
			Construction Subtotal:	**$1,471,160**	
OH & Const. Contingency:	37%			$544,329	
			With Contingency Adjustment:	**$2,015,489**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%			$40,310	
Project Management	5%			$100,774	
Environmental	10%			$201,549	
Design	20%			$403,098	
Right of Way	2%			$40,310	
Flagging	2%			$40,310	
SWPPP	5%			$100,774	
Construction Management & Inspect	20%			$403,098	
			Total Project Cost:	**$3,345,712**	

Notes

1. Rehab Interceptors= Insitu Lining
2. Rehab Manholes= Spray liner in manholes & new gaskets

Date: 10/1/2015
Revised:
By: D.Pike

Oak Shores (CSA 7a) Risk Assessment Study
Recommended Improvements Estimate of Cost

Recommendation No.: 3c
Name: Recolate East & West Interceptors

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Relocate East Interceptor	LF	$150	4745	$711,750	
Rehab East Interceptor Manholes	EA	$2,500	24	$60,000	
Relocate West Interceptor	LF	$150	4905	$735,750	
Rehab West Interceptor Manholes	EA	$2,500	25	$62,500	
Grinder Pumps	EA	$4,500	25	$112,500	
Lift Stations	EA	$45,000	5	$225,000	
Easement Aqcuisition	LS	$50,000	1	$50,000	
			Construction Subtotal:	**$1,957,500**	
OH & Const. Contingency:	37%			$724,275	
			With Contingency Adjustment:	**$2,681,775**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%			$53,636	
Project Management	5%			$134,089	
Environmental	10%			$268,178	
Design	20%			$536,355	
Right of Way	2%			$53,636	
Flagging	2%			$53,636	
SWPPP	5%			$134,089	
Construction Management & Inspect	20%			$536,355	
			Total Project Cost:	**$4,451,747**	

Notes

1. Rehab Manholes= Spray Lining & new gaskets

Date: 10/1/2015
Revised:
By: D.Pike

Oak Shores (CSA 7a) Risk Assessment Study
Recommended Improvements Estimate of Cost

Recommendation No.: 4
Name: Provide Redundant Equipment & Alarms to LS #3

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Add Alarms & SCADA	LS	$4,500	1	$4,500	
Multiple Stage Sensors & SCADA	LS	$11,000	1	$11,000	
			Construction Subtotal:	**$15,500**	
OH & Const. Contingency:	37%			$5,735	
			With Contingency Adjustment:	**$21,235**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%			$425	
Project Management	5%			$1,062	
Environmental	10%	N/A		$0	
Design	20%			$4,247	
Right of Way	2%			$425	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%			$4,247	
			Total Project Cost:	**$31,640**	

Notes

1. Also Have rental agreement for BU Generator

Date: 10/1/2015
Revised:
By: D.Pike

Oak Shores (CSA 7a) Risk Assessment Study
Recommended Improvements Estimate of Cost

Recommendation No.: 5
Name: Provides SCADA Capability System-Wide

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Lake Level Monitor	EA	$1,500	1	$1,500	
Interceptor Flow Meter Monitor	EA	$1,500	6	$9,000	
WWTP Flow Monitor	EA	$1,500	1	$1,500	
Lift Station Pump Control/monitor	EA	$1,500	2	$3,000	
Lift Station Valve control/monitor	EA	$1,500	3	$4,500	
Emergency Power Monitor/Control	EA	$1,500	1	$1,500	
SCADA Infrastructure	EA	$20,000	1	$20,000	
Software & Training	EA	$5,000	1	$5,000	
			Construction Subtotal:	**$46,000**	
OH & Const. Contingency:	37%			$17,020	
			With Contingency Adjustment:	**$63,020**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%			$1,260.40	
Project Management	5%			$3,151	
Environmental	10%	N/A		$0	
Design	20%			$12,604	
Right of Way	2%			$1,260	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%			$12,604	
			Total Project Cost:	**$93,900**	

Notes

1. None

Date: 10/1/2015
Revised: ___________
By: D.Pike

Oak Shores (CSA 7a) Risk Assessment Study
Recommended Improvements Estimate of Cost

Recommendation No.: 6
Name: Provide Back-up Lift Station Pump & Lease/rent Generator

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Purchase 3rd pump	EA	$7,500	1	$7,500	
Storage for pump	EA	$1,500	1	$1,500	
		Construction Subtotal:		**$9,000**	
OH & Const. Contingency:	37%			$3,330	
		With Contingency Adjustment:		**$12,330**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%			$247	
Project Management	5%			$616.50	
Environmental	10%	N/A		$0	
Design	20%	N/A		$0	
Right of Way	2%	N/A		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%	N/A		$0	
		Total Project Cost:		**$13,193**	

Notes

1. None

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study
Revised: ______

Recommended Improvements Estimate of Cost
By: D.Pike

Recommendation No.: 7

Name: Perform Minor Immediate Repairs

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Grading, & subgrade Prep.	LS	$2,500	1	$2,500	
Base Place & Compact	LS	$4,500	1	$4,500	
A/C Pad & Berm	LS	$17,000	1	$17,000	
			Construction Subtotal:	**$24,000**	
OH & Const. Contingency:	37%			$8,880	
			With Contingency Adjustment:	**$32,880**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%			$658	
Project Management	5%			$1,644	
Environmental	10%	N/A		$0	
Design	20%			$6,576	
Right of Way	2%	**N/A**		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%			$6,576	
			Total Project Cost:	**$48,334**	

Notes

1. None

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study
Revised:

Recommended Improvements Estimate of Cost
By: D.Pike

Recommendation No.: 8

Name: Schedule Enhance Frequency of Inspections

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Write Inspection Procedures	LS	$8,000	1	$8,000	
			Construction Subtotal:	**$8,000**	
OH & Const. Contingency:	17%			$1,360	
			With Contingency Adjustment:	**$9,360**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	5%	N/A		$0	
Environmental	10%	N/A		$0	
Design	20%	N/A		$0	
Right of Way	2%	N/A		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%	N/A		$0	
			Total Project Cost:	**$9,360**	

Notes

1. None

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study Revised: ____

Recommended Improvements Estimate of Cost By: D.Pike

Recommendation No.: 9

Name: Develop GIS System

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Prepare basemap	EA	$9,500	1	$9,500	
Input Sewer Atlas Data	EA	$1,500	1	$1,500	
Input Sewer Function Attributes	EA	$1,500	1	$1,500	
Input Form and fields for Inspection	EA	$1,500	1	$1,500	
Input CO Assessors info	EA	$1,500	1	$1,500	
Tablet Device & Software	EA	$1,500	1	$1,500	
PC & Software	EA	$4,800	1	$4,800	
			Construction Subtotal:	**$21,800**	
OH & Const. Contingency:	17%			$3,706	
			With Contingency Adjustment:	**$25,506**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	**N/A**		$0.00	
Project Management	5%			$1,275	
Environmental	10%	**N/A**		$0.00	
Design	20%			$5,101	
Right of Way	2%	**N/A**		$0.00	
Flagging	2%	**N/A**		$0.00	
SWPPP	5%	**N/A**		$0.00	
Construction Management & Inspect	20%	**N/A**		$0.00	
			Total Project Cost:	**$31,883**	

Notes

1. None

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study
Revised:

Recommended Improvements Estimate of Cost
By: D.Pike

Recommendation No.: 10

Name: Develop a comprehensive set of emergengcy operation procedures

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Staff Time To Write Procedures	LS	$8,000	1	$8,000	
			Construction Subtotal:	**$8,000**	
OH & Const. Contingency:	17%			$1,360	
			With Contingency Adjustment:	**$9,360**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	5%	N/A		$0	
Environmental	10%	N/A		$0	
Design	20%	N/A		$0	
Right of Way	2%	N/A		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%	N/A		$0	
			Total Project Cost:	**$9,360**	

Notes

1. None

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study Revised:

Recommended Improvements Estimate of Cost By: D.Pike

Recommendation No.: 11

Name: Adopt enhanced system inspection procedures

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Staff Time To Write Procedures	LS	$5,000	1	$5,000	
			Construction Subtotal:	**$5,000**	
OH & Const. Contingency:	17%			$850	
			With Contingency Adjustment:	**$5,850**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	5%	N/A		$0	
Environmental	10%	N/A		$0	
Design	20%	N/A		$0	
Right of Way	2%	N/A		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%	N/A		$0	
			Total Project Cost:	**$5,850**	

Notes

1. None

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study
Revised:

Recommended Improvements Estimate of Cost
By: D.Pike

Recommendation No.: 12

Name: Ehance staff training

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Staff Time	LS	$10,000	1	$10,000	
			Construction Subtotal:	**$10,000**	
OH & Const. Contingency:	17%			$1,700	
			With Contingency Adjustment:	**$11,700**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	5%	N/A		$0	
Environmental	10%	N/A		$0	
Design	20%	N/A		$0	
Right of Way	2%	N/A		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%	N/A		$0	
			Total Project Cost:	**$11,700**	

Notes

1. None

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study
Revised:

Recommended Improvements Estimate of Cost
By: D.Pike

Recommendation No.: 13

Name: Prepare enhanced standard operating procedures (SOPs)

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Staff Time	LS	$8,000	1	$8,000	
			Construction Subtotal:	**$8,000**	
OH & Const. Contingency:	17%			$1,360	
			With Contingency Adjustment:	**$9,360**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	5%	N/A		$0	
Environmental	10%	N/A		$0	
Design	20%	N/A		$0	
Right of Way	2%	N/A		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%	N/A		$0	
			Total Project Cost:	**$9,360**	

Notes

1.None

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study

Revised: ________

Recommended Improvements Estimate of Cost

By: D.Pike

Recommendation No.: 14

Name: Implement operational improvements (Recommended by County)

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Staff Time	LS	$0	1	$0	TBD
			Construction Subtotal:	**$0**	
OH & Const. Contingency:	17%			$0	
			With Contingency Adjustment:	**$0**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	5%	N/A		$0	
Environmental	10%	N/A		$0	
Design	20%	N/A		$0	
Right of Way	2%	N/A		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%	N/A		$0	
			Total Project Cost:	**$0**	

Notes

1. These recommendations are to be developed by County Staff

Date: 10/1/2015

Oak Shores (CSA 7a) Risk Assessment Study Revised: ____________

Recommended Improvements Estimate of Cost By: D.Pike

Recommendation No.: 15

Name: Prepare Development Standards, Std Plans, Mapping Of Laterals & Easements

Item Description	Unit of Measure	Unit Cost	Quantity	Cost	Remarks
Survey & Mapping	LS	$12,000	1	$12,000	
Development Standards	LS	$7,500	1	$7,500	
Standard Details	LS	$7,500	1	$7,500	
			Construction Subtotal:	**$27,000**	
OH & Const. Contingency:	20%			$5,400	
			With Contingency Adjustment:	**$32,400**	
PROJECT COST FACTORS:					
Preliminary Engineering	2%	N/A		$0	
Project Management	5%	N/A		$0	
Environmental	10%	N/A		$0	
Design	20%	N/A		$0	
Right of Way	2%	N/A		$0	
Flagging	2%	N/A		$0	
SWPPP	5%	N/A		$0	
Construction Management & Inspect	20%	N/A		$0	
			Total Project Cost:	**$32,400**	

Notes

1. None

Appendix C System Layout Map

ATTENTION:

ALL UNDERGROUND UTILITIES AND SUBSTRUCTURES SHOWN HEREON WERE OBTAINED FROM THE BEST AVAILABLE SOURCES AND ARE PRESUMED TO BE ACCURATE AND COMPLETE, BUT SINCE THE INFORMATION WAS OBTAINED FROM OTHERS, THE OFFICE OF MNS ENGINEERS, INC. CANNOT GUARANTEE SAID INFORMATION AS BEING ACCURATE AND COMPLETE. IT SHALL BE THE CONTRACTOR'S SOLE RESPONSIBILITY TO VERIFY, LOCATE, AND PROTECT ALL UTILITIES AND SUBSTRUCTURES SHOWN OR NOT SHOWN.

CALL UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA TOLL FREE AT 1-800-422-4133 TWO WORKING DAYS BEFORE YOU DIG

UNAUTHORIZED CHANGES & USES

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

APPENDIX C

REV	DATE	BY	DESCRIPTION

SCALE: AS SHOWN

MNS ENGINEERS INC
16 N. Oak Street, 2nd Floor
Ventura, CA 93001
805.648.4840 Phone

ENGINEERING
PLANNING
SURVEYING
CONSTRUCTION MANAGEMENT

PROJECT ENGINEER
MNS Project Engineer — DATE
PROJECT MANAGER
MNS Project Manager — DATE

REVIEWED BY:
for Agency / Utility — DATE
REVIEWED BY:
for Agency / Utility — DATE

95% SUBMITTAL
COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS

OAK SHORES RISK ASSESSMENT
EAST AND WEST INTERCEPTOR SEWERLINE LOCATION

WORK ORDER NO. COSLO.110005

SHEET 1 OF 1 SHEETS

P:\COSLO County Of San Luis Obispo\COSLO.110005 Oak Shores Sewer Risk Study\Drawings\
Thu 04.Apr.13 10:58:16 AM

MNS ENGINEERS INC

Appendix D Alternative 3B Layout

ATTENTION:

ALL UNDERGROUND UTILITIES AND SUBSTRUCTURES SHOWN HEREON WERE OBTAINED FROM THE BEST AVAILABLE SOURCES AND ARE PRESUMED TO BE ACCURATE AND COMPLETE, BUT SINCE THE INFORMATION WAS OBTAINED FROM OTHERS, THE OFFICE OF MNS ENGINEERS, INC. CANNOT GUARANTEE SAID INFORMATION AS BEING ACCURATE AND COMPLETE. IT SHALL BE THE CONTRACTOR'S SOLE RESPONSIBILITY TO VERIFY, LOCATE, AND PROTECT ALL UTILITIES AND SUBSTRUCTURES SHOWN OR NOT SHOWN.

CALL UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA TOLL FREE AT 1–800–422–4133 TWO WORKING DAYS BEFORE YOU DIG

UNAUTHORIZED CHANGES & USES

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

APPENDIX E

REV	DATE	BY	DESCRIPTION

SCALE: AS SHOWN

MNS ENGINEERS INC
16 N. Oak Street, 2nd Floor
Ventura, CA 93001
805.648.4840 Phone

ENGINEERING
PLANNING
SURVEYING
CONSTRUCTION MANAGEMENT

PROJECT ENGINEER: MNS Project Engineer — DATE
PROJECT MANAGER: MNS Project Manager — DATE
REVIEWED BY: for Agency / Utility — DATE
REVIEWED BY: for Agency / Utility — DATE

95% SUBMITTAL
COUNTY OF SAN LUIS OBISPO, DEPARTMENT OF PUBLIC WORKS

OAK SHORES RISK ASSESSMENT
PARTIAL INTERCEPTOR RELOCATION ALTERNATIVE

WORK ORDER NO. COSLO.110005

SHEET 1 OF 1 SHEETS

P:\COSLO County Of San Luis Obispo\COSLO.110005 Oak Shores Sewer Risk Study\Drawings\

Wed 03.Apr.13 10:44:40 AM

ENGINEERS INC

Appendix E Alternative 3C Layout

LEGEND

- Existing Interceptor Sewer
- Existing Gravity Sewermain
- Existing Forcemain
- Concept Plan Gravity Sewermain
- Concept Plan Sewer Forcemain
- Existing Sewer Manhole
- Existing Sewer Cleanout
- Concept Plan Sewer Manhole
- Concept Plan Sewer Cleanout
- Existing Sewer Lift Station
- Concept Plan Sewer Lift Station
- (15) Concept Plan Improvement No.
- Concept Plan Grinder Pump Unit

N

SCALE

0 250 500

REVISIONS

Date	By	Comments
mo/day/yr	name	comments

SAN LUIS OBISPO COUNTY
PUBLIC WORKS DEPARTMENT

CSA 7A OAK SHORES
INTERCEPTOR BYPASS STUDY

CONCEPT PLAN SEWER COLLECTION
SYSTEM: EASTSIDE

(Rev 7/12/04) Oak_Shores_Interceptor_Bypass_Study.dwg

LEGEND

- Existing Interceptor Sewer
- Existing Gravity Sewermain
- Existing Forcemain
- Concept Plan Gravity Sewermain
- Concept Plan Sewer Forcemain
- Existing Sewer Manhole
- Existing Sewer Cleanout
- Concept Plan Sewer Manhole
- Concept Plan Sewer Cleanout
- Existing Sewer Lift Station
- Concept Plan Sewer Lift Station
- (15) Concept Plan Improvement No.
- Concept Plan Grinder Pump Unit

N

SCALE

0 250 500

REVISIONS		
Date mo/day/yr	By name	Comments comments

COUNTY OF SAN LUIS OBISPO, CALIFORNIA — ALCALDES 1850 — NOT FOR OURSELVES ALONE

SAN LUIS OBISPO COUNTY
PUBLIC WORKS DEPARTMENT

CSA 7A OAK SHORES
INTERCEPTOR BYPASS STUDY

CONCEPT PLAN SEWER COLLECTION
SYSTEM: WESTSIDE

(Rev 7/12/04) Oak_Shores_Interceptor_Bypass_Study.dwg