CITY OF
Oak Harbor
WHIDBEY ISLAND, WASHINGTON

Comprehensive Stormwater Drainage Plan

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COMPREHENSIVE STORMWATER DRAINAGE PLAN

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Cover Photo: Oak Harbor Area Aerial Photos from Island County Public Works Department Website (http://www.islandcounty.net/PublicWorks/DigitalPhotos/nwmap.htm)

City of Oak Harbor
Comprehensive Stormwater Drainage Plan

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CHAPTER 1.
INTRODUCTION

PURPOSE

The City of Oak Harbor has authorized an evaluation of the drainage and stormwater collection systems within the city limits and in adjacent surrounding areas in order to plan for existing and future infrastructure needs to reduce road and property flooding and reduce stormwater pollution. This report documents the surface water problems identified by the evaluation, assesses alternative solutions, and outlines a recommended capital improvement program (CIP) to solve the problems. It also includes an assessment of the city's stormwater rate structure to ensure that there will be adequate funds into the future to finance the identified improvements. The recommended CIP projects are prioritized to help guide the effective use of the city's limited funding resources.

OAK HARBOR STUDY AREA

The City of Oak Harbor is in the north central portion of Whidbey Island (see Figure 1-1). It lies in a topographic bowl that drains into Oak Harbor (see Figure 1-2). Some areas around the city core and within the study area lie outside the bowl and drain into other drainage systems that convey stormwater flows west to the Strait of Juan de Fuca. The entire study area covers 4,573.5 acres, or about 7.1 square miles. The central core of the city is heavily developed; portions of the study area outside the city core are generally lightly developed in comparison.

The drainage plan study area includes the City of Oak Harbor's urban growth area (UGA) and portions of the surrounding area that are tributary to the city's drainage system. It excludes the Seaplane Base, a portion of Naval Air Station Whidbey Island (NAS Whidbey) that is within the Oak Harbor city limits; drainage at the Seaplane Base is separate from that of the rest of the city.

Characteristics of the drainage network serving the city and surrounding area vary significantly with location. The system serving the core of the city is the largest and most highly developed and is almost entirely piped. This drainage area has previously been termed the "dry creek" basin. Surrounding areas to the west, identified as the "golf course" and "radio tower" basins, are much less developed and storm water runoff is typically conveyed through open ditches and creeks.

REPORT ORGANIZATION

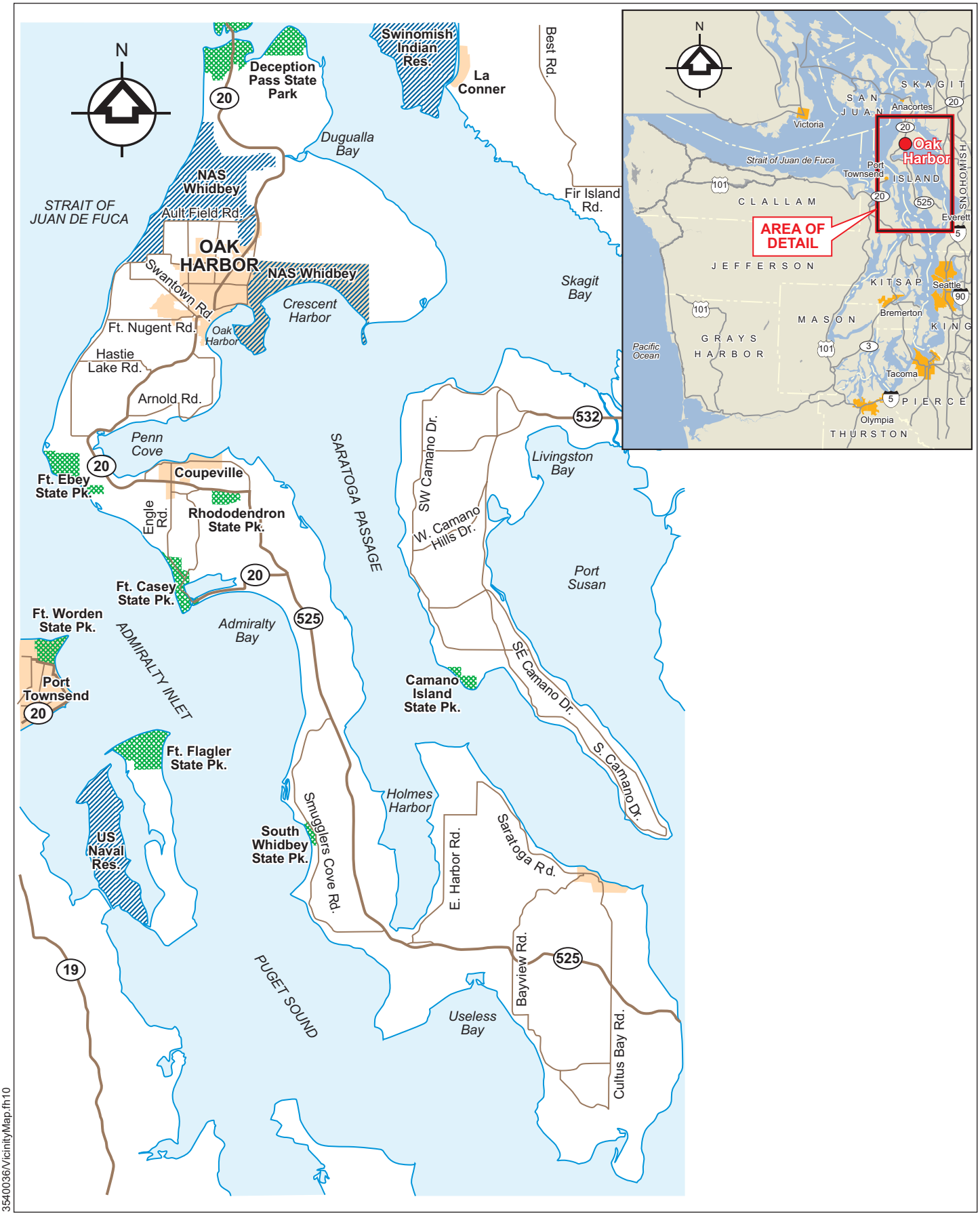
This report has been prepared to help determine existing and future surface water flooding problems and to evaluate and recommend solutions to these problems.

Where appropriate in this report, the study area is discussed as a whole. In some cases, such as the description of conveyance systems, discussions of individual drainage areas are presented as subsections.

Chapter 2 summarizes the drainage basins that compose the study area. The remaining chapters of the report describe the analyses performed and present the resulting recommendations:

- **Hydrologic/Hydraulic Modeling**—Hydrologic and hydraulic modeling was performed for the entire study area to determine the amount of stormwater runoff that would be generated at different locations for existing and future land use conditions. This analysis confirmed existing known problem areas and identified future problem areas. The hydrologic and hydraulic modeling is discussed in Chapter 3.

- **Improvement Alternatives**— A series of improvement alternatives were developed to address the identified problem areas. Alternatives were evaluated to determine which would best solve identified problems without causing additional problems. These analyses are described in Chapter 4.
- **Project Evaluation and Prioritization**—The improvements identified to correct drainage problems were evaluated based on their overall improvement and/or impact on drainage, habitat, and water quality. A process was developed to rank these projects in order of priority based upon the city's funding capacity. These analyses are summarized in Chapter 5.
- **NPDES Phase II**—The city has been labeled a "bubble" community for which the federal regulations provide discretion over whether a Phase II permit is required. The revised draft NPDES permit is scheduled to be released on February 15, 2006 which is expected to clarify whether Oak Harbor must meet Phase II requirements.
- **Recommended Plan Implementation**: The final chapter in the report describes the process of implementing the recommended plan. A discussion of the phasing of improvements is followed by a description of implementation issues.



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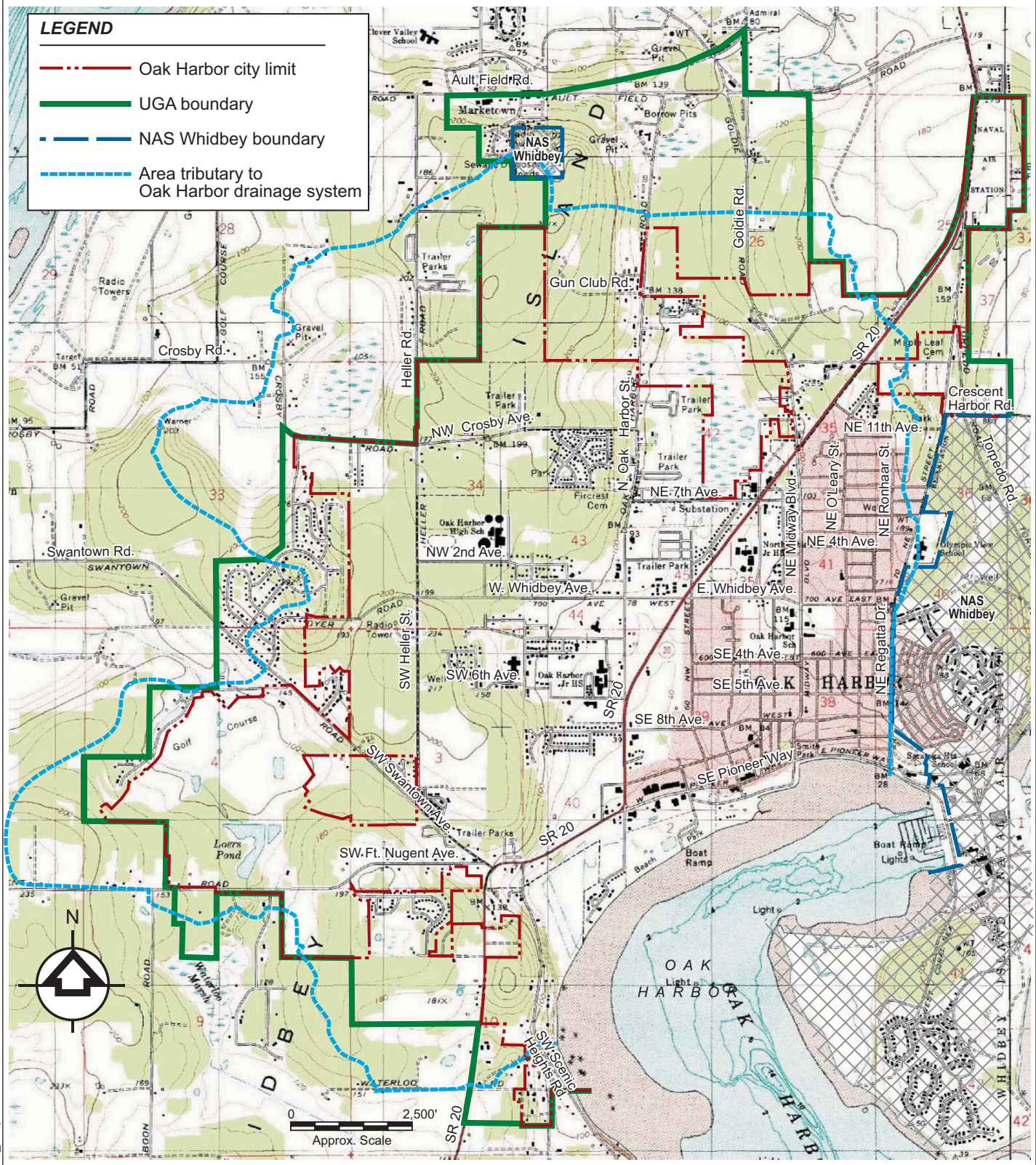
City of Oak Harbor
COMPREHENSIVE STORMWATER
DRAINAGE PLAN UPDATE

Figure 1-1.
OAK HARBOR
DRAINAGE PLAN VICINITY



Source: U.S. Geological Survey. July 1, 1973

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City of Oak Harbor
COMPREHENSIVE STORMWATER DRAINAGE PLAN UPDATE

Figure 1-2.
DRAINAGE PLAN STUDY AREA

CHAPTER 2.
BASIN CHARACTERISTICS

This chapter describes the basin characteristics that affect hydrologic and hydraulic conditions in the study area.

HYDROLOGIC CHARACTERISTICS

The study area consists of about 7.1 square miles of both incorporated and unincorporated land in and around the City of Oak Harbor. Variations in coverage across this area affect the hydrologic response of the area, expressed as the rate and quantity of stormwater runoff.

General Basin Description

This drainage study uses a naming convention that was developed in earlier basin studies for the city, dividing the study area into four major drainage basins:

- **Dry Creek Basin**—This basin contains the central core of the city and is the most developed of the four basins. Very little open drainage remains. The basin is characterized by highly developed residential and commercial areas. Drainage is piped through an extensive collection system directly into Oak Harbor through two primary outfalls. This basin covers about 4.54 square miles.
- **Midway Basin**—This basin in the southeast corner of the study area is effectively a subarea of the Dry Creek basin, sharing the same surficial and drainage characteristics. This area is bordered by the Navy's Seaplane Base and the Dry Creek basin. Drainage is collected and piped through a small-diameter collection system through several small outfalls into Oak Harbor. This basin covers about 0.21 square miles.
- **Golf Course Basin**—The golf course basin is in the southwest portion of the study area. It encompasses the Whidbey Golf and Country Club and the drainage system that flows through it. This basin is developing with primarily residential uses. It covers about 1.18 square miles. Additional area outside the study area is tributary to the Golf Course Basin.
- **Radio Tower Basin**—The radio tower basin is in the northwest portion of the study area. It is currently the least developed of the city's drainage basins, but development in the area is progressing rapidly. The predominant features in this basin are numerous drainage sinks. Stormwater runoff enters these topographically isolated basins and can only exit through infiltration into the groundwater, evaporation, or flooding once the stormwater reaches a great enough depth. This basin covers about 1.22 square miles.

The size, features and characteristics of these basins differ from previous analyses as a result of developed, better resolution mapping and new information. The four major basins were subdivided into 133 subbasins to provide a higher level of resolution in the hydrologic and hydraulic modeling described in Chapter 3.

Soils and Geology

Geologic characteristics in the study area are largely the result of past regional glacial processes. Erosion and deposition associated with glaciation have strongly influenced regional topography, soils, and groundwater characteristics. Once urbanization occurs over a soil type, its characteristics are greatly

altered. The removal of overlying vegetation, disturbance of the soil strata by excavation and compaction, and mixing of soil types from filling or other land altering activity all impact the soil characteristics.

Soils in the study area are highly variable but are generally a sandy loam developed under a heavy stand of timber in a mild, moist, nearly frost-free climate. The parent material is undulating and rolling, gravelly and stony, coarse to moderately coarse textured material, underlain by loose glacial outwash.

There are 18 soil classifications in the study area, plus subvarieties based on slope. Most soils in the central area of the city (Dry Creek and Midway Basin) are of the Townsend variety, which are characterized by a sloping well drained soil underlain by compact gravelly till. In the northern part of this basin, the soil transitions to Whidbey soils, which are well-drained soils underlain by a cemented glacial till. To the west, toward the Golf Course and Radio Tower Basins, the soil transitions to Coveland soil, a poorly drained soil underlain by fine-textured till, marine or lake-laid sediments. Continuing west, the soil transitions into the Hoypus soil category. The general characteristics of this soil group include an excessively drained soil underlain by loose gravelly or sandy drift or wind-reworked areas. Key features of these major groups are as follows:

- **Townsend Soils**—This soil occurs from very near or adjoining the coast to moderately steep slopes of intermittent drainageways. This soil is closely associated with Coveland loams and with Whidbey gravelly sandy loams. Oak Harbor is one of two locations where this soil type is predominant; the other location is at San de Fuca. The soil was developed from cemented gravelly till. Because it is near the coast, its parent materials are mixed with marine and glacial lake sediments. The soil is well drained. Internal drainage is medium, however, because of the nearly impervious hardpan. Native vegetation consisted of grasses, with a few clumps of Garry oak scattered over the area and a few Douglas firs along the outer edges.
- **Whidbey Soils**—Whidbey soils are the most common over Island County, covering about one-third of the county. The cemented gravelly till from which this soil developed was derived largely from granite, quartzite, schist, basalt, slate, and sandstone. Natural drainage is good in this soil. Surface runoff is slow because the surface layer and subsoil absorb the water readily. During the rainy season the lower part of the subsoil immediately above the hardpan remains saturated for long periods. Native vegetation consisted largely of conifers, predominantly Douglas fir with a few hemlocks and cedars.
- **Coveland Soils**—This soil occupies slight depressions in uplands or terraces next to bays and inlets. It is associated with Townsend soils but occupies lower-lying positions. Because of its position in depressions, the soil receives runoff and seepage from higher-lying areas. Although surface runoff is slow, the soil has enough slope that excess water runs off. During rainy seasons, the soil becomes saturated, but the water stands on the surface for only a short time. Native vegetation was mainly grass, with some brush and a few scattered trees.
- **Hoypus Soils**—Hoypus soil is extensive on Whidbey Island. It occupies moraines and outwash plains. The parent material of this soil consists of different kinds of rock. Rock of acid igneous and metamorphic origin predominates, but some basic rocks are included. Natural drainage is somewhat excessive. Internal drainage is very rapid, and the water-holding capacity is low. Native vegetation consisted largely of Douglas fir mixed with some hemlock, spruce, and cedar.

Appendix A summarizes soil distribution for subbasins in the study area.

Groundwater

No analysis of the groundwater regime was conducted for this drainage study.

Topography and Slope

The topography of the study area may generally be described as gently sloping with undulating hills. Exceptions include the steep bluffs to the southwest adjacent to the water and the prominent hills west of the city center. Typical slopes in the study area are 3 to 6 percent. Elevations in the study area range from just over 400 feet (City of Oak Harbor datum) to sea level (100 feet, City of Oak Harbor datum).

Land Use and Cover

Land use and cover strongly influence hydrologic characteristics, including peak storm flows. In general, areas with forest cover and little development have lower peak flows than urbanized areas with other vegetation types. Impervious surfaces, such as pavement, convert nearly all precipitation to runoff almost as soon as it hits the ground (or melts, in the case of snow). Areas with little forest and a high percentage of development can experience high peak storm flows from even a small amount of precipitation.

Land use characterizes the distribution of human activities and is useful for understanding the degree of urbanization. Land use categories, such as residential, commercial, and transportation (roads and highways), are typically assigned a defined percentage of effective impervious area for hydrologic modeling.

The study area exhibits varying levels of development, including highly developed commercial/ transportation corridors (SR 20 through Oak Harbor) to undeveloped second growth woodland. The distribution of existing and future land use types was quantified using information provided by the city, this information was entered into a geographic information system (GIS) to calculate land coverages for each subbasin. This process is described further in the following paragraphs.

Existing Land Use

Existing land use was divided into 15 coverage types, as summarized in Table 2-1. Associated with each coverage type is the estimated effective impervious area. The effective impervious area represents the portion of the impervious area that is directly connected to a drainage conveyance system, such as a pipe or ditch. This portion of runoff represents the rapid response, which tends to generate the greatest discharges from an area. The effective impervious area is equal to or less than the actual impervious area. For example, if a house has its downspouts directly connected to the street drainage system, its runoff response is much quicker than if the same house had splash pads that provided an opportunity for a portion of its runoff to infiltrate into the ground prior to reaching the street drainage system.

A GIS map coverage provided by the city and identified as “land use” was overlaid with the subbasins that compose the study area. Land use coverages were then calculated on a subbasin basis. This mapping represents a hybrid of existing land use and anticipated future development. The city does not maintain a map that depicts existing land use. Therefore, the land cover extent and type estimated through the GIS analysis were reviewed on a subbasin basis for reasonableness, using a 1998 aerial photograph of the study area provided by Island County. Subbasin coverages were adjusted based on visible development in this photo. The greatest difference between the City’s “land use” map and the aerial photo is in the north and west portions of the study area.

A matrix was developed to calculate the effective impervious area for each subbasin in the study area. This value ranged from a low of 0.1 percent to a high of 85.6 percent. Overall effective impervious area was calculated to be 20.1 percent. This matrix is included in Appendix A. Figure 2-1 shows land use for the study area.

TABLE 2-1.
EXISTING LAND USE COVERAGE CATEGORIES

Coverage	Estimated Effective Impervious Area (percent)
Open Space	0
Residential Estate	2
Low Density Residential	4
Medium Density Residential	20
Medium High Density Residential	30
High Density Residential	40
Residential Office	35
Public Facilities	30
Community Commercial	75
Commercial	85
Central Business District	90
Auto Industrial Commercial	85
Highway Corridor Commercial	90
Industrial Park	85
Industrial	95

Future Land Use

Development in any area must conform to the zoning for that area, so City of Oak Harbor zoning was used as a guide in estimating future levels of development for the study area; for areas outside the urban growth area, Island County zoning designations were used. Digital zoning data provided by the City was imported into a GIS system and developed into a composite coverage for the entire study area; from this, coverage on a subbasin basis was calculated. There are 29 different zoning categories in the study area.

Each zoning category was assigned an effective impervious area percentage, based on the description of the zoning category in the city's municipal code and comparison to other municipalities with similar zoning categories where effective impervious area has previously been calculated. Table 2-2 summarizes the zoning categories and the effective impervious area percentage assigned to each. Figure 2-2 shows the zoning for the study area.

A matrix was developed to calculate the effective impervious area for each subbasin in the study area. This value ranged from a low of 1.9 percent to a high of 85.6 percent. Overall effective impervious area was calculated to be 27.8 percent. This matrix is included in Appendix A.

CONVEYANCE SYSTEMS

Drainage network characteristics vary greatly across the study area. The Dry Creek and Midway Basin area is dominated by a piped network. There are two primary outfalls into Oak Harbor, each 42 inches in diameter. Numerous other outfalls (primarily 12-inch diameter) serve much smaller tributary areas along the waterfront. To the west, there are more natural drainage courses that drain the Golf Course and Radio Tower Basin. These are described further below. Figure 2-3 graphically summarizes the network.

TABLE 2-2.
FUTURE LAND USE COVERAGE CATEGORIES

Coverage	Estimated Effective Impervious Area (percent)	Coverage	Estimated Effective Impervious Area (percent)
Airport	75	Open Space	0
Central Business District	90	Park	5
CBD-1	80	Planned Business Park	60
CBD-2	85	Planned Industrial Park	85
Commercial Agriculture	2	Planned Unit Development	65
Community Commercial District	75	Public Facilities District	30
Neighborhood Business	80	Residential Office District	55
Contract Zone	50	Rural	2
Federal Land	30	Rural Agriculture	0
Highway Corridor Commercial	90	Rural Forest	0
Highway Service Commercial District	95	Rural Residential	2
Industrial	95	Rural Service	60
Limited Multi-Family Residential District	40	Rural Village	55
Multi-Family Residential District including Apartments	75	Single Family Residential District	25
Multi-Family Residential District including Mobile Homes	55		

Dry Creek Basin Conveyance

The Dry Creek Basin is almost entirely a piped network. There are a few locations of open ditches remaining. It is an extensive network whose central facilities generally follow SR 20. Generally, drainage from the east of the highway is from the older part of the city. Pipes and ditches from this area tend to be small; pipes are typically 8- to 12-inch concrete pipes. Drainage from the west side of the highway tends to be newer. The pipes are generally 12 to 18 inches in diameter and are frequently constructed of plastic.

The two primary branches of this collection system run in parallel: one is in SR 20 and Oak Harbor Street right-of-way; the second is one or two blocks to the east. An interconnect on SE 11th Avenue provides an opportunity to split and balance the flow between these two collection systems. The flow split is controlled by a slide gate in a large manhole structure. Typically, the gate is positioned so that the majority of the runoff from the west system is diverted into the east system. This relieves the west system to provide additional capacity to receive runoff from a substantial tributary inflow from the west at Pioneer Way. The two systems discharge into Oak Harbor through 42-inch diameter outfalls.

A smaller separate collection system conveys a portion of the Dry Creek Basin through Freund Marsh. Land use tributary to this collection system varies from undeveloped wooded tracts to highly developed

commercial area. The system as it discharges into the ditch network of Freund Marsh is a 24-inch pipe system.

Several small drainage areas in the Dry Creek Basin collect and discharge stormwater into Oak Harbor. These small systems, typically 12-inch, are located along the waterfront. Many collect only a single catchbasin prior to discharging.

Midway Basin Conveyance

The Midway Basin collection and conveyance system services a relatively small portion of the study area. This basin is in the southeast corner of the study area between the Dry Creek Basin and the Navy's Seaplane Base. This area is drained by typically small diameter pipes (12-inch) through numerous separate outfalls.

Golf Course Basin Conveyance

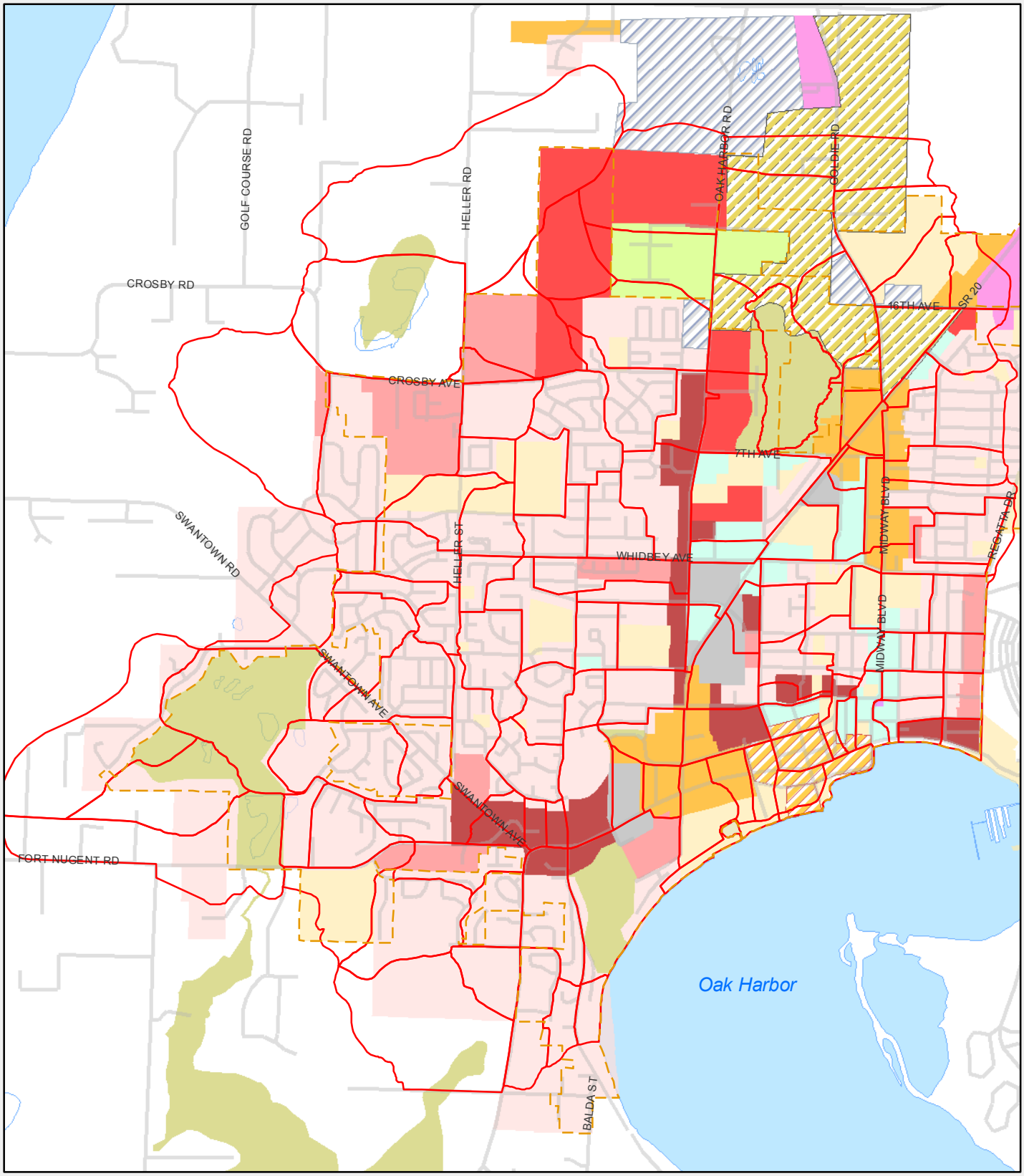
The Golf Course conveyance system is primarily an open-channel system. This basin was studied in 1997 (*Golf Course Drainage Basin Stormwater Mitigation Study*, Fakkema and Kingma, Inc., August 1997). This large basin contains numerous wetlands, ponds and natural and man-made channels. Runoff originates from far south of the city limits and is conveyed through a ditch system constructed through agricultural areas. Runoff continues north and west and passes through a large wetland (Waterloo Marsh) south of Fort Nugent Road. After passing through the wetland, it continues north across Fort Nugent Road and enters Loers Pond. Loers Pond was enlarged in 1979 and provides irrigation water to the Golf Course. The outlet from Loers Pond is adjusted to increase storage during summer. After exiting Loers Pond, flow is diverted from its historical course through a perimeter ditch on the west side of the Golf Course Pond. Water crosses Fairway Lane then sweeps almost due east. Runoff that enters Golf Course Pond is pumped into the channel from the perimeter ditch.

The Golf Course Pond is at the site of a former small lake. During the early 1900s, a farm was developed at this site. In order to create more agricultural land, the water that entered this small lake was diverted into an elevated flume. This flume was replaced in the 1950s with the perimeter ditch in existence today.

The area surrounding the golf course is developing. Most of this development is currently on the east side of the golf course pond. Some of this developing area drains into Loers Pond and is subsequently bypassed around the golf course pond; other areas drain into the golf course pond, which must be then pumped out.

Radio Tower Basin Conveyance

The Radio Tower Basin is dominated by several large and small drainage sinks. This area has limited piped collection systems. These are typically associated with individual housing developments. Roadside ditches convey runoff from these developments into the drainage sinks. There are likely subsurface connections between these drainage sinks because of their similar topography and orientation. Groundwater from this area drains toward the west.



Legend

Landuse

- Auto Industrial Commercial
- Central Business District
- Commercial
- Community Commercial
- Highway Cooridor Commercial
- Industrial
- Low Density Residential
- Medium Density Residential
- Medium High Density Residential
- High Density Residential
- Openspace
- Planned Industrial Park
- Public Facilities
- Residential Estate
- Residential Office
- City Boundary
- Subbasin Boundary
- Street

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Figure 2-1

Landuse

City of Oak Harbor

0 0.125 0.25 0.5
Miles

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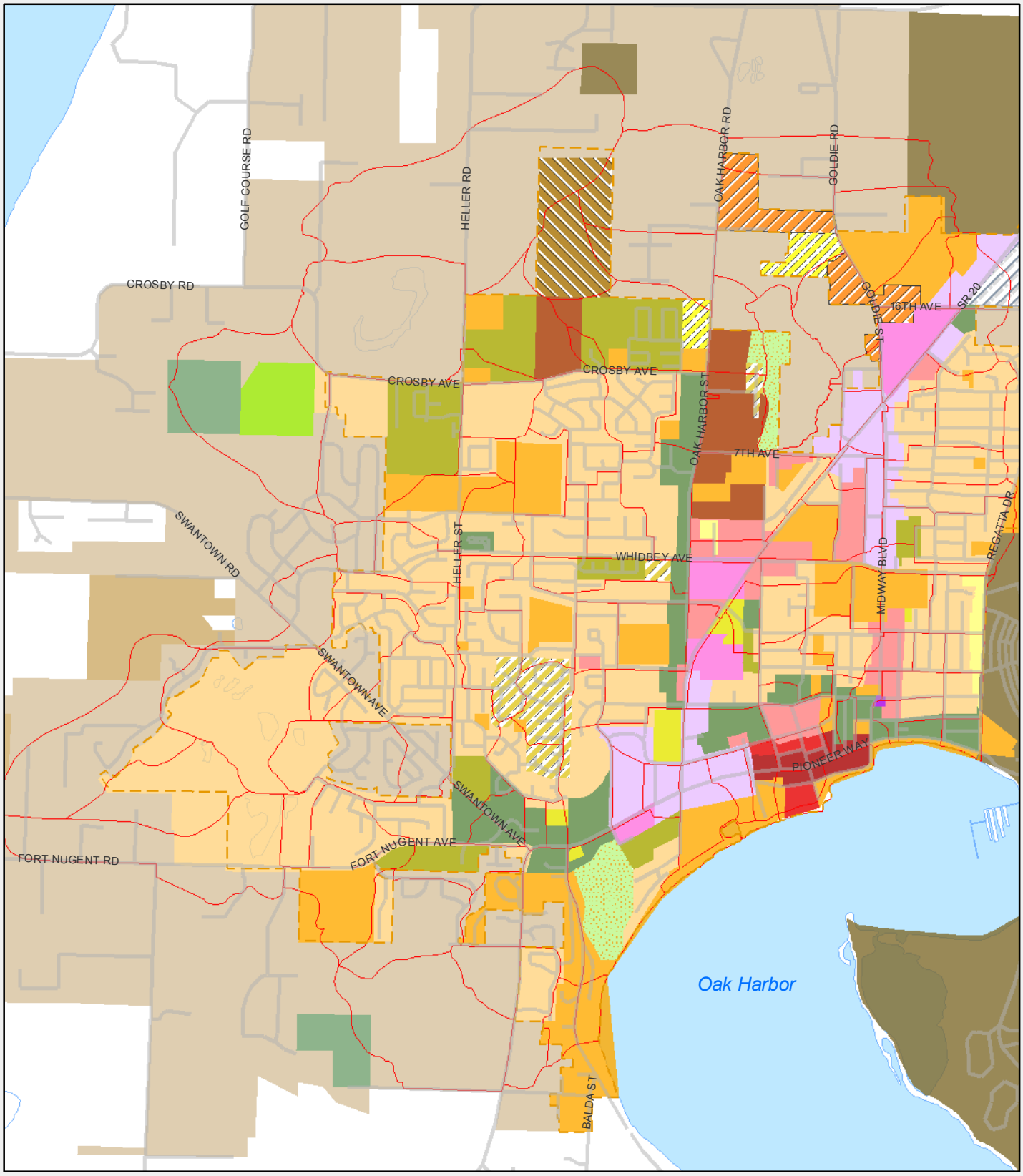

Legend

Zoning

- Airport
- Central Buisness District
- Central Buisness District-1
- Central Buisness District-2
- Commercial Agriculture
- Commercial Other
- Community Commercial
- Contract Zone
- Federal Land
- Highway Service
- Industrial
- Limited Multiple Family Residential
- Multiple Family Residential District
- Multiple Family Residential District
- Neighborhood Buisness
- Open Space
- Park
- Planned Buisness Park
- Planned Industrial Park
- Planned Unit Development
- Public Facilities District
- Residential Office District
- Rural
- Rural Agriculture
- Rural Forest
- Rural Residential
- Rural Service
- Rural Village
- Single Family Residential District
- Unknown
- federal land
- Street
- City Boundary
- Subbasin Boundary

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Figure 2-2

Zoning

City of Oak Harbor

0 0.125 0.25 0.5
Miles

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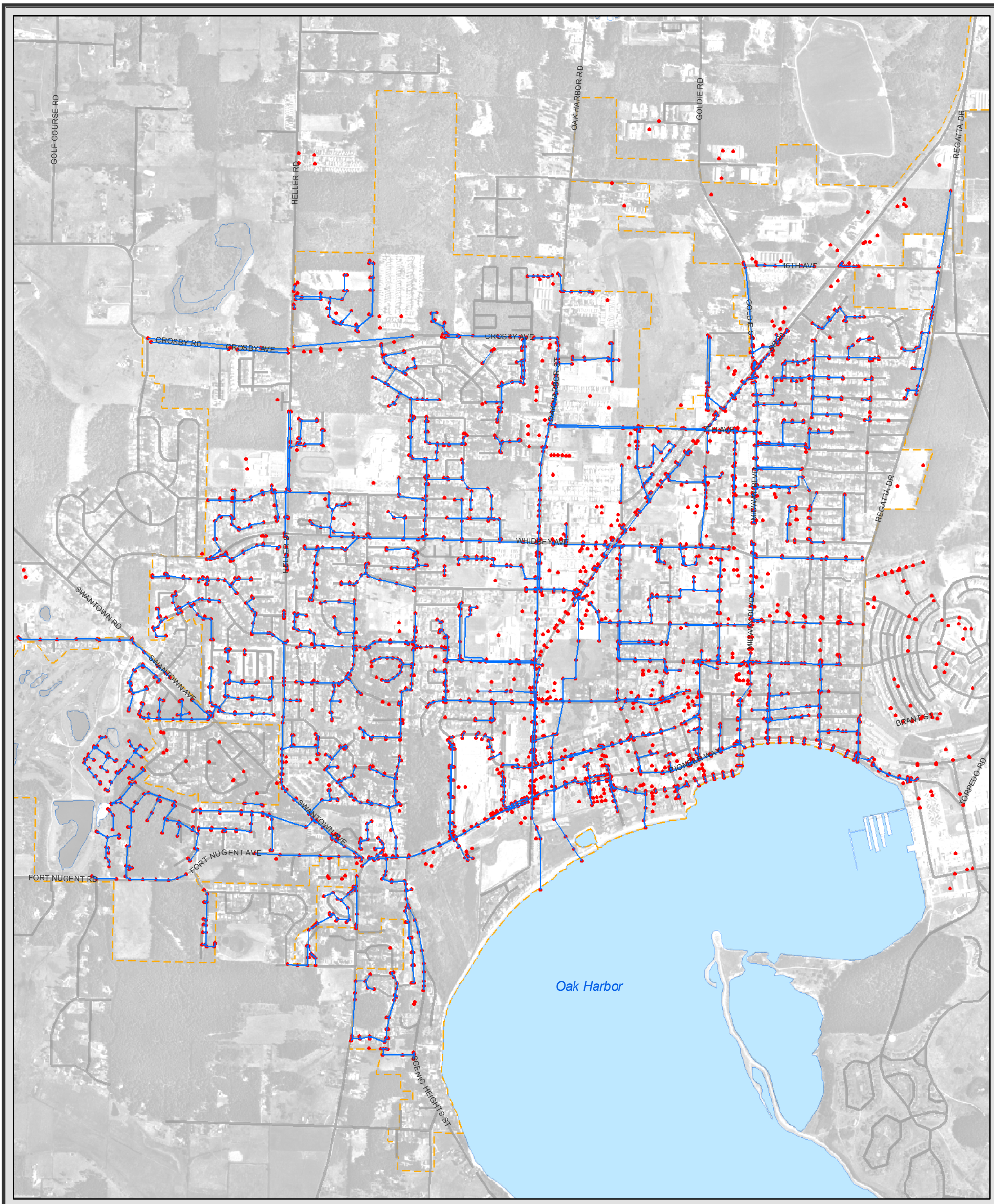

Legend

- Structure
- Pipe Network
- Street
- City Boundary

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Figure 2-3

Existing Stormwater System

City of Oak Harbor

0 0.1 0.2 0.4
Miles

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CHAPTER 3
HYDROLOGIC AND HYDRAULIC MODELING

Hydrologic and hydraulic models were developed for the study area to quantify existing and future surface water conditions and to evaluate potential solutions to identified problems. Hydrologic models determine the amount of stormwater runoff that will be generated from a drainage basin during a storm event or a series of storm events. The storm flow data generated by the hydrologic model are then input into the hydraulic model, which simulates the routing of flows through a conveyance system, such as a ditch or piped storm drain system, to evaluate the system's performance. This chapter describes the hydrologic and hydraulic models that were used for this study.

MODEL SELECTION

The model selected for the City of Oak Harbor analysis of the drainage system needed to have the capability of representing the diverse character and hydraulic features of the city's drainage system. The model needed to represent tidal influence, surcharging and flooding of the pipe and open channel system, split flows, control structures such as the device that regulates flow between the city's parallel 42-inch storm lines, and hydraulic features such as the natural and constructed detention facilities. The Environmental Protection Agency (EPA) Storm Water Management Model (SWMM), version 5, meets these criteria and was selected for use in this analysis.

The SWMM model is a dynamic rainfall-runoff simulation model used for simulation of runoff from primarily urban areas. The runoff component of SWMM, depicting the hydrology, operates on a collection of subcatchment areas (subbasins) that receive precipitation and generate runoff and pollutant loads. The routing portion of SWMM (the hydraulics) transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators. SWMM tracks the quantity and quality of runoff in each subcatchment, and the flow rate, flow depth and quality of water in each pipe and channel.

SWMM was first developed in 1971 and has undergone several major upgrades since then. The version used in this analysis is a complete upgrade of the previous release. SWMM 5 provides an integrated environment for editing study area input data, running hydrologic, hydraulic and water quality simulations, and viewing the results in a variety of formats.

DRAINAGE DATA SOURCES

The information that was used as input into the model came from several sources. This information can be divided into general categories including land cover (extent and type of development), precipitation data, conveyance data and tidal data. These are described below.

Land Cover Data

Land cover used to define the existing and future land use conditions is described in detail in Chapter 2. Existing land use was defined using a combination of aerial photography and a land use map provided by the city. Future land use was based on current city zoning, proposed land use in the City's urban growth area, and Island County zoning outside of the UGA. Each land use and zoning category was assigned an effective impervious area percentage. Land coverage in each subbasin was calculated and the composite effective impervious area percentage was determined for input into the SWMM model.

Precipitation Data

High-resolution long-term rainfall records (spanning several years and recorded at least hourly) are needed to assess peak rainfall intensities, which typically last less than 30 minutes, and associated return frequencies. These peak intensities frequently are the cause of flooding. No such records exist for Island County. Moreover, Whidbey Island experiences considerable variability in rainfall. Locally recorded data is important to capture true local rainfall patterns instead of using recorded data from miles away that likely do not represent local conditions (at least on a storm-specific basis).

Total storm volume may be derived from longer recording intervals such as those recorded by NAS Whidbey, whose recording frequency is 3 hours. Performing statistical analyses on these 24-hour storm volumes to determine return frequency was performed for the city in the previous stormwater drainage plan (Barret, 1994) and was utilized for this study. The result of this analysis is summarized in Table 3-1.

TABLE 3-1.
RAINFALL VOLUME FREQUENCY

Recurrence Interval	Precipitation (inches)
2-year	1.00
10-year	1.77
25-year	2.21
100-year	2.95

A recurrence interval represents, on average, the number of years required for a storm of a given magnitude to occur. For example, a 10-year storm is likely, on average, to occur once every 10 years. Stated another way, a 10-year storm has a 10-percent chance of occurring in a given year. Similarly, a 100-year storm has a 1-percent chance of occurring in a given year.

The City has good rainfall records recorded on a daily total basis. The City also has recently implemented 5-minute rainfall recording through an automatic rain gage. This will provide good local storm information that can be used for modeling in the future and will provide a good foundation for local frequency analysis of rainfall. As a surrogate to recorded local rainfall, the SCS Type 1A 24-hour rainfall hyetograph was selected to represent a typical extreme storm for the city. The City of Oak Harbor was analyzed under the 2-, 10-, 25- and 100-year rainfall.

Conveyance Data

Conveyance information came from four primary sources:

- An AutoCAD drawing from the Engineering Division of the Oak Harbor Development Services Department depicts many features of the existing drainage network and some attributes such as pipe size.
- Information in the city's GBA Master Series database system from the Public Works Department also was used.
- Recent as-built drawings depict recently constructed drainage facilities, normally in association with new subdivisions.

- The city undertook an extensive program throughout the summer using local high school students to document the major drainage systems in the city. This effort included surveying the pipe inverts and documenting the pipe size and material type.

All of this information was combined into a GIS information database. Considerable effort was expended to resolve discrepancies within these data sources to allow this centralized resource to provide useful information for the city into the future.

There are numerous natural and constructed detention facilities in the study area. Natural detention occurs when runoff passes through water bodies, such as Loers Pond and the Golf Course Pond. It also occurs when runoff backs up in ravines or large flat open areas, such as Freund Marsh, the small ravine adjacent to Swantown Avenue near Heller Street, or the large flat area north of NE 7th Avenue between Goldie Street and Oak Harbor Street. Detention is constructed as a result of the City's development standards in order to reduce peak runoff rates after development to rates similar to predevelopment. The city compiled as-built information describing the larger facilities. This data was used to calculate necessary input for the model. Facilities that provide benefit to the city's drainage system and control runoff from large areas were incorporated into the model.

Tidal Data

Most of the city's drainage system discharges into tidally variable Oak Harbor. City staff have observed that flooding in portions of the city is common during periods of heavy rainfall and high tide, so the establishment of tidal conditions in association with extreme rainfall is necessary. The stormwater outfalls are typically submerged under high tide conditions, which has the effect of reducing the capacity of the drainage lines.

The Federal Emergency Management Agency (FEMA) has established extreme tide elevations in association with the FEMA floodplain maps developed for adjacent Crescent Harbor (FEMA, 1995). These were calculated for the 10- and 100-year tide. Using a probability distribution, values for the 2- and 25-year tide were calculated. These are summarized in Table 3-2.

TABLE 3-2.
EXTREME TIDE ELEVATIONS

Recurrence Interval	Elevation (feet, NGVD29)
2-year	7.95
10-year	8.40
25-year	8.67
100-year	9.00

The values in Table 3-2 provide the peak elevation of the tide, not the shape of the tidal cycle. To generate an appropriate shape of the diurnal tide cycle, a representative extreme annual tide was selected. The extreme tide of 1995 was selected, as this was used previously during an analysis of the tide gate for Freund Marsh (Fakkema and Kingma, 1995). The *JTide* program was selected to generate the tide cycle in 10-minute increments for use in the modeling. Figure 3-1 depicts this tide cycle. Once this representative cycle was selected, it was linearly scaled such that the maximum tide match the values shown in Table 3-2.

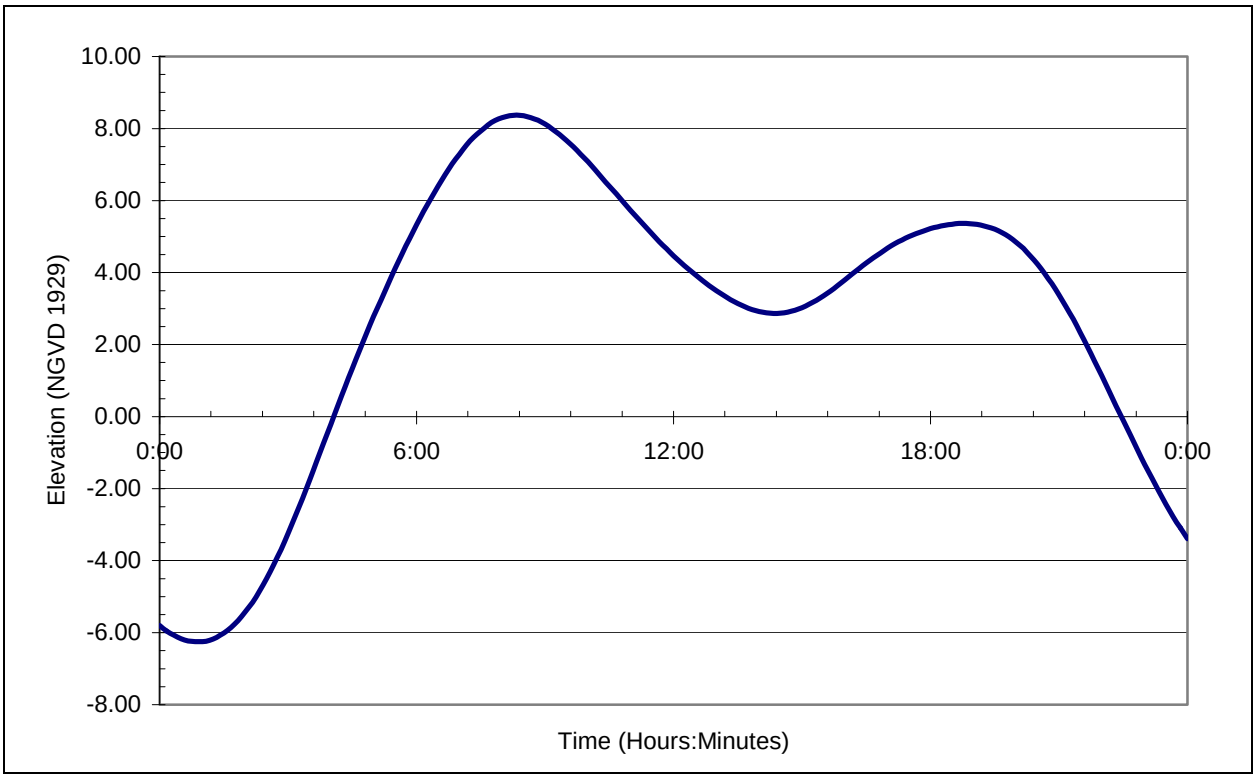


Figure 3-1. Tide Elevations over 24-Hour Period During Extreme Tide of 1995

MODELING METHODOLOGY

To provide the detail desired in the SWMM modeling results, a high level of resolution was used within the model by subdividing the study area into 133 subbasins, varying in size from 6.9 acres to 258 acres. The subbasins with small areas are typically in areas of high development and extensive collection network; large subbasins are where there is little development and a minor collection network. This level of resolution provides the opportunity to evaluate improvement alternatives more thoroughly and provides the opportunity to represent problem areas associated with smaller collection systems. Figure 3-4 shown at the end of this chapter shows the subbasins used in this analysis.

Each modeling evaluation was defined by the combination of land use (existing or future), rainfall event (2-, 10-, 25-, and 100-year), tidal condition (2-, 10-, 25-, and 100-year), and conveyance status (existing or improved). The selection of rainfall event and tidal condition requires further discussion. These events are independent of each other. The occurrence of extreme rainfall is the result of meteorological events. The occurrence of extreme tides is an astronomical event. Consequently, when evaluating the probability of simultaneous occurrence, the probability, for example, of the 10-year rainfall occurring at the same time as the 10-year tide is not once every 10 years, it is once every 100 years (the probabilities are multiplicative). Similarly, the simultaneous occurrence of the 100-year rain and tide is once every 10,000 years. There are, however, factors influencing the tides in Oak Harbor that cannot be predicted from tide tables. These factors include the likelihood of low barometric pressure during a typical Northwest severe rain event, which allows a higher tide. Also, wind fetch, particularly with Oak Harbor's southern exposure, can contribute significantly to high tides. As a result, a design tide approach was taken. Using this approach, the 25-year tide was used in association with the 2-, 10- and 25-year rainfall. To simulate the joint occurrence of extreme conditions, the 100-year tide was used with the 100-year rainfall.

The tidal cycle typically has two peaks, the "higher-high" and the "lower-high." The City's system was analyzed under the condition that the higher-high tide occurs during the period when there is greatest runoff from the watershed. Several hours later, the second high tide occurs, as can be seen in Figure 3-1. This represents a worse-case tidal condition.

Once of the weaknesses of using a single event model to analyze systems that contain detention is that initial conditions may not be accurately represented. In the Northwest, it is common to have multiple storms back-to-back. When an extreme storm arrives, there may still be water remaining in a detention facility from a previous storm. As a result, the full benefit of the detention facility is not realized, which may lead to facility overtopping and larger than desired downstream peak flows. To offset this concern, all detention facilities were assigned an initial depth equal to 25-percent of the available depth.

Outside of the central core of the city (the Dry Creek and Midway Basins), the level of development is typically much less, and there are fewer built drainage systems. These perimeter areas—the Radio Tower and Golf Course Basins—drain into open channel systems that drain to the west. Drainage criteria for these areas are more stringent because of concern for channel erosion, habitat degradation, and adverse impacts on potential fisheries. These areas were evaluated in terms of detention facilities that would meet current Washington Department of Ecology requirements for development to a level allowed by city zoning. The resulting detention sizing is presented as a storage volume per acre of drainage area, which can be used to guide detention requirements when these areas develop. This approach provides an indication of land requirements needed should the city in the future implement regional detention facilities. Regional detention facilities have the benefit of being centralized, fewer and easier to maintain, more adjustable, and potentially less expensive. The following assumptions were used for conceptual sizing of the facilities:

- 2:1 aspect ratio
- 6 feet of active storage depth
- An orifice outlet control structure
- Minor topographical relief at the detention site
- No infiltration at the site.

MODELED FLOW RESULTS

Table 3-3 summarizes representative predicted peak flows for the storms analyzed under existing and future conditions. The table provides a comparison of the change in flows as development occurs, although the values shown do not perfectly represent flows that may occur at some locations in the drainage system; in some cases, due to upstream flooding resulting from a limited-capacity pipe, less than the entire peak flow will reach the downstream system at the point where results were extracted from the analysis.

ANALYSIS OF EXISTING CONDITION DRAINAGE PROBLEMS

The modeling indicted that, overall, the existing drainage system is in relatively good shape to convey expected stormwater runoff within the study area. There are, however, several locations where stormwater conveyance capacity is limited, resulting in flooding potential. The results are graphically summarized in Figure 3-2, which summarizes hydraulic conveyance problems only. As shown on the figure, these problem areas tend to be clustered in discrete locations.

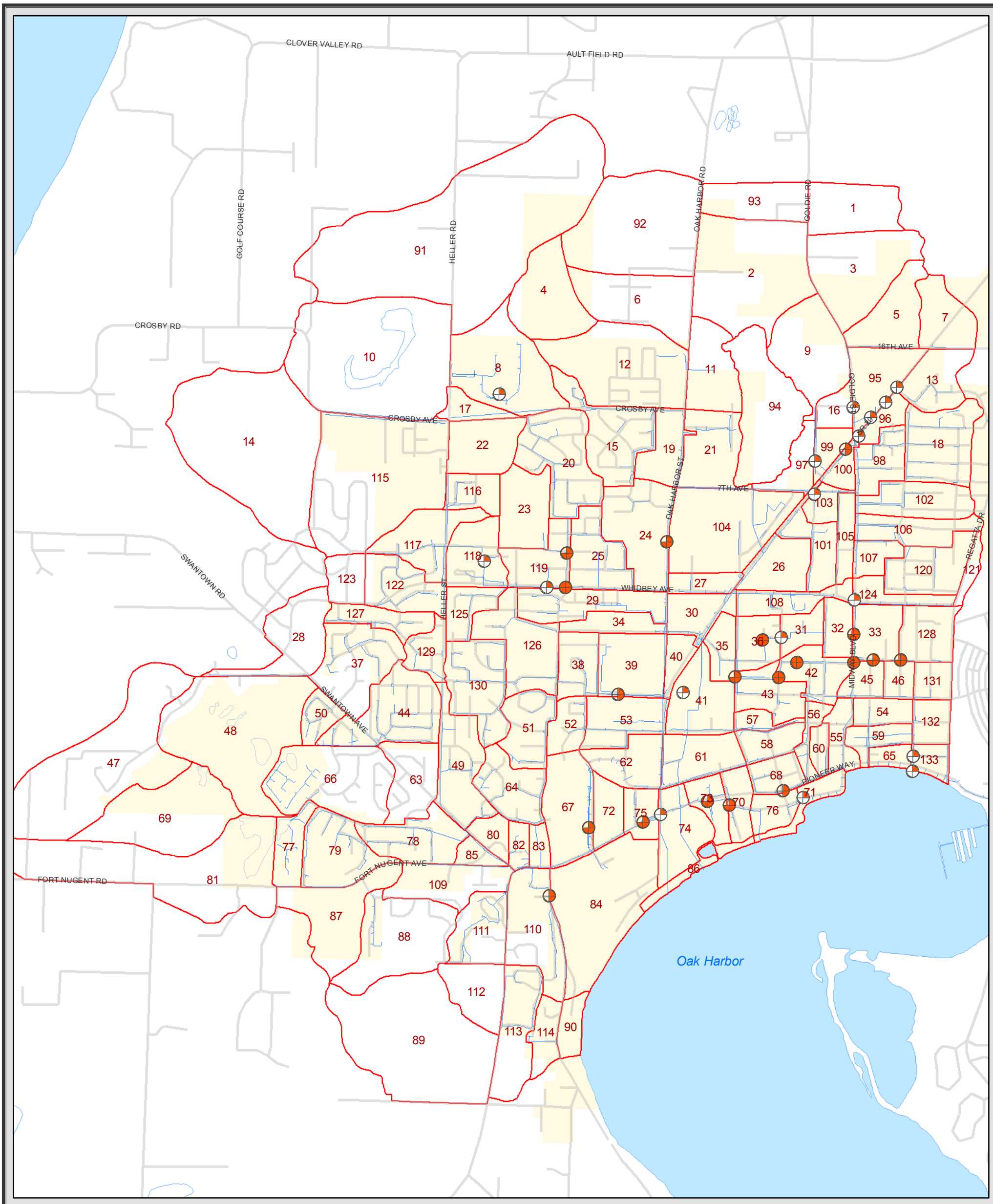
TABLE 3-3.
MODEL RESULTS FOR PEAK FLOWS, EXISTING AND FUTURE CONDITIONS

		Predicted Peak Flow (cubic feet per second)							
		2-year		10-year		25-year		100-year	
Conduit[a]	Description	Existing	Future	Existing	Future	Existing	Future	Existing	Future
C79	Old trunk outfall	28.3	37.4	37.4	42.6	39.1	45.3	46.5	54.6
C83	New trunk outfall	21.4	25.4	27.2	31.3	28.2	31.6	30.6	30.8
C54	SR 20 near SW Barlow St	5.7	8.8	5.7	10.3	5.9	10.3	7.5	10.3
C99	City Beach St outfall	12.4	12.3	19.2	20.3	23.2	24.3	28.9	28.8
C12	Oak Harbor St south of 7th Ave	8.3	12.1	10.1	12.6	10.3	12.6	10.7	12.6
C124	New trunk s. of 7th Ave	10.3	16.8	16.1	25.3	19.7	25.1	22.6	24.8
C167	Collector on 7th east of SR 20	9.6	16.8	17.7	26.9	22.3	28.3	30.0	30.7

a. Conduit locations shown on oversize drawing inserted at the back of this drainage plan.

The existing conditions hydraulic conveyance problem areas are as follows:

- **Oak Harbor Street North of Whidbey Avenue**—A flow restriction in the trunk line that parallels Oak Harbor Street creates flooding starting at the 10-year storm event. The existing storm drainage system at this point is 12-inch.
- **Whidbey Avenue Between Fairhaven Drive and Oak Harbor Street**—High flows and a restrictive pipe system create flooding along several locations in this stretch. This is a chronic problem area. This area is predicted to flood starting at the 2-year storm event. The existing pipe system varies from 12-inch through 18-inch corrugated metal pipe (CMP).
- **SW 6th Avenue West of Oak Harbor Street**—A spot drainage problem occurs at this location. Flooding is predicted to start at the 25-year storm event. The existing storm drainage in this vicinity is 18-inch CMP.
- **Barrington Drive East of SR 20**—Several small problem areas were identified along the stretch of Barrington Drive between SR 20 and about 1,800 feet east. The existing system consists of various pipe sizes ranging from 8 to 18 inches.
- **SR 20 Near Beeksma Drive**—A combination of high flow rates, high tailwater conditions, and restrictive pipe system creates flooding around SR 20 and Beeksma Drive. A slight dip occurs west of this intersection where the flooding is concentrated. Flooding is predicted to start at the 10-year recurrence frequency.
- **SR 20 South of the intersection with Midway Boulevard**—A small flooding problem is predicted to occur here, starting with the 25-year storm event. The existing pipe network in this area is 12-inch.
- **SE 4th Avenue Vicinity Between SE Ely Street and O'Leary Street**—Several flooding problems were predicted throughout this area starting with the 2-year storm. The existing system consists mostly of shallow ditches and 8-inch pipe. This network ultimately drains to the west into the eastern 42-inch trunk line.



Legend

Flood Frequency

- 2 Year
- 10 Year
- 25 Year
- 100 Year
- Pipe Network
- Street
- Subbasin
- City Boundary

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Figure 3-2

Existing Flooding Problems

City of Oak Harbor

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- **SE Pioneer Way Near Ireland Street**—An isolated problem area is predicted on SE Pioneer Way near Ireland Street. A minor amount of flooding is predicted starting at the 25-year storm event. The pipe system in the vicinity of this flooding is 15-inch.
- **SE Bayshore Drive Near SE City Beach Street**—Two locations along this reach are predicted to have minor flooding starting at the 10-year storm event. The existing network in this area varies from 18- to 24-inch diameter.
- **SW Erie Street North of SR 20**—The existing roadside drainage system floods starting at the 10-year storm. The existing system consists of a 12-inch pipe system.
- **SW Scenic Heights South of SR 20**—The existing 12-inch culvert that crosses SW Scenic Heights Street is overtopped starting at the 25-year storm event.

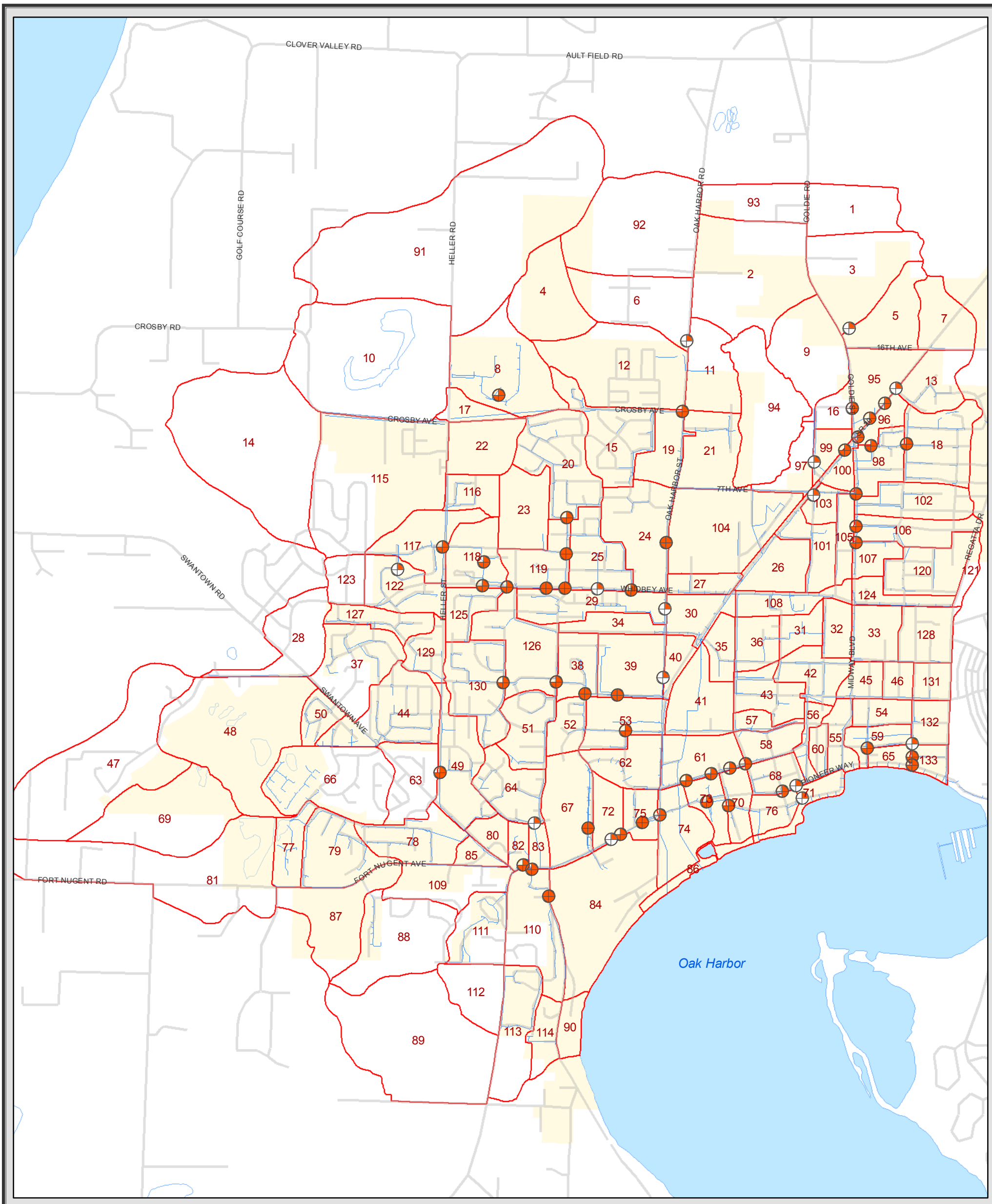
In addition to the hydraulic conveyance problem areas, the following maintenance and erosion problem areas for existing conditions were identified:

- **Liszak Outfall**—This potential erosion problem area is documented in the report prepared by Cane Engineering (*Liszak Outfall Drainage Review*, November 2005). This area lies in the southern extremity of the study area (SW Scenic Heights near SW 29th Place) and includes Subbasins 90, 114, 113, 112 and 89. The report evaluated the drainage situation and has developed a recommended solution. The city will be implementing this project, so it has been included in this drainage plan.
- **Drainage between Goldie Street and Koetje Street**—A poorly defined segment of open channel drainage and small diameter pipes occurs through this area. This is a chronic problem area for the city. The existing drainage path flows through private property through a shallow swale. Over time, the magnitude and frequency of flooding has increased. This site receives runoff from NE Goldie Street and upstream tributary area.

ANALYSIS OF FUTURE CONDITION DRAINAGE PROBLEMS

Results of the future conditions analysis are summarized in Figure 3-3. Generally, the modest increase in study area-wide impervious area percentage from about 20 percent to about 28 percent is predicted to result in a substantial increase in the number of problem areas. This suggests that the city's existing conveyance system is presently operating at its maximum capacity, with little capacity for additional flows. The problem areas under future conditions include all of those identified under existing conditions (although they are more severe under future conditions) as well as the following:

- **Oak Harbor Street Near NW Crosby Avenue**—Several areas along Oak Harbor Street are predicted to flood in this vicinity starting at the 10-year storm event.
- **West Whidbey Avenue from Oak Harbor Street to NW Heller Street**—Numerous problem areas occur throughout this segment with flooding predicted to start at the 2-year storm, much more extensive than the problem areas that occur under existing conditions.
- **NW Columbia Street Between Whidbey and NW 4th Avenue**—Previous problem areas expand under future land use conditions. Problem areas extend further upstream and existing problem areas flood earlier, starting at the 2-year storm.
- **SW 6th Avenue Between Oak Harbor Street and SW Judson Drive**—Under existing conditions, there is an isolated problem on SW 6th Avenue. However, under future unmitigated land use conditions, the flooding becomes extensive along 6th, extending as far west as SW Judson Drive. Flooding is predicted to start at the 2-year storm event.



Legend

Flood Frequency

- 2 Year
- 10 Year
- 25 Year
- 100 Year
- Pipe Network
- Street
- Subbasin
- City Boundary

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Figure 3-3

Future Flooding Problems

City of Oak Harbor

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Miles

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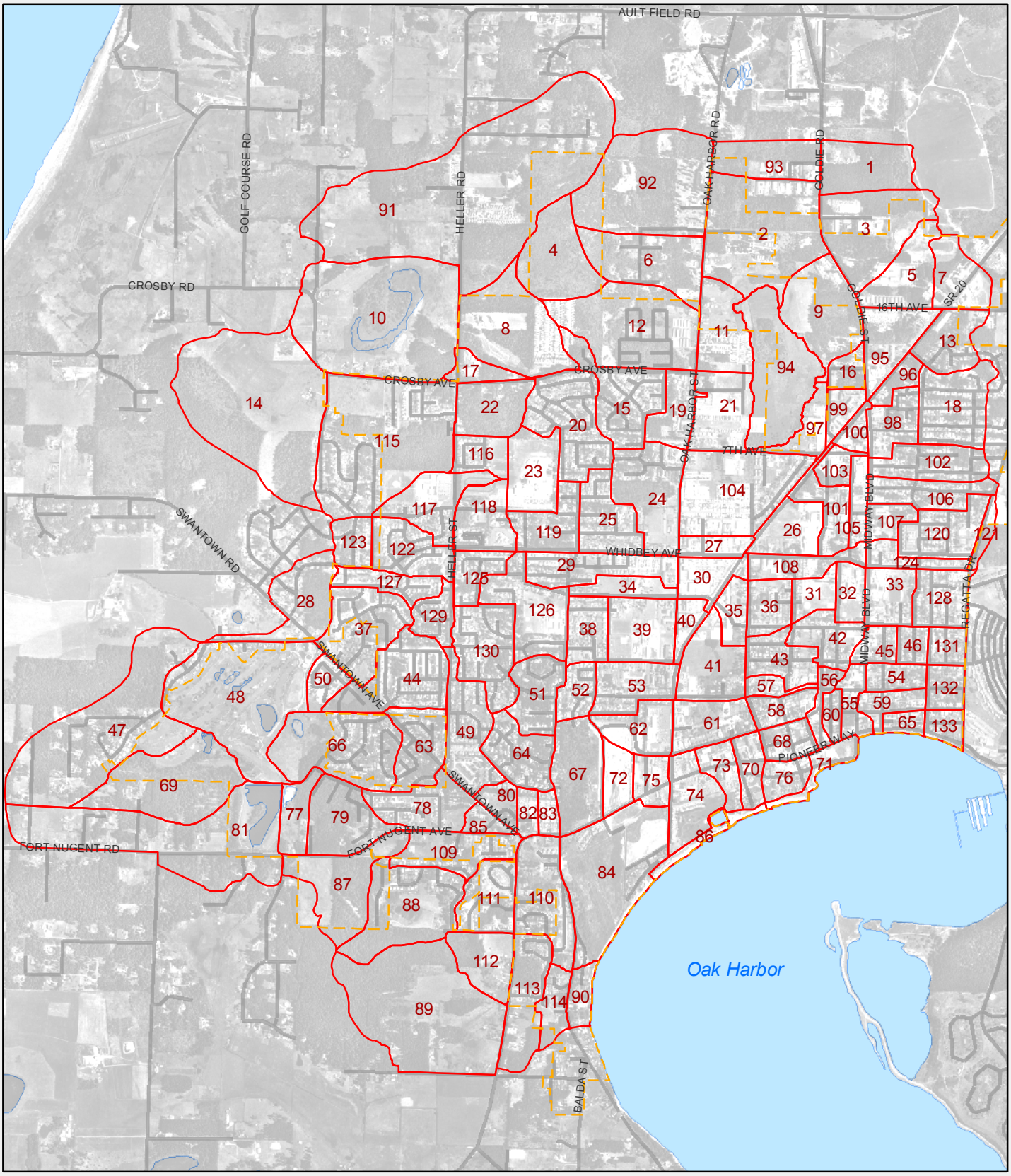
- **NE Midway Boulevard Near NE 7th Avenue**—The drainage system along Midway Boulevard becomes inadequate under future land use conditions. Several blocks of this and the connecting system will flood starting at the 10-year storm event.
- **SE Pasek Street Between Pioneer Way and SE 9th Avenue**—The drainage system becomes overtaxed under future land use with flooding starting at the 10-year event.
- **SE Maylor Street at SE 9th Avenue**—Future land use creates flooding at SE 9th Avenue. The existing drainage system is 12-inch CMP in this area.
- **SR 20 and Beeksma Drive**—The existing flooding in this area is greatly expanded under future land use conditions. The results of the higher peaks and greater runoff volumes from the upper drainage area can be seen in this intersection area with a substantial increase in the extent, volume and frequency of flooding. Flooding is predicted to start at the 2-year event.
- **SR 20 West of Scenic Heights Street** —The drainage system in this area consists of two networks. One network serves SR 20 and tributary areas and drains east along SR 20 to Beeksma Drive. The second drainage system collects runoff from several residential developments, crosses under SR 20, and ultimate drains through Freund Marsh. The second system is predicted to have flooding problems under future land use. Flooding is predicted to start at the 10-year event.
- **SW Heller Street South of SW Barrington Drive**—Future land use creates flooding along Heller Street south of Barrington Drive. The existing pipe system in this area is 12-inch PVC. Flooding is predicted to start at the 10-year event.

FLOW ASSUMPTIONS FOR ANALYSIS OF IMPROVEMENTS

Addressing the predicted future-conditions drainage problems would require costly infrastructure improvements. These costs can be avoided if future development does not lead to increased flow in the city's drainage system. This can be accomplished by requiring detention for future development to mitigate flow increases from newly developed areas. The city currently requires such detention for new development, and the detention must meet the following conditions:

- Peak flows from the developed site may not exceed flows under predevelopment conditions between the 2-year and 100-year storm.
- Predevelopment conditions are defined as forested conditions.
- The sizing of detention facilities to meet this requirement is to be accomplished using the Santa Barbara Urban Hydrograph analysis method, with Washington Department of Ecology volume corrections.

Requiring future development to meet these detention requirements will result in peak flows that should not exceed existing conditions. It is possible that some segment of the drainage network may experience an increase due to the timing of runoff hydrographs that coincide when merged, but this cannot be assessed until the details of individual future developments are known. This is a remote concern. For the analysis of improvement alternatives in this drainage plan (see Chapter 4), it is assumed that detention requirements for future development will be met, so improvements are developed to address only the problem areas present under existing conditions.



Legend

- Street
- City Boundary
- Subbasin Boundary

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Figure 3-4

Subbasins

City of Oak Harbor

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Miles

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CHAPTER 4
STORMWATER IMPROVEMENT ALTERNATIVES

Two improvement alternatives were initially evaluated: one emphasizing conveyance and one emphasizing detention. Alternative 1, the conveyance alternative, focused on enlarging pipes and ditches to provide sufficient capacity for 25-year design storm flows. Alternative 2, the detention alternative, focused on detention facilities upstream or in the vicinity of problem areas; it also includes conveyance system improvements, but they are not as extensive as those required for Alternative 1. After initial analysis of these two alternatives, a hybrid alternative was developed that incorporated the best of the conveyance and detention alternatives to provide a comprehensive solution to drainage problems.

The identified improvements are based on runoff rates for existing land use; it is assumed that detention requirements for future development will maintain the existing flow rates in the city's drainage system. All pipe improvements use hydraulically efficient smooth-bore pipe. No corrugated pipe is used.

ALTERNATIVE 1—CONVEYANCE ALTERNATIVE

Alternative 1 consists of enlarging pipes to correct flooding that occurs during the 25-year storm under existing land use. It is important to note that this approach can result in a "cascade" effect—enlarging a pipe immediately downstream of a flooding problem area addresses the flooding, but it results in additional flow being conveyed to the next pipe segment downstream, which may need to be enlarged to accommodate the new flow. This domino effect can continue for a substantial distance downstream. Following are brief descriptions of the conveyance projects. Figure 4-1 shows the improvement project locations. Summary sheets for each project, provided in Appendix B, include location maps, summaries of problems addressed, and detailed planning level cost estimates.

Alternative 1 Project 1—Pipeline Replacement Along Oak Harbor Street

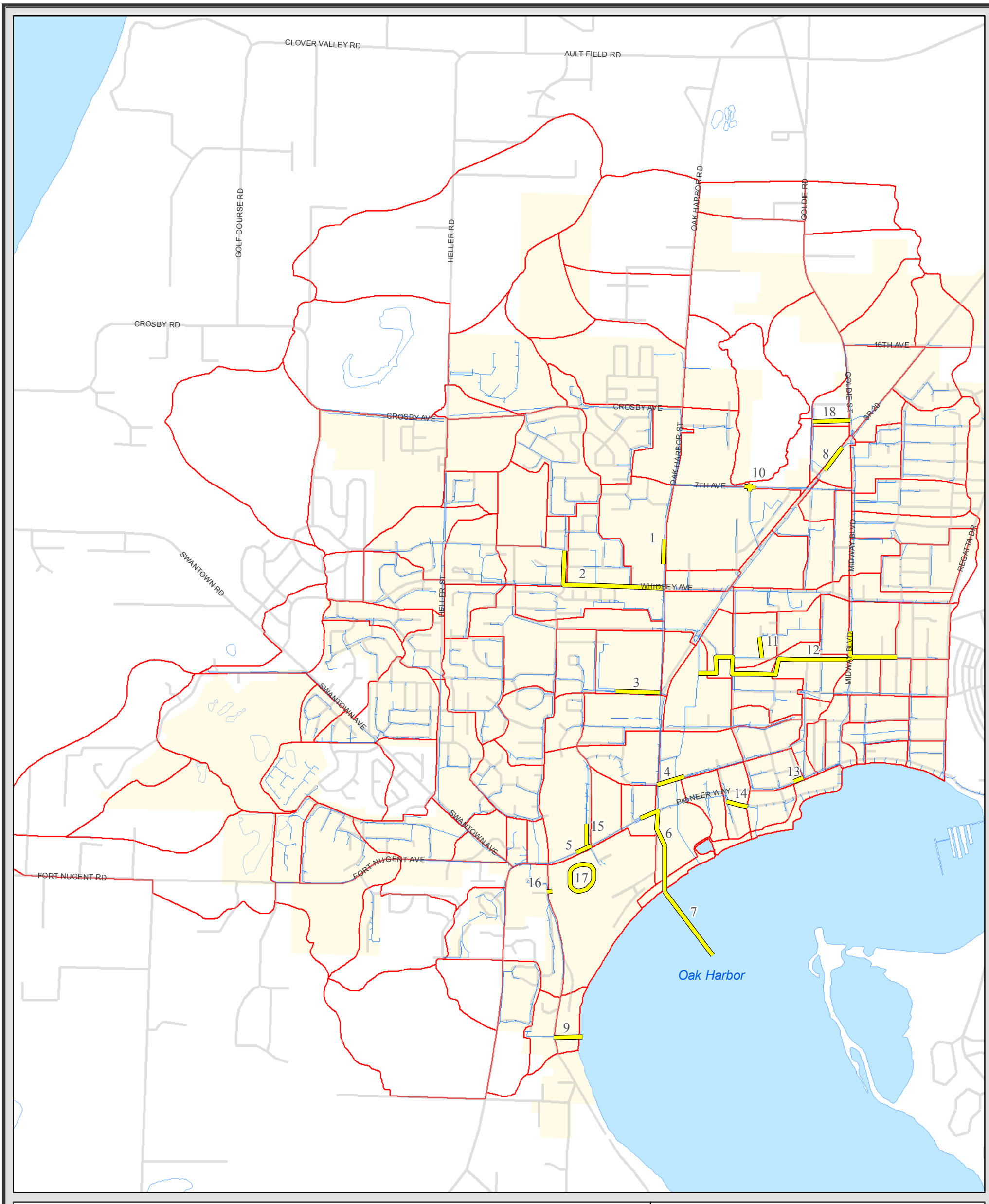
A 422-foot segment of existing 12-inch pipe needs to be replaced with 18-inch pipe. The segment to be replaced parallels Oak Harbor Street north of Whidbey Avenue.

Planning level total project cost = $145,000.

Alternative 1 Project 2—Pipeline Replacement Along West Whidbey Avenue

Several segments of the existing system require replacement along West Whidbey Avenue between Oak Harbor Street and Fairhaven Drive. The existing system in this area varies from 12- to 18-inch CMP. The required new pipe size includes 18-inch (1,880 feet) and 24-inch (634 feet).

Planning level total project cost = $723,000.



Legend

- CIP Project w/ID
- Pipe Network
- Street
- Subbasin
- City Boundary

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Figure 4-1

Alternative 1 CIP Projects

City of Oak Harbor

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Miles

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Alternative 1 Project 3—Pipeline Replacement Along SW 6th Avenue

Correcting the problem area on SW 6th Avenue requires the replacement of existing 18-inch CMP with 18-inch smooth-bore pipe. This 832-foot segment of pipe extends west from the intersection with Oak Harbor Street.

Planning level total project cost = $253,000.

Alternative 1 Project 4—Pipeline Replacement Along Barrington Drive

A short segment of the existing 18-inch drain system requires replacement to correct the flooding problem identified along this segment. About 524 feet of 24-inch pipe is required for this project.

Planning level total project cost = $192,000.

Alternative 1 Project 5—Flow Diversion on SR 20 Near SW Erie Street

This project would achieve several results:

- It would reestablish historical drainage patterns. Presently, most runoff from west of Erie Street is intercepted in the storm drainage system and conveyed east to Beeksma Drive, where it enters a 42-inch trunkline that heads south and outfalls into the harbor. Topography indicates that, prior to development, this runoff would have drained through Freund Marsh.
- It would remove runoff from the 42-inch trunkline, which is currently overtaxed, resulting in flooding near the intersection of SR 20 and Beeksma Drive. The diversion would reduce the magnitude and frequency of flooding at this intersection.
- Low flows, including any intercepted groundwater, would help sustain a constructed wetland that may be a part of the passive park concept being considered for the Freund Marsh area. The passive park concept provides several additional benefits, including the treatment of stormwater runoff, wetland creation with the associated wildlife benefits, and flood relief.

Project components include installing a new catchbasin and segment of pipe that would intercept the SR 20 system and the drainage originating on SW Erie Street and convey this drainage south to the existing drainage network in the Freund Marsh area.

Planning level total project cost = $72,000.

Alternative 1 Project 6—Pipeline Replacement and Lining Trunk

This project would almost entirely eliminate flooding in the vicinity of SR 20 and Beeksma Drive. The project consists of replacing 362 feet of 24-inch CMP with 30-inch pipe. It also includes inserting a smooth liner inside the existing 42-inch CMP trunkline; even though this would reduce cross-sectional area of this 1,558-foot segment of trunkline, the increased smoothness would improve its hydraulics.

The feasibility of lining the 42-inch trunkline may be affected by concerns about seepage, bypassing storm flows, the condition of the existing pipe, tidal backwater, access on the upper segment, and other issues. Potential alternatives to in-situ lining include sliplining, pipe bursting, and pipeline replacement.

Planning level total project cost = $858,000.

Alternative 1 Project 7—Outfall Extension on Existing Trunk

The existing outfall of the 42-inch CMP trunk that parallels Beeksma Drive is prone to plugging, which creates flooding at the intersection of Beeksma Drive and SR 20 and increases maintenance demands. Plugging frequently occurs due to large accumulations of sand and occasionally seaweed. This project consists of extending the trunkline into the bay such that the pipe terminus is always fully submerged. A predesign effort is included to resolve issues including bay bathymetry, permitting, and alignment.

Planning level total project cost = $1,706,000.

Alternative 1 Project 8—Pipeline Replacement Along SR 20 near Midway Blvd

Modeling indicates that an existing segment of 12-inch CMP is restrictive, creating a potential flooding problem. This project consists of replacing this 550-foot segment with 12-inch smooth-bore pipe.

Planning level total project cost = $130,000.

Alternative 1 Project 9—Liszak Outfall Repair

This project would repair erosion that is occurring at an outfall near SW Scenic Heights Road and SW 29th Place. This project is documented in *Liszak Outfall Drainage Review* (Cane Engineering, 2005).

Planning level total project cost = $155,000.

Alternative 1 Project 10—Drainage Component of Passive Park Creation

This project consists of reconfiguring the drainage pipe on NE 7th Avenue near NE Ellis Way in order to provide better control of the drainage exiting the large, flat, low-lying area north of NE 7th Avenue. It includes modifications of the drainage systems along NE 7th Avenue to provide access to the outlets, replacement of a culvert under NE 7th Avenue, and installation of a flow control structure on the north side of NE 7th Avenue. These modifications provide an opportunity for the city to use the area north of NE 7th Avenue area as a passive park.

Planning level total project cost = $126,000.

Alternative 1 Project 11—Pipeline Replacement Along Fisher Court North of SE 4th Avenue

This project replaces a 387-foot segment of 12-inch pipe with 24-inch pipe. This would result in an undesirable configuration of a smaller diameter pipe located downstream (12-inch), however, hydraulically it is adequate under this alternative configuration.

Planning level total project cost = $160,000.

Alternative 1 Project 12—SE 4th Avenue Drainage Improvements

A series of drainage improvements are identified along SE 4th Avenue between about SE Cabot and SE O'Leary Street. A route analysis is also identified to evaluate the feasibility of establishing a new drainage alignment since the existing alignment follows an unusual non-linear route. The existing system

consists of a mix of shallow open ditch and 8-inch through 24-inch CMP. The new system consists of 12-inch through 24-inch pipe.

Planning level total project cost = $1,404,000.

Alternative 1 Project 13—Pipeline Replacement Along Pioneer Avenue Near Hathaway Street

A short segment of existing 15-inch pipe was found to create local flooding. This project consists of replacing this segment with 189 feet of 21-inch pipe to match the adjacent existing pipe system.

Planning level total project cost = $82,000.

Alternative 1 Project 14—Pipeline Replacement Along SE Bayshore Drive East of SE City Beach Street

This project would replace a 409-foot segment of 24-inch pipe with 36-inch pipe. This would eliminate all but 4 minutes of local flooding during the design conditions. Eliminating the additional 4 minutes of flooding in this area was not deemed to be warranted since it would require costly additional upstream pipe replacement.

Planning level total project cost = $198,000.

Alternative 1 Project 15—Pipeline Replacement Along SW Erie Street Near SR 20

The existing 12-inch pipe along SW Erie Street near SR 20 would be replaced with 412 feet of 18-inch pipe to correct the localized flooding problem.

Planning level total project cost = $121,000.

Alternative 1 Project 16—Culvert Replacement Across SW Scenic Heights Street

An existing 12-inch CMP culvert requires replacement with at least a 15-inch culvert to correct the flooding problem at this location. Negotiations are underway with WSDOT, which is proposing drainage modifications in the area. These drainage negotiations may include an increase in the culvert size.

Planning level total project cost = $30,000.

Alternative 1 Project 17—Drainage Component of the Freund Marsh Passive Park Creation

Creation of a passive park at Freund Marsh would include construction elements associated with drainage that passes through the park, including runoff redirected through the marsh resulting from Alternative 1 Project 5.

To compensate for this flow redirection, it is assumed that a volume of earth equal to the volume of diverted runoff would be removed from the park area to compensate for any potential rise in water surface elevation in the park area. The actual amount of earth removal may be more or less, depending on the

layout of features in the passive park, the type of park features, the location of wetlands, tidal conditions, and final topographic configuration of park elements.

Planning level total project cost = $324,000.

Alternative 1 Project 18—Improve Conveyance Between Goldie Street and Koetje Street Near Easy Street

This project would correct a chronic flooding problem by improving conveyance of the existing drainage system between NE Goldie Street and NE Koetje Street near NE Easy Street. The existing drainage flows across private property, frequently creating flooding in the area. Runoff from over 60 acres of upstream drainage area flows through this area. Implementation of this project would require a drainage and construction easement from the property owner. Major project elements are 702 feet of 21-inch pipe, catchbasins, and an energy dissipation structure due to the steepness of the site.

Planning level total project cost = $236,000.

Cost Summary

Table 4-1 summarizes the total project cost for Alternative 1 projects.

TABLE 4-1.
ALTERNATIVE 1 PLANNING LEVEL COST SUMMARY

Project ID Number	Planning Level Total Project Cost
1	$145,000
2	$723,000
3	$253,000
4	$192,000
5	$72,000
6	$858,000
7	$1,706,000
8	$130,000
9	$155,000
10	$126,000
11	$160,000
12	$1,404,000
13	$82,000
14	$198,000
15	$121,000
16	$30,000
17	$324,000
18	$236,000
Total	**$6,915,000**

ALTERNATIVE 2—DETENTION ALTERNATIVE

The detention alternative focuses on implementing detention facilities to correct drainage problems. The detention typically has to be located in the vicinity of the problem areas, though occasionally it may be located further upstream, such as along a trunkline if a diversion from the trunk is possible and land is available to create detention. However, controlling flows after they reach a trunk requires a large detention facility. Such a facility would not be feasible for the trunk that lies in or closely parallel to SR 20 because the area is highly developed and fronts valuable commercial property.

Numerous potential detention facilities were identified that would either fully correct or partially correct existing flooding problems. These facilities are located by street intersection. Normally, the detention facility could be located within about 1,000 feet of an intersection and still function as intended. This flexibility was provided to allow placement of the detention facility when land becomes available.

An important consideration for the city's detention requirements is the duration of flows originating from a development. A flow-duration requirement was established to protect open channels from erosion and subsequent habitat degradation. Since the Dry Creek and Midway Basin are piped directly into the harbor, there are no open channels to protect, except for limited roadside ditches. This is not true, however, for the Radio Tower and Golf Course Basins. In these basins, Department of Ecology design criteria that include a duration-matching component for detention facility design were used to size facilities for this analysis. The detention alternative required retrofitting detention facilities to address specific problem areas. The criteria used for these retrofits involved configuring the facility volume and/or orifice controls to correct drainage problems for the 25-year design storm condition.

Following are brief descriptions and planning level total cost estimates for the projects included in the detention alternative. Several projects are the same as in Alternative 1 because implementation of detention to correct flooding at some locations was not practical. Other projects are similar to Alternative 1 but, because detention was implemented upstream, the improvements to downstream pipe sizes were reduced and are thus slightly different. Figure 4-2 shows the improvement project locations. Summary sheets for each project, provided in Appendix C, include location maps, summaries of problems addressed, and detailed planning level cost estimates. Note that the estimated cost of acquiring land is not included in cost estimates for the detention projects.

Alternative 2 Project 1—Pipeline Replacement Along Oak Harbor Street

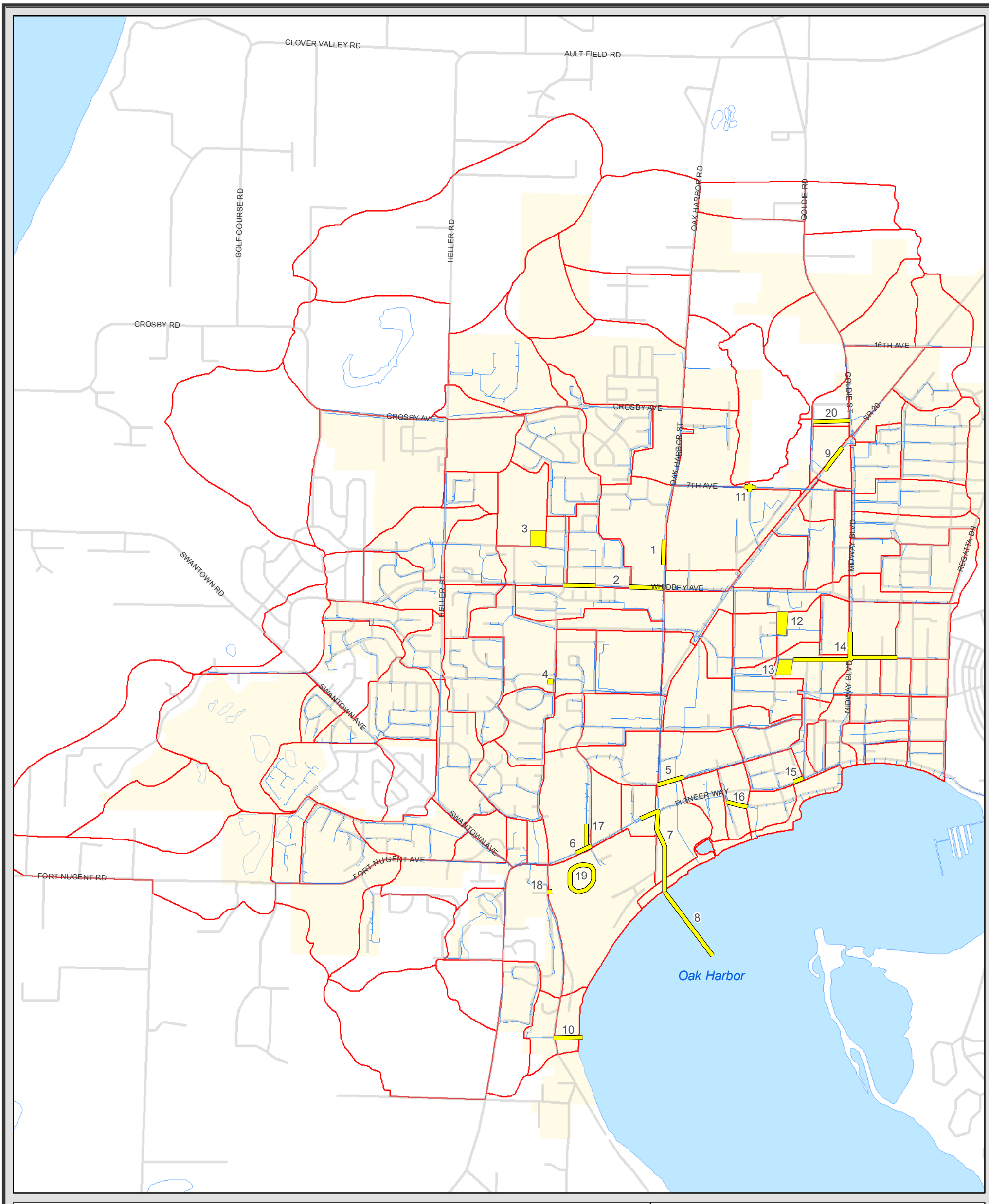
A 422-foot segment of existing 12-inch pipe needs to be replaced with 18-inch pipe. The segment to be replaced parallels Oak Harbor Street north of Whidbey Avenue.

Planning level total project cost = $145,000.

Alternative 2 Project 2—Pipeline Replacement Along West Whidbey Avenue

Upstream detention (Alternative 2 Project 3) would allow a reduction in the size and extent of necessary pipeline replacement along West Whidbey Avenue between Oak Harbor Street and Fairhaven Drive (compared to the replacement required for Alternative 1). Two pipe segments included in this project include 634 feet of 18-inch pipe between Oak Harbor Street and NW Bosun Street and 614 feet between Discovery Street and Columbia Drive. Both segments are located on Whidbey Avenue.

Planning level total project cost = $355,000.



Legend

- CIP Project w/ID
- CIP Detention Project w/ID
- Pipe Network
- Street
- Subbasin
- City Boundary

TetraTech/KCM disclaims any warranty of merchantability or warranty of fitness of this map for any particular purposes, either expressed or implied. Graphical information shown on this figure is approximate and shall not be used for any other purposes.

Figure 4-2

Alternative 2 CIP Projects

City of Oak Harbor

0 0.125 0.25 0.5
Miles

TETRA TECH/KCM

Alternative 2 Project 3—Detention Near NW Jib Street and NW 2nd Avenue

Providing detention in the vicinity of NW Jib Street and NW 2nd Avenue to control runoff from Subbasin 23 would substantially reduce capacity problems downstream along Whidbey Avenue and in the trunkline paralleling Oak Harbor Street. Restricting the discharge to no more than 2 cfs would require a 0.17-acre-foot facility, measuring about 54 feet by 65 feet, with 3 feet of active storage. A control structure using a 6-inch orifice would regulate discharge from the site.

Planning level total project cost = $124,000.

Alternative 2 Project 4—Detention Near SW 6th Avenue and SW Fairhaven Drive

This small detention facility to be located near the intersection of SW 6th Avenue and SW Fairhaven Drive would be approximately 34 feet by 37 feet at the surface. It would have an approximate active storage volume of 3,600 cubic feet, with an active storage depth of 2.76 feet, and use an outlet control structure with a 3.25-inch diameter orifice.

Planning level total project cost = $94,000.

Alternative 2 Project 5—Pipeline Replacement Along Barrington Drive

A short segment of the existing 18-inch drain system requires replacement to correct the flooding problem identified along this segment. About 524 feet of 24-inch pipe is required for this project.

Planning level total project cost = $192,000.

Alternative 2 Project 6—Flow Diversion on SR 20 Near SW Erie Street

This project would achieve several results:

- It would reestablish historical drainage patterns. Presently, most stormwater runoff from west of Erie Street is intercepted in the storm drainage system and conveyed east to Beeksma Drive, where it enters a 42-inch trunkline that heads south and outfalls into the harbor. Topography indicates that, prior to development, this runoff would have drained through Freund Marsh.
- It would remove runoff from the 42-inch trunkline, which is currently overtaxed, resulting in flooding near the intersection of SR 20 and Beeksma Drive. The diversion would reduce the magnitude and frequency of flooding at this intersection.
- Low flows, including any intercepted groundwater, would help sustain a constructed wetland that may be a part of the passive park concept being considered for the Freund Marsh area. The passive park concept provides several additional benefits, including the treatment of stormwater runoff, wetland creation with the associated wildlife benefits, and flood relief.

Project components include installing a new catchbasin and segment of pipe that would intercept the SR 20 system and the drainage originating on SW Erie Street and convey this drainage south to the existing drainage network in the Freund Marsh area.

Planning level total project cost = $72,000.

Alternative 2 Project 7—Pipeline Replacement and Lining Trunk

This project would almost entirely eliminate flooding in the vicinity of SR 20 and Beeksma Drive. The project consists of replacing 362 feet of 24-inch CMP with 30-inch pipe. It also includes inserting a smooth liner inside the existing 42-inch CMP trunkline; even though this would reduce cross-sectional area of this 1,558-foot segment of trunkline, the increased smoothness would improve its hydraulics.

The feasibility of lining the 42-inch trunkline may be affected by concerns about seepage, bypassing storm flows, the condition of the existing pipe, tidal backwater, access on the upper segment, and other issues. Potential alternatives to in-situ lining include sliplining, pipe bursting, and a full pipeline replacement.

Planning level total project cost = $858,000.

Alternative 2 Project 8—Outfall Extension on Existing Trunk

The existing outfall of the 42-inch CMP trunk that parallels Beeksma Drive is prone to plugging, which creates flooding at the intersection of Beeksma Drive and SR 20 and increases maintenance demands. Plugging frequently occurs due to large accumulations of sand and occasionally seaweed. This project consists of extending the trunkline into the bay such that the pipe terminus is always fully submerged. A predesign effort is included to resolve issues including bay bathymetry, permitting, and alignment.

Planning level total project cost = $1,706,000.

Alternative 2 Project 9—Pipeline Replacement Along SR 20 Near Midway Blvd

Modeling indicates that an existing segment of 12-inch CMP is restrictive, creating a potential flooding problem. This project consists of replacing this 550-foot segment with 12-inch smooth-bore pipe.

Planning level total project cost = $130,000.

Alternative 2 Project 10—Liszak Outfall Repair

This project would repair erosion that is occurring at an outfall near SW Scenic Heights Road and SW 29th Place. This project is documented in *Liszak Outfall Drainage Review* (Cane Engineering, November 2005).

Planning level total project cost = $155,000.

Alternative 2 Project 11—Drainage Component of Passive Park Creation

This project consists of reconfiguring the drainage pipe on NE 7th Avenue near NE Ellis Way in order to provide better control of the drainage exiting the large, flat, low-lying area north of NE 7th Avenue. It includes modifications of the drainage systems along NE 7th Avenue to provide access to the outlets, replacement of a culvert under NE 7th Avenue, and installation of a flow control structure on the north side of NE 7th Avenue. These modifications provide an opportunity for the city to use the area north of NE 7th Avenue area as a passive park.

Planning level total project cost = $126,000.

Alternative 2 Project 12—Detention Near SE Glencoe Street and SE 3rd Avenue

A small detention facility would eliminate some minor downstream flooding in this area and thus avoid the need for a downstream pipe segment replacement. This 0.08-acre-foot facility would have about 3 feet of active storage, with a discharge controlled by a 7-inch diameter orifice.

Planning level total project cost = $112,000.

Alternative 2 Project 13—Detention Near SE Glencoe Street and SE 4th Avenue

A moderate-sized detention facility near the intersection of SE Glencoe Street and SE 4th Avenue would offset required pipeline improvements in the area. This detention facility would reduce the amount of required pipeline replacement by about 2,700 feet, as well as reducing the required associated ancillary drainage components, such as catchbasins and inlets. About 3.5 feet of active depth would be required, providing about 1.1 acre-feet of active storage volume. A single 5-inch orifice would be used to regulate discharge from this site into the limited-capacity downstream system. A minor trace of flooding is still predicted downstream (less than 18 cubic feet for less than 2 minutes), which was deemed insignificant, so the facility was not enlarged to eliminate this occurrence.

Planning level total project cost = $198,000.

Alternative 2 Project 14—SE 4th Avenue Drainage Improvements

The detention identified in this area (Alternative 2, Projects 12 and 13) would greatly reduce the need for pipeline replacements in the area. However, there would still be some reaches that require replacement. This project consists of those replacements. A stretch of existing shallow ditch and 8-inch pipe between about SE O'Leary Street and SE Glencoe Street are identified for replacement with 12- and 15-inch pipe.

Planning level total project cost = $589,000.

Alternative 2 Project 15—Pipeline Replacement Along Pioneer Avenue near Hathaway Street

A short segment of existing 15-inch pipe was found to create local flooding. This project consists of replacing this segment with 189 feet of 21-inch pipe to match the adjacent existing pipe system.

Planning level total project cost = $82,000.

Alternative 2 Project 16—Pipeline Replacement Along SE Bayshore Drive East of SE City Beach Street

This project would replace a 409-foot segment of 24-inch pipe with 36-inch pipe. This would eliminate all but 4 minutes of local flooding during the design conditions. Eliminating the additional 4 minutes of flooding in this area was not deemed to be warranted since it would require costly additional upstream pipe replacement.

Planning level total project cost = $198,000.

Alternative 2 Project 17—Pipeline Replacement along SW Erie Street near SR 20

The existing 12-inch pipe along SW Erie Street near SR 20 would be replaced with 412 feet of 18-inch pipe to correct the localized flooding problem.

Planning level total project cost = $121,000.

Alternative 2 Project 18—Culvert Replacement Crossing SW Scenic Heights Street

An existing 12-inch CMP culvert requires replacement with at least a 15-inch culvert to correct the flooding problem at this location. Negotiations are underway with WSDOT, which is proposing drainage modifications in the area. These drainage negotiations may include an increase in the culvert size.

Planning level total project cost = $30,000.

Alternative 2 Project 19—Drainage Component of the Freund Marsh Passive Park Creation

Creation of a passive park at Freund Marsh would include construction elements associated with drainage that passes through the park, including runoff redirected through the marsh resulting from Alternative 2 Project 6. To compensate for this flow redirection, it is assumed that a volume of earth equal to the volume of diverted runoff would be removed from the park area to compensate for any potential rise in water surface elevation in the park area. The actual amount of earth removal may be more or less, depending on the layout of features in the passive park, the type of park features, the location of wetlands, tidal conditions, and final topographic configuration of park elements.

Planning level total project cost = $324,000.

Alternative 2 Project 20—Improve Conveyance Between Goldie Street and Koetje Street Near Easy Street

This project would correct a chronic flooding problem by improving conveyance of the existing drainage system between NE Goldie Street and NE Koetje Street near NE Easy Street. The existing drainage flows across private property, frequently creating flooding in the area. Runoff from over 60 acres of upstream drainage area flows through this area. Implementation of this project would require a drainage and construction easement from the property owner. Major project elements are 702 feet of 21-inch pipe, catchbasins, and an energy dissipation structure due to the steepness of the site.

Planning level total project cost = $236,000.

Cost Summary

Table 4-2 summarizes the total project cost for Alternative 2 projects.

TABLE 4-2.
ALTERNATIVE 1 PLANNING LEVEL COST SUMMARY

Project ID Number	Planning Level Total Project Cost
1	$145,000
2	$355,000
3	$124,000
4	$94,000
5	$192,000
6	$72,000
7	$858,000
8	$1,706,000
9	$130,000
10	$155,000
11	$126,000
12	$112,000
13	$198,000
14	$589,000
15	$82,000
16	$198,000
17	$121,000
18	$30,000
19	$324,000
20	$236,000
Total	**$5,847,000**

ALTERNATIVE 3—PREFERRED ALTERNATIVE

Table 4-3 summarizes representative peak flows from throughout the drainage system for the alternatives. The influence of the detention facilities can be seen in the reduction of several of the predicted flow rates between Alternative 1 and Alternative 2.

After the initial assessment of Alternatives 1 and 2, a meeting was held with city staff to review the alternatives and develop a third, preferred alternative combining the best elements of the Alternatives 1 and 2. The meeting assessed the feasibility of implementing the detention facilities included in Alternative 2. The full set of selection and ranking criteria used for this assessment is discussed in Chapter 5. Conceptually, the detention facilities were considered feasible and implementable. The timing of their implementation will depend on the availability of property and the degree of drainage problems the city experiences in each area.

TABLE 4-3.
25-YEAR PEAK FLOW COMPARISON

		25-Year Peak Flow (cubic feet per second)			
		Existing Land Use			Future
Conduit[a]	Description	No Improvements	Alternative 1	Alternative 2	Land Use
C79	Old trunk outfall	39.1	42.4	42.4	45.3
C83	New trunk outfall	28.2	42.1	37.2	31.6
C54	SR-20 near SW Barlow St	5.9	2.9	2.0	10.3
C99	City Beach St outfall	23.2	27.6	27.6	24.3
C12	Oak Harbor St south of 7th Ave	10.3	19.2	15.6	12.6
C124	New trunk south of 7th Ave	19.7	19.7	8.4	25.1
C167	Collector on 7th east of SR-20	22.3	22.3	22.3	28.3

a. Conduit locations shown on oversize drawing inserted at the back of this drainage plan.

Since there were no deletions from the detention facilities included in Alternative 2, and since implementing detention will save the city costs associated with pipeline enlargements that would otherwise be required, the preferred alternative (Alternative 3) is the same as Alternative 2.

CONCEPTUAL DEVELOPMENT OF REGIONAL DETENTION FACILITIES

A series of regional detention facilities were conceptually identified for subbasins on the periphery of the Dry Creek basin. The city could construct such regional facilities in anticipation of construction within a subbasin. Developers would then pay a fee to the city to use the regional detention facility in lieu of being required to construct facilities for each development in the tributary area. This would reduce the number of detention sites that must be maintained and ensure continued proper operation. The developer would be required to ensure that the drainage system between the development and the regional detention facility has adequate capacity and durability (i.e., erosion resistance) to convey the developed site runoff to the detention site.

Eight regional detention facilities were conceptually developed, sited in eight subbasins representing a variety of soil types and land coverages. The facilities were located where significant changes in land use are anticipated as development occurs. Specific locations where the facilities would be built in each subbasin were not identified, in order to retain flexibility in the timing of construction, the availability of land, and the location and extent of future development that would use the facilities.

Analysis Approach

Selected Standards and Model

Current Department of Ecology drainage standards were used to size the facilities because the Radio Tower and Golf Course Basins drain into natural drainage courses, as opposed to a piped conveyance system typical of the Dry Creek and Midway Basin. As a result, erosion and habitat issues require a higher standard to control runoff from developing areas. Consequently, the WWHM2 model was used to size facilities for these areas.

General Assumptions

The detention facilities were sized with common geometric and control attributes so they may be readily compared. Table 4-4 summarizes these attributes.

TABLE 4-4.
COMMON DETENTION ATTRIBUTES

Side slope ratio	3:1 (horizontal to vertical)
Active storage depth	6 feet
Freeboard	1 foot
Control structure	Three stage orifice with overflow

The following other assumptions were made:

- The facility serves a large development
- The pond is located at the lowest point in the development so that all runoff can be conveyed by gravity instead of pumping
- Groundwater is encountered near the base of the pond.

Rainfall

The WWHM2 model relies on long-term historical rainfall information. The nearest applicable long-term rainfall information to Oak Harbor is the City of Everett (hourly rainfall data from 10/1/1948 to 9/30/1997). WWHM2 model uses a rainfall scaling factor to adjust Everett data to local conditions . This factor is programmed into WWHM2 and is set at 0.80 for Oak Harbor. Therefore, in order to apply the Ecology-approved WWHM2 to Oak Harbor the scaling factor of 0.80 was used for preliminary sizing of stormwater detention facilities.

There is considerable variation of rainfall over Whidbey Island, particularly in the north-south direction. Available local rainfall records, recorded at the City Beach Street wastewater treatment plant, indicate that a more representative scaling factor is probably about 0.6 on average. As an example of the variability of local rainfall, the ratio of Oak Harbor and Everett annual rainfall between 1984 and 1996 varied from 0.42 to 0.86, with an average of 0.57. This analysis of historical rainfall is based on 24-hour rainfall amounts and may not necessarily represent shorter duration storm events.

Available 24-hour rainfall records at the City Beach Street gauge suggest that the WWHM2 scaling ratio could possibly be reduced for Oak Harbor. However, rainfall data for shorter periods, more representative of storms, is needed before further adjustment in the rainfall scaling ratio is made. The City has modified their operation of their gauge to record in 5-minute increments. This will allow a more detailed comparison of storm rainfall between Oak Harbor and Everett to be made in the future. For the planning-level analysis conducted for this study, the WWHM2 rainfall scaling ratio of 0.80 was applied for the preliminary sizing of facilities. If future analysis of rainfall data currently being recorded by the City demonstrates that a lower scale ratio is supportable, then final design of the facilities can be optimized and presumably result in marginally smaller sizes than presented in this plan.

Infiltration and Soil Types

Detention requirements can be significantly affected by soil types in the area being served by the detention facility. The Hoypus soils in the study area are outwash soils (Type A) that provide a good opportunity for infiltration. The till soils (Type C or D), such as Whidbey or Mukilteo, provide little opportunity for infiltration. When development occurs over a Type A soil, there can be a tremendous difference in pre- and post-development runoff. Under predevelopment conditions, little if any surface runoff occurs since most rainfall is absorbed into the soil. As a result, detention facilities sized to control surface runoff to predevelopment levels can be significantly larger than those serving the same tributary area built over Type C or D soils, which already generate runoff in the undeveloped condition. Consequently, smaller detention facilities are required for till areas. It is highly recommended to use infiltration to the greatest extent possible when developing over outwash soils. Extremely large detention facilities could otherwise be required. However, for purposes of this example, this was assumed not to occur because groundwater was found to occur within 5 feet of the surface.

Analysis Results

The detention facilities were sized using the standards and assumptions described above. Table 4-5 summarizes the results, including an indication of facility size in terms of storage volume per acre of tributary area per land use type

TABLE 4-5.
DETENTION CHARACTERISTICS

Location	Serving Subbasin	Tributary Area (acres)	Dominant Future Land Uses	Future Percent Impervious	Dominant Soil Types	Required Volume (acre-feet)	Volume/ Tributary Area (acre-feet/acre)
Dry Creek	2	94.57	32% Industrial, 51% Rural	45.6	50% Hoypus, 28% Whidbey	15.2	0.16
Dry Creek	4	44.46	88% Planned business park	54.1	100% Hoypus	8.5	0.19
Dry Creek	9	49.12	27% Industrial, 69% Rural	30.2	80% Whidbey	5.1	0.10
Dry Creek	12	76.98	60% Limited multi-family	41.4	81% Hoypus	14.2	0.18
Golf Course	48	110.29	87% Single family residential	21.9	32% Mukilteo, 27% Norma, 40% Whidbey	8.7	0.08
Golf Course	69	70.50	72% Single family residential	18.5	95% Whidbey	5.3	0.08
Golf Course	81	121.51	62% Rural, 38% SFR	10.7	97% Whidbey	5.2	0.04
Radio Tower	115	125.70	41% Limited multi-family, 36% Rural	23.1	93% Hoypus	12.0	0.10

CHAPTER 5
PROJECT EVALUATION AND PRIORITIZATION

This chapter focuses on the costs of the identified projects, the city's funding capability, the priority of the projects, and the resulting implementation schedule.

COST ESTIMATES

Cost estimates were developed for each identified project and are included in Appendix B (Alternative 1) and Appendix C (Alternative 2). The cost estimates are based on a standard cost estimating approach and consist of the following elements:

- **Unit Costs**—Unit costs are based on the *Engineering News Record* 2005 construction index for Seattle (8431.30). They are appropriate for common applications without unusual project conditions or constraints that may cause them to vary up or down. These prices are quantity sensitive. The unit prices are assessed on a project-specific basis and are adjusted if a project requires special consideration.
- **Dewatering**—This element pertains to removal of groundwater or surface water necessary to properly construct the project. A typical value is 5 percent of the construction cost.
- **Erosion and Sedimentation Control**—This element represents erosion prevention measures required of the contractor when constructing a project. These may include such items as silt fencing, catchbasin inlet protection, and spreading straw over disturbed soils during idle construction periods. A typical value is 10 percent of the construction cost.
- **Traffic Control**—This element is assigned a typical value of 3 percent of the construction cost.
- **Contingency**—The contingency assigned to each project is 30 percent. This relatively high but typical value is used since there are considerable uncertainties associated with the identified projects. These uncertainties include lack of detailed site survey, uncertain geotechnical conditions and associated design constraints, potential utility interference, alignment and property/easement requirements, and other ancillary drainage components (such as inlets) that may require replacement.
- **Mobilization**—This element represents the cost of the contractor gathering and transporting his equipment to the construction site and the removal of the equipment when the project is completed. A value of 10 percent of the construction cost is used.
- **Sales Tax**—The city is required to pay state sales tax on drainage construction improvements. The rate of 8.3 percent is applied to the construction cost and is included in the estimate.
- **Engineering/Legal/Administration**—This element represents the cost to design the improvement, the city's legal costs, and the city administration costs. It is assigned using the following sliding scale based on the construction cost:
  - Construction cost range $0 to $10,000, use 100 percent of the construction cost
  - Construction cost range $10,001 to $50,000, use 85 percent of the construction cost
  - Construction cost range $50,001 to $100,000, use 50 percent of the construction cost
  - Construction cost range $100,001 to $250,000, use 35 percent of the construction cost

  - Construction cost greater than $250,000, use 25 percent of the construction cost

- **Construction Management**—This cost is assigned 20 percent of the construction cost and covers the cost of city staff or engineering consultant to monitor and document the construction to ensure that it is built to the plans and specifications of the project.
- **Permitting**—Permitting costs are assigned using the following sliding scale based on the construction cost:
  - Construction cost range $0 to $50,000, use 20 percent of the construction cost
  - Construction cost range $50,001 to $250,000, use 10 percent of the construction cost
  - Construction cost greater than $250,000, use 5 percent of the construction cost

A line item was shown for land acquisition, however, since individual parcels were not identified for acquisition and the city owns land throughout the study area that may be used for some projects, land costs were not included for any project. For any project that requires land acquisition if there is no city-owned land available, the cost will increase accordingly.

FUNDING SOURCES

Current Stormwater Funding

The city has a dedicated source of revenue in the form of monthly stormwater utility fees. The city collected $539,286 in stormwater utility charges in 2002, $576,610 in 2003 and $598,920 in 2004. These charges are deposited in the Storm Drain Fund and used for operating expenses, repair and replacement, capital improvements, debt service and reserves. In addition, there is a Storm Cumulative Reserve Fund where capital-related revenue is deposited for future capital improvements.

Residential customers pay a flat rate of $4.81 per month for stormwater. Other properties pay based on measured impervious area, as shown in Table 5-1. The current rates have been in effect since 2003.

TABLE 5-1.
STORM DRAIN MONTHLY RATES, EFFECTIVE MARCH 20, 2003

Residential	$4.81	Flat Rate
Commercial	$4.81	per 2,500 square feet of impervious area
Non-Profit	$1.21	per 2,500 square feet of impervious area
Schools	$3.62	per 2,500 square feet of impervious area

The city is discussing an increase in the monthly rate to meet increases in operating expenses. A separate discussion on funding of the capital program will follow this comprehensive planning effort and related rate study.

Capital Program Funding Methods

Some cities prefer a “pay-as-you-go” method of funding capital improvements and seek grants and/or partnerships to leverage ratepayer investment in the system. This means that the capital portion of the rate is either used in the year collected or held in reserve for future capital improvements as can be afforded. The fund balance typically fluctuates under this method of funding. For years when the fund balance

appears high, it is important to identify the minimum target reserve or set-aside emergency and cash flow reserves to avoid potential depletion of the fund.

Other common methods of funding capital improvements include borrowing, ranging from selling bonds on the open market to procuring low-interest loans from a state or federal program. The choice of financing at any time should include an evaluation of the risks associated with the various alternatives:

- Risk that project costs will increase
- Risk of not receiving the funding package
- Risk associated with financing costs.

These risks change over time, depending on trends related to the construction cost index and interest rates.

The following sources of funding are available for capital projects but are not recommended for ongoing operations:

- **Grants**—Grant funds are a good source of capital funding because the money does not have to be repaid. Unfortunately, grants can be hard to come by. The city should continue to monitor and pursue grants when available.
- **Low-Interest Loans**—The State of Washington operates several low-interest loan programs for surface water and water quality capital projects. The Public Works Trust Fund has both a Pre-Construction and a Construction program, with loans with interest rates up to 2 percent and loan terms up to 20 years. The Department of Ecology operates several programs: the Centennial Clean Water Fund, the Water Pollution Control State Revolving Fund, Section 319 Non-point Source Fund, and the Flood Control Assistance Program. Ecology funds may include partial grants and loans with interest up to 2 percent.
- **Bond sales**—The city has the authority to sell several types of bonds that would be appropriate for capital projects: revenue, general obligation, limited general obligation and local improvement district bonds. In general, bonds can be a more costly form of funding capital projects than grants and low-interest loans from the state, but the timing is controlled by the utility and the assurance of receiving financing is higher than applying to competitive programs.
- **Contributions, Joint Projects**—Pursuing contributions from benefiting parties or joint projects can provide cost savings to the storm drain fund when appropriate for the project.
- **System Development Charge (SDC)**—This is a method of having development contribute its fair share of the system cost upon connection. This recognizes that a stormwater system is in place and that new development benefits by connecting into it. In return for connection, developers pay a one-time fee that is deposited into the capital reserves and used to fund capital projects or associated debt. These charges can be calculated for system-wide improvements or can differ by specific area or facility. Oak Harbor currently uses system development charges for water and sewer facilities.
- **Developer Extension**—Developers may be required to extend the drainage system to serve property that is to be developed. These projects are funded and completed by the developer. When complete, the facilities are deeded to the city.
- **Latecomer's Fees**—This fee would be the result of a latecomer's agreement with a developer that has constructed an improvement that serves an area beyond his/her property and is deeded to the city. The latecomer's agreement specifies that other properties that connect into

the improvements within a certain period of time must contribute their fair share. The city would collect the latecomer's fee and forward it to the developer.

- **Local Improvement Districts (LID/ULID)**—All benefiting properties share in the cost of installing necessary improvements. Assessments are filed on each property and the property owners pay the annual assessments over a specified number of years.
- **Fee-In-Lieu-Of**—This method works with regional-type facilities. The city would fund the capital improvement up front and would be repaid as development occurs and pays its share of the cost.
- **City Participation in Oversizing—**When the comprehensive plan calls for a larger facility or line than is necessary for the next development, the city may participate in the cost of oversizing according to city policy. In order to do so, the capital improvement must have been identified as city-funded in the capital facility plan. Some cities provide a credit toward the system development charge and others have a reserve for oversizing. In order to provide credit, the project must be included in the system development charge calculation.

These methods can be used in combination with one another and should be consistent with city policy.

EVALUATION MATRIX

A matrix was developed to provide guidance in prioritizing the recommended projects. The matrix consists of several criteria against which each project is evaluated. Each project is assigned points for each criterion, varying from one to five. A value of one indicates a low value or risk, such as a minor flooding problem or a problem that has little flooding impact on citizens of Oak Harbor. A value of five indicates a project that has a high value or risk and corrects a major flooding problem or one that impacts a large number of citizens. A weighting factor is applied to individual criteria to give greater emphasis to those considered more important to the city. A larger value indicates a greater importance to the city. As a result of applying the scoring and weighting factor, projects that receive higher scores are considered more urgent/important to implement than those that receive lower scores. The criteria, and their weighting factors, are as follows:

- **Historical Flooding Problem**—This criterion flags problem areas that the city has had to address repeatedly over the years. A low score indicates that the problem is infrequent and requires minimal staff effort to correct. A high value reflects a frequently occurring problem area that requires significant staff effort to correct. **Weighting factor = 2.5.**
- **Predicted Flooding Problem**—This criterion is based on the predicted flooding areas identified through the modeling performed for this drainage plan. A low score indicates a problem area predicted to have a low magnitude of flood volume and little impact on the citizens of Oak Harbor. An example of this problem is a predicted flooding location with minor flood volume not fronted by developed property. A high score indicates a significant flooding location with high likelihood of impacting traffic or flooding of developed property. **Weighting factor = 1.0.**
- **Frequency of Flooding Problem**—This criterion scores projects based on the frequency of predicted flooding. A low score indicates that the proposed project corrects infrequent flooding, such as that which would occur during a 100-year, 24-hour storm event. A high score would be assigned to a project that corrects frequent and chronic flooding, such as in an area that has received frequent citizen complaints or that floods during a 2-year storm event. **Weighting factor = 2.0.**
- **Project Cost**—This criterion rates the total economic impact on the city for construction of the proposed project. Scoring considers the total project cost, which includes design,

construction, construction management, and contingency (see Appendix A for detailed project cost components). A low-scoring project has a high economic impact on the city. A high score indicates a project with a low economic impact on the city. **Weighting factor = 2.0.**

- **Relation to Other City Projects**—This criterion defines the relationship of the proposed project to other projects that the city may be considering in the area and the ease with which the recommended project can be incorporated with the other city project. For example, if the city is considering a road widening project and the proposed flood correcting project consists of a pipe replacement that can be easily incorporated into the design, the project is assigned a high score. Conversely, if a proposed pipeline replacement project occurs where the city has just widened and paved a road and the proposed pipeline project would cut through this recently finished area, it would be assigned a low score. **Weighting factor = 2.0.**
- **Construction Related Impacts**—Many construction project elements can be objectionable to the public during construction. Depending on the type and location of construction, construction noise or impacts on transportation or recreation can be issues. This criterion assigns a low score to a project that would have a significant adverse impact on transportation or recreation, or is located where construction noise would be especially undesirable. A project would receive a high score if few or no adverse construction impacts are anticipated. **Weighting factor = 0.5.**
- **Multiple Use Potential**—Frequently, opportunities exist during project design to provide multiple uses of the final facility. For example, a regional detention facility may be able to double as a park or playfield during non-storm periods. A project with no multiple-use potential, such as the replacement of an undersized pipe, is assigned a low score for this criterion. A high score is assigned if other beneficial uses may be incorporated into the project. **Weighting factor = 2.0.**

PROJECT PRIORITIZATION

The evaluation matrix was used to determine the priorities of the projects that compose the Preferred Alternative. Table 5-2 summarizes the matrix and its results. The five highest priority projects are as follows:

1. Alternative 2, Project 6—Flow diversion on SR-20 near SW Erie Street
2. Alternative 2, Project 8—Outfall extension on existing trunk
3. Alternative 2, Project 11—Drainage component of passive park creation
4. Alternative 2, Project 19—Drainage component of the Freund Marsh passive park creation
5. Alternative 2, Project 3—Detention near NW Jib Street and NW 2nd Avenue.

The results of the evaluation matrix are used to develop the capital improvement project list and sequencing, as discussed in Chapter 7.

TABLE 5-2.
EVALUATION MATRIX

Project Number	Score: Historical Flooding Problem[a] (Weight Factor = 2.5)	Predicted Flooding Problem[b] (Weight Factor = 1.0)	Frequency of Flooding Problem[c] (Weight Factor = 2.0)	Project Cost[d] (Weight Factor = 2.0)	Relation to Other City Projects[e] (Weight Factor = 2.0)	Construction Related Impacts[f] (Weight Factor = 0.5)	Multiple Use Potential[g] (Weight Factor = 2.0)	**Weighted Total**	Rank
1	3	2	3	3	3	2	1	**30.5**	11
2[h]	5	3	4	2	3	3	1	**37.0**	6
3[h]	3	3	4	3	4	4	2	**38.5**	5
4	4	2	2	4	3	4	2	**36.0**	8
5	2	2	3	3	3	2	1	**28.0**	15
6[i]	5	3	3	4	5	1	2	**44.0**	1
7[i]	5	3	2	1	3	1	1	**30.0**	13
8	5	3	5	1	5	5	1	**42.0**	2
9	1	1	2	3	3	1	1	**22.0**	20
10	4	3	3	3	3	5	1	**35.3**	9
11	2	3	3	3	5	4	5	**42.0**	2
12	1	2	4	3	2	4	2	**28.5**	14
13[j]	1	2	4	3	2	4	3	**30.5**	11
14[j]	1	3	4	1	3	3	1	**25.0**	19
15	2	1	2	4	3	2	1	**27.0**	17
16	1	2	3	3	3	4	1	**26.5**	18
17	2	1	3	3	3	4	1	**28.0**	15
18	3	1	2	5	4	4	1	**34.5**	10
19	2	3	3	2	5	3	5	**39.5**	4
20[k]	5	4	4	2	2	1	2	**37.0**	6

a. Scoring based on history of flood problem—**1:** no flooding; **3:** neutral; **5:** city-noted chronic problem
b. Scoring based on predicted flood volume in acre-feet—**1:** <=0.01; **2:** 0.01 – 0.2; **3:** 0.21 – 0.5; **4:** 0.51 – 0.8; **5:** >0.8
c. Scoring based on predicted flood frequency—**1:** 100-year; **2:** 25-year; **3:** 10-year; **4:** 2-year; **5:** every rain event
d. Scoring based on estimate project cost—**1:** >$400k; **2:** $200k - $400k; **3:** $100k - $200k; **4:** $50k - $100k; **5:** <$50k
e. Scoring based on effect on other city projects—**1:** adversely affects other projects; **3:** no effect; **5:** works well with another project
f. Scoring based on construction impact—**1:** impact on major street or business area; **3:** impact on minor residential street; **5:** little impact
g. Scoring based on potential for multiple uses of project—**1:** no multiple use potential; **3:** potential to coordinate with nearby project; **5:** great multiple use potential
h. Projects 2 and 3 are related
i. Projects 6 and 7 are related
j. Projects 13 and 14 are related
k. Volume determined by flow through improvement

CHAPTER 6.
NPDES PHASE II COMPLIANCE

This section provides a description of the City of Oak Harbor's obligations and requirements under the National Pollutant Discharge Evaluation System (NPDES) Municipal Storm Water Phase II Final Rule (December 1999). These requirements have not yet been finalized; as described below.

BACKGROUND

The federal Clean Water Act is the primary federal law protecting water quality and includes the NPDES permit program. Point source discharges (typically thought of as "end-of-pipe" discharges) to waters of the U.S., including stormwater and wastewater discharges, are regulated through NPDES permits issued by the U.S. Environmental Protection Agency (EPA) or delegated states. In Washington, NPDES permits are issued and implemented by the Washington Department of Ecology.

The stormwater portion of the federal NPDES regulations has been implemented in two phases. Phase I addressed stormwater discharges by large and medium municipal separate storm sewer systems (MS4s) and certain industrial activities, including construction sites disturbing more than 5 acres. The term "separate" means that wastewater such as sewage is not combined with stormwater runoff. The Phase I stormwater regulations were published in 1990. Phase II addresses MS4s in smaller municipalities and construction sites disturbing between 1 and 5 acres; those regulations were adopted in December 1999.

The Phase II rules identify additional municipalities subject to NPDES municipal stormwater permitting requirements. Cities and counties in Washington are required to apply for stormwater Phase II permit coverage if they meet all of the following conditions:

- Own and operate a municipal separate storm sewer drain system
- Discharge from the MS4 to surface waters
- Are located within a census-defined urbanized area, or are otherwise designated by Ecology.

There are three ways by which a small MS4 may be designated as a "regulated small MS4" that requires permit coverage:

- Small MS4s located within the boundaries of a U.S. Census Bureau-defined urbanized area based on the latest decennial census are automatically designated.
- Small MS4s that are located outside of Urbanized Areas serving jurisdictions with a population of at least 10,000 and a population density of at least 1,000 people per square mile and which meet certain criteria are to be evaluated for designation by the permitting authority (Ecology).
- Small MS4s outside of Urbanized Areas that contribute substantially to pollutant loadings of a physically interconnected MS4 that is regulated by the NPDES stormwater program are designated.

Ecology developed maps to illustrate the census-defined Urbanized Areas for Washington state and a list of 115 towns, cities and counties that may need to obtain a Phase II permit. The list includes towns, cities and counties that meet any one of the following criteria:

- Phase II jurisdictions inside the Urbanized Areas

- Jurisdictions with populations less than 1,000 inside the Urbanized Areas
- Jurisdictions outside the Urbanized Areas meeting the thresholds of population of at least 10,000 and population density of at least 1,000 people per square mile.

"BUBBLE" COMMUNITIES

According to the census data, the City of Oak Harbor falls under the last bullet above, and as such, is what has been labeled a "bubble" community for which the federal regulations provide discretion over whether a Phase II permit is required. Other communities in Western Washington that fall into this classification (located outside a census-defined urbanized area, but meeting the population and population density thresholds) include Aberdeen, Anacortes, Centralia, and Port Angeles.

Ecology developed criteria to address whether bubble communities would be designated a regulated small MS4s that require an NPDES Phase II permit. If either of the following criteria is met, the community is designated and must obtain permit coverage:

- The MS4 discharges stormwater to impaired or sensitive waters.
- The MS4 is a significant contributor of pollutants to waters of the United States, based on best available science and readily available information.

"Impaired waters" are Clean Water Act Section 303(d)-listed water bodies. "Sensitive waters" include public drinking water intakes and their designated protection areas; designated public swimming areas; shellfish beds; state-designated outstanding resource waters; national marine sanctuaries; state aquatic reserves; and waters determined to be critical habitat for threatened or endangered species.

In its evaluation of the City of Oak Harbor's bubble status, Ecology cited the city's location adjacent to Puget Sound and Oak Harbor, the presence of shellfish beds and proposed bull trout critical habitat as considerations under the first criterion. The agency also considered that the City of Oak Harbor is growing in population. These considerations were the basis for Ecology's decision to designate the city for NPDES Phase II status.

The city has received notification from Ecology that it has been designated for NPDES Phase II permit coverage. This notification does not require the city to file application or notice of intent (NOI) for permit coverage. If the city remains a designated jurisdiction, it will be required to file for permit coverage within 60 days after the permit is final (likely to occur in the fall of 2006).

STATUS OF NPDES PHASE II PERMIT

Ecology has developed separate NPDES Phase II permits for Western and Eastern Washington. The first preliminary draft Phase II permit for Western Washington was released on May 16, 2005. Ecology received substantial comment on the draft from agencies, cities, counties, and private organizations. The City of Oak Harbor submitted individual comments challenging its designation status under Phase II and endorsing comments submitted by the APWA Stormwater Managers and the Association of Washington Cities and Counties. Concerns identified in comments by these two groups and other Phase II cities include the following:

- The draft permit's requirement for permittees to conduct research on BMP effectiveness
- Assigning responsibility to Phase II permittees to identify facilities needing NPDES permits
- Adequate staffing levels at Ecology, with trained personnel capable of reviewing and approving any submittals for NPDES permits

- Coordination with other jurisdictions should be encouraged but not a permit requirement
- Utilizing forested conditions as a pre-developed condition for redevelopment, asserted to cause jurisdictions extensive legal liability for a takings claims
- Requiring jurisdictions to view conversion of hardened surfaces such as gravel roads used for many years to asphalt as "new construction" will result in fewer roads being converted so that these road remain substandard for the traveling public
- The definition of new discharge and its apparent certification by the local jurisdiction for new developments not causing water quality standard exceedances even after application of the *Ecology Stormwater Management Manual* causes many concerns
- The proposal in the permit to require new developments to use the *Ecology Stormwater Management Manual* (or equivalent) within a short period of time after adoption ignores state vesting laws
- The permit appears to shift from a technology-based permit to a standards-based one, contrary to what was agreed to by Ecology and the Westside Stormwater Committee in 2003.
- The deadlines are unreasonable for the majority of the Phase II permittees
- The number of submittals and types of reports needed appears to be mainly busy-work and outside the Clean Water Act obligations
- The requirement to submit all data in GIS formats conforming to the state's standards is unworkable
- Monitoring should only be focused on program elements. Compliance monitoring of permit commitments appears to be reasonable, but standards monitoring is not
- The definition of "new discharge" seems to include any change to an existing outfall
- The only monitoring required in many other states with adopted permits is evaluation of program compliance.

Ecology received comments from numerous agencies and environmental organizations as well. The nature of these comments is more favorable toward monitoring and more aggressive efforts to prevent stormwater impacts, such as designating additional urban growth areas for permit coverage, including Island County around the City of Oak Harbor (Puget Sound Action Team). There was some general agreement, however, that BMP effectiveness monitoring should be done through a regional effort, external from permit requirements.

The revised draft NPDES Phase II permit is scheduled to be released on February 15, 2006. Following a three-month review period, the permit will be finalized, currently anticipated in September 2006.

PROBABLE NPDES PHASE II REQUIREMENTS

The full requirements for permittees under the NPDES Phase II permit will not be known until the permit becomes final. However much of the basis has been laid out in the preliminary draft permit, which is focused around the "six minimum measures" specified in the federal regulations. Table 6-1 summarizes the major requirements in the preliminary draft permit and actions that will be necessary from the city should they remain in the final permit. Actions that would be required of the city under the preliminary draft Phase II permit include the following:

- Adopt stormwater compliance standards specified in the permit, or equivalent.
- Develop a monitoring program (not actually conduct sampling) over the course of the permit.

- Conduct a targeted public education and outreach program to address a minimum of eight specified topics/audiences.
- Convene an ongoing public participation forum on matters related to the city's stormwater program.
- Develop and implement a program to address illicit (non-stormwater) discharges.
- Update the city's program addressing stormwater runoff from new development, redevelopment, and construction sites of 1 acre or larger.
- Develop and implement a pollution prevention and operation and maintenance program that complies with the permit standards.

A number of the required elements and actions in the Phase II permit are at least partially addressed by existing city code and programs. Oak Harbor city code already references the most current version of the *Ecology Stormwater Management Manual* as technical guidance, prohibits non-stormwater discharges, and requires stormwater site planning and control from new development, redevelopment and construction sites of 1 acre and larger. The city conducts public education, pollution prevention, and an operation and maintenance program (including illicit discharge detection). Most of these programs would require additional effort, however, under the preliminary draft Phase II permit.

FINANCIAL/TECHNICAL ASSISTANCE TO PHASE II COMMUNITIES

Ecology has offered grants of $75,000 to 32 Phase II communities across the state to assist with development of the communities' stormwater management programs. Oak Harbor has applied for and will receive the grant assistance.

RECOMMENDED NEXT STEPS

The City of Oak Harbor has been actively tracking development of the NPDES Phase II Municipal Stormwater General Permit, and also initiating and implementing stormwater program elements independently of the NPDES program. At this point, we recommend the following actions related to the Phase II permit:

- Obtain the final draft NPDES Phase II permit when it is released on February 15, 2006. Review changes from the preliminary draft, and evaluate the impact on the City
- Continue to assess whether the City will appeal its Phase II designation
- Provide comments to Ecology on designation status and the final draft permit
- If the City accepts designation status, continue pursuing $75,000 grant assistance. Develop and finalize scope of work for grant.
- Continue to track Ecology permit development and finalization
- Prepare to submit Notice of Intent (NOI) when permit becomes final (anticipated for September 2006)
- Further evaluate actions required by the permit; begin programming these activities into the City's budget and work plan.

TABLE 6-1.
NPDES PHASE II MUNICIPAL STORMWATER PERMIT GAP ANALYSIS[a]

Schedule	Performance Measure	Current Activity?	Action Required
Submit Application for NPDES Phase II Coverage			
Within 60 days of General Phase II permit becoming final	Submit complete Notice of Intent (NOI)	No	Submit NOI
Compliance with Standards			
Upon effective permit date	**Existing discharges**—reduce discharge of pollutants to the maximum extent possible (MEP) **New discharges**—must comply with all applicable surface water, ground water and sediment management standards *Note: Compliance determined through assessment that discharges are controlled in accordance with technical standards Ecology's Best Management Practices (BMP) selection and site planning process and "Controlling Stormwater Runoff from New Development, Redevelopment, and Construction Sites* *Note on interim management: From the effective date of the permit until the City adopts the required technical standards, the City must provide the following information to project proponents of projects that will disturb 1 acre:* • *Stormwater discharges from project site must not cause or contribute to a violation of applicable surface water, ground water and sediment management standards, including the State's narrative criteria for water quality; and* • *Project proponents may apply the technical standards referenced above as a means of achieving compliance; and* • *If project proponent chooses not to apply the technical standards referenced above, they must be prepared to demonstrate that the new stormwater discharge does not cause or contribute to a violation of applicable surface water, ground water and sediment management standards.*	Partial (current Ecology standards adopted by reference)	Evaluate City discharges for compliance with MEP standard for existing discharges

a. Based on the First Preliminary Draft Proposed Municipal Stormwater NPDES General Permit for Western Washington Phase II Small Municipal Separate Stormwater Sewer Systems, version 6, May 16, 2005. The second draft of this permit is scheduled for release on February 15, 2006

TABLE 6-1 (continued).
NPDES PHASE II MUNICIPAL STORMWATER PERMIT GAP ANALYSIS[a]

Schedule	Performance Measure	Current Activity?	Action Required
Monitoring Program			
Submit for approval within four years of effective permit date	Monitoring program must address the following questions: • Is Stormwater Management Program (SWMP) adequate to prevent adverse impacts? • Is permittee's SWMP preventing impacts?	No	Develop monitoring program *<u>Note:</u> February 15, 2006 draft permit will contain revised requirement.*
Stormwater Management Program (SWMP)			
General			
None	Include ongoing program for gathering, maintaining, and using information to track SWMP development and implementation, evaluate permit compliance/non-compliance, and to determine effectiveness of the SWMP implementation. Track and report cost of SWMP development and implementation Include process for consideration of public comments Annual updates required	No	Develop process to track, document, and report SWMP development and activities

a. Based on the First Preliminary Draft Proposed Municipal Stormwater NPDES General Permit for Western Washington Phase II Small Municipal Separate Stormwater Sewer Systems, version 6, May 16, 2005. The second draft of this permit is scheduled for release on February 15, 2006

TABLE 6-1 (continued).
NPDES PHASE II MUNICIPAL STORMWATER PERMIT GAP ANALYSIS[a]

Schedule	Performance Measure	Current Activity?	Action Required
SWMP (continued)			
Public Education and Outreach			
Develop and begin to implement a program within two years from effective permit date	Multimedia approach, targeted and presented to specific audiences including, at a minimum: • General audience—importance of improving water quality, reducing impervious surface and protecting beneficial uses of waters of the state, potential impacts caused by stormwater discharges, and methods for avoiding, minimizing, reducing and/or eliminating the adverse impacts of stormwater runoff • General audience—provide and encourage participation in environmental stewardship • General audience—individual actions that can improve water quality and reduce impervious surfaces • General audience—proper use and disposal of pesticides, herbicides, and fertilizers • Engineers, construction contractors, developers, development review staff, and land use planners—information on technical standards, the development of stormwater site plans and erosion control plans, and stormwater best management practices for reducing adverse impacts from stormwater runoff from development sites. • Engineers, contractors, developers, and public—land development practices and non-structural BMPs such as low impact development • Businesses and others—illicit discharges • Public, businesses and others—promoting proper management and disposal of toxic materials	Partial	Obtain or develop specified educational materials Develop and implement program to communicate and distribute educational materials
Public Involvement and Participation			
No later than one year from effective permit date	Provide opportunity for public to participate in decision-making processes involving the SWMP Public participation opportunities must be ongoing Make SWMP and all documentation related to it and this permit available on the City's website Annual report must be submitted to Ecology in electronic format for posting on Ecology's website	No	Convene a citizen-based committee to participate in SWMP Create a location within the City's website for the SWMP and related documentation

a. Based on the First Preliminary Draft Proposed Municipal Stormwater NPDES General Permit for Western Washington Phase II Small Municipal Separate Stormwater Sewer Systems, version 6, May 16, 2005. The second draft of this permit is scheduled for release on February 15, 2006

TABLE 6-1 (continued).
NPDES PHASE II MUNICIPAL STORMWATER PERMIT GAP ANALYSIS[a]

Schedule	Performance Measure	Current Activity?	Action Required
SWMP (continued)			
Illicit Discharge and Detection			
Within four years of effective permit date (fully implement)	Map of municipal storm sewer Ordinance prohibiting non-stormwater discharges Program to detect and address non-stormwater discharges Training to field staff on identification and reporting of illicit discharges	Partial (storm sewer mapping, ordinance prohibiting non-stormwater discharges)	Develop and implement an ongoing program to detect and address non-stormwater discharges Initiate training for field staff
Controlling Stormwater Runoff from New Development, Redevelopment and Construction Sites (1 acre or more)			
Within one year of effective permit date	Ordinance or enforceable mechanism that addresses runoff from new development, redevelopment, and construction site projects and covers all elements specified in the permit.	Partial (ordinance, process)	Assess whether update needed to ordinances to address runoff from new development, redevelopment, and construction site projects and to ensure adequate long-term operations and maintenance
Within two years of effective permit date	Process of permits, plan review, inspections, and enforcement capability to meet standards specified in the permit Ordinance or enforceable mechanism to ensure adequate long-term operations and maintenance Record-keeping for inspections and enforcement Process to make NOI copies available to project proponents Training for staff assigned to this function within the City		Review process of permits, plan review, inspections and enforcement capability for compliance with permit standards Establish record-keeping systems for inspections and enforcement Prepare to make NOI copies available to project proponents Initiate staff training

a. Based on the First Preliminary Draft Proposed Municipal Stormwater NPDES General Permit for Western Washington Phase II Small Municipal Separate Stormwater Sewer Systems, version 6, May 16, 2005. The second draft of this permit is scheduled for release on February 15, 2006

TABLE 6-1 (continued).
NPDES PHASE II MUNICIPAL STORMWATER PERMIT GAP ANALYSIS[a]

Schedule	Performance Measure	Current Activity?	Action Required
SWMP (continued)			
Pollution Prevention and Operation and Maintenance for Municipal Operations			
Within 3 years of effective permit date (develop and implement)	Maintenance standards at least as protective as those specified in the Stormwater Management Manual for Western Washington	Partial	Review maintenance standards for compliance with permit standards
	Annual inspection and follow-up maintenance of all municipally owned or operated stormwater treatment and flow control facilities		Develop and implement inspection and maintenance program that includes treatment and flow control facilities, catch basins, and spot checks after storm events. Program will include documentation of inspections and maintenance.
	Spot checks of potentially damaged treatment and flow control facilities after major storm events		
	Inspection of all catch basins and inlets owned or operated by the City at least once before the end of the permit term. Clean out catch basins if necessary		
	Compliance with inspection requirements will be determined by the presence of an established inspection program designed to inspect all sites (documented?)		Develop and implement a program to reduce stormwater impacts from all City-owned facilities and properties
	Establish and implement practices to reduce stormwater impacts associated with runoff from public streets, public parking lots, public roads, highways, and public road maintenance activities		Initiate training for City staff
	Establish and implement policies and procedures to reduce pollutants in discharges from all lands owned or maintained by the City		Develop and implement SWPPPs for specified facilities
	Training for all City employees whose job function may impact stormwater quality		
	Develop and implement Stormwater Pollution Prevention Plans (SWPPP) for all heavy equipment maintenance or storage yards, and material storage facilities owned or operated by the City that are not covered under the Industrial Stormwater General permit.		
	Record keeping of inspections and maintenance or repair activities		

1. This evaluation is based on the First Preliminary Draft Proposed Municipal Stormwater NPDES General Permit for Western Washington Phase II Small Municipal Separate Stormwater Sewer Systems, version 6, May 16, 2005. The second draft of this permit is scheduled for release on February 15, 2006

CHAPTER 7
RECOMMENDED PLAN IMPLEMENTATION

This chapter presents a capital improvement program (CIP) based on information developed in the preceding chapters. The CIP outlines an implementation schedule reflecting individual project priorities and the city's ability to finance the projects.

CAPITAL IMPROVEMENT PROGRAM

Table 7-1 depicts a CIP using an annual allocation of $250,000 applied toward drainage capital improvements. When a project cost exceeds this value, the CIP for that project may be viewed as the time it takes to "bank" the funds before the project can be constructed. The project would then be constructed at the end of this banking period when sufficient funds are available. Alternatively, a short term loan may be obtained to construct the project at the start of this period and paid back over the remainder of the period. The CIP does not indicate the time necessary for project construction. The estimated $5,847,000 cost is in 2005 dollars. No escalation rate has been applied.

Another way to represent the CIP is to assume a time frame in which all the identified projects are to be implemented. A typical planning period is 20 years. Using this period, approximately $292,350 per year must be allocated to drainage improvements. Table 7-2 depicts the CIP under this scenario. Again, present costs are shown with no escalation.

The $5,847,000 of capital improvement projects identified relate to replacement and improvement of the stormwater system. The concept of regional facilities has been presented in this drainage plan, but no specific regional projects are identified or cost estimates provided.

STORMWATER PROGRAM FUNDING SCENARIOS

Two funding scenarios were developed for the CIP: pay-as-you-go or revenue bonds. For the evaluation of funding scenarios, cost escalation was applied to address increases in construction cost by the time projects are implemented. In order to ensure that the projects can be funded, the costs were escalated by 5 percent each year, reflecting the anticipated increase in the construction cost index. The total escalated cost was then divided by the number of equivalent residential units (ERUs) served to estimate the cost per ERU per month. The ERUs have been estimated for 2004 by dividing the Storm Drain Charges by the monthly residential rate of $4.81. The result is 10,376 ERUs. For this planning level analysis, the number of ERUs was assumed to be constant over the CIP implementation period.

Scenario 1—Pay As You Go

This scenario evaluates the average monthly cost per user to fund the capital improvements over a 10-year period, 15-year period and 20-year period using only revenue from stormwater utility fees. The $5,847,000 total CIP cost in present-day dollars was escalated 5 percent per year for the number of years evaluated to identify a total escalated cost. That total was divided by the number of years to determine an average annual cost. From that value, the cost per ERU per month was calculated assuming a constant 10,376 ERUs. Table 7-3 summarizes the results.

TABLE 7-1.
CAPITAL IMPROVEMENT PROGRAM FOR ANNUAL ALLOCATION OF $250,000

Rank	Project #	Description	Total Project Cost	Annual Expenditure ($1,000)																							
			Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
1	6	Flow diversion on SR 20 near SW Erie St.	$72,000	**72**																							
2	8	Outfall extension on existing trunk	$1,706,000	**178**	**250**	**250**	**250**	**250**	**250**	**250**	**28**																
3	11	Drainage component of passive park	$126,000								**126**																
4	19	Drainage component of Freund Marsh passive park	$324,000								**96**	**228**															
5	3	Detention near NW Jib St. and NW 2nd Ave.	$124,000									**22**	**102**														
6	2	Pipe replacement on W Whidbey Ave.	$355,000										**148**	**207**													
7	20	Conveyance improvement	$236,000											**43**	**193**												
8	4	Detention near SW 6th Ave and SW Fairhaven Dr.	$94,000												**57**	**37**											
9	10	Liszak outfall repair	$155,000													**155**											
10	18	Culvert replacement crossing SW Scenic Heights St.	$30,000													**30**											
11	1	Pipe replacement on Oak Harbor St.	$145,000													**28**	**117**										
12	13	Detention near SE Glencoe St. and SE 4th Ave.	$198,000														**133**	**65**									
13	7	Pipe replacement and lining trunk	$858,000															**185**	**250**	**250**	**173**						
14	12	Detention near SE Glencoe St and SE 3rd Ave.	$112,000																		**77**	**35**					
15	5	Pipe replacement on Barrington Dr.	$192,000																			**192**					
16	17	Pipe replacement on SE Erie St. near SR 20	$121,000																			**23**	**98**				
17	15	Pipe replacement on Pioneer Ave. near Hathaway St.	$82,000																				**82**				
18	16	Pipe replacement on SE Bayshore Dr near SE City Beach St	$198,000																				**70**	**128**			
19	14	SE 4th Ave drainage improvements	$589,000																					**122**	**250**	**217**	
20	9	Pipe replacement on SR 20 near Midway Blvd	$130,000																							**33**	**97**
		Total	**$5,847,000**																								

TABLE 7-2.
CAPITAL IMPROVEMENT PROGRAM FOR 20-YEAR IMPLEMENTATION SCHEDULE

Rank	Project #	Description	Total Project Cost	Annual Expenditure ($1,000)																			
			Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
1	6	Flow diversion on SR 20 near SW Erie St.	$72,000	**72**																			
2	8	Outfall extension on existing trunk	$1,706,000	**220**	**292**	**292**	**292**	**292**	**292**	**26**													
3	11	Drainage component of passive park	$126,000							**126**													
4	19	Drainage component of Freund Marsh passive park	$324,000							**140**	**184**												
5	3	Detention near NW Jib St. and NW 2nd Ave.	$124,000								**108**	**16**											
6	2	Pipe replacement on W Whidbey Ave.	$355,000									**276**	**79**										
7	20	Conveyance improvement	$236,000										**213**	**23**									
8	4	Detention near SW 6th Ave and SW Fairhaven Dr.	$94,000											**94**									
9	10	Liszak outfall repair	$155,000											**155**									
10	18	Culvert replacement crossing SW Scenic Heights St.	$30,000											**20**	**10**								
11	1	Pipe replacement on Oak Harbor St.	$145,000												**145**								
12	13	Detention near SE Glencoe St. and SE 4th Ave.	$198,000												**137**	**61**							
13	7	Pipe replacement and lining trunk	$858,000													**231**	**292**	**292**	**43**				
14	12	Detention near SE Glencoe St and SE 3rd Ave.	$112,000																**112**				
15	5	Pipe replacement on Barrington Dr.	$192,000																**137**	**55**			
16	17	Pipe replacement on SE Erie St. near SR 20	$121,000																	**121**			
17	15	Pipe replacement on Pioneer Ave. near Hathaway St.	$82,000																	**82**			
18	16	Pipe replacement on SE Bayshore Dr near SE City Beach St	$198,000																	**34**	**164**		
19	14	SE 4th Ave drainage improvements	$589,000																		**128**	**292**	**169**
20	9	Pipe replacement on SR 20 near Midway Blvd	$130,000																				**130**
		Total	**$5,847,000**																				

TABLE 7-3.
ESTIMATED COSTS FOR SCENARIO 1, PAY-AS-YOU-GO

	Avg. Annual Cost ($2005)	Average Annual Program (includes Construction Cost Escalation of 5% per year)			
		Total CIP	Avg./Yr.	ERUs	**Cost/ERU/Mo**
10-Year Total	584,700	7,722,008	772,201	10,376	**$6.20**
15-Year Total	389,800	8,831,890	588,793	10,376	**$4.73**
20-Year Total	292,350	10,150,173	507,509	10,376	**$4.08**

Scenario 2—Sell Revenue Bonds

This scenario evaluates the average monthly cost per user to fund the capital improvements by selling revenue bonds for the total project cost. Costs associated with selling revenue bonds were added to the project costs to ensure that the city could fund this alternative. It was assumed that financing costs would be 3 percent and an additional 10 percent was included to reflect borrowing the reserve requirement. Annual repayment cost was calculated assuming an annual interest of 5.5 percent, and the monthly cost per ERU was calculated from the annual repayment cost. Table 7-4 summarizes the results.

TABLE 7-4.
SCENARIO 2: SELL REVENUE BONDS

Total Capital Improvements ($2005)	$5,847,000
Add Financing & Borrow Reserve	760,110
Estimated Bond Sale	$6,607,110
Est. Annual Payment (5.5% interest, 20 yrs.)	$552,879
Storm Drain ERUs	10,376 ERUs
Cost per ERU per Month	**$4.44**

Summary

Depending on the selected payment method, the capital program will cost about $4.00 to $4.45 per ERU per month to construct and fund the improvements over 20 years. This estimate could be reduced by developer contributions to the identified projects, by the city receiving grants or lower-interest loans, or by mixing pay-as-you-go with some borrowing. The monthly cost per ERU would be increased by shortening the CIP schedule to 10 or 15 years.

IMPLEMENTATION ISSUES

Matrix Ranking and Criteria

The evaluation matrix should be viewed only as a tool for establishing relative priorities. Many conditions could warrant a change in the priorities established from the matrix approach. Criteria used in the evaluation matrix for this report are the most significant criteria for long-term planning. Other criteria

could come into play, however, if unforeseen situations warrant reevaluation of project priorities. These situations could include the following:

- Emergencies such as a culvert becoming plugged and washing out a road during a large storm. The matrix may have identified replacement of the culvert as a relatively low priority, but since the road would have to be reopened immediately, the project would be implemented immediately.
- A funding windfall such as a grant or mitigation money becoming available. A grant might only apply to a specific project, which would move the project forward for implementation.
- Future regulatory or political mandates that would require implementation of a project out of the sequence arrived at through the evaluation matrix.

System Inventory

The city undertook a major effort to inventory elements of its major drainage trunklines during the summer of 2005. This effort provided the basis of the information used in this analysis. The inventory provided a common data source used to resolve missing information, datum differences and conflicting information. It would be beneficial for this effort to continue in order to comprehensively document the city's entire collection system. The data gathered in this effort was entered into a GIS database and provided to the city as part of this project. This information can be easily supplemented and expanded to include newly acquired information on both the existing network and drainage elements that are added as new development occurs.

Flow Splitter Control

A flow control structure is situated on SE 11th Avenue east of SR 20. This structure is used to regulate the split of flow between the "old" trunk line that generally follows the north-south alignment of Oak Harbor Street with the "new" trunk line, also flowing north to south, east of the "old" line. The structure regulates flow using a vertically mounted slide gate. Flows from both upper trunk lines enter this control structure. The present setting is an opening of 8 to 12 inches, allowing a limited amount of flow to reenter the old trunk line at this point. The remaining capacity of the old trunk line downstream of this point is soon filled by downstream incoming tributary flow. This restriction is used for flow entering the old trunk line to help reduce the frequency and depth of flooding in the SR 20 and Beeksma intersection area. The existing land use analysis using the hydraulic model found this to be a good setting. If future development occurs without sufficient flow controls, this setting will have to be changed. Depending on the degree of flow modifications and upstream conveyance improvements that would be required to accommodate future flow increases (if allowed), the slide gate would need to be opened to about half open (1.5 feet).

This control point was found satisfactory under both Alternative 1 and Alternative 2 configurations.

Other Issues

As improvements are implemented that reduce flood storage that occurs in intersections, streets and yards, drainage systems downstream may be subjected to higher flow rates. The implementation of conveyance system improvements, as a general rule, should therefore begin downstream and work upstream. On the other hand, projects that include detention should be implemented upstream first and progress downstream. Detention immediately improves conditions downstream by reducing peak flows.

The model of future land use conditions made no assumptions about future drainage controls or the location or size of on-site detention that may be required as a condition of development. Consequently,

flows predicted during future conditions should be conservative. On-site detention should be required with development or redevelopment within the drainage system in compliance with applicable city code.

CONCLUSION

The capital improvement program identifies a long-term solution to existing problems in the study area. It should be used as a guideline for planning and budgeting resources to address the drainage deficiencies. However, flexibility should be maintained to modify the CIP as needed to address unforeseen problems and development issues. This may involve implementing projects out of sequence, identifying and implementing projects not currently recommended, or not implementing a currently identified project because of unforeseen changes in tributary characteristics.

City of Oak Harbor

Comprehensive Stormwater Drainage Plan

APPENDIX A.
SUBBASIN HYDROLOGIC FEATURES

January 2006

Soil Coverage
Approximate percent coverage

City of Oak Harbor
Comprehensive Drainage Analysis
KCM #3540036-004

Basin #	1 **Ba**	2 **Ca**	3 **Ch**	4 **Cn**	5 **Ea**	6 **Ha**	7 **Hoypus** Series	8 **Kc**	9 **Lb**	10 **Mc**	11 **Norma** Series	12 **Rc**	13 **Semia** Series	14 **Se**	15 **Swan** Series	16 **Td**	17 **Town** Series	18 **Wa**	Percent Check Column	Weighted Soil Characteristics initial	final	decay
1							100.0%												OK	8.0	0.45	4
2							50.3%				15.5%		3.3%		2.7%			28.2%	OK	5.7	0.28	4
3							99.8%											0.2%	OK	8.0	0.45	4
4							100.0%												OK	8.0	0.45	4
5							70.5%											29.5%	OK	6.8	0.36	4
6				1.0%			94.7%								1.2%			3.1%	OK	7.8	0.43	4
7							69.3%	2.4%										28.3%	OK	6.8	0.37	4
8							100.0%												OK	8.0	0.45	4
9							4.7%				6.8%		7.0%				1.3%	80.2%	OK	3.9	0.15	4
10	2.1%						12.9%			23.2%	1.0%				18.5%			42.3%	OK	3.8	0.14	4
11				74.8%			1.3%				2.8%		2.8%		18.3%				OK	3.0	0.05	4
12				19.1%			80.9%												OK	7.0	0.37	4
13							51.3%	34.8%										13.9%	OK	6.4	0.41	4
14	0.9%				4.5%		55.6%			3.4%	7.3%		20.1%					8.2%	OK	5.4	0.28	4
15							100.0%												OK	8.0	0.45	4
16							79.1%										0.7%	20.2%	OK	7.2	0.39	4
17							100.0%												OK	8.0	0.45	4
18							100.0%												OK	8.0	0.45	4
19							90.8%								9.2%				OK	7.5	0.41	4
20							100.0%												OK	8.0	0.45	4
21				8.1%			6.0%						10.2%		75.7%				OK	3.1	0.07	4
22							100.0%												OK	8.0	0.45	4
23							100.0%												OK	8.0	0.45	4
24							68.2%										31.8%		OK	6.6	0.35	4
25							67.7%										32.3%		OK	6.5	0.35	4
26							12.8%				12.1%							75.1%	OK	4.4	0.18	4
27											13.3%						51.5%	35.2%	OK	3.6	0.14	4
28											3.1%							96.9%	OK	4.0	0.15	4
29							39.9%							5.4%			54.7%		OK	5.3	0.28	4
30				0.7%							27.6%			24.9%			42.6%	4.2%	OK	3.5	0.16	4
31																	92.4%	7.6%	OK	3.5	0.15	4
32																	86.6%	13.4%	OK	3.6	0.15	4
33																		100.0%	OK	4.0	0.15	4
34							9.2%							13.4%			77.4%		OK	4.0	0.20	4
35				12.2%							1.3%						86.5%		OK	3.4	0.14	4
36																	100.0%		OK	3.5	0.15	4
37							1.9%											98.1%	OK	4.1	0.16	4
38							53.4%										46.6%		OK	5.9	0.31	4
39				15.8%										13.7%			70.5%		OK	3.5	0.15	4
40				50.4%										43.5%			6.1%		OK	3.5	0.16	4
41				51.8%							10.7%						37.5%		OK	3.2	0.09	4
42																	100.0%		OK	3.5	0.15	4

Basin #	Ba	Ca	Ch	Cn	Ea	Ha	Hoypus Series	Kc	Lb	Mc	Norma Series	Rc	Semia Series	Se	Swan Series	Td	Town Series	Wa	Check Column	initial	final	decay
43																	100.0%		OK	3.5	0.15	4
44							82.7%											17.3%	OK	7.3	0.40	4
45																	100.0%		OK	3.5	0.15	4
46																	100.0%		OK	3.5	0.15	4
47										0.8%	12.9%							86.3%	OK	3.9	0.14	4
48				0.7%						31.5%	27.3%							40.5%	OK	3.1	0.09	4
49							100.0%												OK	8.0	0.45	4
50																		100.0%	OK	4.0	0.15	4
51							100.0%												OK	8.0	0.45	4
52							100.0%												OK	8.0	0.45	4
53				48.5%			14.0%										37.5%		OK	3.9	0.14	4
54																	100.0%		OK	3.5	0.15	4
55																	100.0%		OK	3.5	0.15	4
56																	100.0%		OK	3.5	0.15	4
57																	100.0%		OK	3.5	0.15	4
58																	100.0%		OK	3.5	0.15	4
59																	100.0%		OK	3.5	0.15	4
60																	100.0%		OK	3.5	0.15	4
61				8.4%													91.6%		OK	3.5	0.14	4
62				80.5%			1.8%										17.7%		OK	3.2	0.07	4
63							73.5%											26.5%	OK	6.9	0.37	4
64							100.0%												OK	8.0	0.45	4
65							100.0%												OK	8.0	0.45	4
66				7.0%			16.0%				4.1%							72.9%	OK	4.5	0.19	4
67							74.8%										25.2%		OK	6.9	0.37	4
68																	100.0%		OK	3.5	0.15	4
69											5.5%							94.5%	OK	3.9	0.14	4
70			5.7%			36.3%										10.0%	48.0%		OK	4.3	0.11	4
71			34.3%														65.7%		OK	3.7	0.20	4
72				35.1%					0.1%								64.8%		OK	3.3	0.11	4
73			2.6%			24.7%										54.1%		18.6%	OK	3.4	0.08	4
74			16.7%			25.5%										37.1%	20.7%		OK	3.7	0.11	4
75				72.8%												21.1%	6.1%		OK	2.8	0.06	4
76			59.8%			6.0%											34.2%		OK	3.9	0.23	4
77															7.7%			92.3%	OK	3.9	0.14	4
78							23.4%											76.6%	OK	4.9	0.22	4
79																		100.0%	OK	4.0	0.15	4
80							100.0%												OK	8.0	0.45	4
81											2.3%				0.4%			97.3%	OK	4.0	0.15	4
82							100.0%												OK	8.0	0.45	4
83							100.0%												OK	8.0	0.45	4
84			16.5%	0.7%		2.4%	9.6%		39.6%			4.0%				16.4%	7.4%	3.4%	OK	3.2	0.15	4
85							55.5%											44.5%	OK	6.2	0.32	4
86			98.5%			1.5%													OK	4.0	0.30	4
87							30.1%											69.9%	OK	5.2	0.24	4
88							15.9%				4.6%							79.5%	OK	4.6	0.19	4
89				5.0%			41.1%				10.3%				18.4%			25.2%	OK	5.3	0.24	4
90							63.4%					1.6%						35.0%	OK	6.5	0.34	4

Basin #	Ba	Ca	Ch	Cn	Ea	Ha	Hoypus Series	Kc	Lb	Mc	Norma Series	Rc	Semia Series	Se	Swan Series	Td	Town Series	Wa	Check Column	initial	final	decay
91							32.7%				9.3%		1.2%		5.3%			51.5%	OK	5.1	0.23	4
92							84.5%											15.5%	OK	7.4	0.40	4
93							100.0%												OK	8.0	0.45	4
94				1.0%						19.7%			77.8%				1.5%		OK	1.3	0.03	4
95							60.8%											39.2%	OK	6.4	0.33	4
96							100.0%												OK	8.0	0.45	4
97							6.6%						15.6%				77.8%		OK	3.4	0.15	4
98							100.0%												OK	8.0	0.45	4
99							79.6%										20.4%		OK	7.1	0.39	4
100							100.0%												OK	8.0	0.45	4
101							70.5%										1.1%	28.4%	OK	6.8	0.36	4
102							100.0%												OK	8.0	0.45	4
103							100.0%												OK	8.0	0.45	4
104							9.1%						10.8%		16.9%		42.4%	20.8%	OK	3.7	0.15	4
105							87.5%											12.5%	OK	7.5	0.41	4
106							100.0%												OK	8.0	0.45	4
107							65.4%											34.6%	OK	6.6	0.35	4
108																	22.7%	77.3%	OK	3.9	0.15	4
109							11.0%											89.0%	OK	4.4	0.18	4
110							79.8%										1.6%	18.6%	OK	7.2	0.39	4
111							24.1%											75.9%	OK	5.0	0.22	4
112							5.3%				23.7%							71.0%	OK	4.0	0.14	4
113							12.7%				16.2%							71.1%	OK	4.3	0.17	4
114							1.8%				5.0%							93.2%	OK	4.0	0.15	4
115							92.8%				1.8%				0.4%			5.0%	OK	7.7	0.43	4
116							100.0%												OK	8.0	0.45	4
117							83.7%											16.3%	OK	7.3	0.40	4
118							56.3%											43.7%	OK	6.3	0.32	4
119							84.3%											15.7%	OK	7.4	0.40	4
120							22.3%										4.5%	73.2%	OK	4.9	0.22	4
121							19.5%											80.5%	OK	4.8	0.21	4
122							0.3%											99.7%	OK	4.0	0.15	4
123																		100.0%	OK	4.0	0.15	4
124																	64.2%	35.8%	OK	3.7	0.15	4
125							63.6%											36.4%	OK	6.5	0.34	4
126							100.0%												OK	8.0	0.45	4
127							3.2%											96.8%	OK	4.1	0.16	4
128																	98.5%	1.5%	OK	3.5	0.15	4
129							94.7%											5.3%	OK	7.8	0.43	4
130							100.0%												OK	8.0	0.45	4
131																	86.8%	13.2%	OK	3.6	0.15	4
132																	78.2%	21.8%	OK	3.6	0.15	4
133																	100.0%		OK	3.5	0.15	4

Basin #	Ba	Ca	Ch	Cn	Ea	Ha	Hoypus Series	Kc	Lb	Mc	Norma Series	Rc	Semia Series	Se	Swan Series	Td	Town Series	Wa	Check Column	initial	final	decay
		Soil Description					Hydrologic soil group		fi in/hr	fo in/hr	decay Hr^-1											
1	Ba	Bellingham silt loam, 0 to 3% slopes					D		2	0.05	4											
2	Ca	Carbondale muck, 0 to 2% slopes					D		1	0.02	4											
3	Ch	Coastal Beaches, 0 to 2% slopes					B		4	0.3	4											
4	Cn	Coveland loam, 0 to 5% slopes					D		3	0.05	4											
5	Ea	Ebeys sandy loam, 0 to 5% slopes					C		3.5	0.15	4											
6	Ha	Hovde sand, 0 to 2% slopes					D		6	0.05	4											
7	Hoypus	Hoypus gravelly loamy sand, 0 to 15 slop					A		8	0.45	4											
8	Kc	Keystone loamy sand, 5 to 15% slopes					A		5	0.45	4											
9	Lb	Lummi silt loam, 0 to 2% slopes					D		2	0.05	4											
10	Mc	Mukilteo peat, 0 to 2% slopes					D		2	0.05	4											
11	Norma	Norma (silt) loam series					D		3	0.05	4											
12	Rc	Rough broken land					B		3.5	0.3	4											
13	Semi	Semiahmoo muck series					D		1	0.02	4											
14	Se	Snakelum coarse sandy loam, 0 to 5% sl					B		4	0.3	4											
15	Swan	Swantown gravelly sandy loam series					D		3	0.05	4											
16	Td	Tidal marsh, 0 to 2% slopes					D		2	0.05	4											
17	Town	Townsend sandy loam series					C		3.5	0.15	4											
18	Wa	Whidbey gravelly sandy loam, 0 to 5% sl					C		4	0.15	4											

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City of Oak Harbor
Existing Land Use - % Impervious

Estimated effective percent impervious.
Note: The heading represents land use with the indicated effective percent impervious.
Values are not adjusted in this table to reflect individual subbasin adjustments based on the aerial photo.
Coverage based on the City's "Land Use" map.

Last Printed: 1/23/2006

Subbasin Number	Open Space	Resident-ial Estate	***Residential*** Low	Medium	Medium High	High	Resident-ial Office	Public Facilities	Commun-ity Comm-ercial	Commer-cial	Central Business District	Auto Industrial Comm.	Highway Corridor Comm.	Industrial Park	Industrial	**Un-known**	Imperv. Weighted Average	Basin Area acres	Imperv Area acres	Notes
	0%	***2%***	***4%***	***20%***	***30%***	***40%***	***35%***	***30%***	***75%***	***85%***	***90%***	***85%***	***90%***	***85%***	***95%***	***15%***				
1														100.0			85.0	36.0	30.6	23.2% unk to ind park
2		22.4			2.8									72.5	2.3		65.1	94.6	61.6	
3								62.1						37.5	0.4		50.9	60.6	30.8	9.0% unk to pub fac
4		0.9		9.3	89.8												28.8	44.5	12.8	9.3% unk to med res
5								69.8	9.0					2.8	18.4		47.6	32.5	15.5	5.8% unk to pub fac
6		86.4			11.7									0.6	1.3		7.0	49.4	3.4	
7			0.2		0.5			26.4	34.5			37.8		0.6			66.6	26.7	17.8	0.7% unk to com com
8			0.5	70.1	29.4												22.9	63.7	14.6	11.3% unk to med res
9	4.0								0.2					71.2	24.6		84.0	49.1	41.3	
10	99.7			0.3													0.1	142.7	0.1	77.6% unk to open
11	17.8				38.5									43.7			48.7	33.4	16.3	
12		11.0	62.8		8.9			5.5						0.4	11.4		18.2	77.0	14.0	
13			65.6		13.8		9.9	1.8				5.9		3.0			18.3	26.1	4.8	
14	92.0		3.7	4.3													1.0	147.5	1.5	92.0% unk to open
15			93.8		5.4			0.8									5.6	43.4	2.4	
16									63.7					36.3			78.6	10.4	8.2	
17			0.3	99.2	0.5												20.0	11.2	2.2	8.1% unk to med res
18			94.5					5.5									5.4	42.1	2.3	
19			15.4		7.9	62.9		13.8									32.3	21.8	7.0	
20			99.8		0.2												4.1	50.2	2.0	
21	30.9				68.9		0.2										20.7	35.5	7.4	
22			98.7	1.3													4.2	30.2	1.3	
23			20.4					79.6									24.7	31.5	7.8	
24			62.7	0.6	0.2	35.7	0.5	0.3									17.2	48.2	8.3	
25			96.8	3.2													4.5	31.3	1.4	
26			2.3				22.6	73.2					1.9				31.7	24.9	7.9	
27			0.6				95.8						3.6				36.8	11.7	4.3	
28			100.0														4.0	38.7	1.5	1.7% unk to low res
29			41.9	44.5		13.2							0.4				16.2	33.3	5.4	
30							19.7						80.3				79.2	19.8	15.7	
31			26.0					74.0									23.2	13.2	3.1	
32			1.8				5.4	92.8									29.8	13.6	4.1	
33			38.4				16.1	45.5									20.8	22.1	4.6	
34			86.1			12.6	0.3						1.0				9.5	14.8	1.4	
35				17.9		34.3	12.6						35.2				53.4	13.8	7.4	
36			98.4	0.3		1.0	0.3										4.5	18.6	0.8	
37			100.0														4.0	45.5	1.8	
38			90.4				9.6										7.0	21.2	1.5	
39			28.3			24.5	1.4	45.5					0.3				25.3	34.3	8.7	
40						1.2	64.2		2.5				32.1				53.7	10.1	5.4	
41			20.7	4.6		9.9			14.9				49.9				61.8	34.8	21.5	
42			79.2				11.7	9.1									10.0	23.0	2.3	
43			64.3	0.8		21.8		13.1									15.4	23.8	3.7	

City of Oak Harbor
Existing Land Use - % Impervious

Estimated effective percent impervious.
Note: The heading represents land use with the indicated effective percent impervious.
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Coverage based on the City's "Land Use" map.

Last Printed: 1/23/2006

Subbasin Number	Open Space	Resident-ial Estate	***Residential*** Low	Medium	Medium High	High	Resident-ial Office	Public Facilities	Commun-ity Comm-ercial	Commer-cial	Central Business District	Auto Industrial Comm.	Highway Corridor Comm.	Industrial Park	Industrial	**Un-known**	Imperv. Weighted Average	Basin Area acres	Imperv Area acres	Notes
	0%	***2%***	***4%***	***20%***	***30%***	***40%***	***35%***	***30%***	***75%***	***85%***	***90%***	***85%***	***90%***	***85%***	***95%***	***15%***				
44			100.0														4.0	49.3	2.0	
45			37.1				62.9										23.5	11.5	2.7	
46			100.0														4.0	9.2	0.4	
47	70.4		29.6														1.2	121.0	1.4	61.1% unk to open
48	82.3		17.7														0.7	110.3	0.8	
49			66.9	27.9		1.9		3.3									10.0	39.3	3.9	
50			100.0														4.0	12.2	0.5	
51			97.8					2.2									4.6	27.6	1.3	
52			100.0														4.0	14.8	0.6	
53			85.4			9.6			5.0								11.0	29.3	3.2	
54			72.5				27.4			0.1							12.6	12.5	1.6	
55			2.8			2.5	66.6	17.5		0.9	9.7						39.2	13.9	5.4	5.4% unk to res off
56			18.9			20.7	10.0	24.3			26.1						43.3	9.3	4.0	
57			31.4			48.8	17.3	2.5									27.6	7.3	2.0	
58						0.5	48.3	14.3			36.9						54.6	14.8	8.1	
59			56.7			4.3	36.2			2.8							19.0	13.1	2.5	2.6% unk to res off
60							77.8	1.0			21.2						46.6	6.9	3.2	
61						53.5			43.7		2.8						56.7	27.5	15.6	
62	8.5		16.1						75.4								57.2	25.2	14.4	
63			100.0														4.0	29.9	1.2	
64			99.2					0.8									4.2	29.4	1.2	
65						100.0											40.0	7.2	2.9	21.2% unk to hi res
66	1.6		98.4														3.9	64.4	2.5	
67	0.3		56.1			36.6			1.4				5.6				23.0	40.8	9.4	
68								1.4			98.6						89.2	14.6	13.0	
69	56.6		43.4														1.7	70.5	1.2	30.6% unk to open
70								40.7	5.2		54.1						64.8	14.6	9.5	
71								30.5			69.5						71.7	12.2	8.7	15.8% unk to pub fac
72									22.8				77.2				86.6	15.4	13.3	
73								20.6	79.4								65.7	14.7	9.7	
74			0.4	1.7				51.7	46.2								50.5	30.3	15.3	
75				3.2					96.5				0.3				73.3	13.9	10.2	
76								20.7			79.3						77.6	13.2	10.2	
77	6.4		93.6														3.7	18.0	0.7	
78			73.6			26.4											13.5	32.9	4.4	
79			100.0														4.0	37.9	1.5	
80			16.8	0.8		82.4											33.8	10.5	3.5	
81	74.0		26.0														1.0	121.5	1.3	52.7% unk to open
82			17.2			82.8											33.8	7.8	2.6	
83			17.4			82.6											33.7	7.1	2.4	
84	45.1		21.4	19.5		7.5			0.1				6.4				13.6	86.5	11.8	0.7% unk to op space
85						100.0											40.0	7.5	3.0	
86			23.4					76.6									23.9	9.3	2.2	9.0% unk to low res

City of Oak Harbor
Existing Land Use - % Impervious

Estimated effective percent impervious.
Note: The heading represents land use with the indicated effective percent impervious.
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Coverage based on the City's "Land Use" map.

Last Printed: 1/23/2006

Subbasin Number	Open Space	Resident-ial Estate	***Residential*** Low	Medium	Medium High	High	Resident-ial Office	Public Facilities	Commun-ity Comm-ercial	Commer-cial	Central Business District	Auto Industrial Comm.	Highway Corridor Comm.	Industrial Park	Industrial	**Un-known**	Imperv. Weighted Average	Basin Area acres	Imperv Area acres	Notes
	0%	***2%***	***4%***	***20%***	***30%***	***40%***	***35%***	***30%***	***75%***	***85%***	***90%***	***85%***	***90%***	***85%***	***95%***	***15%***				
87	13.3		6.0	11.5				69.2									23.3	47.4	11.0	13.2% unk to open
88			98.7					1.3									4.3	61.0	2.6	9.3% unk to low res
89	64.5		35.5														1.4	81.5	1.2	56.9% unk to open
90			100.0														4.0	11.3	0.5	
91	90.0		0.2		9.0										0.8		3.5	258.2	9.0	87.9% unk to open
92		6.2			73.7										20.1		41.3	96.3	39.8	
93					0.8									81.8	17.4		86.3	31.2	26.9	
94	88.2													11.8			10.0	63.6	6.4	
95									1.3					98.7			84.9	30.3	25.7	
96			30.5				27.8		36.3					5.4			42.8	9.9	4.2	
97	49.4		2.6				2.5		45.5								35.1	15.7	5.5	
98			59.6						40.4								32.7	21.4	7.0	
99									100.0								75.0	10.7	8.0	
100									100.0								75.0	8.5	6.4	
101			0.3				65.1	0.6	5.3				28.7				52.8	21.7	11.5	
102			84.5					3.4	12.1								13.5	29.8	4.0	
103							27.3		64.9				7.8				65.3	9.6	6.3	
104	0.2		21.5		20.8	4.9	27.6	24.2	0.2				0.6				26.7	70.2	18.7	
105									100.0								75.0	12.3	9.2	
106			89.5					2.1	8.4								10.5	24.7	2.6	
107			21.4	14.1					64.5								52.1	11.5	6.0	
108			35.8				29.2	22.5	12.5								27.8	19.5	5.4	
109			50.7	45.2		4.1											12.7	31.6	4.0	
110			80.5			19.5											11.0	44.9	4.9	
111			100.0														4.0	29.2	1.2	
112			100.0														4.0	26.5	1.1	
113			100.0														4.0	38.0	1.5	
114			100.0														4.0	15.0	0.6	
115			48.2	47.1				4.7									12.8	125.7	16.0	0.7% unk to med res
116			64.6	1.4				34.0									13.1	16.1	2.1	
117			41.5	0.5				58.0									19.2	33.2	6.4	
118			66.0					34.0									12.8	28.7	3.7	
119			99.2	0.6				0.2									4.1	26.5	1.1	
120			87.4	5.2				7.4									6.8	31.7	2.1	0.8% unk to low res
121			59.7					40.3									14.5	6.4	0.9	59.7% unk to low res
122			99.9					0.1									4.0	30.3	1.2	
123			100.0														4.0	14.8	0.6	
124			52.8	7.3				5.1	34.8								31.2	13.5	4.2	0.7% unk to low res
125			91.3					8.7									6.3	16.4	1.0	
126			67.9					32.1									12.3	42.4	5.2	
127			100.0														4.0	18.2	0.7	
128			55.9	44.1													11.1	24.4	2.7	5.3% unk to med res
129			98.3					1.7									4.4	15.2	0.7	

City of Oak Harbor
Existing Land Use - % Impervious

Estimated effective percent impervious.
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Coverage based on the City's "Land Use" map.

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Subbasin Number	Open Space	Resident-ial Estate	***Residential*** Low	Medium	Medium High	High	Resident-ial Office	Public Facilities	Commun-ity Comm-ercial	Commer-cial	Central Business District	Auto Industrial Comm.	Highway Corridor Comm.	Industrial Park	Industrial	**Un-known**	Imperv. Weighted Average	Basin Area acres	Imperv Area acres	Notes
	0%	***2%***	***4%***	***20%***	***30%***	***40%***	***35%***	***30%***	***75%***	***85%***	***90%***	***85%***	***90%***	***85%***	***95%***	***15%***				
130			98.2					1.8									4.5	41.9	1.9	
131			40.6	59.4													13.5	11.5	1.6	5.1% unk to med res
132			40.1	58.7		0.1		1.1									13.7	13.4	1.8	6.1% unk to med res
133				0.1		84.3		15.6									38.4	9.8	3.8	8.0% unk to hi res
															Basin		20.1%	4573.5	920.8	
															totals					

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City of Oak Harbor
Future Land Use - % Impervious
Updated

Estimated effective percent impervious.
Note: The heading represents a typical usage with the indicated percent impervious.
It is not all inclusive of all possible development that may fall into the category.
Tabled values are approximate percent coverage of composite land uses

Last Printed: 1/23/2006

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				
Subbasin	Airport	Central Business District	CBD-1	CBD-2	Commer-cial Agri-culture	Commun. Comm. District	Contract Zone	Federal Land	Highway Corridor Comm	Highway Service Com Dis	Industrial	Lim Mult Family Res Dist	Mult Fam Res Dist Inc Apts	Mult Fam Res Dist inc mob h	Neighbor-hood Business	Open Space	Park	Planned Business Park	Planned Industrial Park	Planned Unit Devel	Public Facilities District	Residential Office District	Rural	Rural Agriculture	Rural Forest	Rural Residen-tial	Rural Service	Rural Village	Single Family Res Dist	Un-known	Imperv. Weighted Average	Basin Area acres	Imperv Area acres	Notes
Number	*75%*	*90%*	*80%*	*85%*	*2%*	*75%*	*50%*	*30%*	*90%*	*95%*	*95%*	*40%*	*75%*	*55%*	*80%*	*0%*	*5%*	*60%*	*85%*	*65%*	*30%*	*55%*	*2%*	*0%*	*0%*	*2%*	*60%*	*55%*	*25%*	*15%*				
1								21.6															78.4								8.0	36.0	2.9	
2											31.5								17.2				51.3								45.6	94.6	43.1	
3								8.2			0.5								0.3		52.0		39.0								19.6	60.6	11.9	
4														1.6				88.4					10.0								54.1	44.5	24.1	
5						10.8		4.5			21.5										63.2										48.8	32.5	15.9	
6																		11.6	1.5				86.9								10.0	49.4	4.9	
7						38.1		0.7		29.4			1.4								26.4		4.0								65.8	26.7	17.6	
8												42.7		29.1				0.2			15.3		12.7								38.0	63.7	24.2	
9											26.7								4.1				69.2								30.2	49.1	14.8	
10																							100.0								2.0	142.7	2.9	
11														37.8		12.0				4.1			46.1								25.2	33.4	8.4	
12												59.5		7.5				0.8	11.8		9.2		11.2								41.4	77.0	31.9	
13						21.9							12.7								1.3	0.8	22.2						41.1		37.5	26.1	9.8	
14					26.0																		47.8		23.0				3.2		2.3	147.5	3.4	
15												12.7		4.8							0.7								81.8		28.4	43.4	12.3	
16						18.9					11.0												70.1								26.0	10.4	2.7	
17												56.3		0.3							26.6		12.7						4.1		31.9	11.2	3.6	
18																					1.9								98.1		25.1	42.1	10.6	
19												0.4	66.0	5.2							15.5								12.9		60.4	21.8	13.2	
20														0.1															99.9		25.0	50.2	12.6	
21														88.0		1.4				10.1		0.4							0.1		57.2	35.5	20.3	
22												1.2																	98.8		25.2	30.2	7.6	
23																					79.1								20.9		29.0	31.5	9.1	
24													36.7							0.5									62.8		43.7	48.2	21.0	
25												2.5								0.3									97.2		25.6	31.3	8.0	
26																					68.4	27.8							3.8		36.8	24.9	9.2	
27						21.9							1.0									77.1									59.6	11.7	7.0	3.4%Unk to res of dist
28																							96.2	1.7					2.1		2.4	38.7	0.9	
29						0.1						32.7	13.0							12.3									41.9		43.8	33.3	14.6	
30						75.6	3.8															20.6									69.9	19.8	13.8	
31																					73.9								26.1		28.7	13.2	3.8	
32																					88.9	4.1							7.0		30.7	13.6	4.2	
33							3.6														57.4	17.2							21.8		33.9	22.1	7.5	
34						0.1							11.3									0.1							88.5		30.7	14.8	4.5	
35						9.9	30.8					12.7	24.3									14.3							8.0		56.0	13.8	7.7	
36													1.0									0.5							98.5		25.7	18.6	4.8	
37																							39.0						61.0		16.0	45.5	7.3	
38																						9.5							90.5		27.9	21.2	5.9	
39													26.0								44.4	1.0							28.6		40.5	34.3	13.9	
40						26.7	6.6						3.3									63.4										60.7	10.1	6.1	
41						53.6	8.4					5.0	6.1																26.9		57.7	34.8	20.1	
42																					9.1	6.1							84.8		27.3	23.0	6.3	
43												0.5	21.6								13.2								64.7		36.5	23.8	8.7	
44																							2.8						97.2		24.4	49.3	12.0	
45																						72.3							27.7		46.7	11.5	5.4	
46																													100.0		25.0	9.2	2.3	
47																							81.2	9.1					9.7		4.0	121.0	4.9	
48																							13.4						86.6		21.9	110.3	24.2	
49												27.6	9.7							1.8	3.5		2.9						54.5		34.6	39.3	13.6	
50																													100.0		25.0	12.2	3.1	
51																				94.1	2.5								3.4		81.6	27.6	22.5	
52																				12.0									88.0		32.2	14.8	4.8	
53						2.9							16.4									6.6							74.1		36.6	29.3	10.7	
54															1.0							34.4							64.6		35.9	12.5	4.5	
55		9.7											41.9		1.8						30.7	13.1							2.8		58.7	13.9	8.2	
56		24.2											33.4								21.4								21.0		58.5	9.3	5.4	
57													67.2								1.9	5.6							25.3		60.4	7.3	4.4	
58			0.2	37.6									3.1								12.1	47.0									63.9	14.8	9.5	
59													31.8		4.0						2.6	18.3							43.3		48.7	13.1	6.4	
60		15.5											80.7								3.8										75.6	6.9	5.2	
61			1.7			35.8							56.6									5.9									73.9	27.5	20.3	
62						49.7	40.6						1.0																8.7		60.5	25.2	15.2	
63																							85.2						14.8		5.4	29.9	1.6	
64													1.9							30.3	1.6								66.2		44.2	29.4	13.0	
65													79.4								20.6										85.7	7.2	4.7	
66																							55.1						44.9		12.3	64.4	7.9	
67						6.1	0.7						37.4							7.0									48.8		51.1	40.8	20.9	
68		52.3	32.2	14.7																	0.8										85.6	14.6	12.5	
69																							28.3						71.7		18.5	70.5	13.0	
70		30.1	14.0	12.3																	43.6										61.8	14.6	9.0	
71		51.5	15.3																		33.2										68.6	12.2	8.4	

City of Oak Harbor
Future Land Use - % Impervious
Updated

Estimated effective percent impervious.
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Subbasin Number	1 Airport *75%*	2 Central Business District *90%*	3 CBD-1 *80%*	4 CBD-2 *85%*	5 Commercial Agriculture *2%*	6 Commun. Comm. District *75%*	7 Contract Zone *50%*	8 Federal Land *30%*	9 Highway Corridor Comm *90%*	10 Highway Service Com Dis *95%*	11 Industrial *95%*	12 Lim Mult Family Res Dist *40%*	13 Mult Fam Res Dist inc Apts *75%*	14 Mult Fam Res Dist inc mob h *55%*	15 Neighborhood Business *80%*	16 Open Space *0%*	17 Park *5%*	18 Planned Business Park *60%*	19 Planned Industrial Park *85%*	20 Planned Unit Devel *65%*	21 Public Facilities District *30%*	22 Residential Office District *55%*	23 Rural *2%*	24 Rural Agriculture *0%*	25 Rural Forest *0%*	26 Rural Residential *2%*	27 Rural Service *60%*	28 Rural Village *55%*	29 Single Family Res Dist *25%*	30 Unknown *15%*	Imperv. Weighted Average	Basin Area acres	Imperv Area acres	Notes
72						100.0																									75.0	15.4	11.6	
73						78.5															21.5										65.3	14.7	9.6	
74						41.7						0.3									57.4								0.6		48.8	30.3	14.8	
75						97.6						2.4																			74.2	13.9	10.3	
76		35.9	38.3																		25.8										70.7	13.2	9.3	
77																													100.0		25.0	18.0	4.5	
78													24.5										5.6						69.9		36.0	32.9	11.8	
79																													100.0		25.0	37.9	9.5	
80												0.8	99.1																0.1		74.7	10.5	7.8	
81																							62.1						37.9		10.7	121.5	13.0	
82													81.3																18.7		65.7	7.8	5.1	
83							32.8						52.0																15.2		59.2	7.1	4.2	
84						6.3	1.4					13.0	5.3			42.2					13.1								18.7		23.2	86.5	20.1	
85													91.2																8.8		70.6	7.5	5.3	
86																					99.7								0.3		30.0	9.3	2.8	
87												9.4									70.1		11.6						8.9		27.2	47.4	12.9	
88												0.1									1.6		83.5						14.8		5.9	61.0	3.6	
89																							96.8		3.2						1.9	81.5	1.6	
90																					100.0										30.0	11.3	3.4	
91								2.5										7.3					90.2								6.9	258.2	17.9	
92											0.1							12.1					87.8								9.1	96.3	8.8	
93											14.1												85.9								15.1	31.2	4.7	
94														1.1		24.0							74.9								2.1	63.6	1.3	
95						84.4					14.1												1.5								76.7	30.3	23.2	
96						35.8																38.6							25.6		54.5	9.9	5.4	
97						28.3																5.7	60.9						5.1		26.9	15.7	4.2	
98						27.6																							72.4		38.8	21.4	8.3	
99						97.5																	2.5								73.2	10.7	7.8	
100						100.0																									75.0	8.5	6.4	
101						4.6															5.1	60.9							29.4		45.8	21.7	9.9	
102						8.8															3.4								87.8		29.6	29.8	8.8	
103						65.7																24.8							9.5		65.3	9.6	6.3	
104													0.8	31.7							23.1	23.5							20.9		43.1	70.2	30.3	3.7%unk to res of dist
105						100.0																									75.0	12.3	9.2	
106						10.3															1.0								88.7		30.2	24.7	7.5	
107						43.2						33.0																	23.8		51.6	11.5	5.9	
108						11.6															31.3	27.7							29.4		40.7	19.5	7.9	
109												45.2											43.1						11.7		21.9	31.6	6.9	
110													16.2								51.5		28.4						3.9		29.1	44.9	13.1	
111																					50.9		49.1								16.3	29.2	4.7	
112																							99.3						0.7		2.2	26.5	0.6	
113																					2.4		44.8						52.8		14.8	38.0	5.6	
114																					76.1		13.4						10.5		25.7	15.0	3.9	
115												40.5									4.7		35.8						19.0		23.1	125.7	29.0	
116												0.4									33.7								65.9		26.7	16.1	4.3	
117												0.4	0.1								58.1		1.3						40.1		27.7	33.2	9.2	
118													17.2								33.5								49.3		35.3	28.7	10.1	
119												0.6																	99.4		25.1	26.5	6.6	
120												5.3									6.9								87.8		26.1	31.7	8.3	
121								57.4													38.2								4.4		29.8	6.4	1.9	
122																					0.1		10.9						89.0		22.5	30.3	6.8	
123																							100.0								2.0	14.8	0.3	
124						20.9						16.0									11.7								51.4		38.4	13.5	5.2	2.3% unk to SFR
125																					8.7								91.3		25.4	16.4	4.2	
126																				6.2	32.2								61.6		30.3	42.4	12.9	
127																							2.4						97.6		24.4	18.2	4.4	
128								5.1																					94.9		25.3	24.4	6.2	24.0% unk to SFR
129																					1.6								98.4		25.1	15.2	3.8	
130																				30.1	1.7								68.2		43.1	41.9	18.1	
131								5.2																					94.8		25.3	11.5	2.9	29.7% unk to SFR
132								6.1					9.3								1.1								83.5		30.0	13.4	4.0	9.7% unk to SFR
133								1.9					76.4								21.7										64.4	9.8	6.3	
															Basin totals																27.8%	4573.5	1271.0	

S:\Active\3540036 - Oak Harbor Stormwater Complan\SWMM\zoning\[Impervious-future-update.XLS]Impervious-future

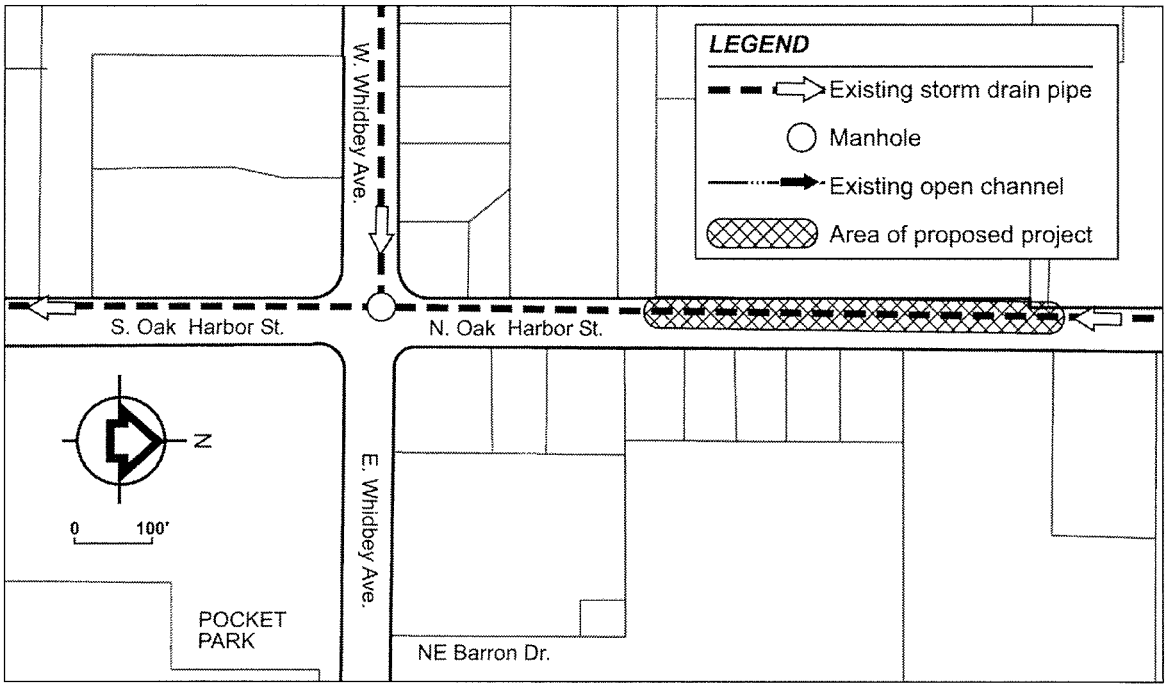
City of Oak Harbor

Comprehensive Stormwater Drainage Plan

APPENDIX B.
PROJECT SUMMARY SHEETS – ALTERNATIVE 1

January 2006

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 1 PIPELINE REPLACEMENT ALONG OAK HARBOR STREET



PROBLEM DESCRIPTION

Capacity restrictions create back-up and flooding from the pipe system that parallels Oak Harbor Street. Flooding starts at the 10-year storm.

PROJECT DESCRIPTION

A 422-foot segment of existing 12-inch pipe needs to be replaced with 18-inch pipe. The segment to be replaced parallels Oak Harbor Street north of Whidbey Avenue.

ESTIMATED PROJECT COST

$145,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

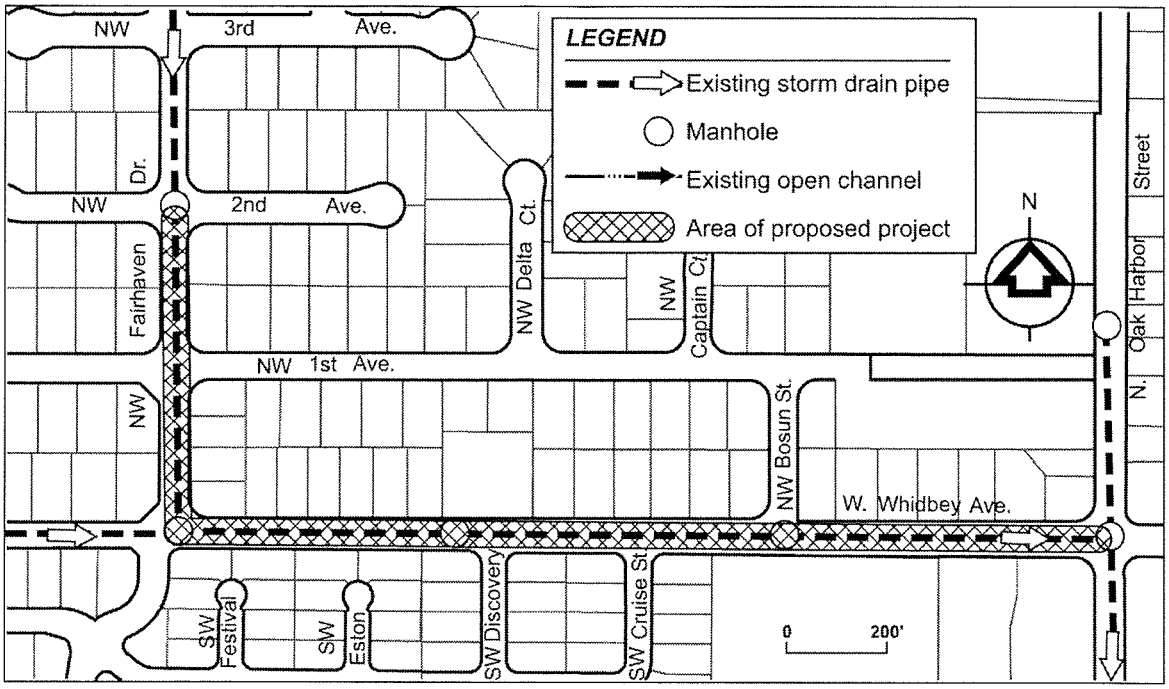
PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 1 - Project 1 **CHECKED BY:** AMM
DESCRIPTION: Pipeline replacement along Oak Harbor Street
BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	176	SY	$ 23.00	$ 4,048
2	REMOVE PIPE	422	LF	$ 17.25	$ 7,280
3	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	422	LF	$ 57.50	$ 24,265
4	CATCHBASIN TYPE 2 48"	2	EA	$ 3,380.00	$ 6,760
5	ASPHALT CONCRETE PAVEMENT PATCHING	41	TN	$ 115.00	$ 4,715
				Subtotal	$ 47,068
	DEWATERING	5%			$ 2,353
	EROSION & SEDIMENTATION CONTROL	10%			$ 4,707
	TRAFFIC CONTROL	3%			$ 1,412
	CONTINGENCY	30%			$ 14,120
				Subtotal	$ 69,660
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 6,966
				Construction Subtotal (Rounded)	$ 77,000
	STATE SALES TAX	8.3%			$ 6,391
	ENGINEERING/LEGAL/ADMIN	50%			$ 38,500
	CONSTRUCTION MANAGEMENT	20%			$ 15,400
	PERMITTING	10%			$ 7,700
				Project Subtotal (Rounded)	$ 145,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 145,000**

Notes:
1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 2 PIPELINE REPLACEMENT ALONG WEST WHIDBEY AVENUE



PROBLEM DESCRIPTION

Upstream flows exceed the capacity of this CMP pipe system. This creates flooding from the pipe system causing overflows to run down the street shoulder starting at the 2-year storm.

PROJECT DESCRIPTION

Several segments of the existing system require replacement along West Whidbey Avenue between Oak Harbor Street and Fairhaven Drive. The existing system in this area varies from 12- to 18-inch corrugated metal pipe (CMP). The required new pipe size includes 18-inch (1,880 feet) and 24-inch (634 feet).

ESTIMATED PROJECT COST

$723,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

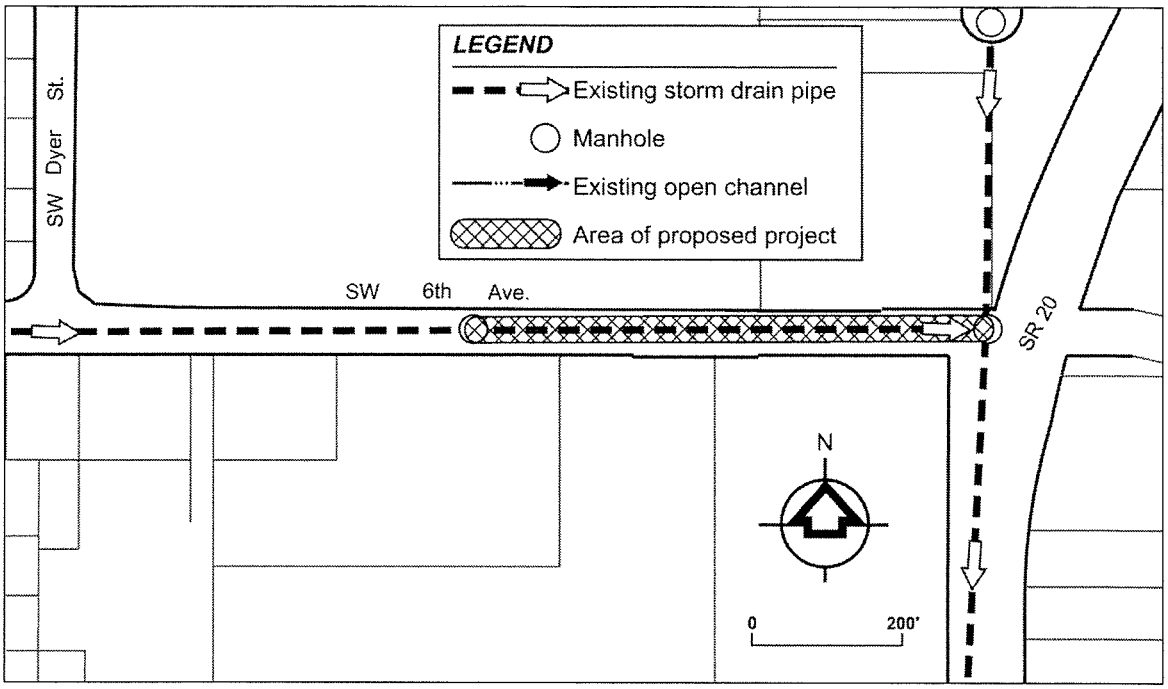
PROJECT:	**Alternative 1 - Project 2**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Pipeline replacement along W. Whidbey Ave.**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	1,100	SY	$ 23.00	$ 25,300
2	REMOVE PIPE	2,514	LF	$ 17.25	$ 43,367
3	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	1,880	LF	$ 57.50	$ 108,100
4	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	634	LF	$ 74.75	$ 47,392
5	CATCHBASIN TYPE 2 48"	8	EA	$ 3,380.00	$ 27,040
6	ASPHALT CONCRETE PAVEMENT PATCHING	257	TN	$ 115.00	$ 29,555
				Subtotal	$ 280,753
	DEWATERING	5%			$ 14,038
	EROSION & SEDIMENTATION CONTROL	10%			$ 28,075
	TRAFFIC CONTROL	3%			$ 8,423
	CONTINGENCY	30%			$ 84,226
				Subtotal	$ 415,514
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 41,551
				Construction Subtotal (Rounded)	$ 457,000
	STATE SALES TAX	8.3%			$ 37,931
	ENGINEERING/LEGAL/ADMIN	25%			$ 114,250
	CONSTRUCTION MANAGEMENT	20%			$ 91,400
	PERMITTING	5%			$ 22,850
				Project Subtotal (Rounded)	$ 723,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 723,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 3 PIPELINE REPLACEMENT ALONG SW 6TH AVENUE



PROBLEM DESCRIPTION

Pipe capacity restriction creates flooding starting at the 25-year storm.

PROJECT DESCRIPTION

Correcting the problem area on SW 6th Avenue requires the replacement of existing 18-inch CMP with 18-inch smooth-bore pipe. This 832-foot segment of pipe extends west from the intersection with Oak Harbor Street.

ESTIMATED PROJECT COST

$253,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

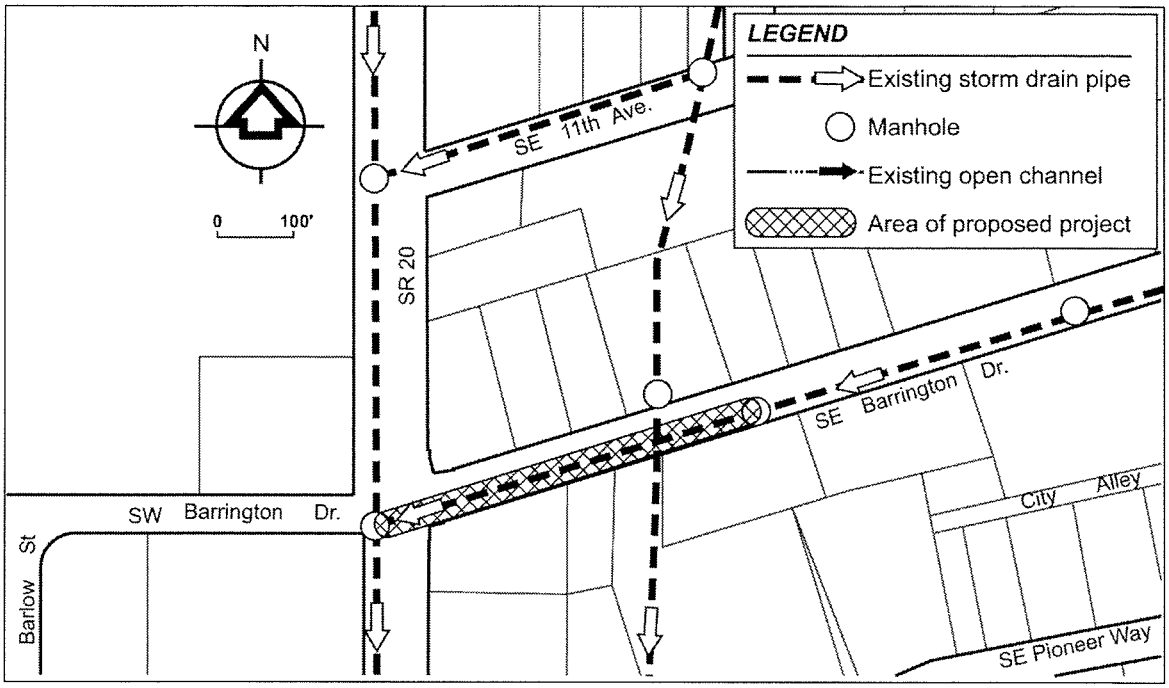
PROJECT:	**Alternative 1 - Project 3**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Pipeline replacement along SW 6th Ave**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	347	SY	$ 23.00	$ 7,981
2	REMOVE PIPE	832	LF	$ 17.25	$ 14,352
3	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	832	LF	$ 57.50	$ 47,840
4	CATCHBASIN TYPE 2 48"	3	EA	$ 3,380.00	$ 10,140
5	ASPHALT CONCRETE PAVEMENT PATCHING	81	TN	$ 115.00	$ 9,315
				Subtotal	$ 89,628
	DEWATERING	5%			$ 4,481
	EROSION & SEDIMENTATION CONTROL	10%			$ 8,963
	TRAFFIC CONTROL	3%			$ 2,689
	CONTINGENCY	30%			$ 26,888
				Subtotal	$ 132,649
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 13,265
				Construction Subtotal (Rounded)	$ 146,000
	STATE SALES TAX	8.3%			$ 12,118
	ENGINEERING/LEGAL/ADMIN	35%			$ 51,100
	CONSTRUCTION MANAGEMENT	20%			$ 29,200
	PERMITTING	10%			$ 14,600
				Project Subtotal (Rounded)	$ 253,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 253,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 4 PIPELINE REPLACEMENT ALONG BARRINGTON DRIVE



PROBLEM DESCRIPTION

The last segment of pipe along Barrington creates a constriction. This in turn causes back-up and flooding along Barrington for several blocks upstream starting at the 10-year storm. Replacing only the terminal segment of pipe corrects the back-up and flooding.

PROJECT DESCRIPTION

A short segment of the existing 18-inch drain system requires replacement to correct the flooding problem identified along this segment. About 524 feet of 24-inch pipe is required for this project.

ESTIMATED PROJECT COST

$192,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 1 - Project 4**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Pipeline replacement along Barrington Drive**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	262	SY	$ 23.00	$ 6,026
2	REMOVE PIPE	524	LF	$ 17.25	$ 9,039
3	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	524	LF	$ 74.75	$ 39,169
4	CATCHBASIN TYPE 2 48"	2	EA	$ 3,380.00	$ 6,760
5	ASPHALT CONCRETE PAVEMENT PATCHING	61	TN	$ 115.00	$ 7,015
				Subtotal	$ 68,009
	DEWATERING	5%			$ 3,400
	EROSION & SEDIMENTATION CONTROL	10%			$ 6,801
	TRAFFIC CONTROL	3%			$ 2,040
	CONTINGENCY	30%			$ 20,403
				Subtotal	$ 100,653
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 10,065
				Construction Subtotal (Rounded)	$ 111,000
	STATE SALES TAX	8.3%			$ 9,213
	ENGINEERING/LEGAL/ADMIN	35%			$ 38,850
	CONSTRUCTION MANAGEMENT	20%			$ 22,200
	PERMITTING	10%			$ 11,100
				Project Subtotal (Rounded)	$ 192,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 192,000**

Notes:

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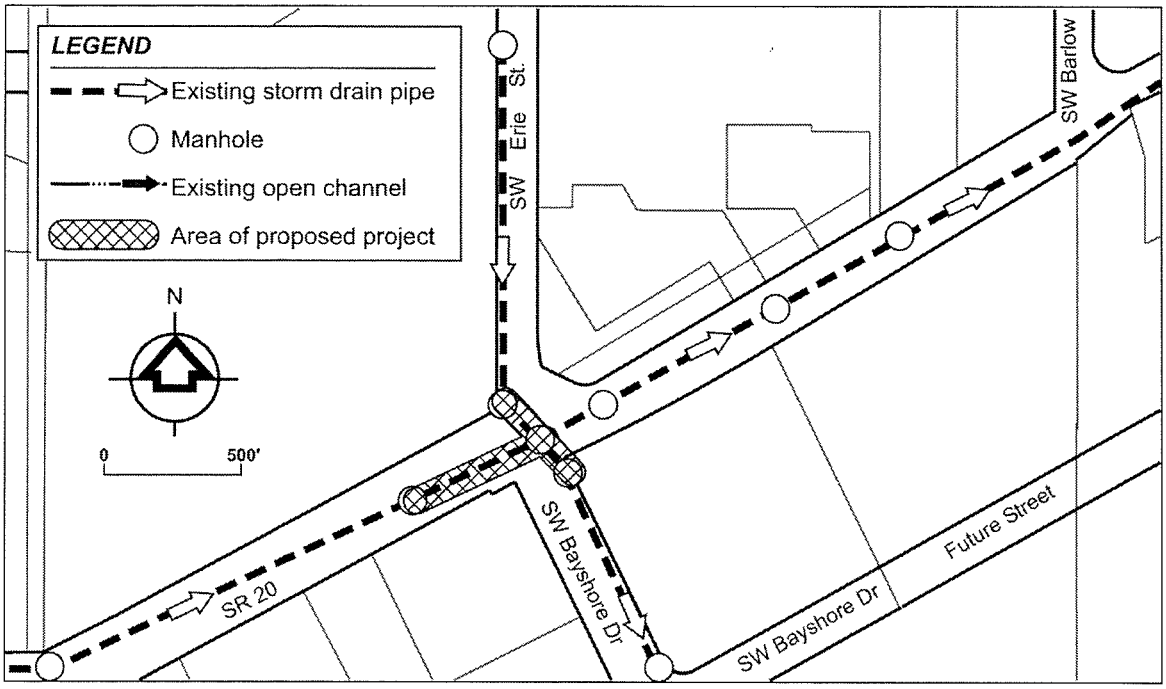
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 5 FLOW DIVERSION ON SR 20 NEAR SW ERIE STREET



PROBLEM DESCRIPTION

Excess flows piped to the City's 42-inch trunk system at the intersection of SR-20 and Beeksma Drive overwhelms the capacity of the trunk creating frequent flooding in and around this intersection area.

PROJECT DESCRIPTION

Project components include installing a new catchbasin and segment of pipe that would intercept the SR 20 system and the drainage originating on SW Erie Street and convey this drainage south to the existing drainage network in the Freund Marsh area.

This project would achieve several results:

- It would reestablish historical drainage patterns. Presently, most stormwater runoff from west of Erie Street is intercepted in the storm drainage system and conveyed east to Beeksma Drive, where it enters a 42-inch trunkline that heads south and outfalls into the harbor. Topography indicates that, prior to development, this runoff would have drained through Freund Marsh.
- It would remove runoff from the 42-inch trunkline, which is currently overtaxed, resulting in flooding near the intersection of SR 20 and Beeksma Drive. The diversion would reduce the magnitude and frequency of flooding at this intersection.
- Low flows, including any intercepted groundwater, would help sustain a constructed wetland that may be a part of the passive park concept being considered for the Freund Marsh area. The passive park concept provides several additional benefits, including the treatment of stormwater runoff, wetland creation with the associated wildlife benefits, and flood relief.

ESTIMATED PROJECT COST

$72,000

ASSOCIATED PROJECTS

Alternative 1-Project 17 needs to be coordinated with this project. Sufficient conveyance and storage capacity within the marsh area must be provided during the passive park concept and development.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 1 - Project 5**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Flow diversion on SR-20 near SW Erie St**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	50	SY	$ 23.00	$ 1,150
2	REMOVE PIPE	100	LF	$ 17.25	$ 1,725
3	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	100	LF	$ 74.75	$ 7,475
4	CATCHBASIN TYPE 2 72"	1	EA	$ 7,475.00	$ 7,475
5	ASPHALT CONCRETE PAVEMENT PATCHING	12	TN	$ 115.00	$ 1,380
				Subtotal	$ 19,205
	DEWATERING	5%			$ 960
	EROSION & SEDIMENTATION CONTROL	10%			$ 1,921
	TRAFFIC CONTROL	3%			$ 576
	CONTINGENCY	30%			$ 5,762
				Subtotal	$ 28,423
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 2,842
				Construction Subtotal (Rounded)	$ 31,000
	STATE SALES TAX	8.3%			$ 2,573
	ENGINEERING/LEGAL/ADMIN	85%			$ 26,350
	CONSTRUCTION MANAGEMENT	20%			$ 6,200
	PERMITTING	20%			$ 6,200
				Project Subtotal (Rounded)	$ 72,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 72,000**

Notes:

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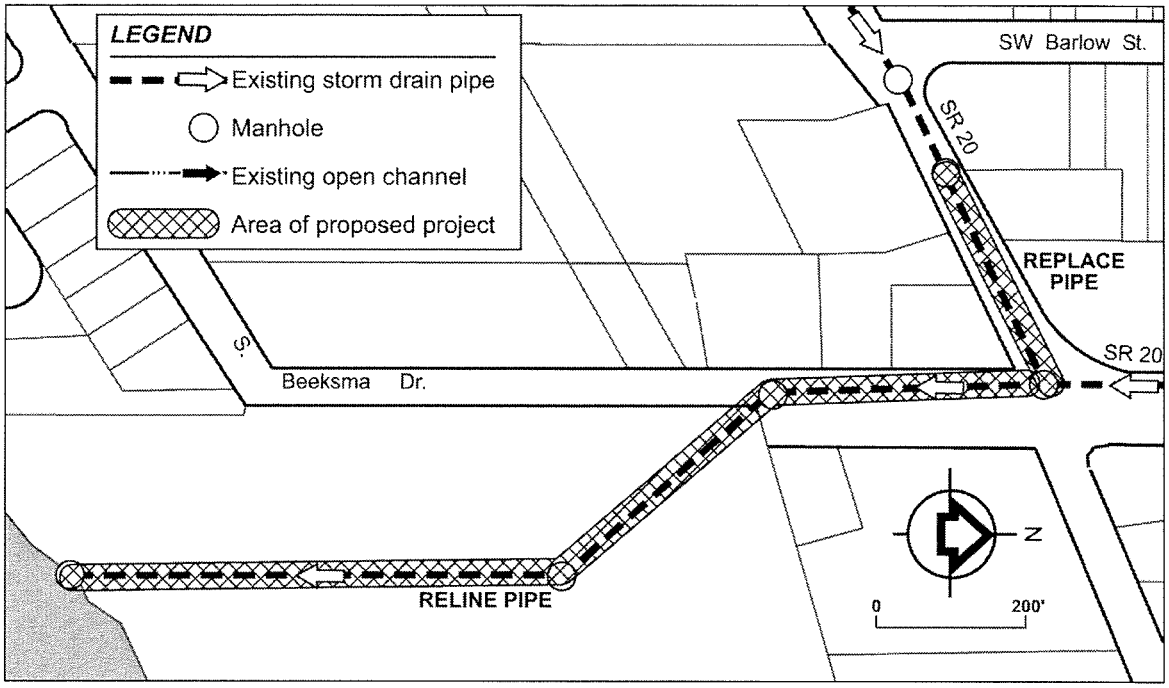
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 6 PIPELINE REPLACEMENT AND LINING TRUNK



PROBLEM DESCRIPTION

High tributary flows and limited capacity create flooding around the intersection of SR-20 and Beeksma Drive starting at the 10-year storm. Sand blockages at the trunk outfall increase this flooding frequency.

PROJECT DESCRIPTION

This project would almost entirely eliminate flooding in the vicinity of SR 20 and Beeksma Drive. The project consists of replacing 362 feet of 24-inch CMP with 30-inch pipe. It also includes inserting a smooth liner inside the existing 42-inch CMP trunkline; even though this would reduce cross-sectional area of this 1,558-foot segment of trunkline, the increased smoothness would improve its hydraulics.

The feasibility of lining the 42-inch trunkline may be affected by concerns about seepage, bypassing storm flows, the condition of the existing pipe, tidal backwater, access on the upper segment, and other issues. Potential alternatives to sliplining include in-situ lining, pipe bursting, and a full pipeline replacement.

The pipe segment along SR-20 may be constructed separately from the existing pipe relining.

ESTIMATED PROJECT COST

$858,000

ASSOCIATED PROJECTS

Alternative 1-Project 5 diverts flow from this area which, in combination with these improvements, greatly improves the functionality of this system and reduces the potential for flooding.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 1 - Project 6 **CHECKED BY:** AMM

DESCRIPTION: Pipe replacement and slip-lining existing 42" near SR-20 and Beeksma Drive

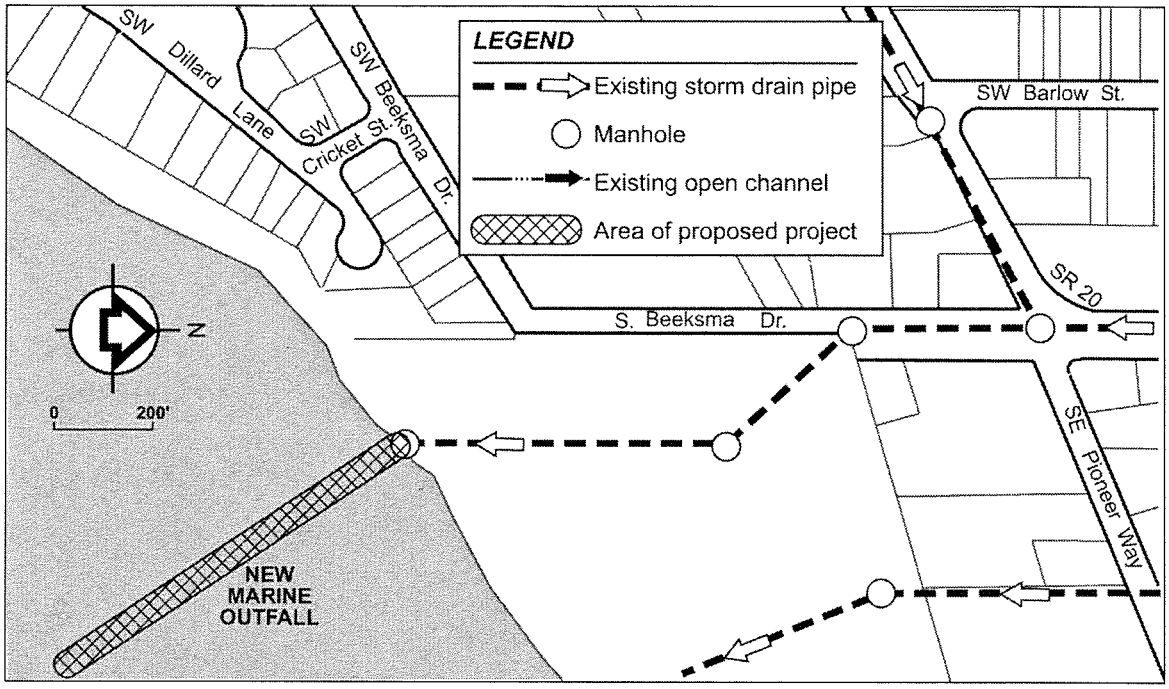
BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	272	SY	$ 23.00	$ 6,256
2	REMOVE PIPE	362	LF	$ 17.25	$ 6,245
3	30" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	362	LF	$ 97.75	$ 35,386
4	SLIP-LINE EXISTING 42" CMP SDR 26	1,558	LF	$ 161.00	$ 250,838
5	INSTALLATION PITS	1	LS	$ 6,000.00	$ 6,000
6	FLOW DIVERSION	1	LS	$ 10,000.00	$ 10,000
7	ASPHALT CONCRETE PAVEMENT PATCHING	63	TN	$ 115.00	$ 7,245
				Subtotal	$ 321,969
	DEWATERING	10%			$ 32,197
	EROSION & SEDIMENTATION CONTROL	10%			$ 32,197
	TRAFFIC CONTROL	3%			$ 9,659
	CONTINGENCY	30%			$ 96,591
				Subtotal	$ 492,613
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 49,261
				Construction Subtotal (Rounded)	$ 542,000
	STATE SALES TAX	8.3%			$ 44,986
	ENGINEERING/LEGAL/ADMIN	25%			$ 135,500
	CONSTRUCTION MANAGEMENT	20%			$ 108,400
	PERMITTING	5%			$ 27,100
				Project Subtotal (Rounded)	$ 858,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 858,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 7 OUTFALL EXTENSION ON EXISTING TRUNK



PROBLEM DESCRIPTION

The existing outfall of the 42-inch CMP trunk that parallels Beeksma Drive is prone to plugging, which creates flooding at the intersection of Beeksma Drive and SR 20 and increases maintenance demands. Plugging frequently occurs due to large accumulations of sand and occasionally seaweed.

PROJECT DESCRIPTION

This project consists of extending the trunkline into the bay such that the pipe terminus is always fully submerged. A predesign effort is included to resolve issues including bay bathymetry, permitting, and alignment. Based on USGS bathymetry data from the 1980s, approximately 1200 feet of outfall is necessary to provide about 2-feet of water over the top of the pipe during low tide.

ESTIMATED PROJECT COST

$1,706,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

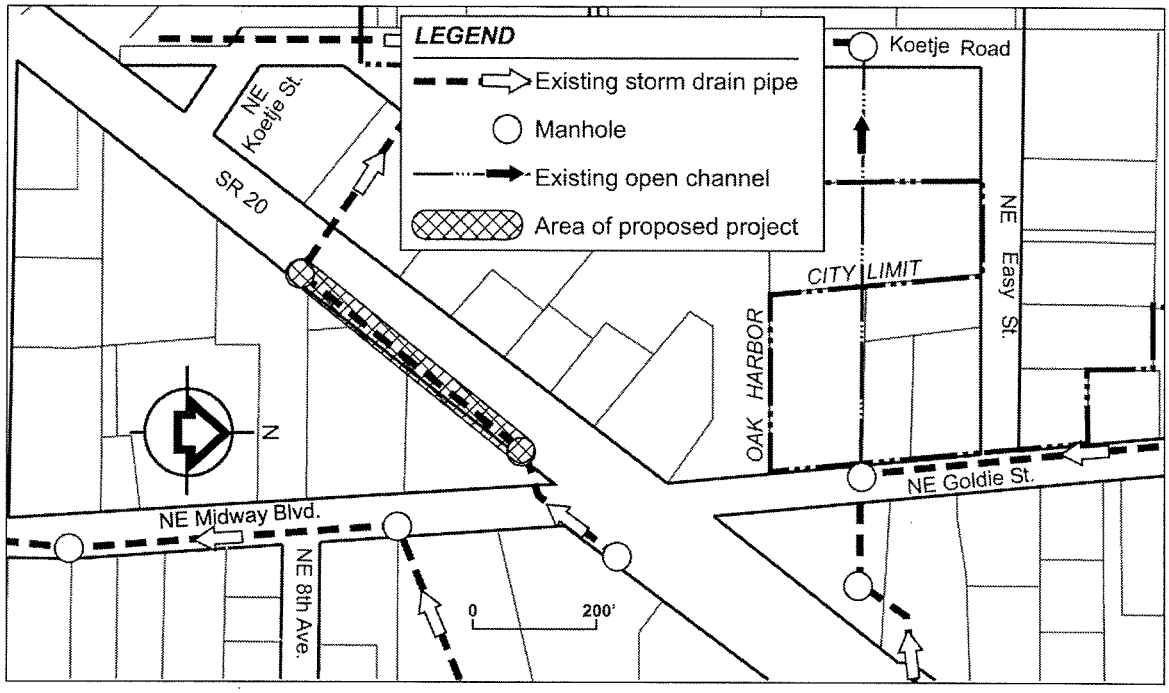
PROJECT:	**Alternative 1 - Project 7**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Outfall extension on existing 42-inch near Beeksma Drive**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REINF. CONC. PIPE 48-INCH (Marine outfall)	1,200	LF	$ 350.00	$ 420,000
2	SEDIMENTATION CURTAIN	1	LS	$ 16,900.00	$ 16,900
3	MARINE EXCAVATION	4,533	CY	$ 20.00	$ 90,660
4	MARINE BACKFILL	2,267	CY	$ 23.00	$ 52,141
5	"FISH MIX" TRENCH COVER	1,289	CY	$ 32.00	$ 41,248
				Subtotal	$ 620,949
	DEWATERING	10%			$ 62,095
	EROSION & SEDIMENTATION CONTROL	10%			$ 62,095
	TRAFFIC CONTROL	3%			$ 18,628
	CONTINGENCY	30%			$ 186,285
				Subtotal	$ 950,052
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 95,005
				Construction Subtotal (Rounded)	$ 1,045,000
	STATE SALES TAX	8.3%			$ 86,735
	ENGINEERING/LEGAL/ADMIN	25%			$ 261,250
	PREDESIGN	5%			$ 52,250
	CONSTRUCTION MANAGEMENT	20%			$ 209,000
	PERMITTING	5%			$ 52,250
				Project Subtotal (Rounded)	$ 1,706,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 1,706,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 8
PIPELINE REPLACEMENT ALONG SR 20
NEAR MIDWAY BOULEVARD



PROBLEM DESCRIPTION

Modeling indicates that an existing segment of 12-inch CMP is restrictive, creating a potential flooding problem along SR-20 starting at the 25-year storm.

PROJECT DESCRIPTION

This project consists of replacing this 550-foot segment with 12-inch smooth-bore pipe.

ESTIMATED PROJECT COST

$130,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 1 - Project 8 **CHECKED BY:** AMM
DESCRIPTION: Pipe replacement along SR-20 near Midway Blvd.
BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	214	SY	$ 23.00	$ 4,922
2	REMOVE PIPE	550	LF	$ 17.25	$ 9,488
3	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	550	LF	$ 40.25	$ 22,138
4	ASPHALT CONCRETE PAVEMENT PATCHING	50	TN	$ 115.00	$ 5,750
				Subtotal	$ 42,297
	DEWATERING	5%			$ 2,115
	EROSION & SEDIMENTATION CONTROL	10%			$ 4,230
	TRAFFIC CONTROL	3%			$ 1,269
	CONTINGENCY	30%			$ 12,689
				Subtotal	$ 62,600
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 6,260
				Construction Subtotal (Rounded)	$ 69,000
	STATE SALES TAX	8.3%			$ 5,727
	ENGINEERING/LEGAL/ADMIN	50%			$ 34,500
	CONSTRUCTION MANAGEMENT	20%			$ 13,800
	PERMITTING	10%			$ 6,900
				Project Subtotal (Rounded)	$ 130,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 130,000**

Notes:

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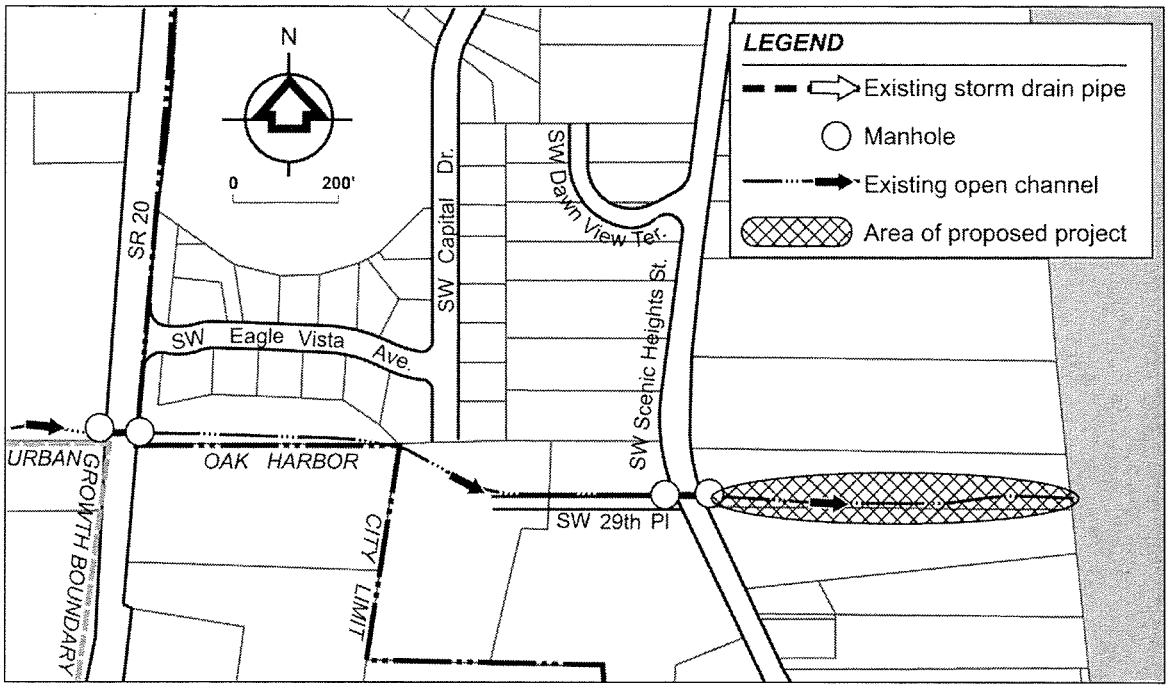
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 9
LISZAK OUTFALL REPAIR



PROBLEM DESCRIPTION

Erosion is occurring at an outfall near SW Scenic Heights Road and SW 29th Place. Since settlement of the area, the tributary area has been greatly modified, both in terms of tributary area and land coverage. The corresponding change in flow regime is believed to have created an erosion problem.

PROJECT DESCRIPTION

This project would repair the erosion. The project is documented in *Liszak Outfall Drainage Review* (Cane Engineering, November 2005).

ESTIMATED PROJECT COST

$155,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 1 - Project 9**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Liszak Project - erosion prevention**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Liszak Project per "Liszak Outfall Drainage Review", Cane Engineering, November 2005	1	LS	$ 77,976.00	$ 77,976
	(Elements accounted for in above referenced source are "zeroed-out" below.)			**Subtotal**	$ 77,976
	DEWATERING	0%			$ -
	EROSION & SEDIMENTATION CONTROL	0%			$ -
	TRAFFIC CONTROL	0%			$ -
	CONTINGENCY	0%			$ -
				Subtotal	$ 77,976
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 7,798
				Construction Subtotal (Rounded)	$ 86,000
	STATE SALES TAX	0.0%			$ -
	ENGINEERING/LEGAL/ADMIN	50%			$ 43,000
	CONSTRUCTION MANAGEMENT	20%			$ 17,200
	PERMITTING	10%			$ 8,600
				Project Subtotal (Rounded)	$ 155,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 155,000**

Notes:

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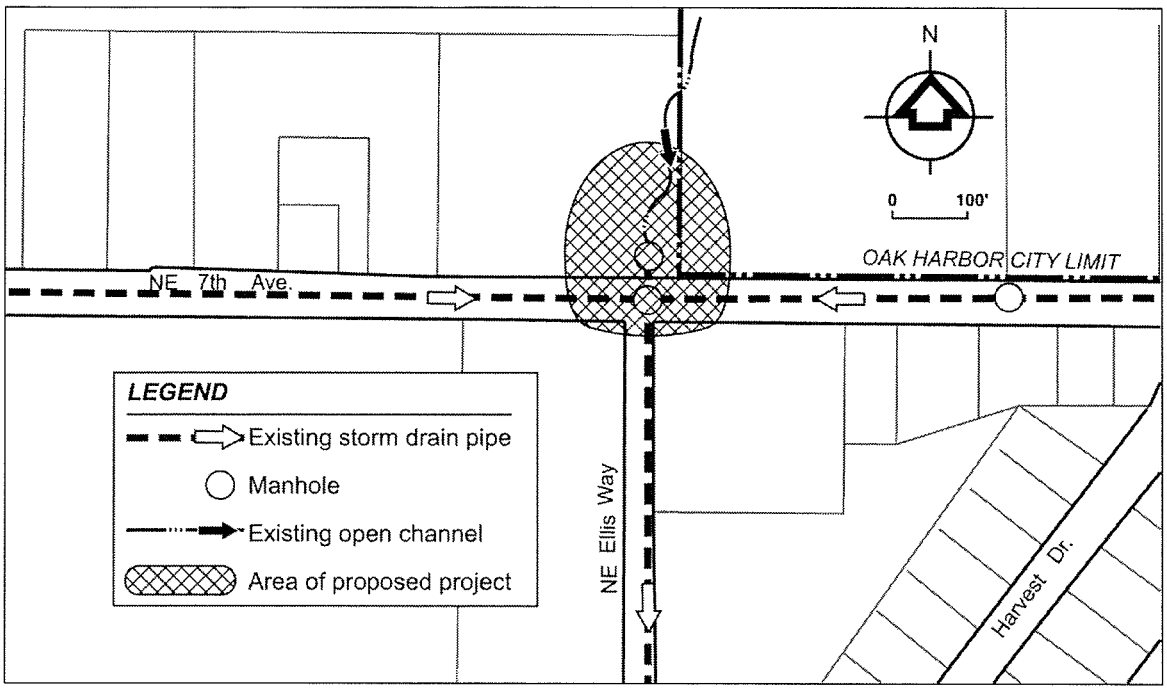
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 10 DRAINAGE COMPONENT OF PASSIVE PARK CREATION



PROBLEM DESCRIPTION

The existing pipe network in this area is difficult to access and maintain. In addition, the network is poorly documented. Flow passes through this area in an uncontrolled manner that contributes to downstream flooding.

PROJECT DESCRIPTION

This project consists of reconfiguring the drainage pipe on NE 7th Avenue near NE Ellis Way in order to provide better control of the drainage exiting the large, flat, low-lying area north of NE 7th Avenue. It includes modifications of the drainage systems along NE 7th Avenue to provide access to the outlets, replacement (or modification) of a culvert under NE 7th Avenue, and installation of a flow control structure on the north side of NE 7th Avenue. These modifications provide an opportunity for the City to use the area north of NE 7th Avenue area as a passive park.

ESTIMATED PROJECT COST

$126,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 1 - Project 10 **CHECKED BY:** AMM
DESCRIPTION: Drainage component of passive park creation
BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	73	SY	$ 23.00	$ 1,679
2	30" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	40	LF	$ 97.75	$ 3,910
3	REINF. CONC. PIPE 48-INCH	60	LF	$ 195.50	$ 11,730
4	DETAILED VICINITY SURVEY	1	LS	$ 5,000.00	$ 5,000
5	FLOW CONTROL STRUCTURE, 72-INCH	1	LS	$ 11,730.00	$ 11,730
6	UTILITY RELOCATION	1	LS	$ 5,000.00	$ 5,000
7	ASPHALT CONCRETE PAVEMENT PATCHING	17	TN	$ 115.00	$ 1,955
				Subtotal	$ 41,004
	DEWATERING	5%			$ 2,050
	EROSION & SEDIMENTATION CONTROL	10%			$ 4,100
	TRAFFIC CONTROL	3%			$ 1,230
	CONTINGENCY	30%			$ 12,301
				Subtotal	$ 60,686
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 6,069
				Construction Subtotal (Rounded)	$ 67,000
	STATE SALES TAX	8.3%			$ 5,561
	ENGINEERING/LEGAL/ADMIN	50%			$ 33,500
	CONSTRUCTION MANAGEMENT	20%			$ 13,400
	PERMITTING	10%			$ 6,700
				Project Subtotal (Rounded)	$ 126,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 126,000**

Notes:

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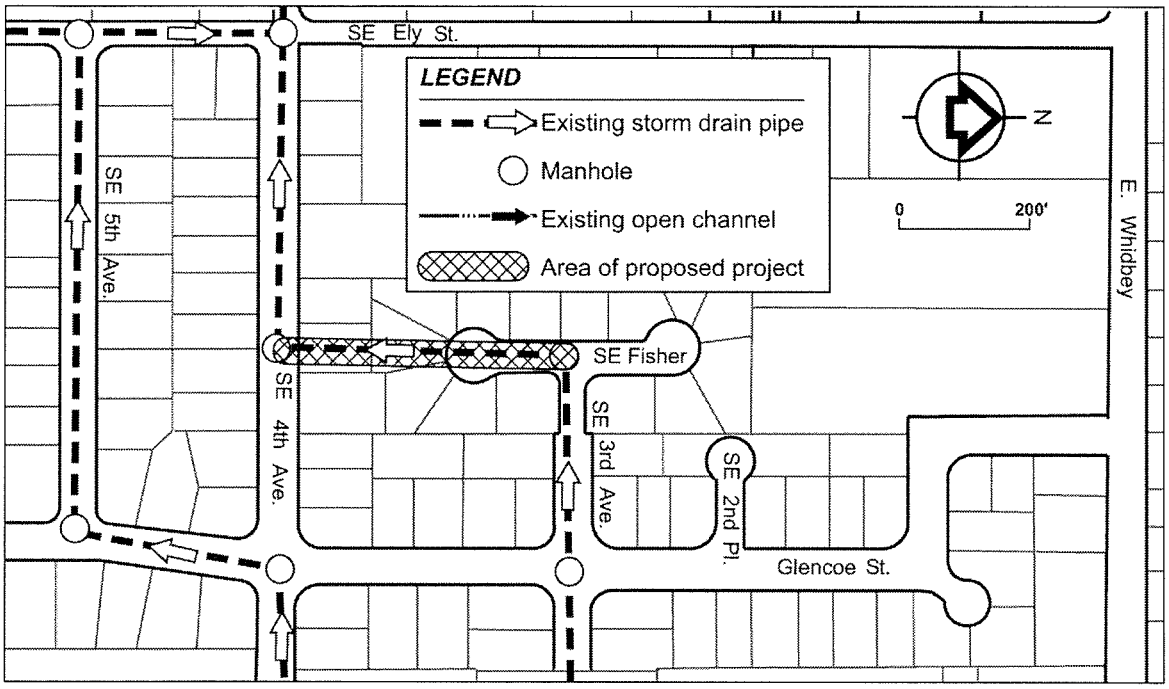
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 11 PIPELINE REPLACEMENT ALONG FISHER COURT NORTH OF SE 4TH AVENUE



PROBLEM DESCRIPTION

The existing drainage system is inadequate to convey the predicted peak flows originating from the upstream tributary area, resulting in system back-up and roadside flooding starting at the 2-year storm.

PROJECT DESCRIPTION

This project replaces a 387-foot segment of 12-inch pipe with 24-inch pipe. This would result in an undesirable configuration of a smaller diameter pipe located downstream (12-inch), however, hydraulically it is adequate under this alternative configuration.

ESTIMATED PROJECT COST

$160,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 1 - Project 11**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Pipe replacement along Fisher Ct north of SE 4th Ave**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	194	SY	$ 23.00	$ 4,462
2	REMOVE PIPE	387	LF	$ 17.25	$ 6,676
3	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	387	LF	$ 74.75	$ 28,928
4	CATCH BASIN TYPE 2 48"	2	EA	$ 3,380.00	$ 6,760
5	ASPHALT CONCRETE PAVEMENT PATCHING	45	TN	$ 115.00	$ 5,175
				Subtotal	$ 52,001
	DEWATERING	5%			$ 2,600
	EROSION & SEDIMENTATION CONTROL	10%			$ 5,200
	TRAFFIC CONTROL	3%			$ 1,560
	CONTINGENCY	30%			$ 15,600
				Subtotal	$ 76,961
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 7,696
				Construction Subtotal (Rounded)	$ 85,000
	STATE SALES TAX	8.3%			$ 7,055
	ENGINEERING/LEGAL/ADMIN	50%			$ 42,500
	CONSTRUCTION MANAGEMENT	20%			$ 17,000
	PERMITTING	10%			$ 8,500
				Project Subtotal (Rounded)	$ 160,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 160,000**

Notes:

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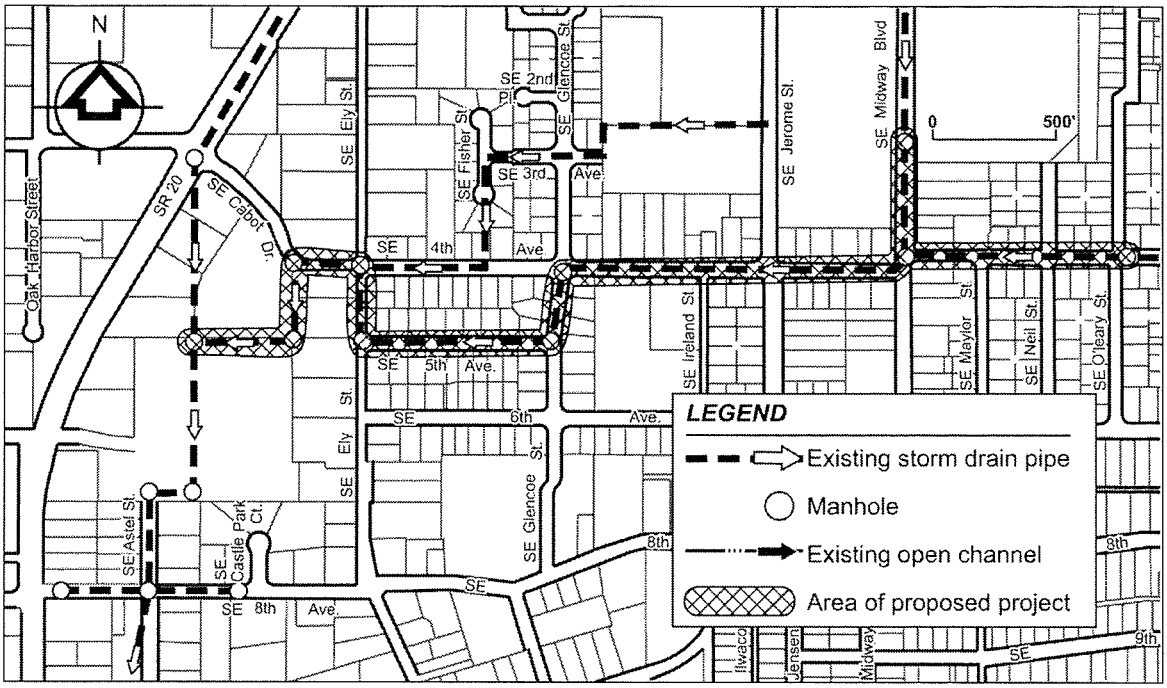
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 12
SE 4TH AVENUE DRAINAGE IMPROVEMENTS



PROBLEM DESCRIPTION

The extensive network of very small existing ditches and pipe does not provide sufficient capacity to convey the 25-year storm runoff. As a result, localized roadside flooding is predicted starting at the 2-year storm.

PROJECT DESCRIPTION

A series of drainage improvements are identified along SE 4th Avenue between about SE Cabot and SE O'Leary Street. A route analysis is also identified to evaluate the feasibility of establishing a new drainage alignment since the existing alignment follows an unusual non-linear route. The existing system consists of a mix of shallow open ditch and 8-inch through 24-inch CMP. The new system consists of 12 inch through 24-inch pipe.

ESTIMATED PROJECT COST

$1,404,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 1 - Project 12 — CHECKED BY: AMM
DESCRIPTION: SE 4th Ave drainage improvement between about SE Cabot and SE Oleary St
BY: GLG — DATE: 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	ROUTE ANALYSIS	1	LS	$ 5,000.00	$ 5,000
2	REMOVE PAVEMENT	2,234	SY	$ 23.00	$ 51,382
3	REMOVE PIPE	5,166	LF	$ 17.25	$ 89,114
4	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	907	LF	$ 40.25	$ 36,507
5	15" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	2,149	LF	$ 48.90	$ 105,086
6	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	826	LF	$ 57.50	$ 47,495
7	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	1,284	LF	$ 74.75	$ 95,979
8	CATCH BASIN TYPE 2 48"	10	EA	$ 3,381.00	$ 33,810
9	CATCH BASIN TYPE 2 54"	4	EA	$ 4,347.00	$ 17,388
10	CATCH BASIN TYPE 1	2	EA	$ 1,530.00	$ 3,060
11	ASPHALT CONCRETE PAVEMENT PATCHING	521	TN	$ 115.00	$ 59,915
				Subtotal	$ 544,735
	DEWATERING	5%			$ 27,237
	EROSION & SEDIMENTATION CONTROL	10%			$ 54,474
	TRAFFIC CONTROL	3%			$ 16,342
	CONTINGENCY	30%			$ 163,421
				Subtotal	$ 806,208
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 80,621
				Construction Subtotal (Rounded)	$ 887,000
	STATE SALES TAX	8.3%			$ 73,621
	ENGINEERING/LEGAL/ADMIN	25%			$ 221,750
	CONSTRUCTION MANAGEMENT	20%			$ 177,400
	PERMITTING	5%			$ 44,350
				Project Subtotal (Rounded)	$ 1,404,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 1,404,000**

Notes:
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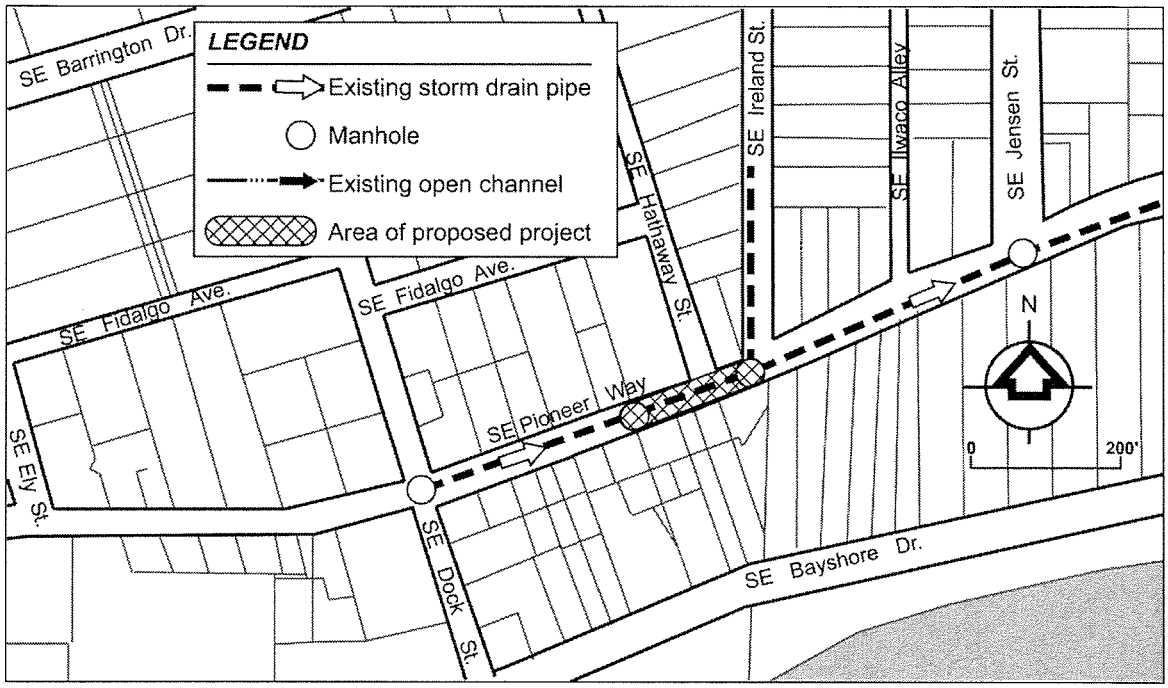
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 13 PIPELINE REPLACEMENT ALONG PIONEER AVENUE NEAR HATHAWAY STREET



PROBLEM DESCRIPTION

A short segment of existing 15-inch pipe was found to create local flooding starting at the 25-year storm.

PROJECT DESCRIPTION

This project consists of replacing the undersized segment with 189 feet of 21-inch pipe to match the adjacent existing pipe system.

ESTIMATED PROJECT COST

$82,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 1 - Project 13**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Pipe replacement along Pioneer Ave near SE Hathaway St**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	87	SY	$ 23.00	$ 2,001
2	REMOVE PIPE	189	LF	$ 17.25	$ 3,260
3	21" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	189	LF	$ 74.75	$ 14,128
4	ASPHALT CONCRETE PAVEMENT PATCHING	20	TN	$ 115.00	$ 2,300
				Subtotal	$ 21,689
	DEWATERING	5%			$ 1,084
	EROSION & SEDIMENTATION CONTROL	10%			$ 2,169
	TRAFFIC CONTROL	3%			$ 651
	CONTINGENCY	30%			$ 6,507
				Subtotal	$ 32,100
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 3,210
				Construction Subtotal (Rounded)	$ 35,000
	STATE SALES TAX	8.3%			$ 2,905
	ENGINEERING/LEGAL/ADMIN	85%			$ 29,750
	CONSTRUCTION MANAGEMENT	20%			$ 7,000
	PERMITTING	20%			$ 7,000
				Project Subtotal (Rounded)	$ 82,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 82,000**

Notes:

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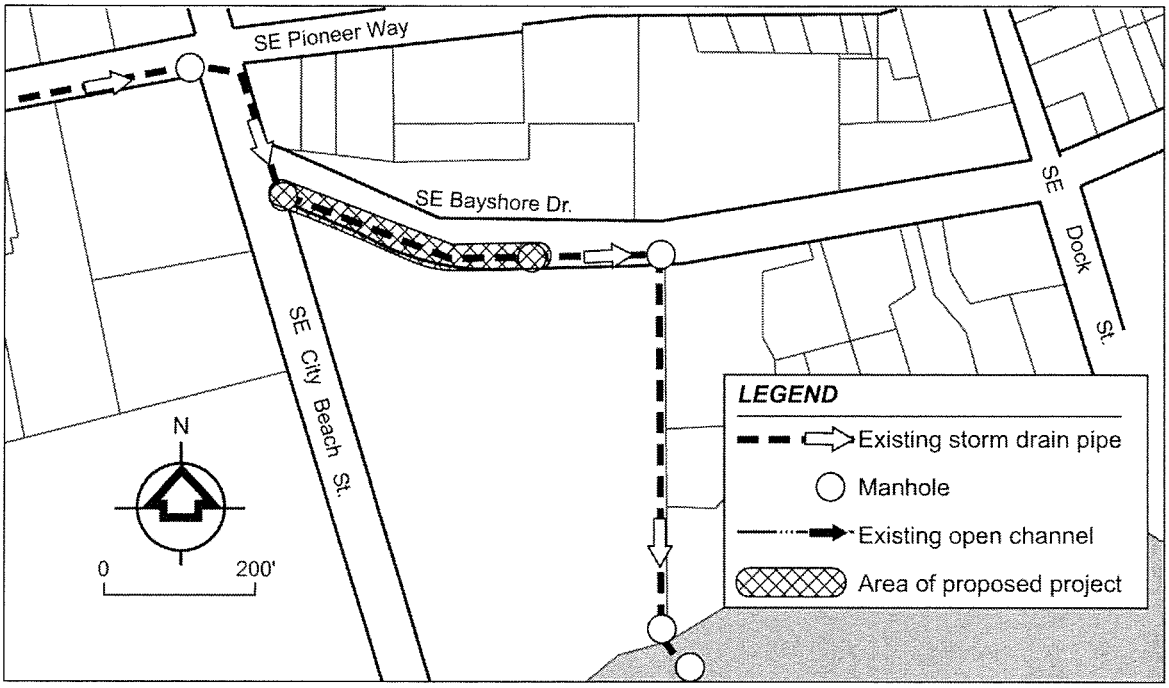
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 14 PIPELINE REPLACEMENT ALONG SE BAYSHORE DRIVE EAST OF SE CITY BEACH STREET



PROBLEM DESCRIPTION

A local pipe restriction was found to create flooding starting at the 10-year storm.

PROJECT DESCRIPTION

This project would replace a 409-foot segment of 24-inch pipe with 36-inch pipe. This would eliminate all but 4 minutes of local flooding during the design conditions. Eliminating the additional 4 minutes of flooding in this area was not deemed to be warranted since it would require costly additional upstream pipe replacement.

ESTIMATED PROJECT COST

$198,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 1 - Project 14 **CHECKED BY:** AMM
DESCRIPTION: Pipe replacement along SE Bayshore Dr east of SE City Beach St
BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	273	SY	$ 23.00	$ 6,279
2	REMOVE PIPE	409	LF	$ 17.25	$ 7,055
3	36" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	409	LF	$ 115.00	$ 47,035
4	ASPHALT CONCRETE PAVEMENT PATCHING	64	TN	$ 115.00	$ 7,360
				Subtotal	$ 67,729
	DEWATERING	10%			$ 6,773
	EROSION & SEDIMENTATION CONTROL	10%			$ 6,773
	TRAFFIC CONTROL	3%			$ 2,032
	CONTINGENCY	30%			$ 20,319
				Subtotal	$ 103,626
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 10,363
				Construction Subtotal (Rounded)	$ 114,000
	STATE SALES TAX	8.3%			$ 9,462
	ENGINEERING/LEGAL/ADMIN	35%			$ 39,900
	CONSTRUCTION MANAGEMENT	20%			$ 22,800
	PERMITTING	10%			$ 11,400
				Project Subtotal (Rounded)	$ 198,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 198,000**

Notes:

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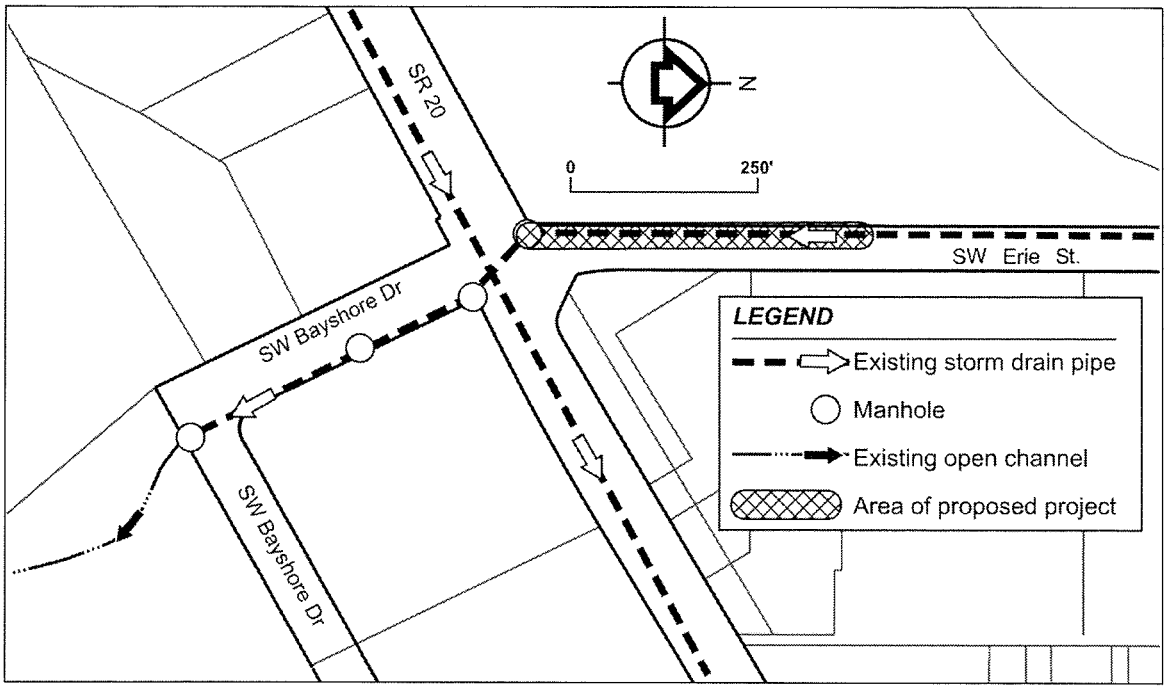
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 15 PIPELINE REPLACEMENT ALONG SW ERIE STREET NEAR SR 20



PROBLEM DESCRIPTION

Existing runoff conditions result in predicted flooding starting at the 10-year storm because of a restrictive pipe segment.

PROJECT DESCRIPTION

The existing 12-inch pipe along SE Erie Street near SR 20 would be replaced with 412 feet of 18-inch pipe to correct the localized flooding problem.

ESTIMATED PROJECT COST

$121,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 1 - Project 15**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Pipe replacement along SW Erie St near SR-20**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	172	SY	$ 23.00	$ 3,956
2	REMOVE PIPE	412	LF	$ 17.25	$ 7,107
3	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	412	LF	$ 57.50	$ 23,690
4	ASPHALT CONCRETE PAVEMENT PATCHING	40	TN	$ 115.00	$ 4,600
				Subtotal	$ 39,353
	DEWATERING	5%			$ 1,968
	EROSION & SEDIMENTATION CONTROL	10%			$ 3,935
	TRAFFIC CONTROL	3%			$ 1,181
	CONTINGENCY	30%			$ 11,806
				Subtotal	$ 58,242
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 5,824
				Construction Subtotal (Rounded)	$ 64,000
	STATE SALES TAX	8.3%			$ 5,312
	ENGINEERING/LEGAL/ADMIN	50%			$ 32,000
	CONSTRUCTION MANAGEMENT	20%			$ 12,800
	PERMITTING	10%			$ 6,400
				Project Subtotal (Rounded)	$ 121,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 121,000**

Notes:

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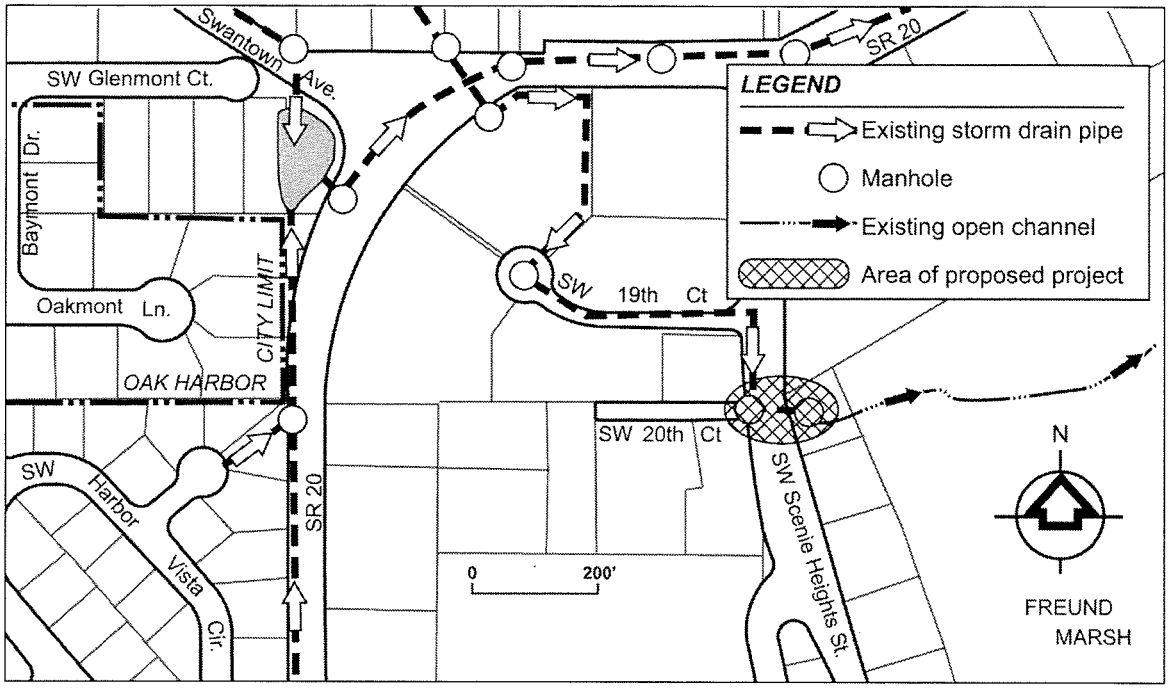
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 16
CULVERT REPLACEMENT
ACROSS SW SCENIC HEIGHTS STREET



PROBLEM DESCRIPTION

An existing 12-inch CMP culvert requires replacement with at least a 15-inch culvert to correct the flooding problem at this location. Flooding is predicted to occur starting at the 25-year storm.

PROJECT DESCRIPTION

Negotiations are underway with Washington State Department of Transportation, which is proposing drainage modifications in the area. These drainage negotiations may include an increase in the culvert size.

ESTIMATED PROJECT COST

$30,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 1 - Project 16**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Culvert replacement crossing SW Scenic Heights St**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	37	SY	$ 23.00	$ 851
2	REMOVE PIPE	88	LF	$ 17.25	$ 1,518
3	15" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	88	LF	$ 48.90	$ 4,303
4	ASPHALT CONCRETE PAVEMENT PATCHING	9	TN	$ 115.00	$ 1,035
				Subtotal	$ 7,707
	DEWATERING	5%			$ 385
	EROSION & SEDIMENTATION CONTROL	10%			$ 771
	TRAFFIC CONTROL	3%			$ 231
	CONTINGENCY	30%			$ 2,312
				Subtotal	$ 11,407
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 1,141
				Construction Subtotal (Rounded)	$ 13,000
	STATE SALES TAX	8.3%			$ 1,079
	ENGINEERING/LEGAL/ADMIN	85%			$ 11,050
	CONSTRUCTION MANAGEMENT	20%			$ 2,600
	PERMITTING	20%			$ 2,600
				Project Subtotal (Rounded)	$ 30,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 30,000**

Notes:

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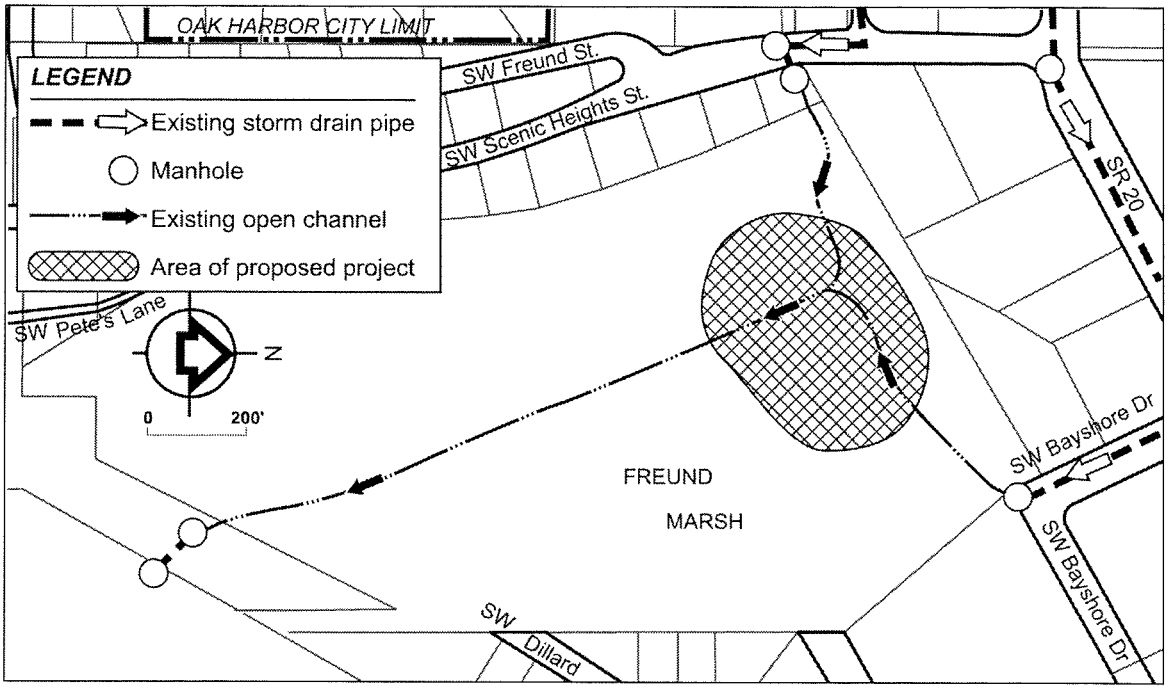
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 17 DRAINAGE COMPONENT OF THE FREUND MARSH PASSIVE PARK CREATION



PROBLEM DESCRIPTION

Since settlement of the area, historic drainage patterns have changed. Construction of roadways including SR-20 has diverted flow that used to flow through this area, based upon topography of the adjacent hillsides. A related project attempts to correct some of this earlier flow modifications. This proposed project provides modification of the area to accommodate the proposed diverted flow in the associated project in such a way that these modifications may be consistent with and incorporated into a passive park in the area.

PROJECT DESCRIPTION

Creation of a passive park at Freund Marsh would include construction elements associated with drainage that passes through the park, including runoff redirected through the marsh resulting from Alternative 1 Project 5. To compensate for this flow redirection, it is assumed that a volume of earth equal to the volume of diverted runoff would be removed from the park area to compensate for any potential rise in water surface elevation in the park area. The actual amount of earth removal may be more or less, depending on the layout of features in the passive park, the type of park features, the location of wetlands, tidal conditions, and final topographic configuration of park elements.

ESTIMATED PROJECT COST

$324,000

ASSOCIATED PROJECTS

Alternative 1 – Project 5 is associated with this project.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 1 - Project 17**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Freund Marsh passive park creation - drainage component**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	COMMON EXCAVATION (QTY>=1000)	6,453	CY	$ 17.25	$ 111,314
				Subtotal	$ 111,314
	DEWATERING	10%			$ 11,131
	EROSION & SEDIMENTATION CONTROL	10%			$ 11,131
	TRAFFIC CONTROL	3%			$ 3,339
	CONTINGENCY	30%			$ 33,394
				Subtotal	$ 170,311
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 17,031
				Construction Subtotal (Rounded)	$ 187,000
	STATE SALES TAX	8.3%			$ 15,521
	ENGINEERING/LEGAL/ADMIN	35%			$ 65,450
	CONSTRUCTION MANAGEMENT	20%			$ 37,400
	PERMITTING	10%			$ 18,700
				Project Subtotal (Rounded)	$ 324,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 324,000**

Notes:

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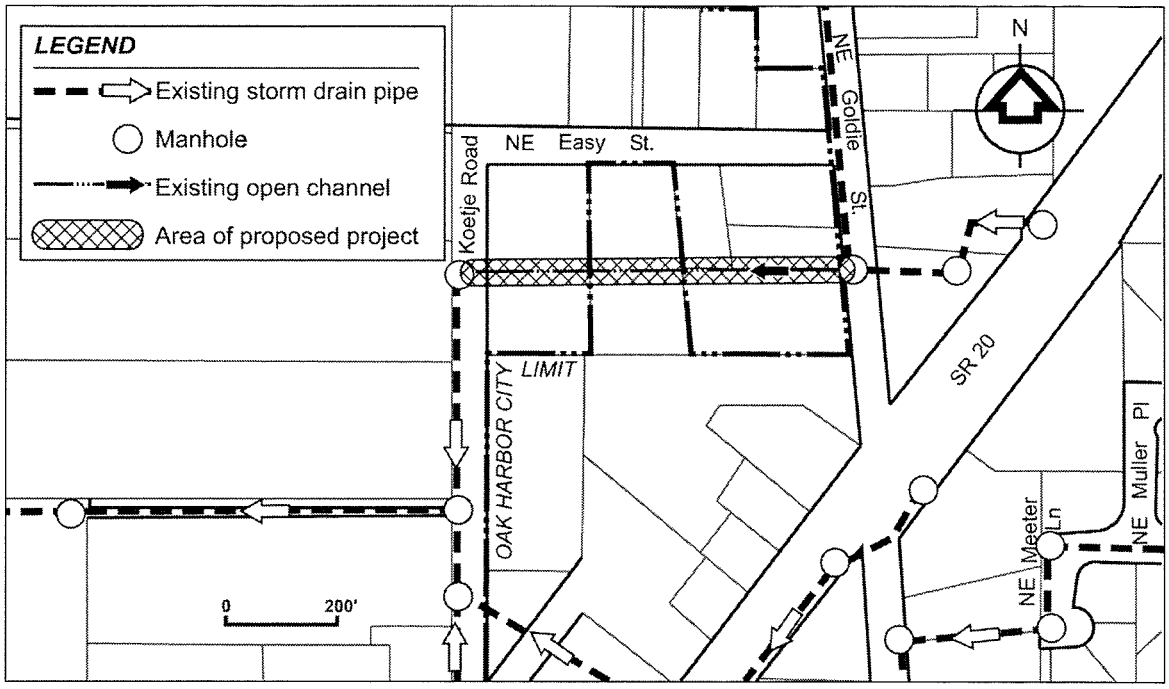
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 1 PROJECT 18 IMPROVE CONVEYANCE BETWEEN GOLDIE STREET AND KOETJE STREET NEAR EASY STREET



PROBLEM DESCRIPTION

The existing drainage path in the area passes through private property. As development has occurred upstream, flow characteristics have changed. As a result, the existing system is now inadequate to convey the predicted peak flows.

PROJECT DESCRIPTION

This project would correct a chronic flooding problem by improving conveyance of the existing drainage system between NE Goldie Street and NE Koetje Street near NE Easy Street. The existing drainage flows across private property, frequently creating flooding in the area. Runoff from over 60 acres of upstream drainage area flows through this area. Implementation of this project would require a drainage and construction easement from the property owner. Major project elements are 702 feet of 21-inch pipe, catchbasins, and an energy dissipation structure due to the steepness of the site.

ESTIMATED PROJECT COST

$236,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 1 - Project 18 **CHECKED BY:** AMM

DESCRIPTION: Improve conveyance between Goldie St. and Koetje St. near Easy St.

BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	DETAILED SITE SURVEY	1	LS	$ 7,500.00	$ 7,500
2	21" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	702	LF	$ 74.75	$ 52,475
3	CATCHBASIN TYPE 2 48"	2	EA	$ 3,380.00	$ 6,760
4	ENERGY DISSIPATOR	1	LS	$ 7,500.00	$ 7,500
5	PAVEMENT, ASPHALT CONCRETE CL B (QTY<500)	75	TN	$ 92.00	$ 6,900
				Subtotal	$ 81,135
	DEWATERING	5%			$ 4,057
	EROSION & SEDIMENTATION CONTROL	10%			$ 8,113
	TRAFFIC CONTROL	3%			$ 2,434
	CONTINGENCY	30%			$ 24,340
				Subtotal	$ 120,079
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 12,008
				Construction Subtotal (Rounded)	$ 132,000
	STATE SALES TAX	8.3%			$ 10,956
	ENGINEERING/LEGAL/ADMIN	35%			$ 46,200
	CONSTRUCTION MANAGEMENT	20%			$ 26,400
	PERMITTING	10%			$ 13,200
				Project Subtotal (Rounded)	$ 229,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	EASEMENT	1	LS	$ 5,000.00	$ 5,000
	CONTINGENCY	30%			$ 1,500
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 236,000**

Notes:

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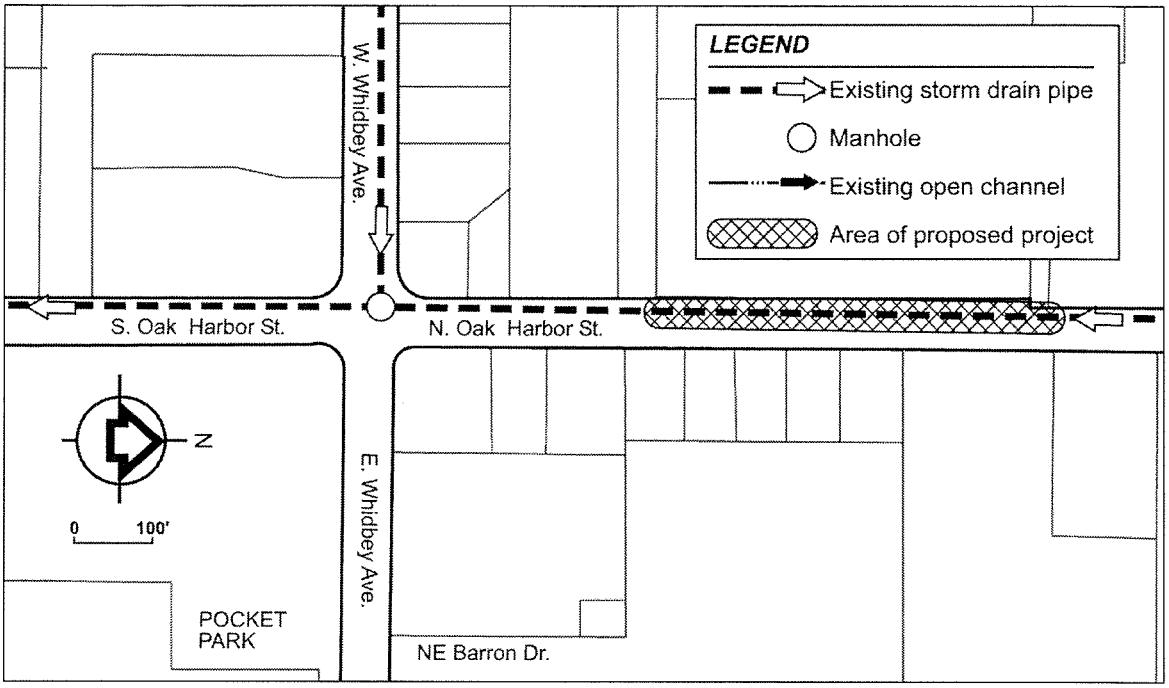
City of Oak Harbor

Comprehensive Stormwater Drainage Plan

APPENDIX C.
PROJECT SUMMARY SHEETS – ALTERNATIVE 2

January 2006

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 1 PIPELINE REPLACEMENT ALONG OAK HARBOR STREET



PROBLEM DESCRIPTION

Capacity restrictions create back-up and flooding from the pipe system that parallels Oak Harbor Street. Flooding starts at the 10-year storm.

PROJECT DESCRIPTION

A 422-foot segment of existing 12-inch pipe needs to be replaced with 18-inch pipe. The segment to be replaced parallels Oak Harbor Street north of Whidbey Avenue.

ESTIMATED PROJECT COST

$145,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 1 **CHECKED BY:** AMM
DESCRIPTION: Pipeline replacement along Oak Harbor Street
BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	176	SY	$ 23.00	$ 4,048
2	REMOVE PIPE	422	LF	$ 17.25	$ 7,280
3	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	422	LF	$ 57.50	$ 24,265
4	CATCHBASIN TYPE 2 48"	2	EA	$ 3,380.00	$ 6,760
5	ASPHALT CONCRETE PAVEMENT PATCHING	41	TN	$ 115.00	$ 4,715
				Subtotal	$ 47,068
	DEWATERING	5%			$ 2,353
	EROSION & SEDIMENTATION CONTROL	10%			$ 4,707
	TRAFFIC CONTROL	3%			$ 1,412
	CONTINGENCY	30%			$ 14,120
				Subtotal	$ 69,660
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 6,966
				Construction Subtotal (Rounded)	$ 77,000
	STATE SALES TAX	8.3%			$ 6,391
	ENGINEERING/LEGAL/ADMIN	50%			$ 38,500
	CONSTRUCTION MANAGEMENT	20%			$ 15,400
	PERMITTING	10%			$ 7,700
				Project Subtotal (Rounded)	$ 145,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 145,000**

Notes:
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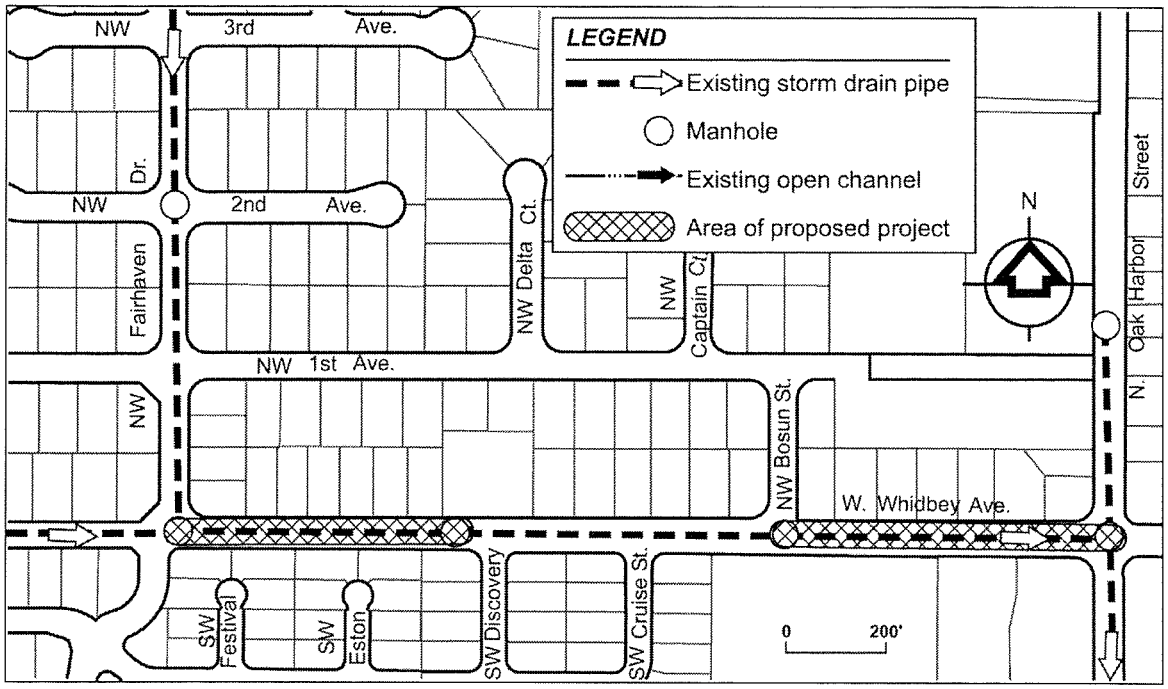
PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 2 PIPELINE REPLACEMENT ALONG WEST WHIDBEY AVENUE



PROBLEM DESCRIPTION

Upstream flows exceed the capacity of this CMP pipe system. This creates flooding from the pipe system causing overflows to run down the street shoulder starting at the 2-year storm.

PROJECT DESCRIPTION

Upstream detention (Alternative 2 Project 3) would allow a reduction in the size and extent of necessary pipeline replacement along West Whidbey Avenue between Oak Harbor Street and Fairhaven Drive (compared to the replacement required for Alternative 1). Two pipe segments included in this project include 634 feet of 18-inch pipe between Oak Harbor Street and NW Bosun Street and 614 feet between Discovery Street and Columbia Drive. Both segments are located on Whidbey Avenue.

ESTIMATED PROJECT COST

$355,000

ASSOCIATED PROJECTS

Alternative 2 – Project 3, consisting of a small detention facility, provides sufficient attenuation of peak flows that allows less length and smaller diameters of the pipe replacements identified for this project.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 2 **CHECKED BY:** AMM
DESCRIPTION: Pipeline replacement along W. Whidbey Ave.
BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	495	SY	$ 23.00	$ 11,385
2	REMOVE PIPE	1,248	LF	$ 17.25	$ 21,528
3	15" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	614	LF	$ 48.90	$ 30,025
4	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	634	LF	$ 57.50	$ 36,455
5	CATCHBASIN TYPE 2 48"	4	EA	$ 3,380.00	$ 13,520
6	ASPHALT CONCRETE PAVEMENT PATCHING	115	TN	$ 115.00	$ 13,225
				Subtotal	$ 126,138
	DEWATERING	5%			$ 6,307
	EROSION & SEDIMENTATION CONTROL	10%			$ 12,614
	TRAFFIC CONTROL	3%			$ 3,784
	CONTINGENCY	30%			$ 37,841
				Subtotal	$ 186,684
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 18,668
				Construction Subtotal (Rounded)	$ 205,000
	STATE SALES TAX	8.3%			$ 17,015
	ENGINEERING/LEGAL/ADMIN	35%			$ 71,750
	CONSTRUCTION MANAGEMENT	20%			$ 41,000
	PERMITTING	10%			$ 20,500
				Project Subtotal (Rounded)	$ 355,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 355,000**

Notes:

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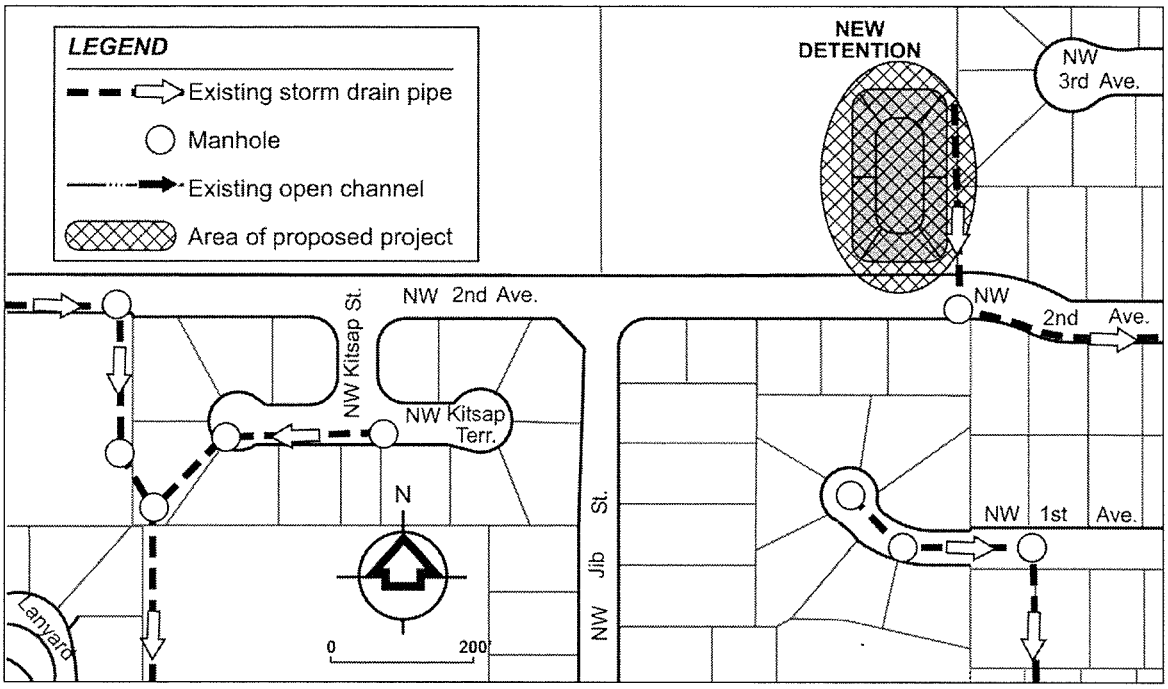
PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 3 DETENTION NEAR NW JIB STREET AND NW 2ND AVENUE



PROBLEM DESCRIPTION

Downstream flooding along W Whidbey Avenue can be reduced as well as reducing the size and length of downstream improvements if detention is provided in this general area. Downstream flooding starts at the 2-year storm.

PROJECT DESCRIPTION

Providing detention in the vicinity of NW Jib Street and NW 2nd Avenue to control runoff from Subbasin 23 would substantially reduce capacity problems downstream along Whidbey Avenue and in the trunkline paralleling Oak Harbor Street. Restricting the discharge to no more than 2 cubic feet per second (cfs) would require a 0.17-acre-foot facility, measuring about 54 feet by 65 feet, with 3 feet of active storage. A control structure using a 6-inch orifice would regulate discharge from the site.

ESTIMATED PROJECT COST

$124,000

ASSOCIATED PROJECTS

Alternative 2 – Project 2 is associated with this project.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 2 - Project 3**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Detention near NW Jib St. & NW 2nd Ave.**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEAR AND GRUB	7,176	SF	$ 2.00	$ 14,352
2	COMMON EXCAVATION (QTY<1000)	404	CY	$ 31.05	$ 12,544
3	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	50	LF	$ 40.25	$ 2,013
4	FLOW CONTROL STRUCTURE, 48"	1	EA	$ 4,600.00	$ 4,600
5	ASPHALT CONCRETE PAVEMENT PATCHING	5	TN	$ 115.00	$ 575
6	EROSION CONTROL, HYDRO-SEEDING (QTY>=5000)	7,176	SF	$ 0.17	$ 1,220
7	CHAIN LINK FENCE, 6-FOOT	346	LF	$ 13.80	$ 4,775
8	CHAIN LINK GATE, 12-FT WIDE	1	EA	$ 690.00	$ 690
				Subtotal	$ 40,768
	DEWATERING	5%			$ 2,038
	EROSION & SEDIMENTATION CONTROL	10%			$ 4,077
	TRAFFIC CONTROL	3%			$ 1,223
	CONTINGENCY	30%			$ 12,231
				Subtotal	$ 60,337
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 6,034
				Construction Subtotal (Rounded)	$ 66,000
	STATE SALES TAX	8.3%			$ 5,478
	ENGINEERING/LEGAL/ADMIN	50%			$ 33,000
	CONSTRUCTION MANAGEMENT	20%			$ 13,200
	PERMITTING	10%			$ 6,600
				Project Subtotal (Rounded)	$ 124,000
	LAND ACQUISITION (none allocated)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 124,000**

Notes:

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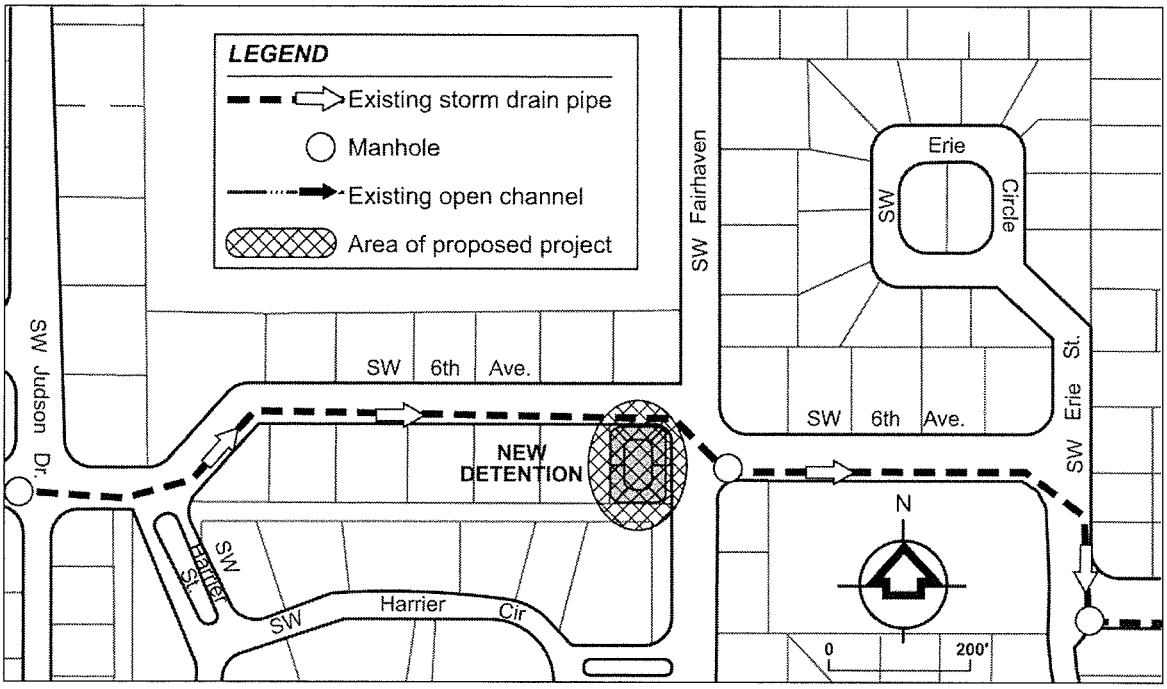
PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 4 DETENTION NEAR SW 6TH AVENUE AND SW FAIRHAVEN DRIVE



PROBLEM DESCRIPTION

Downstream flooding along SW 6th Ave occurs starting at the 25-year storm.

PROJECT DESCRIPTION

This small detention facility to be located near the intersection of SW 6th Avenue and SW Fairhaven Drive would be approximately 34 feet by 37 feet at the surface. It would have an approximate active storage volume of 3,600 cubic feet, with an active storage depth of 2.76 feet, and use an outlet control structure with a 3.25-inch diameter orifice.

ESTIMATED PROJECT COST

$94,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

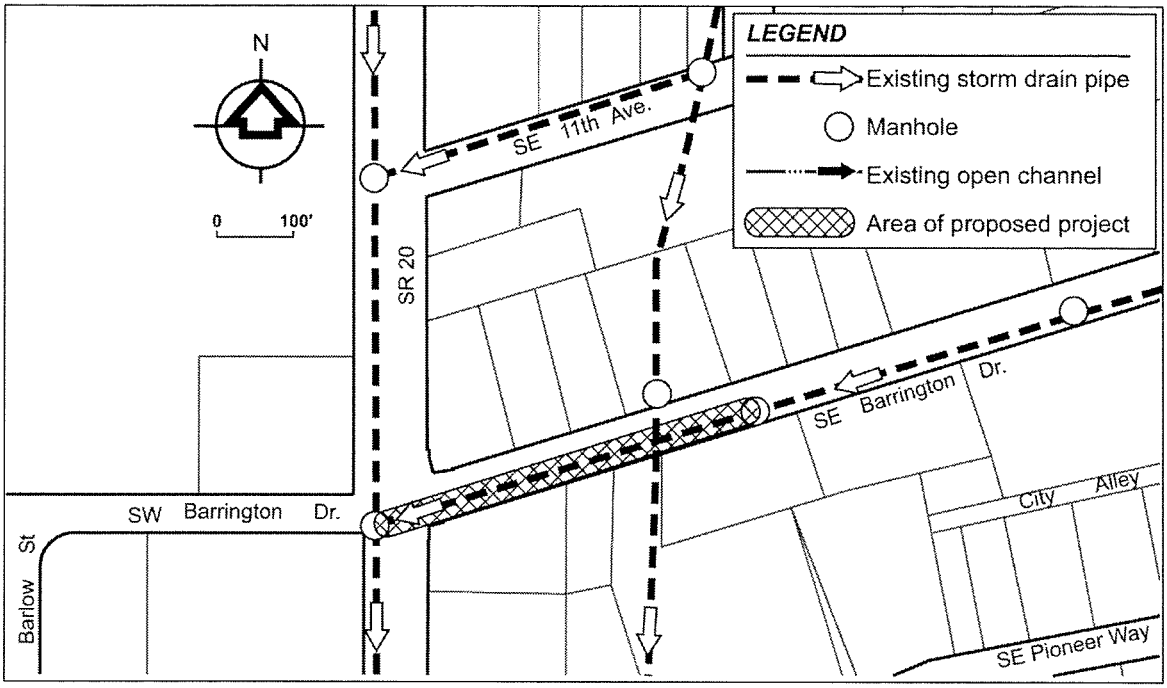
PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 4 **CHECKED BY:** AMM
DESCRIPTION: 6th and Fairhaven Detention
BY: GLG **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEAR AND GRUB	5,312	SF	$ 2.00	$ 10,624
2	COMMON EXCAVATION (QTY<1000)	219	CY	$ 31.05	$ 6,800
3	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	50	LF	$ 40.25	$ 2,013
4	FLOW CONTROL STRUCTURE, 48"	1	EA	$ 4,600.00	$ 4,600
5	ASPHALT CONCRETE PAVEMENT PATCHING	5	TN	$ 115.00	$ 575
6	EROSION CONTROL, HYDRO-SEEDING (QTY>=5000)	5,312	SF	$ 0.17	$ 903
7	CHAIN LINK FENCE, 6-FOOT	320	LF	$ 13.80	$ 4,416
8	CHAIN LINK GATE, 12-FT WIDE	1	EA	$ 690.00	$ 690
				Subtotal	$ 30,620
	DEWATERING	5%			$ 1,531
	EROSION & SEDIMENTATION CONTROL	10%			$ 3,062
	TRAFFIC CONTROL	3%			$ 919
	CONTINGENCY	30%			$ 9,186
				Subtotal	$ 45,318
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 4,532
				Construction Subtotal (Rounded)	$ 50,000
	STATE SALES TAX	8.3%			$ 4,150
	ENGINEERING/LEGAL/ADMIN	50%			$ 25,000
	CONSTRUCTION MANAGEMENT	20%			$ 10,000
	PERMITTING	10%			$ 5,000
				Project Subtotal (Rounded)	$ 94,000
	LAND ACQUISITION (none, City owned)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 94,000**

Notes:
1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 5 PIPELINE REPLACEMENT ALONG BARRINGTON DRIVE



PROBLEM DESCRIPTION

The last segment of pipe along Barrington creates a constriction. This in turn causes back-up and flooding along Barrington for several blocks upstream starting at the 10-year storm. Replacing only the terminal segment of pipe corrects the back-up and flooding.

PROJECT DESCRIPTION

A short segment of the existing 18-inch drain system requires replacement to correct the flooding problem identified along this segment. About 524 feet of 24-inch pipe is required for this project.

ESTIMATED PROJECT COST

$192,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

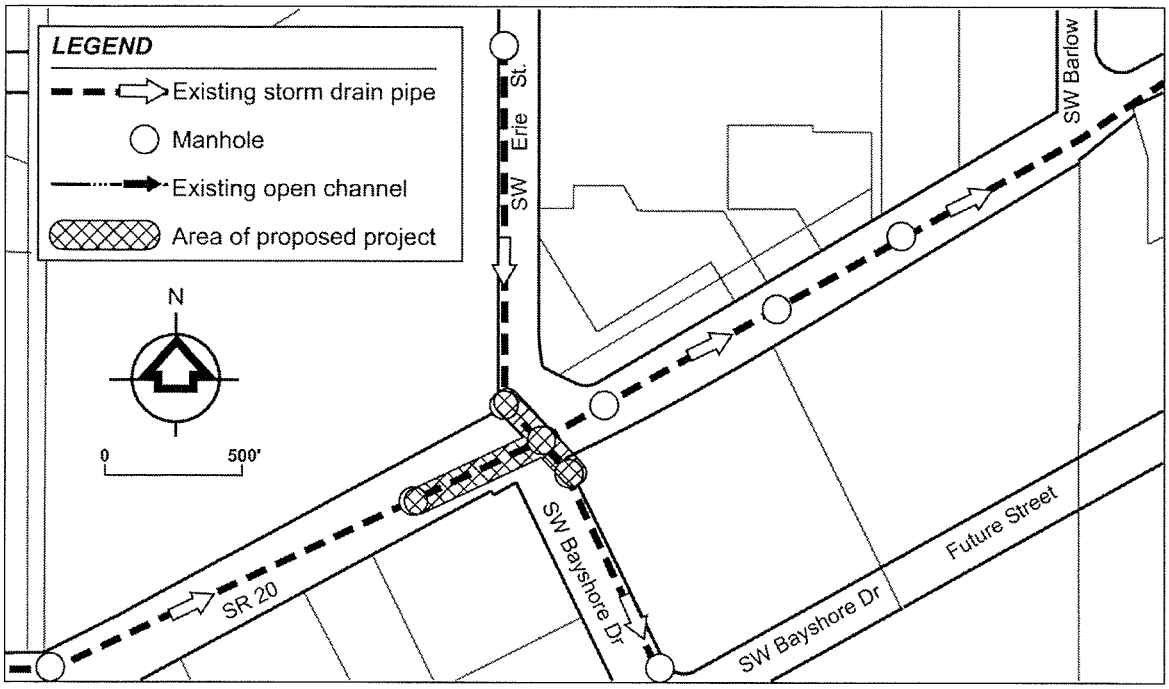
PROJECT: Alternative 2 - Project 5 **CHECKED BY:** AMM
DESCRIPTION: Pipeline replacement along Barrington Drive
BY: GLG **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	262	SY	$ 23.00	$ 6,026
2	REMOVE PIPE	524	LF	$ 17.25	$ 9,039
3	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	524	LF	$ 74.75	$ 39,169
4	CATCHBASIN TYPE 2 48"	2	EA	$ 3,380.00	$ 6,760
5	ASPHALT CONCRETE PAVEMENT PATCHING	61	TN	$ 115.00	$ 7,015
				Subtotal	$ 68,009
	DEWATERING	5%			$ 3,400
	EROSION & SEDIMENTATION CONTROL	10%			$ 6,801
	TRAFFIC CONTROL	3%			$ 2,040
	CONTINGENCY	30%			$ 20,403
				Subtotal	$ 100,653
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 10,065
				Construction Subtotal (Rounded)	$ 111,000
	STATE SALES TAX	8.3%			$ 9,213
	ENGINEERING/LEGAL/ADMIN	35%			$ 38,850
	CONSTRUCTION MANAGEMENT	20%			$ 22,200
	PERMITTING	10%			$ 11,100
				Project Subtotal (Rounded)	$ 192,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 192,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 6 FLOW DIVERSION ON SR 20 NEAR SW ERIE STREET



PROBLEM DESCRIPTION

Excess flows piped to the City's 42-inch trunk system at the intersection of SR-20 and Beeksma Drive overwhelms the capacity of the trunk creating frequent flooding in and around this intersection area.

PROJECT DESCRIPTION

Project components include installing a new catchbasin and segment of pipe that would intercept the SR 20 system and the drainage originating on SW Erie Street and convey this drainage south to the existing drainage network in the Freund Marsh area.

This project would achieve several results:

- It would reestablish historical drainage patterns. Presently, most stormwater runoff from west of Erie Street is intercepted in the storm drainage system and conveyed east to Beeksma Drive, where it enters a 42-inch trunkline that heads south and outfalls into the harbor. Topography indicates that, prior to development, this runoff would have drained through Freund Marsh.
- It would remove runoff from the 42-inch trunkline, which is currently overtaxed, resulting in flooding near the intersection of SR 20 and Beeksma Drive. The diversion would reduce the magnitude and frequency of flooding at this intersection.
- Low flows, including any intercepted groundwater, would help sustain a constructed wetland that may be a part of the passive park concept being considered for the Freund Marsh area. The passive park concept provides several additional benefits, including the treatment of stormwater runoff, wetland creation with the associated wildlife benefits, and flood relief.

ESTIMATED PROJECT COST

$72,000

ASSOCIATED PROJECTS

Alternative 2 - Project 19 needs to be coordinated with this project. Sufficient conveyance and storage capacity within the marsh area must be provided during the passive park concept and development.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 2 - Project 6**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Flow diversion on SR-20 near SW Erie St**		
BY:	**GLG**	**DATE:**	**12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	50	SY	$ 23.00	$ 1,150
2	REMOVE PIPE	100	LF	$ 17.25	$ 1,725
3	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	100	LF	$ 74.75	$ 7,475
4	CATCHBASIN TYPE 2 72"	1	EA	$ 7,475.00	$ 7,475
5	ASPHALT CONCRETE PAVEMENT PATCHING	12	TN	$ 115.00	$ 1,380
				Subtotal	$ 19,205
	DEWATERING	5%			$ 960
	EROSION & SEDIMENTATION CONTROL	10%			$ 1,921
	TRAFFIC CONTROL	3%			$ 576
	CONTINGENCY	30%			$ 5,762
				Subtotal	$ 28,423
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 2,842
				Construction Subtotal (Rounded)	$ 31,000
	STATE SALES TAX	8.3%			$ 2,573
	ENGINEERING/LEGAL/ADMIN	85%			$ 26,350
	CONSTRUCTION MANAGEMENT	20%			$ 6,200
	PERMITTING	20%			$ 6,200
				Project Subtotal (Rounded)	$ 72,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 72,000**

Notes:

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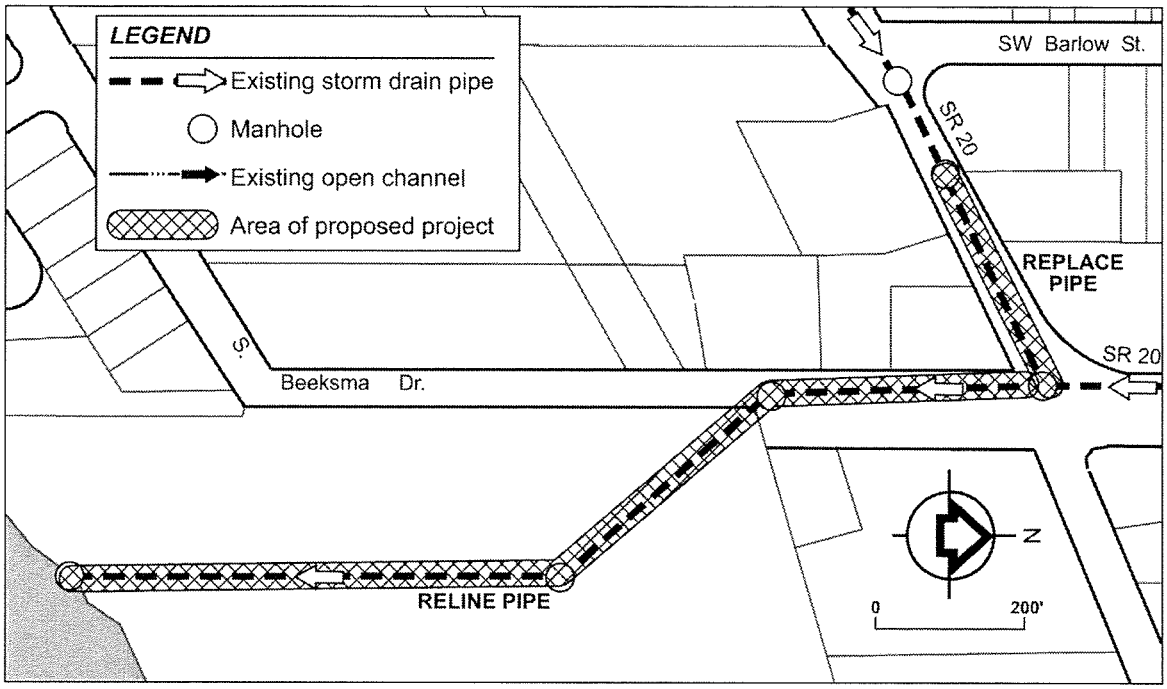
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 7 PIPELINE REPLACEMENT AND LINING TRUNK



PROBLEM DESCRIPTION

High tributary flows and limited capacity create flooding around the intersection of SR-20 and Beeksma Drive starting at the 10-year storm. Sand blockages at the trunk outfall increase this flooding frequency.

PROJECT DESCRIPTION

This project would almost entirely eliminate flooding in the vicinity of SR 20 and Beeksma Drive. The project consists of replacing 362 feet of 24-inch CMP with 30-inch pipe. It also includes inserting a smooth liner inside the existing 42-inch CMP trunkline; even though this would reduce cross-sectional area of this 1,558-foot segment of trunkline, the increased smoothness would improve its hydraulics.

The feasibility of lining the 42-inch trunkline may be affected by concerns about seepage, bypassing storm flows, the condition of the existing pipe, tidal backwater, access on the upper segment, and other issues. Potential alternatives to sliplining include in-situ lining, pipe bursting, and a full pipeline replacement.

The pipe segment along SR-20 may be constructed separately from the existing pipe relining.

ESTIMATED PROJECT COST

$858,000

ASSOCIATED PROJECTS

Alternative 2 - Project 6 diverts flow from this area which, in combination with these improvements, greatly improves the functionality of this system and reduces the potential for flooding.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: **Alternative 2 - Project 7** CHECKED BY: **AMM**

DESCRIPTION: **Pipe replacement and slip-lining existing 42" near SR-20 and Beeksma Drive**

BY: **GLG** DATE: **12/5/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	272	SY	$ 23.00	$ 6,256
2	REMOVE PIPE	362	LF	$ 17.25	$ 6,245
3	30" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	362	LF	$ 97.75	$ 35,386
4	SLIP-LINE EXISTING 42" CMP SDR 26	1,558	LF	$ 161.00	$ 250,838
5	INSTALLATION PITS	1	LS	$ 6,000.00	$ 6,000
6	FLOW DIVERSION	1	LS	$ 10,000.00	$ 10,000
7	ASPHALT CONCRETE PAVEMENT PATCHING	63	TN	$ 115.00	$ 7,245
				Subtotal	$ 321,969
	DEWATERING	10%			$ 32,197
	EROSION & SEDIMENTATION CONTROL	10%			$ 32,197
	TRAFFIC CONTROL	3%			$ 9,659
	CONTINGENCY	30%			$ 96,591
				Subtotal	$ 492,613
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 49,261
				Construction Subtotal (Rounded)	$ 542,000
	STATE SALES TAX	8.3%			$ 44,986
	ENGINEERING/LEGAL/ADMIN	25%			$ 135,500
	CONSTRUCTION MANAGEMENT	20%			$ 108,400
	PERMITTING	5%			$ 27,100
				Project Subtotal (Rounded)	$ 858,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 858,000**

Notes:

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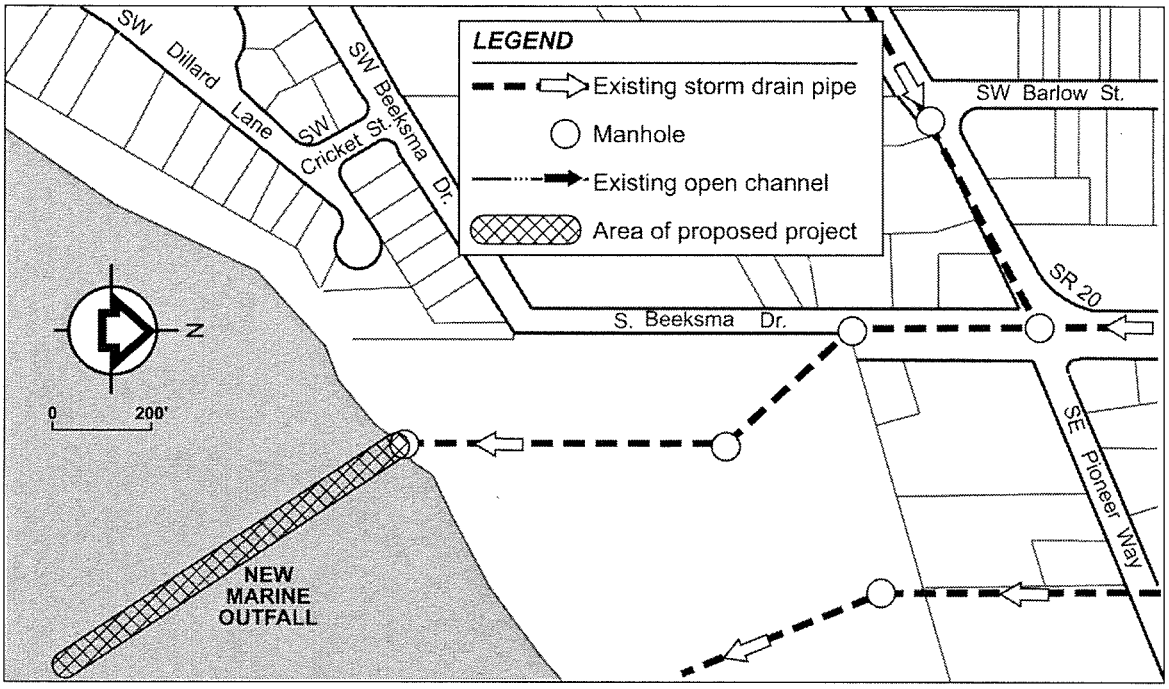
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 8 OUTFALL EXTENSION ON EXISTING TRUNK



PROBLEM DESCRIPTION

The existing outfall of the 42-inch CMP trunk that parallels Beeksma Drive is prone to plugging, which creates flooding at the intersection of Beeksma Drive and SR 20 and increases maintenance demands. Plugging frequently occurs due to large accumulations of sand and occasionally seaweed.

PROJECT DESCRIPTION

This project consists of extending the trunkline into the bay such that the pipe terminus is always fully submerged. A predesign effort is included to resolve issues including bay bathymetry, permitting, and alignment. Based on USGS bathymetry data from the 1980s, approximately 1200 feet of outfall is necessary to provide about 2-feet of water over the top of the pipe during low tide.

ESTIMATED PROJECT COST

$1,706,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

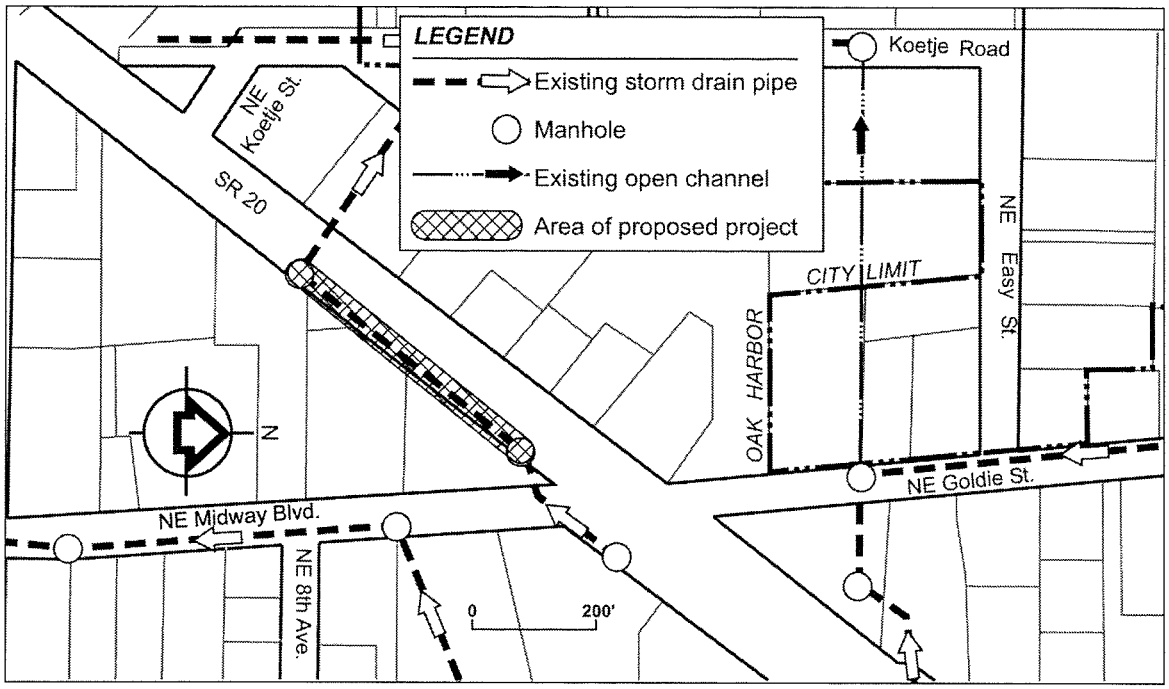
PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 8 **CHECKED BY:** AMM
DESCRIPTION: Outfall extension on existing 42-inch near Beeksma Drive
BY: GLG **DATE:** 12/5/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REINF. CONC. PIPE 48-INCH (Marine outfall)	1,200	LF	$ 350.00	$ 420,000
2	SEDIMENTATION CURTAIN	1	LS	$ 16,900.00	$ 16,900
3	MARINE EXCAVATION	4,533	CY	$ 20.00	$ 90,660
4	MARINE BACKFILL	2,267	CY	$ 23.00	$ 52,141
5	"FISH MIX" TRENCH COVER	1,289	CY	$ 32.00	$ 41,248
				Subtotal	$ 620,949
	DEWATERING	10%			$ 62,095
	EROSION & SEDIMENTATION CONTROL	10%			$ 62,095
	TRAFFIC CONTROL	3%			$ 18,628
	CONTINGENCY	30%			$ 186,285
				Subtotal	$ 950,052
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 95,005
				Construction Subtotal (Rounded)	$ 1,045,000
	STATE SALES TAX	8.3%			$ 86,735
	ENGINEERING/LEGAL/ADMIN	25%			$ 261,250
	PREDESIGN	5%			$ 52,250
	CONSTRUCTION MANAGEMENT	20%			$ 209,000
	PERMITTING	5%			$ 52,250
				Project Subtotal (Rounded)	$ 1,706,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 1,706,000**

Notes:
1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 9 PIPELINE REPLACEMENT ALONG SR 20 NEAR MIDWAY BOULEVARD



PROBLEM DESCRIPTION

Modeling indicates that an existing segment of 12-inch CMP is restrictive, creating a potential flooding problem starting at the 25-year storm.

PROJECT DESCRIPTION

This project consists of replacing this 550-foot segment with 12-inch smooth-bore pipe.

ESTIMATED PROJECT COST

$130,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 2 - Project 9**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Pipe replacement along SR-20 near Midway Blvd.**		
BY:	**GLG**	**DATE:**	**12/6/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	214	SY	$ 23.00	$ 4,922
2	REMOVE PIPE	550	LF	$ 17.25	$ 9,488
3	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	550	LF	$ 40.25	$ 22,138
4	ASPHALT CONCRETE PAVEMENT PATCHING	50	TN	$ 115.00	$ 5,750
				Subtotal	$ 42,297
	DEWATERING	5%			$ 2,115
	EROSION & SEDIMENTATION CONTROL	10%			$ 4,230
	TRAFFIC CONTROL	3%			$ 1,269
	CONTINGENCY	30%			$ 12,689
				Subtotal	$ 62,600
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 6,260
				Construction Subtotal (Rounded)	$ 69,000
	STATE SALES TAX	8.3%			$ 5,727
	ENGINEERING/LEGAL/ADMIN	50%			$ 34,500
	CONSTRUCTION MANAGEMENT	20%			$ 13,800
	PERMITTING	10%			$ 6,900
				Project Subtotal (Rounded)	$ 130,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 130,000**

Notes:

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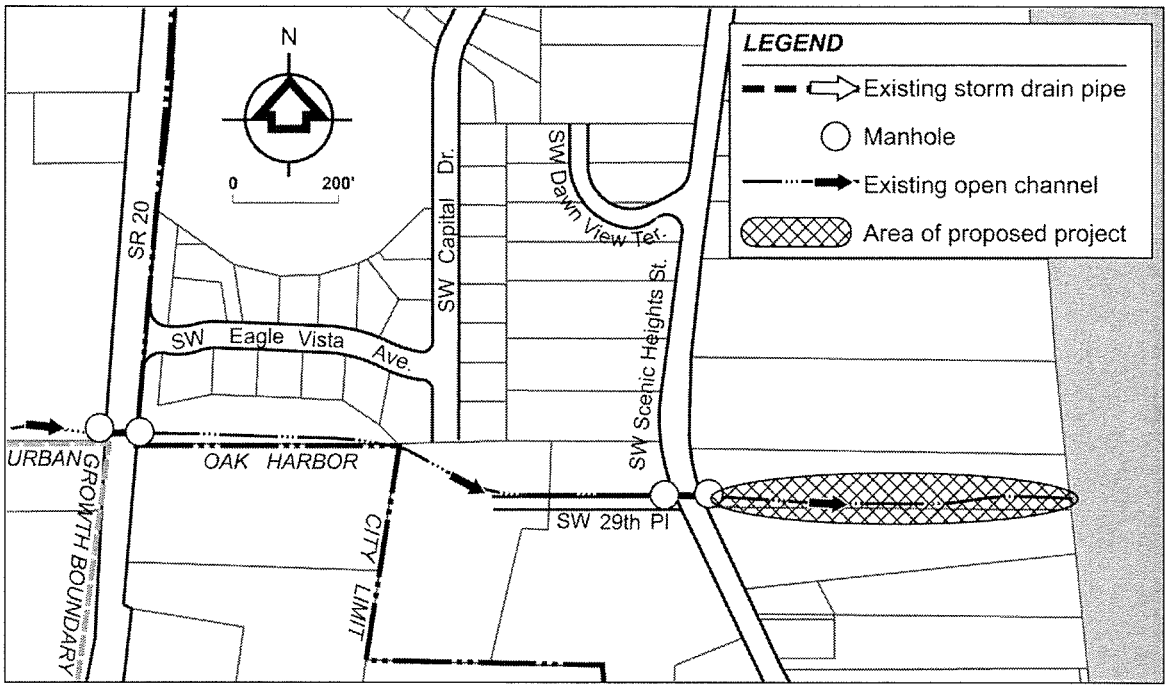
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 10
LISZAK OUTFALL REPAIR



PROBLEM DESCRIPTION

Erosion is occurring at an outfall near SW Scenic Heights Road and SW 29th Place. Since settlement of the area, the tributary area has been greatly modified, both in terms of tributary area and land coverage. The corresponding change in flow regime is believed to have created an erosion problem.

PROJECT DESCRIPTION

This project would repair the erosion. The project is documented in *Liszak Outfall Drainage Review* (Cane Engineering, November 2005).

ESTIMATED PROJECT COST

$155,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT:	**Alternative 2 - Project 10**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Liszak Project - erosion prevention**		
BY:	**GLG**	**DATE:**	**12/6/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Liszak Project per "Liszak Outfall Drainage Review", Cane Engineering, November 2005	1	LS	$ 77,976.00	$ 77,976
	(Elements accounted for in above referenced source are "zeroed-out" below.)			**Subtotal**	$ 77,976
	DEWATERING	0%			$ -
	EROSION & SEDIMENTATION CONTROL	0%			$ -
	TRAFFIC CONTROL	0%			$ -
	CONTINGENCY	0%			$ -
				Subtotal	$ 77,976
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 7,798
				Construction Subtotal (Rounded)	$ 86,000
	STATE SALES TAX	0.0%			$ -
	ENGINEERING/LEGAL/ADMIN	50%			$ 43,000
	CONSTRUCTION MANAGEMENT	20%			$ 17,200
	PERMITTING	10%			$ 8,600
				Project Subtotal (Rounded)	$ 155,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 155,000**

Notes:

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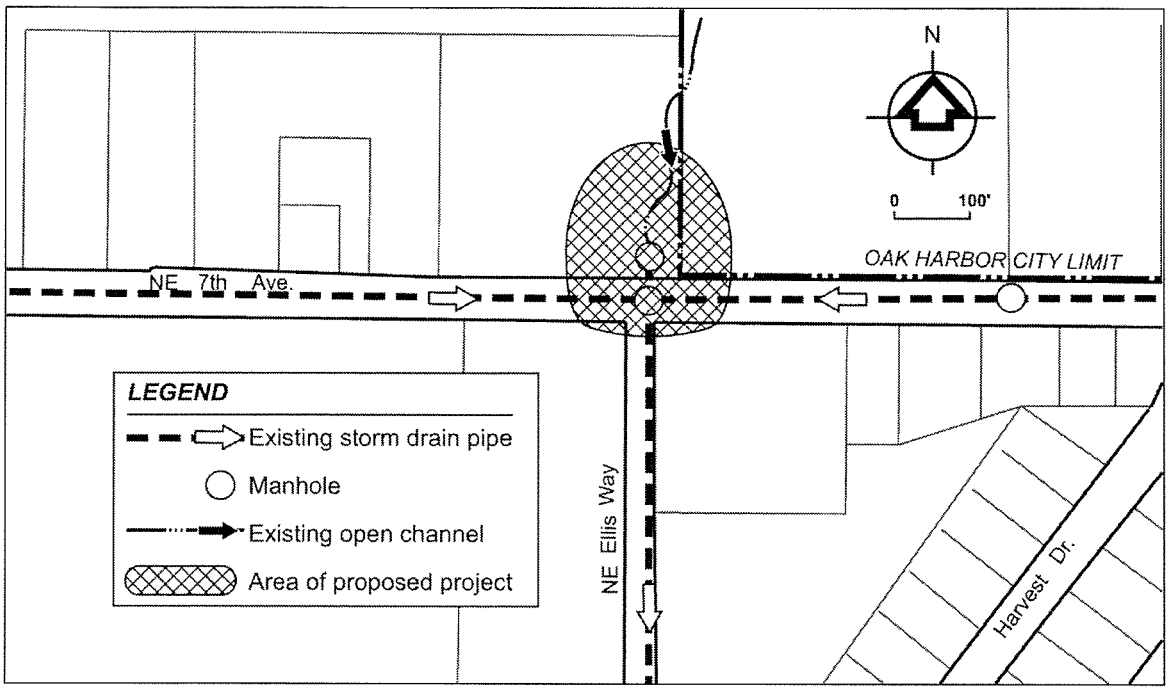
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 11 DRAINAGE COMPONENT OF PASSIVE PARK CREATION



PROBLEM DESCRIPTION

The existing pipe network in this area is difficult to access and maintain. In addition, the network is poorly documented. Flow passes through this area in an uncontrolled manner that contributes to downstream flooding.

PROJECT DESCRIPTION

This project consists of reconfiguring the drainage pipe on NE 7th Avenue near NE Ellis Way in order to provide better control of the drainage exiting the large, flat, low-lying area north of NE 7th Avenue. It includes modifications of the drainage systems along NE 7th Avenue to provide access to the outlets, replacement of a culvert under NE 7th Avenue, and installation of a flow control structure on the north side of NE 7th Avenue. These modifications provide an opportunity for the City to use the area north of NE 7th Avenue area as a passive park.

ESTIMATED PROJECT COST

$126,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 11 **CHECKED BY:** AMM
DESCRIPTION: Drainage component of passive park creation
BY: GLG **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	73	SY	$ 23.00	$ 1,679
2	30" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	40	LF	$ 97.75	$ 3,910
3	REINF. CONC. PIPE 48-INCH	60	LF	$ 195.50	$ 11,730
4	DETAILED VICINITY SURVEY	1	LS	$ 5,000.00	$ 5,000
5	FLOW CONTROL STRUCTURE, 72-INCH	1	LS	$ 11,730.00	$ 11,730
6	UTILITY RELOCATION	1	LS	$ 5,000.00	$ 5,000
7	ASPHALT CONCRETE PAVEMENT PATCHING	17	TN	$ 115.00	$ 1,955
				Subtotal	$ 41,004
	DEWATERING	5%			$ 2,050
	EROSION & SEDIMENTATION CONTROL	10%			$ 4,100
	TRAFFIC CONTROL	3%			$ 1,230
	CONTINGENCY	30%			$ 12,301
				Subtotal	$ 60,686
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 6,069
				Construction Subtotal (Rounded)	$ 67,000
	STATE SALES TAX	8.3%			$ 5,561
	ENGINEERING/LEGAL/ADMIN	50%			$ 33,500
	CONSTRUCTION MANAGEMENT	20%			$ 13,400
	PERMITTING	10%			$ 6,700
				Project Subtotal (Rounded)	$ 126,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 126,000**

Notes:

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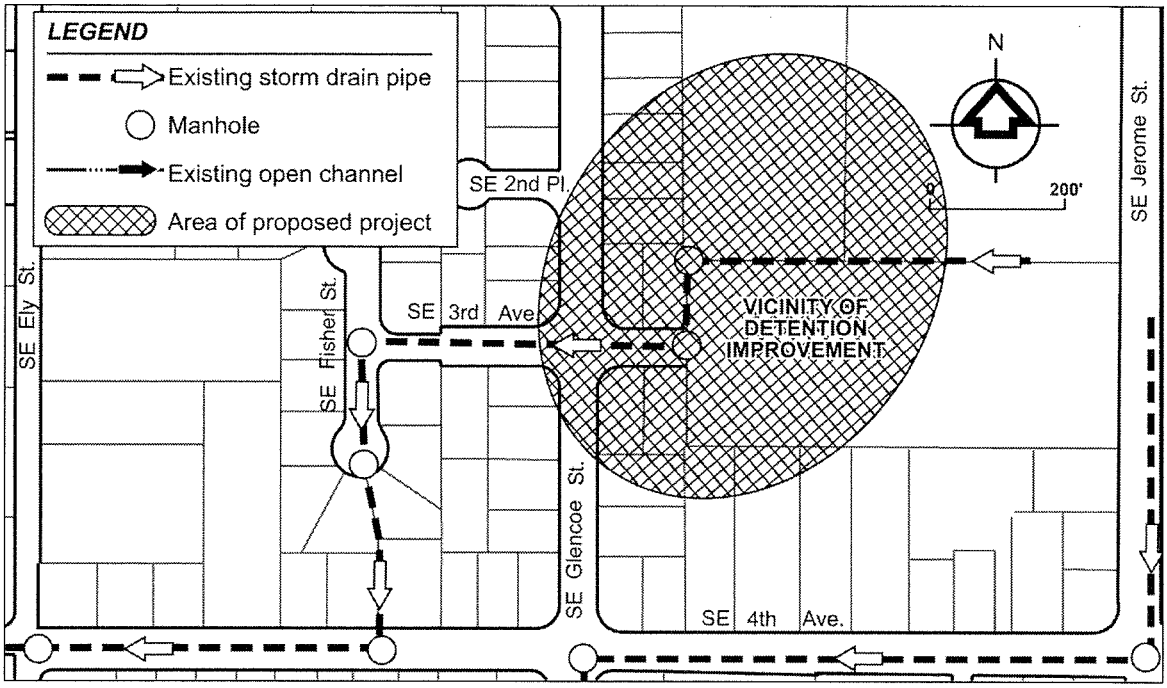
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 12 DETENTION NEAR SE GLENCOE STREET AND SE 3RD AVENUE



PROBLEM DESCRIPTION

The existing drainage system is inadequate to convey the predicted peak flows originating from the upstream tributary area, resulting in system back-up and roadside flooding starting at the 2-year storm.

PROJECT DESCRIPTION

A small detention facility would eliminate some minor downstream flooding in this area and thus avoid the need for a downstream pipe segment replacement. This 0.08-acre-foot facility would have about 3 feet of active storage, with a discharge controlled by a 7-inch diameter orifice.

ESTIMATED PROJECT COST

$112,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

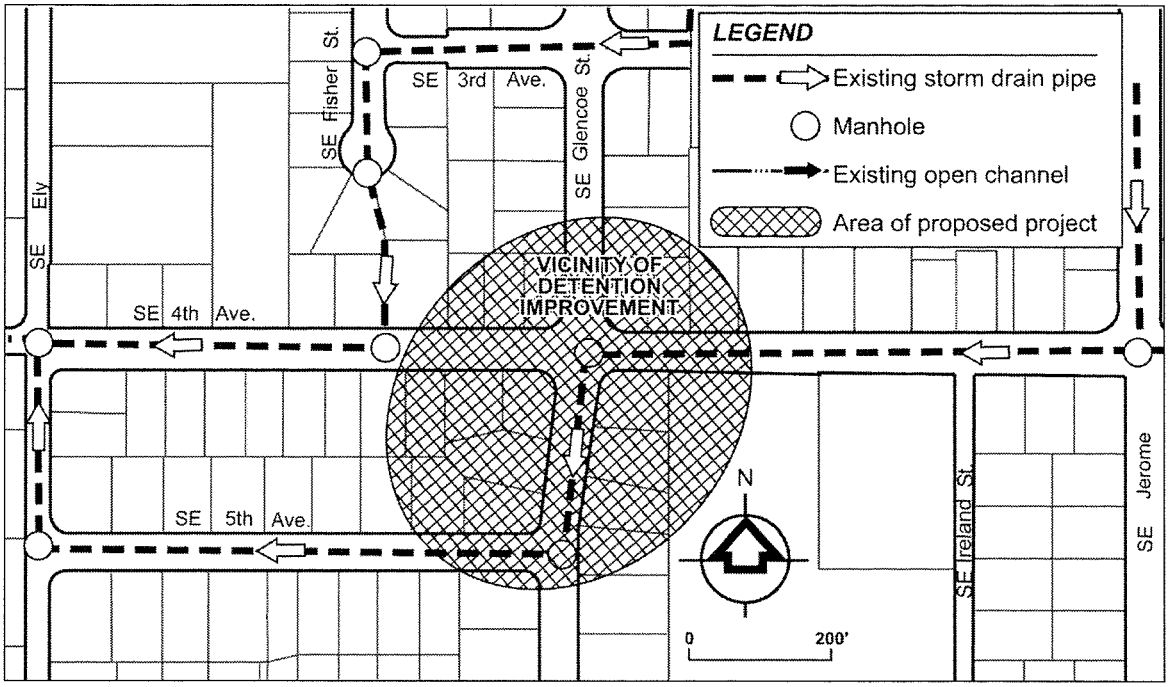
PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 12 **CHECKED BY:** AMM
DESCRIPTION: Detention near SE Glencoe St & SE 3rd Ave.
BY: GLG **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEAR AND GRUB	4,972	SF	$ 2.00	$ 9,944
2	COMMON EXCAVATION (QTY<1000)	190	CY	$ 31.05	$ 5,900
3	15" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	60	LF	$ 48.90	$ 2,934
4	FLOW CONTROL STRUCTURE, 48"	1	EA	$ 4,600.00	$ 4,600
5	ASPHALT CONCRETE PAVEMENT PATCHING	5	TN	$ 115.00	$ 575
6	EROSION CONTROL, HYDRO-SEEDING (QTY>=5000)	4,972	SF	$ 0.17	$ 845
7	CHAIN LINK FENCE, 6-FOOT	300	LF	$ 13.80	$ 4,140
8	CHAIN LINK GATE, 12-FT WIDE	1	EA	$ 690.00	$ 690
				Subtotal	$ 29,628
	DEWATERING	5%			$ 1,481
	EROSION & SEDIMENTATION CONTROL	10%			$ 2,963
	TRAFFIC CONTROL	3%			$ 889
	CONTINGENCY	30%			$ 8,888
				Subtotal	$ 43,849
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 4,385
				Construction Subtotal (Rounded)	$ 48,000
	STATE SALES TAX	8.3%			$ 3,984
	ENGINEERING/LEGAL/ADMIN	85%			$ 40,800
	CONSTRUCTION MANAGEMENT	20%			$ 9,600
	PERMITTING	20%			$ 9,600
				Project Subtotal (Rounded)	$ 112,000
	LAND ACQUISITION (none, City owned)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 112,000**

Notes:
1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 13 DETENTION NEAR SE GLENCOE STREET AND SE 4TH AVENUE



PROBLEM DESCRIPTION

The extensive network of very small existing ditches and pipe throughout the area does not provide sufficient capacity to convey the 25-year storm runoff. As a result, localized roadside flooding is predicted starting at the 2-year storm.

PROJECT DESCRIPTION

A moderate-sized detention facility near the intersection of SE Glencoe Street and SE 4th Avenue would offset required pipeline improvements in the area. This detention facility would reduce the amount of required pipeline replacement by about 2,700 feet, as well as reducing the required associated ancillary drainage components, such as catchbasins and inlets. About 3.5 feet of active depth would be required, providing about 1.1 acre-feet of active storage volume. A single 5-inch orifice would be used to regulate discharge from this site into the limited-capacity downstream system. A minor trace of flooding is still predicted downstream (less than 18 cubic feet for less than 2 minutes), which was deemed insignificant, so the facility was not enlarged to eliminate this occurrence.

ESTIMATED PROJECT COST

$198 ,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

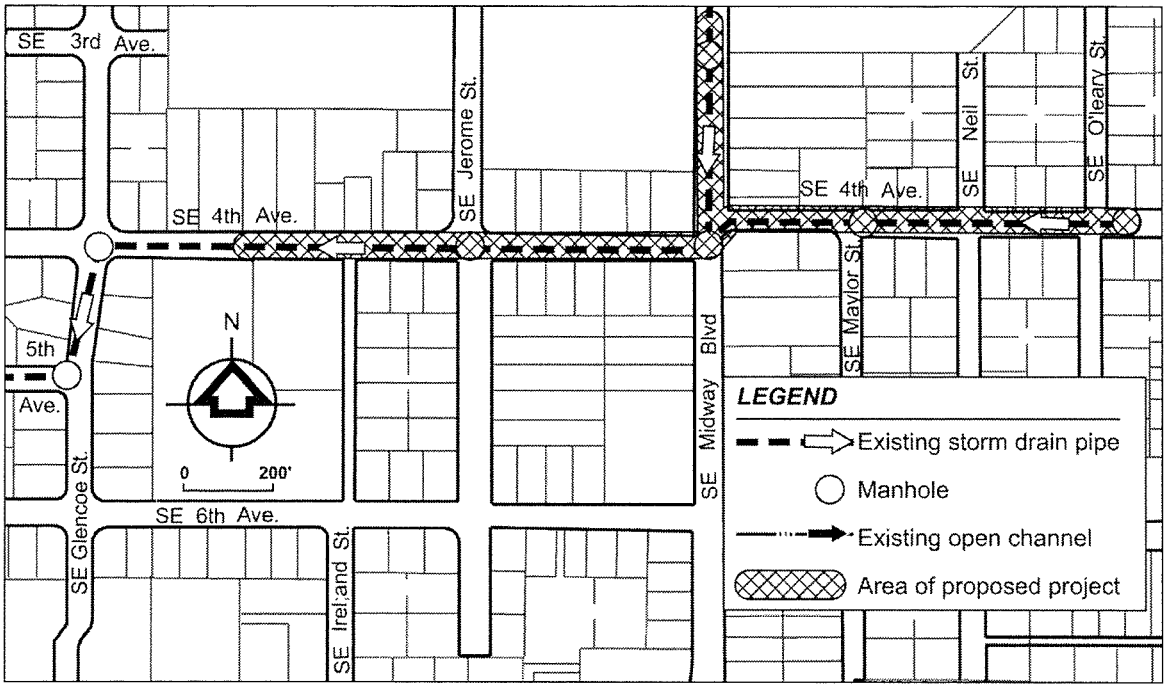
PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 13 **CHECKED BY:** AMM
DESCRIPTION: Detention near SE Glencoe St & SE 4th Ave.
BY: GLG **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEAR AND GRUB	0.57	AC	$ 5,750.00	$ 3,260
2	COMMON EXCAVATION (QTY>=1000)	2,462	CY	$ 17.25	$ 42,470
3	15" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	100	LF	$ 48.90	$ 4,890
4	FLOW CONTROL STRUCTURE, 48"	1	EA	$ 4,600.00	$ 4,600
5	ASPHALT CONCRETE PAVEMENT PATCHING	9	TN	$ 115.00	$ 1,035
6	EROSION CONTROL, HYDRO-SEEDING (QTY>=5000)	24,704	SF	$ 0.17	$ 4,200
7	CHAIN LINK FENCE, 6-FOOT	641	LF	$ 13.80	$ 8,846
8	CHAIN LINK GATE, 12-FT WIDE	1	EA	$ 690.00	$ 690
				Subtotal	$ 69,990
	DEWATERING	5%			$ 3,500
	EROSION & SEDIMENTATION CONTROL	10%			$ 6,999
	TRAFFIC CONTROL	3%			$ 2,100
	CONTINGENCY	30%			$ 20,997
				Subtotal	$ 103,586
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 10,359
				Construction Subtotal (Rounded)	$ 114,000
	STATE SALES TAX	8.3%			$ 9,462
	ENGINEERING/LEGAL/ADMIN	35%			$ 39,900
	CONSTRUCTION MANAGEMENT	20%			$ 22,800
	PERMITTING	10%			$ 11,400
				Project Subtotal (Rounded)	$ 198,000
	LAND ACQUISITION (none, City owned)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 198,000**

Notes:
1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 14
SE 4TH AVENUE DRAINAGE IMPROVEMENTS



PROBLEM DESCRIPTION

The extensive network of very small existing ditches and pipe throughout the area does not provide sufficient capacity to convey the 25-year storm runoff. As a result, localized roadside flooding is predicted starting at the 2-year storm.

PROJECT DESCRIPTION

The detention identified in this area (Alternative 2, Projects 12 and 13) would greatly reduce the need for pipeline replacements in the area. However, there would still be some reaches that require replacement. This project consists of those replacements. A stretch of existing shallow ditch and 8-inch pipe between about SE O'Leary Street and SE Glencoe Street are identified for replacement with 12- and 15-inch pipe.

ESTIMATED PROJECT COST

$589,000

ASSOCIATED PROJECTS

Alternative 2 – Project 13 located immediately downstream of this project is required to address all of the existing problem areas predicted throughout this area.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

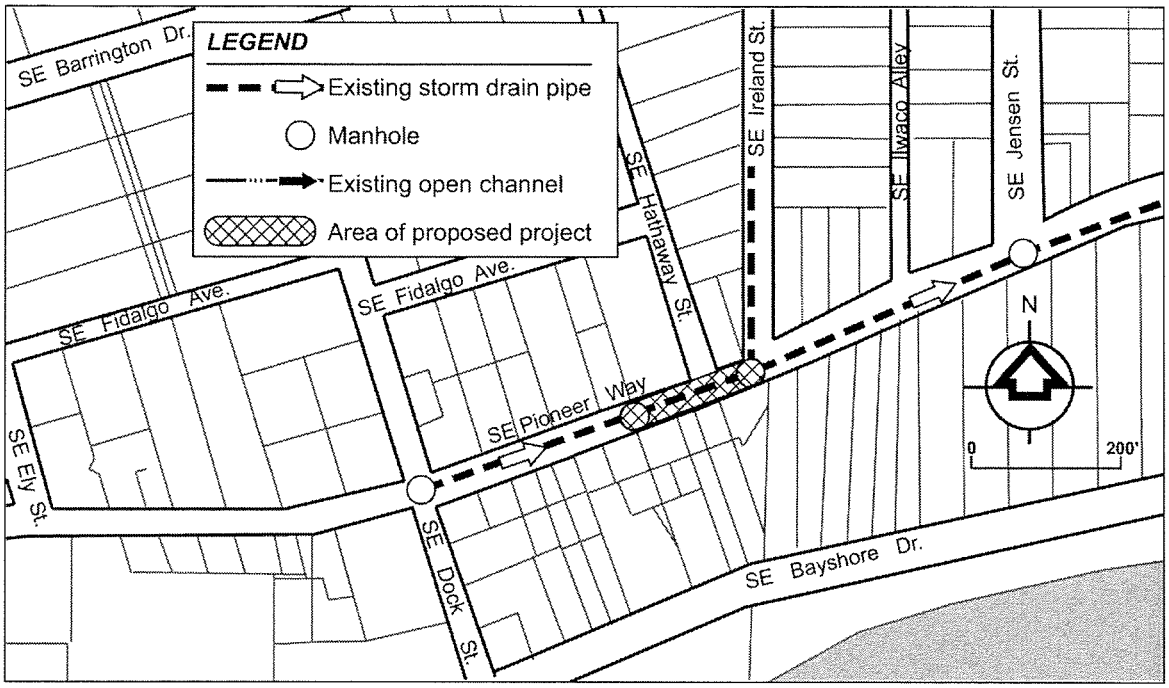
PROJECT:	**Alternative 2 - Project 14**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**SE 4th Ave drainage improvement between about SE Glencoe and SE Oleary St**		
BY:	**GLG**	**DATE:**	**12/6/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	897	SY	$ 23.00	$ 20,631
2	REMOVE PIPE	2,491	LF	$ 17.25	$ 42,970
3	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	907	LF	$ 40.25	$ 36,507
4	15" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	1,584	LF	$ 48.90	$ 77,458
5	CATCH BASIN TYPE 2 48"	7	EA	$ 3,381.00	$ 23,667
6	CATCH BASIN TYPE 1	2	EA	$ 1,530.00	$ 3,060
7	ASPHALT CONCRETE PAVEMENT PATCHING	209	TN	$ 115.00	$ 24,035
				Subtotal	$ 228,327
	DEWATERING	5%			$ 11,416
	EROSION & SEDIMENTATION CONTROL	10%			$ 22,833
	TRAFFIC CONTROL	3%			$ 6,850
	CONTINGENCY	30%			$ 68,498
				Subtotal	$ 337,924
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 33,792
				Construction Subtotal (Rounded)	$ 372,000
	STATE SALES TAX	8.3%			$ 30,876
	ENGINEERING/LEGAL/ADMIN	25%			$ 93,000
	CONSTRUCTION MANAGEMENT	20%			$ 74,400
	PERMITTING	5%			$ 18,600
				Project Subtotal (Rounded)	$ 589,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 589,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 15 PIPELINE REPLACEMENT ALONG PIONEER AVENUE NEAR HATHAWAY STREET



PROBLEM DESCRIPTION

A short segment of existing 15-inch pipe was found to create local flooding starting at the 25-year storm.

PROJECT DESCRIPTION

This project consists of replacing the undersized segment with 189 feet of 21-inch pipe to match the adjacent existing pipe system.

ESTIMATED PROJECT COST

$82,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

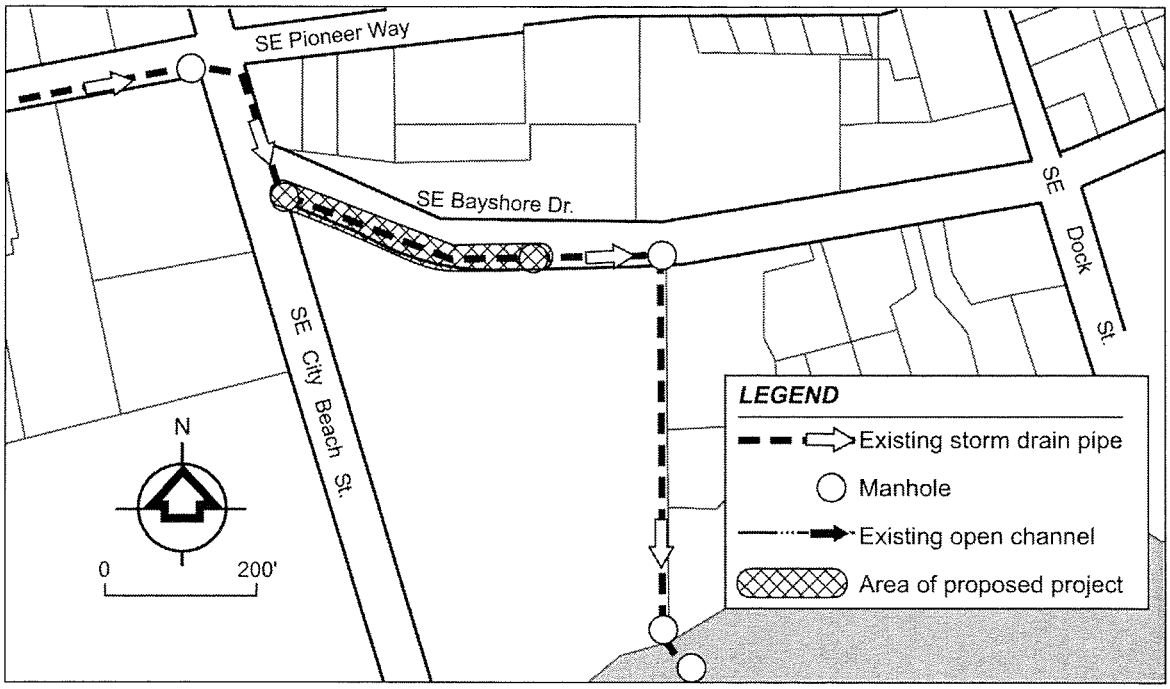
PROJECT:	**Alternative 2 - Project 15**	**CHECKED BY:**	**AMM**
DESCRIPTION:	**Pipe replacement along Pioneer Ave near SE Hathaway St**		
BY:	**GLG**	**DATE:**	**12/6/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	87	SY	$ 23.00	$ 2,001
2	REMOVE PIPE	189	LF	$ 17.25	$ 3,260
3	21" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	189	LF	$ 74.75	$ 14,128
4	ASPHALT CONCRETE PAVEMENT PATCHING	20	TN	$ 115.00	$ 2,300
				Subtotal	$ 21,689
	DEWATERING	5%			$ 1,084
	EROSION & SEDIMENTATION CONTROL	10%			$ 2,169
	TRAFFIC CONTROL	3%			$ 651
	CONTINGENCY	30%			$ 6,507
				Subtotal	$ 32,100
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 3,210
				Construction Subtotal (Rounded)	$ 35,000
	STATE SALES TAX	8.3%			$ 2,905
	ENGINEERING/LEGAL/ADMIN	85%			$ 29,750
	CONSTRUCTION MANAGEMENT	20%			$ 7,000
	PERMITTING	20%			$ 7,000
				Project Subtotal (Rounded)	$ 82,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 82,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 16 PIPELINE REPLACEMENT ALONG SE BAYSHORE DRIVE EAST OF SE CITY BEACH STREET



PROBLEM DESCRIPTION

A local pipe restriction was found to create flooding starting at the 10-year storm.

PROJECT DESCRIPTION

This project would replace a 409-foot segment of 24-inch pipe with 36-inch pipe. This would eliminate all but 4 minutes of local flooding during the design conditions. Eliminating the additional 4 minutes of flooding in this area was not deemed to be warranted since it would require costly additional upstream pipe replacement.

ESTIMATED PROJECT COST

$198,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

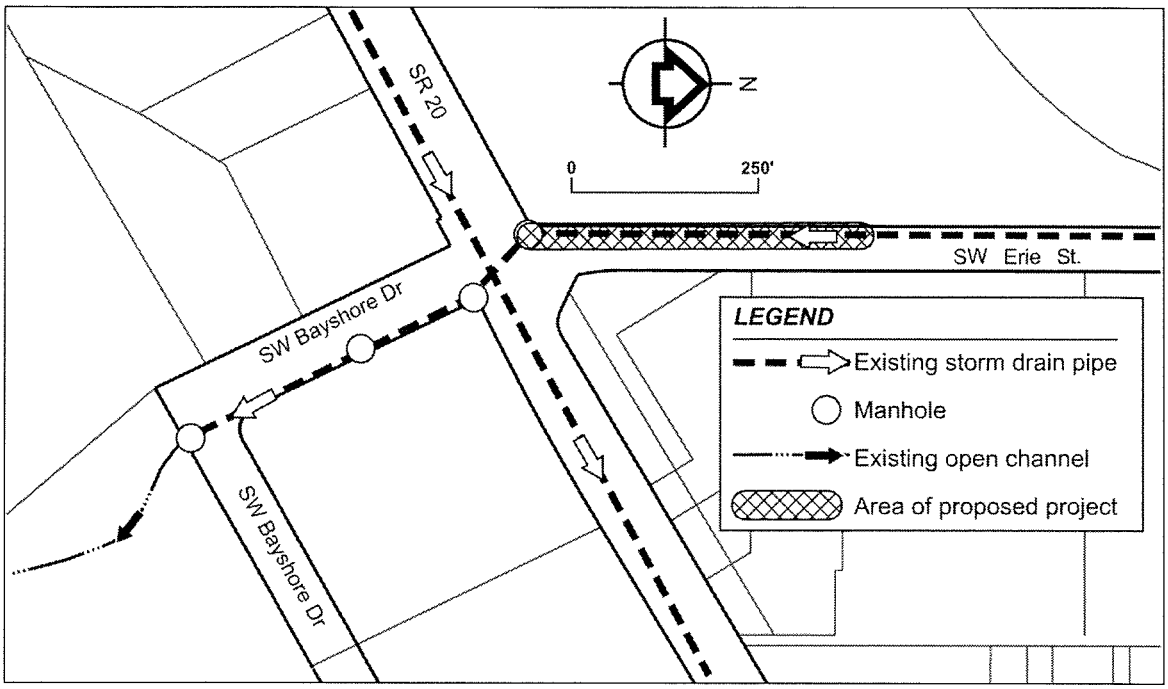
PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 16 **CHECKED BY:** AMM
DESCRIPTION: Pipe replacement along SE Bayshore Dr east of SE City Beach St
BY: GLG **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	273	SY	$ 23.00	$ 6,279
2	REMOVE PIPE	409	LF	$ 17.25	$ 7,055
3	36" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	409	LF	$ 115.00	$ 47,035
4	ASPHALT CONCRETE PAVEMENT PATCHING	64	TN	$ 115.00	$ 7,360
				Subtotal	$ 67,729
	DEWATERING	10%			$ 6,773
	EROSION & SEDIMENTATION CONTROL	10%			$ 6,773
	TRAFFIC CONTROL	3%			$ 2,032
	CONTINGENCY	30%			$ 20,319
				Subtotal	$ 103,626
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 10,363
				Construction Subtotal (Rounded)	$ 114,000
	STATE SALES TAX	8.3%			$ 9,462
	ENGINEERING/LEGAL/ADMIN	35%			$ 39,900
	CONSTRUCTION MANAGEMENT	20%			$ 22,800
	PERMITTING	10%			$ 11,400
				Project Subtotal (Rounded)	$ 198,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 198,000**

Notes:
1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 17 PIPELINE REPLACEMENT ALONG SW ERIE STREET NEAR SR 20



PROBLEM DESCRIPTION

Existing runoff conditions result in predicted flooding starting at the 10-year storm because of a restrictive pipe segment.

PROJECT DESCRIPTION

The existing 12-inch pipe along SE Erie Street near SR 20 would be replaced with 412 feet of 18-inch pipe to correct the localized flooding problem.

ESTIMATED PROJECT COST

$121,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

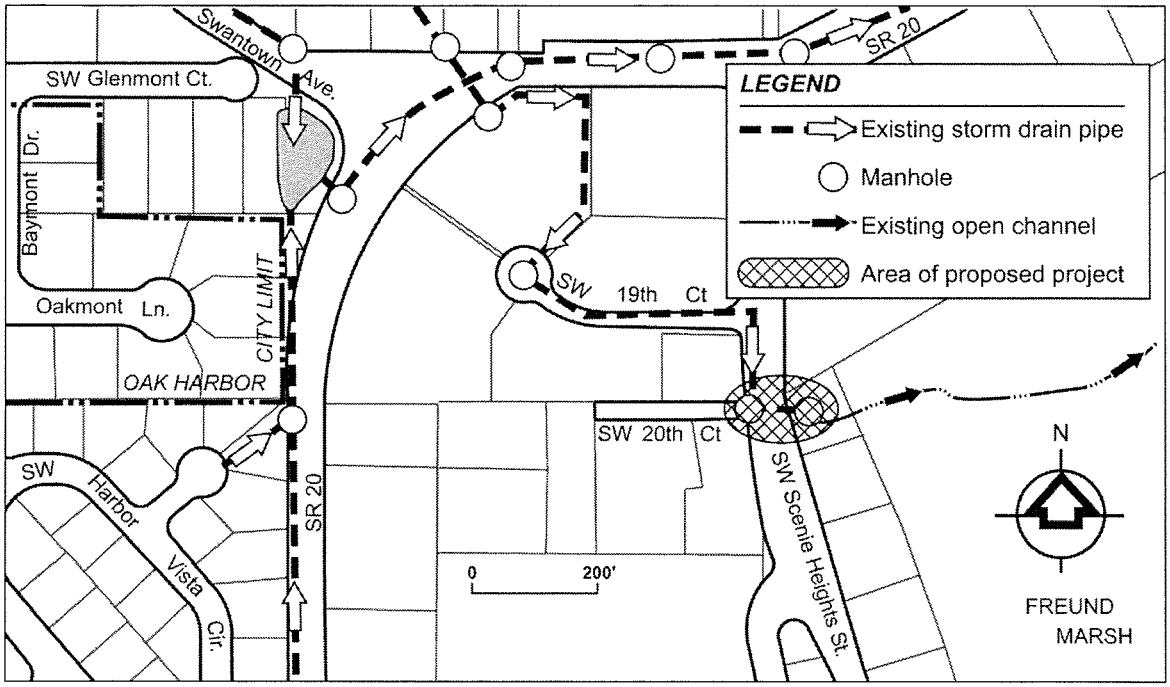
PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: **Alternative 2 - Project 17** CHECKED BY: **AMM**
DESCRIPTION: **Pipe replacement along SE Erie St near SR-20**
BY: **GLG** DATE: **12/6/2005**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	172	SY	$ 23.00	$ 3,956
2	REMOVE PIPE	412	LF	$ 17.25	$ 7,107
3	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	412	LF	$ 57.50	$ 23,690
4	ASPHALT CONCRETE PAVEMENT PATCHING	40	TN	$ 115.00	$ 4,600
				Subtotal	$ 39,353
	DEWATERING	5%			$ 1,968
	EROSION & SEDIMENTATION CONTROL	10%			$ 3,935
	TRAFFIC CONTROL	3%			$ 1,181
	CONTINGENCY	30%			$ 11,806
				Subtotal	$ 58,242
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 5,824
				Construction Subtotal (Rounded)	$ 64,000
	STATE SALES TAX	8.3%			$ 5,312
	ENGINEERING/LEGAL/ADMIN	50%			$ 32,000
	CONSTRUCTION MANAGEMENT	20%			$ 12,800
	PERMITTING	10%			$ 6,400
				Project Subtotal (Rounded)	$ 121,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 121,000**

Notes:
1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 18
CULVERT REPLACEMENT
ACROSS SW SCENIC HEIGHTS STREET



PROBLEM DESCRIPTION

An existing 12-inch CMP culvert requires replacement with at least a 15-inch culvert to correct the flooding problem at this location. Flooding is predicted to occur starting at the 25-year storm.

PROJECT DESCRIPTION

Negotiations are underway with Washington State Department of Transportation, which is proposing drainage modifications in the area. These drainage negotiations may include an increase in the culvert size.

ESTIMATED PROJECT COST

$30,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

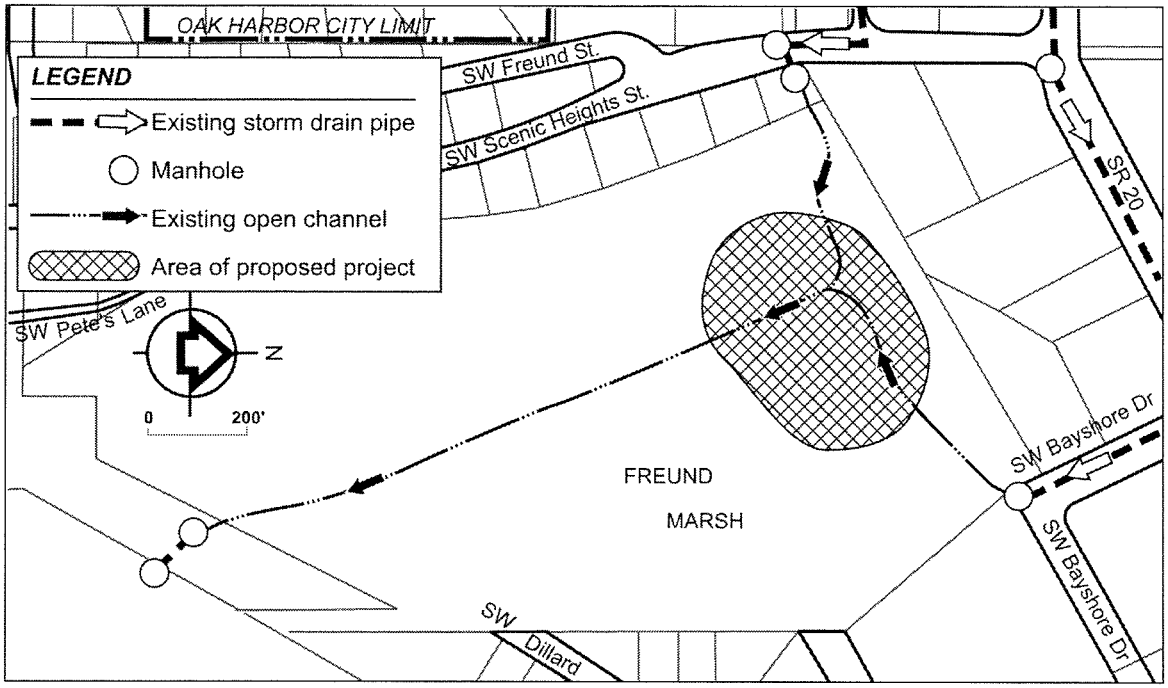
PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 18 **CHECKED BY:** AMM
DESCRIPTION: Culvert replacement crossing SW Scenic Heights St
BY: GLG **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	REMOVE PAVEMENT	37	SY	$ 23.00	$ 851
2	REMOVE PIPE	88	LF	$ 17.25	$ 1,518
3	15" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	88	LF	$ 48.90	$ 4,303
4	ASPHALT CONCRETE PAVEMENT PATCHING	9	TN	$ 115.00	$ 1,035
				Subtotal	$ 7,707
	DEWATERING	5%			$ 385
	EROSION & SEDIMENTATION CONTROL	10%			$ 771
	TRAFFIC CONTROL	3%			$ 231
	CONTINGENCY	30%			$ 2,312
				Subtotal	$ 11,407
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 1,141
				Construction Subtotal (Rounded)	$ 13,000
	STATE SALES TAX	8.3%			$ 1,079
	ENGINEERING/LEGAL/ADMIN	85%			$ 11,050
	CONSTRUCTION MANAGEMENT	20%			$ 2,600
	PERMITTING	20%			$ 2,600
				Project Subtotal (Rounded)	$ 30,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 30,000**

Notes:
1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 19 DRAINAGE COMPONENT OF THE FREUND MARSH PASSIVE PARK CREATION



PROBLEM DESCRIPTION

Since settlement of the area, historic drainage patterns have changed. Construction of roadways including SR-20 has diverted flow that used to flow through this area, based upon topography of the adjacent hillsides. A related project attempts to correct some of this earlier flow modifications. This proposed project provides modification of the area to accommodate the proposed diverted flow in the associated project in such a way that these modifications may be consistent with and incorporated into a passive park in the area.

PROJECT DESCRIPTION

Creation of a passive park at Freund Marsh would include construction elements associated with drainage that passes through the park, including runoff redirected through the marsh resulting from Alternative 2 Project 6. To compensate for this flow redirection, it is assumed that a volume of earth equal to the volume of diverted runoff would be removed from the park area to compensate for any potential rise in water surface elevation in the park area. The actual amount of earth removal may be more or less, depending on the layout of features in the passive park, the type of park features, the location of wetlands, tidal conditions, and final topographic configuration of park elements.

ESTIMATED PROJECT COST

$324,000

ASSOCIATED PROJECTS

Alternative 2 – Project 6 is associated with this project.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

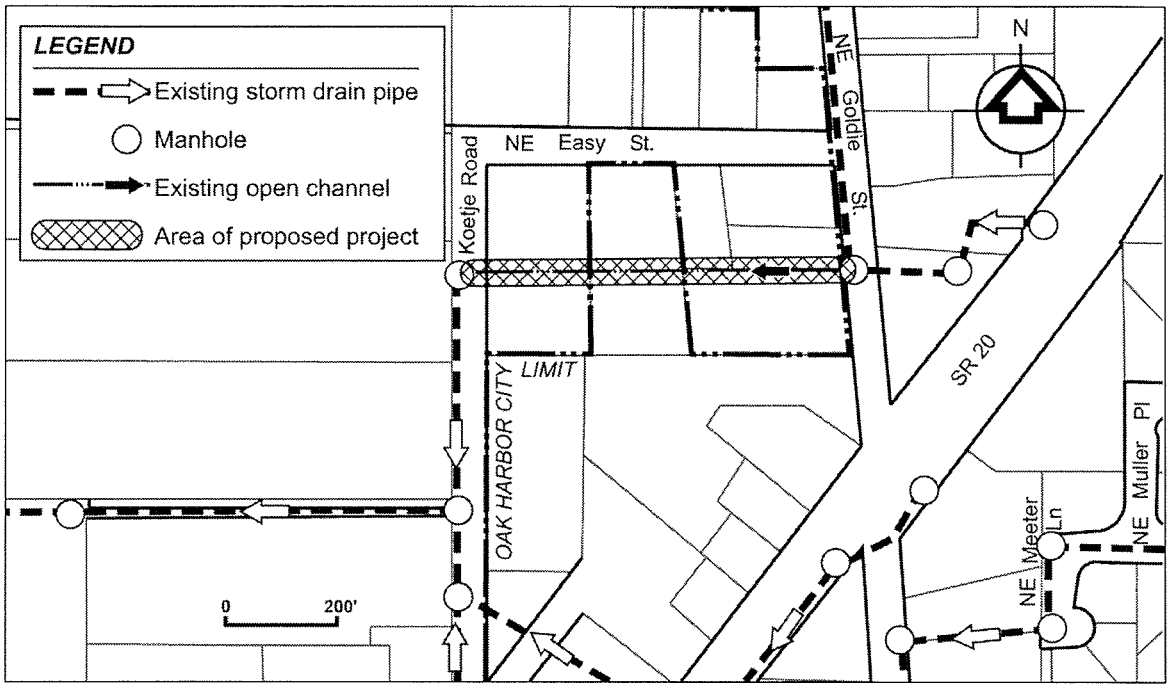
PROJECT: Alternative 2 - Project 19 **CHECKED BY:** AMM
DESCRIPTION: Freund Marsh passive park creation - drainage component
BY: GLG **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	COMMON EXCAVATION (QTY>=1000)	6,453	CY	$ 17.25	$ 111,314
				Subtotal	$ 111,314
	DEWATERING	10%			$ 11,131
	EROSION & SEDIMENTATION CONTROL	10%			$ 11,131
	TRAFFIC CONTROL	3%			$ 3,339
	CONTINGENCY	30%			$ 33,394
				Subtotal	$ 170,311
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 17,031
				Construction Subtotal (Rounded)	$ 187,000
	STATE SALES TAX	8.3%			$ 15,521
	ENGINEERING/LEGAL/ADMIN	35%			$ 65,450
	CONSTRUCTION MANAGEMENT	20%			$ 37,400
	PERMITTING	10%			$ 18,700
				Project Subtotal (Rounded)	$ 324,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	CONTINGENCY	30%			$ -
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 324,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.

PROJECT SUMMARY: ALTERNATIVE 2 PROJECT 20 IMPROVE CONVEYANCE BETWEEN GOLDIE STREET AND KOETJE STREET NEAR EASY STREET



PROBLEM DESCRIPTION

The existing drainage path in the area passes through private property. As development has occurred upstream, flow characteristics have changed. As a result, the existing system is now inadequate to convey the predicted peak flows.

PROJECT DESCRIPTION

This project would correct a chronic flooding problem by improving conveyance of the existing drainage system between NE Goldie Street and NE Koetje Street near NE Easy Street. The existing drainage flows across private property, frequently creating flooding in the area. Runoff from over 60 acres of upstream drainage area flows through this area. Implementation of this project would require a drainage and construction easement from the property owner. Major project elements are 702 feet of 21-inch pipe, catchbasins, and an energy dissipation structure due to the steepness of the site.

ESTIMATED PROJECT COST

$236,000

ASSOCIATED PROJECTS

None.

COMPLETE COST ESTIMATE

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT: Alternative 2 - Project 20 — **CHECKED BY:** AMM

DESCRIPTION: Improve conveyance between Goldie St. and Koetje St. near Easy St.

BY: GLG — **DATE:** 12/6/2005

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	DETAILED SITE SURVEY	1	LS	$ 7,500.00	$ 7,500
2	21" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	702	LF	$ 74.75	$ 52,475
3	CATCHBASIN TYPE 2 48"	2	EA	$ 3,380.00	$ 6,760
4	ENERGY DISSIPATOR	1	LS	$ 7,500.00	$ 7,500
5	PAVEMENT, ASPHALT CONCRETE CL B (QTY<500)	75	TN	$ 92.00	$ 6,900
				Subtotal	$ 81,135
	DEWATERING	5%			$ 4,057
	EROSION & SEDIMENTATION CONTROL	10%			$ 8,113
	TRAFFIC CONTROL	3%			$ 2,434
	CONTINGENCY	30%			$ 24,340
				Subtotal	$ 120,079
	MOBILIZATION (GENERAL REQUIREMENT)	10%			$ 12,008
				Construction Subtotal (Rounded)	$ 132,000
	STATE SALES TAX	8.3%			$ 10,956
	ENGINEERING/LEGAL/ADMIN	35%			$ 46,200
	CONSTRUCTION MANAGEMENT	20%			$ 26,400
	PERMITTING	10%			$ 13,200
				Project Subtotal (Rounded)	$ 229,000
	LAND ACQUISITION (none)	0.00	AC	$ 150,000.00	$ -
	EASEMENT	1	LS	$ 5,000.00	$ 5,000
	CONTINGENCY	30%			$ 1,500
2005 Dollars				**Total Estimated Project Cost (Rounded)**	**$ 236,000**

Notes:

1. The above cost opinion is in 2005 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared for guidance in project evaluation from the information available at the time of preparation and for the assumptions stated. The final costs of the project will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope and schedule, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.