



SFA Design Group, LLC

STRUCTURAL | CIVIL | LAND USE PLANNING | SURVEYING

THE COTTAGES AT NESKOWIN STORM WATER ANALYSIS MEMO

To Whom It May Concern:

I am writing in reference to the Cottages at Neskowin Cluster Development located in Neskowin, Oregon. The proposed development is located on Tax Lot #812 Tillamook County Tax Map 5S 11W Sec 25. The proposed development is a 25-lot cluster subdivision on 8.81 acres. The total area of the parent parcel is 35.14 acres. The proposed project will be to develop 25 single-family detached homes with the infrastructure to support the development.

Hawk Creek currently flows through the site from east to west and ultimately flows under Highway 101. Once through the culvert Hawk Creek flows through or adjacent to the Neskowin Marsh Golf Course where Butte Creek and northern drainage areas combine with Hawk Creek. Once through or adjacent to the Neskowin Marsh Golf Course the Creek continues through Neskowin and flows around Proposal Rock Inn where Neskowin Creek joins the Creek and continues to the Pacific Ocean. The area of the basin prior crossing the Highway is 1,760 acres and once across the Highway and the confluence of Butte Creek the basin area at that point is 3,060 acres. When Neskowin Creek joins Hawk and Butte Creek the basin area is 13,425 acres. As referenced in the attached exhibits.

With the large basins and relatively flat topography near the multiple confluences of additional Creeks, along with the influence of the Pacific Ocean, there is a Flood Plain that extends to the western portion of the site. Currently the FIRM map for the area shows that the Base Flood enters the property at the western edge located primarily prior to Hawk Creek entering the culvert under Highway 101. The proposed development is not proposing any improvements that would impact the mapped Flood Plain Volume.

There has been some discussion of how this development will impact the flooding condition of the area and how we have safe guarded the project by raising the private drive and the lots along the wetlands and creek. The area that we are proposing to fill within the existing wetlands is where historically there has been nuisance flooding. In our site visits in 2008 following a large rain event we mapped by observation the flood debris location on the site. What we found was that the debris followed the wetland boundary very closely, which makes sense due to the fact that in order to have a wetland a key component is hydrology. The depth of the nuisance flooding on average was 6" or less, which you would expect in an area of such flat topography. The conclusion that we

have reached was that the main conveyance of storm water was located within the creek banks but during larger events where the soils have become saturated surface water would collect along the undulations next to the creek.

With the improvements we are proposing and the resulting increase in storm water we have taken a very conservative look at our effect to the overall water surface elevation down stream of our release from the water quality swale. What we found was that the existing peak flow at the 100 year event in the Hawk Creek Basin prior to the Highway 101 crossing is 366.1 cfs. Not taking any lag time (the time between the peak flow from the entire basin to the peak flow of the site) in the basin into account and combining the peak storm water collected on site and the peak storm water from the upstream basin our peak flow would be 367.7 cfs. Accordingly, the development increases the peak flow by 1.6 cfs, or 0.4%, if not considering the effects of lag time. The effect of lag time is important to understand when looking at how the hydrology in the area functions. As stated above all of the combining peak flows were not taking into account lag time. The peak flow from the 1,760 acre basin will reach the culvert going under Highway 101 almost 2 hours after the peak runoff from our 35 acre site. Therefore; the lag time between the large basin and our site is almost 2 hours. We chose to be conservative and not to take the lag time into account knowing that if we did take it into account, our site would have even less impact on the peak flow of this basin.

With the flows known we analyzed the anticipated 100 year peak flow water surface within Hawk Creek today to be 15.85 feet at our studied cross section. By developing the proposed subdivision we will be increasing the water surface in Hawk Creek by 0.01 feet to an elevation of 15.86 feet. In terms of storm water analysis this is a very difficult measurement to make since our impact is so insignificant.

The reason our site does not affect the basin or water surface in a noticeable way is a result of the large basin that the site is located within. If we were in a much smaller basin then our relative impact would be much greater. By taking a conservative approach to the analysis and not applying any lag time within the basin we are able to show that we are not impacting the water surface in a noticeable way.

This project will also provide water quality for the storm water prior to discharging into the wetlands which drain into Hawk Creek by means of a Water Quality Swale. The purpose of the Water Quality Swales is to remove the phosphorus and heavy metals associated with impervious surfaces.

Due to the proximity of the development to the creek, the available capacity within the existing conveyance system and ultimately the Pacific Ocean, we will not be providing Detention on the site. The storm water collected on the development will be delivered to the Creek through the existing wetlands rather than be detained. This allows the storm water a chance to flush prior to the large upstream basin's peak storm water entering the drainage system. The reason not to detain is that if we held our storm water on site and slowly released it, by the time the upstream flows reached our site we would increase the duration of the rain event in the Creek and drainage system.

This project will follow all local and state regulations to treat and convey the storm water collected on site in a safe and acceptable manner. If you should have any questions please don't hesitate to contact me directly.

Sincerely,

Brent E. Fitch, PE
Civil Project Manager - Principal



SANTA BARBARA URBAN HYDROGRAPHS

JOB: 173-002
PROJECT: The Cottages at Neskowin
FILE: 1732_prelim HYDRO_Phase 1.xls

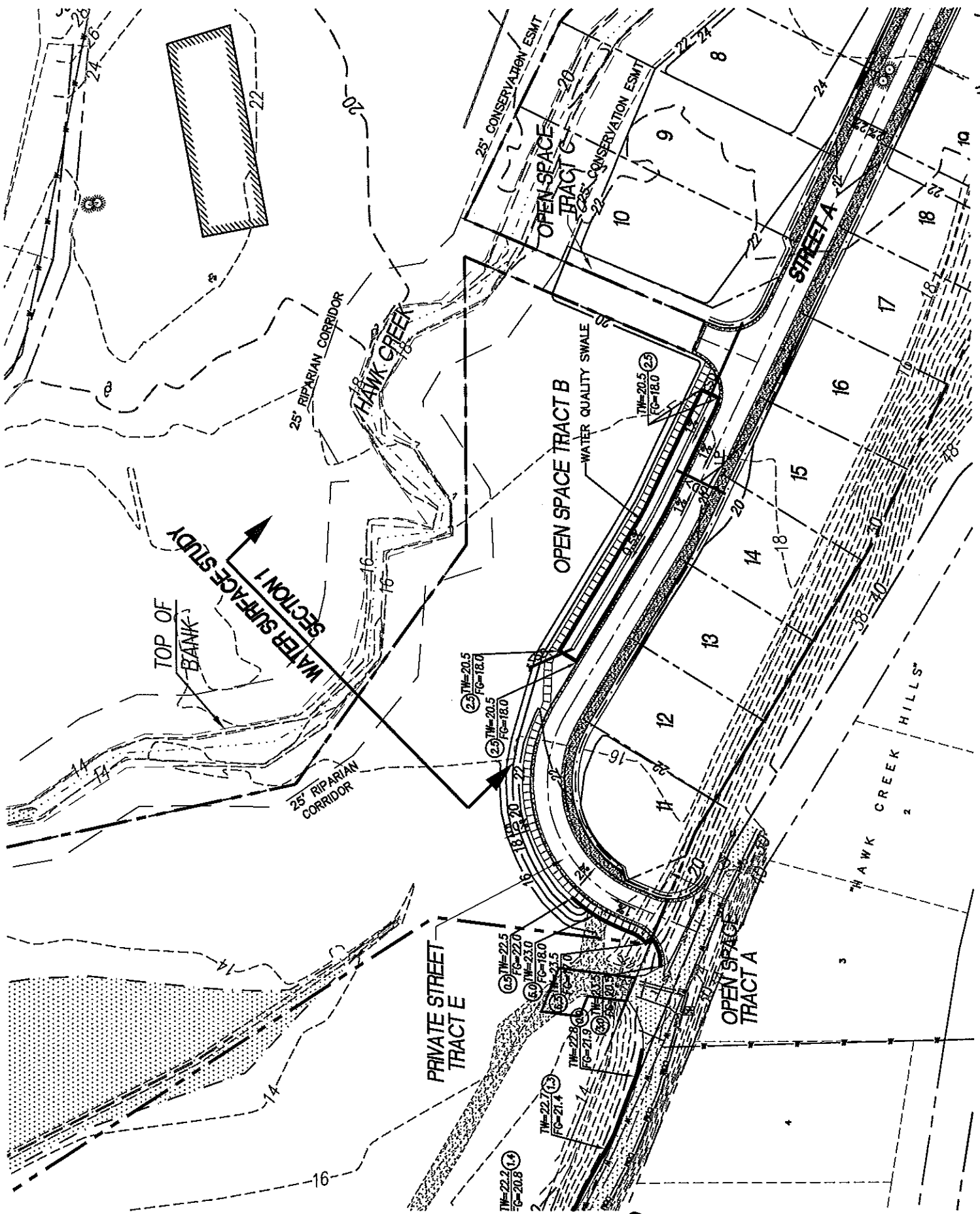
| DESCRIPTION | DESIGN STORM (YR) | DURATION (HR) | PRECIP (IN) | AREA TOTAL (AC) | % IMP | AREA | | CN PER. | CN IMP. | TIME (MIN) | Q (CFS) |
|--------------------------------------|-------------------|---------------|-------------|-----------------|-------|------------|-----------|---------|---------|------------|---------|
| | | | | | | PERV. (AC) | IMP. (AC) | | | | |
| PREDEVELOPED 2-YEAR PEAK DISCHARGE | 2 | 24 | 4.55 | 5.11 | 0.0 | 5.11 | 0.00 | 78 | 98 | 36.9 | 1.80 |
| DEVELOPED 2-YEAR PEAK DISCHARGE | 2 | 24 | 4.55 | 5.11 | 46.7 | 2.72 | 2.39 | 80 | 98 | 30.3 | 3.08 |
| PREDEVELOPED 10-YEAR PEAK DISCHARGE | 10 | 24 | 6 | 5.11 | 0.0 | 5.11 | 0.00 | 78 | 98 | 36.9 | 2.96 |
| DEVELOPED 10-YEAR PEAK DISCHARGE | 10 | 24 | 6 | 5.11 | 46.7 | 2.72 | 2.39 | 80 | 98 | 30.3 | 4.39 |
| PREDEVELOPED 25-YEAR PEAK DISCHARGE | 25 | 24 | 7 | 5.11 | 0.0 | 5.11 | 0.00 | 78 | 98 | 36.9 | 3.80 |
| DEVELOPED 25-YEAR PEAK DISCHARGE | 25 | 24 | 7 | 5.11 | 46.7 | 2.72 | 2.39 | 80 | 98 | 30.3 | 5.31 |
| PREDEVELOPED 100-YEAR PEAK DISCHARGE | 100 | 24 | 8 | 5.11 | 0.0 | 5.11 | 0.00 | 78 | 98 | 36.9 | 4.66 |
| DEVELOPED 100-YEAR PEAK DISCHARGE | 100 | 24 | 8 | 5.11 | 46.7 | 2.72 | 2.39 | 80 | 98 | 30.3 | 6.25 |



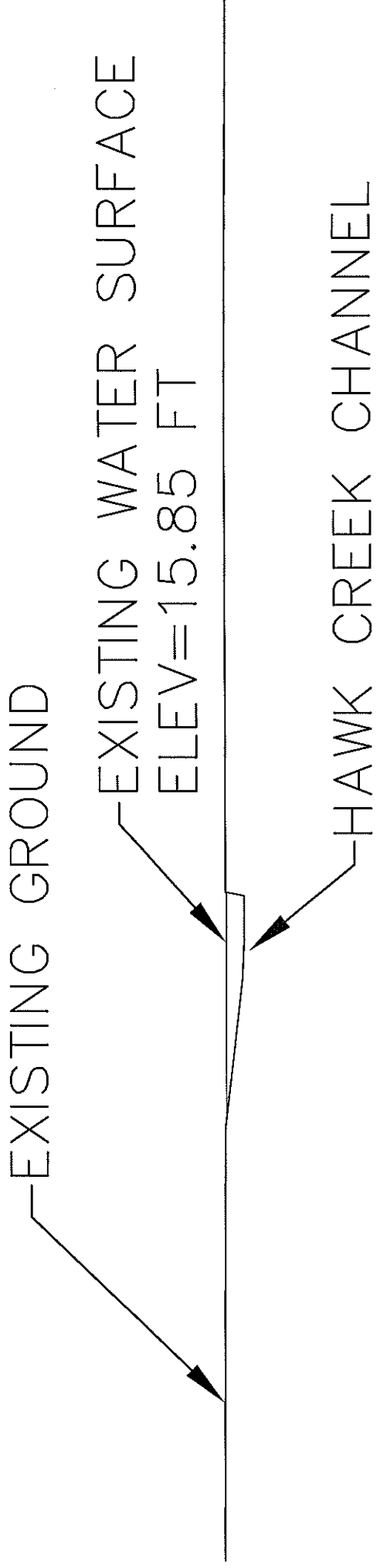
**SANTA BARBARA URBAN HYDROGRAPHS
ANALYSIS OF HAWK CREEK BASIN PRIOR TO HWY 101 CROSSING**

JOB: 173-002
PROJECT: Hawk Creek Subdivision
FILE: 1732_prelim HYDRO_UBA.xls

| DESCRIPTION | DESIGN STORM (YR) | DURATION (HR) | PRECIP (IN) | AREA TOTAL (AC) | % IMP | AREA PERV. (AC) | CN PER. | AREA IMP. (AC) | CN IMP. | TIME (MIN) | Q (CFS) |
|--------------------------------------|-------------------|---------------|-------------|-----------------|-------|-----------------|---------|----------------|---------|------------|---------|
| PREDEVELOPED 2-YEAR PEAK DISCHARGE | 2 | 24 | 4.55 | 1,760.00 | 0.70 | 1747.68 | 58.1 | 12.32 | 98 | 148.19 | 102.71 |
| PREDEVELOPED 10-YEAR PEAK DISCHARGE | 10 | 24 | 6 | 1,760.00 | 0.70 | 1747.68 | 58.1 | 12.32 | 98 | 148.19 | 199.03 |
| PREDEVELOPED 25-YEAR PEAK DISCHARGE | 25 | 24 | 7 | 1,760.00 | 0.70 | 1747.68 | 58.1 | 12.32 | 98 | 148.19 | 276.34 |
| PREDEVELOPED 100-YEAR PEAK DISCHARGE | 100 | 24 | 8 | 1,760.00 | 0.70 | 1747.68 | 58.1 | 12.32 | 98 | 148.19 | 366.10 |



1" = 80'
 4^N



WATER SURFACE STUDY SECTION 1

SCALE 1" = 20'

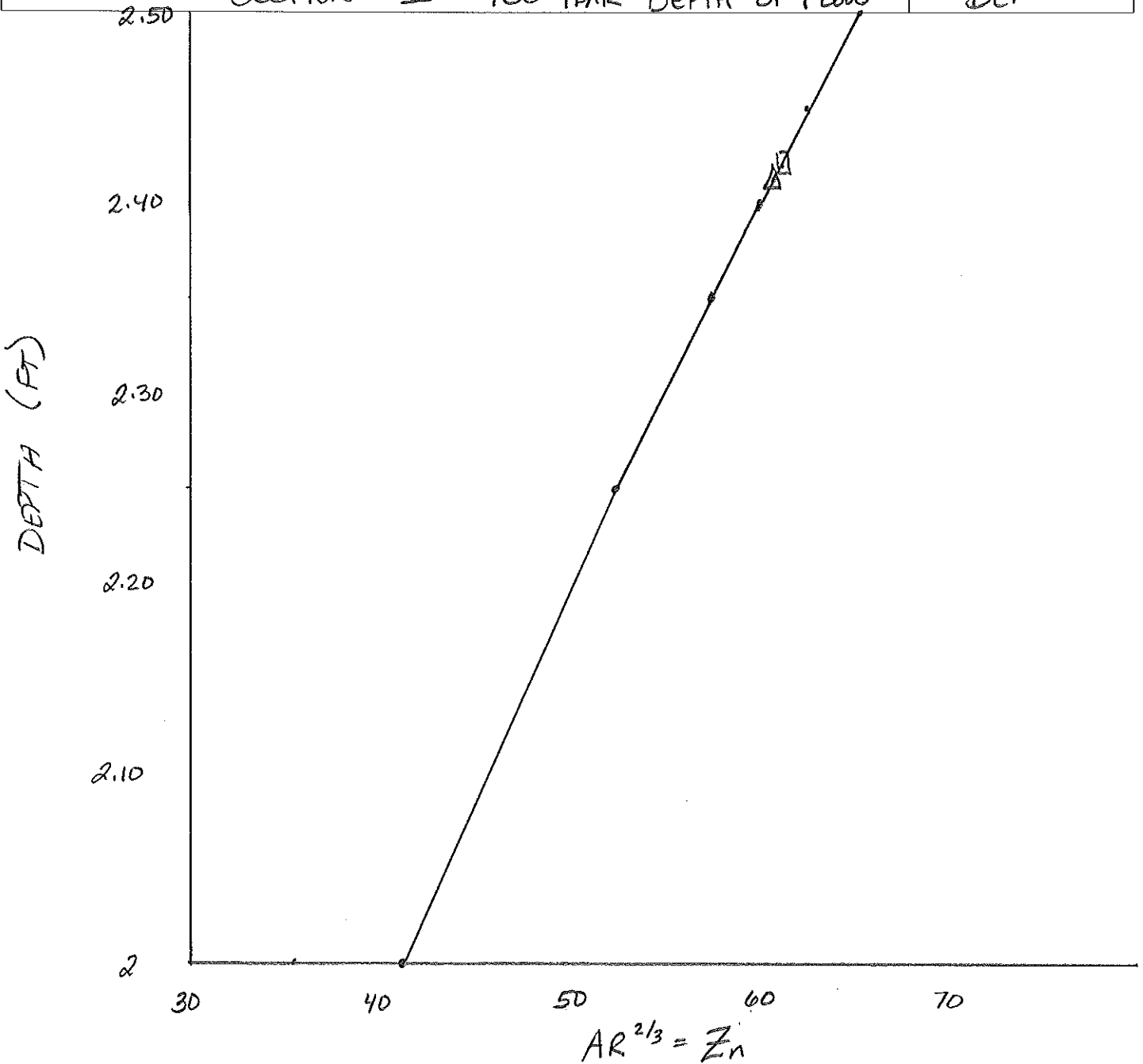


Project
COTTAGES AT NESKOWIN

Date
8/28/09

Subject
SECTION 1 - 100 YEAR DEPTH OF FLOW

By
BEF



→ $\Delta = AR^{2/3}$ @ 100 YR PRIOR TO DEVELOPMENT $Q = 366.10$

$AR^{2/3} = 60.97$

$D = 2.41'$

ELEV = $13.44 + 2.41 = 15.85$ FT

$n = 0.035$

$S = 0.02$

⇒ $Q = AR^{2/3}$ @ 100 YR WITH PHASE 1 $Q = 367.69$ CFS

$AR^{2/3} = 61.24$

$D = 2.42'$

ELEV = $13.44 + 2.42 = 15.86$ FT

$n = 0.035$

$S = 0.02$

$$AR^{2/3} = 60.97 \quad @ \quad Q = 366.10 \quad n = 0.035 \quad S = 0.02$$

$$AR^{2/3} = 61.24 \quad @ \quad Q = 367.69 \text{ cfs} \quad n = 0.035 \quad S = 0.02$$

| <u>y</u> | <u>A</u> | <u>P</u> | <u>R</u> | <u>AR^{2/3}</u> |
|----------|----------|----------|----------|-------------------------|
| 2 | 35.48 | 28.48 | 1.246 | 41.08 |
| 2.5 | 49.96 | 33.32 | 1.499 | 65.45 |
| 2.25 | 42.44 | 30.90 | 1.373 | 52.44 |
| 2.35 | 45.38 | 31.87 | 1.424 | 57.44 |
| 2.40 | 46.88 | 32.35 | 1.449 | 60.03 |
| 2.45 | 48.41 | 32.83 | 1.474 | 62.71 |

$$AR^{2/3} = \frac{Qn}{1.486 S^{1/2}}$$

AREAS FOUND BY SECTION.

WETTED PERIMETER FOUND BY SECTION.