



To: A.P. Kohut
Senior Geological Engineer
Groundwater Section
Water Management Branch

Date: September 14, 1983

File: 82 F/5

Re: Development of Agricultural Production on Crown Land in Ootischenia

1. Purpose of Study:

At the request of the Agricultural Engineering Branch, Ministry of Agriculture and Food, a review of groundwater conditions around the Ootischenia area has been completed. This review has been limited to a review of office information only.

As obtaining a reliable water supply is considered a limiting factor in the enhancement of agricultural production this review was carried out to determine if and to what extent groundwater potential existed and could be developed to meet the requirements for each of the 5 parcels of Crown Land as shown in figure 1.

The land will be developed under the Property Management Branch agricultural lease program.

Information on anticipated well depth and capacity for wells constructed near or within the boundaries of each parcel has been requested. Cost estimates for well construction and testing have also been requested.

2. Sources of Review:

Groundwater information reviewed was obtained from well records on Groundwater Section's files. Available "Soils and Landforms" mapping (Ministry of Environment, 1976) for the study area was also reviewed. Aerial photographs, groundwater reports, and general information on file was examined. Table 1 was prepared outlining available information on 54 existing wells such as well location, depth, yield, static water level and aquifer description.

3. Previous Investigations:

There have been several site specific groundwater studies conducted during the last 20 years in the Castlegar and Ootischenia areas. High capacity wells have been constructed in various areas. The Selkirk

APK

College aquifer, for example, located southeast of Castlegar on the south side of the junction of the Kootenay and Columbia Rivers was developed in the mid-seventies and wells capable of yielding thousands of gallons per minute have been constructed in this aquifer. Studies have shown that the geology in the Castlegar-Ootischenia area is extremely variable and complex. Although some areas have shown it is possible to construct high capacity wells in highly permeable deposits, other areas have revealed only small yielding wells from relatively impermeable material.

4. Geology:

The geology of the Castlegar-Ootischenia area has been studied since the early 1960's in connection with the search for water. The geology of the study area as stated previously, is extremely varied and complex. Castlegar is on the western end of a terminal moraine formed by ice which moved down the Kootenay River valley. This moraine is comprised of very bouldery deposits varying from clean gravels to compact till. The moraine in places is quite permeable and in some areas relatively impermeable. South of Castlegar, well records indicate that much of the low-lying areas adjacent to the Columbia River are underlain by thick fine-grained sediment mostly silty sand and minor silt and clay over bedrock. In contrast thick sand and gravel formations are evident on the upland near the Castlegar Golf Course.

5. Development of Crown Land:

As stated previously a major consideration in the development of Crown Land for agricultural production is the location and development of a reliable water source to meet the specific requirements of each parcel. The potential for groundwater development within each parcel is discussed below. Groundwater information is lacking for some areas and test drilling may be necessary to fully assess the potential of these areas. Previous groundwater studies in other areas have indicated some areas have excellent groundwater potential. Prior to instigating any test drilling program, preliminary field work would first be necessary to confirm the local geologic and groundwater conditions.

5.1 Parcel 1:

Parcel 1 as shown in figure 1 is described as 94 acres in size with an irrigation requirement of 775 gpm or 8.25 gpm of water per acre. It is located at an elevation of approximately 1900 feet and about 450 feet above the elevation of the Columbia River. It is crown land near the Castlegar Golf Course.

Groundwater Section records indicate the nearest wells are about 1300 feet to the east and to the west of this land. Bedrock was encountered at varying depths in almost all wells reviewed. Well records indicate depth to bedrock varies between 93 and 183 feet. High-capacity wells are evident on and near the Golf Course where test and production wells have been constructed in permeable medium to coarse sand above the bedrock. One particular well was pumped at a rate of 425 gpm for a period of 3½ hours. Aquifers appear to be generally under water table conditions in this area with recorded static water levels in wells between 81 and 100 feet below ground surface. Long-term groundwater availability in this area is limited by well interference and annual recharge. Wells to the west are located at a lower elevation and are generally bottomed in silt with aquifer material above the silt appearing silty, dirty and relatively impermeable. Recharge to this latter area may occur from higher elevations to the east and/or from the Columbia River. Wells near the Golf Course up on the bench are probably recharged from higher elevations to the north and east.

Drilling would have to be undertaken on Parcel 1 to determine whether aquifer conditions similar to the Golf Course area underlie this region.

The depth of wells in this area would be in the neighborhood of 200 feet when bedrock may be encountered. The entire aquifer thickness above the bedrock should be penetrated and a screen assembly be installed to obtain maximum specific capacity and well efficiency. If test drilling is successful and a high-yield aquifer is proven then a larger diameter well or well field consisting of 2 or more 8-inch diameter wells may be designed. Wells should be spaced as far apart as possible so their areas of influence will have a minimum of interference with each other.

Following is an estimate of costs involved for one 8-inch diameter, 200 feet deep well, constructed in overburden. The cable-tool method of drilling is recommended because of advantages in the collection of accurate formation samples for well screen design.

1. Mob and demob (lump sum)	500.00
2. 10-inch drive shoe	300.00
3. 20 feet of 10-inch cased drilling @ 48.00/ft.	960.00
4. 8-inch drive shoe	185.00
5. 20 feet of 8-inch overlap casing @ 16.25/ft.	325.00
6. 180 feet of 8-inch cased drilling @ 38.00/ft.	6840.00
7. 15 feet of 8-inch screen and fittings (lump sum)	1500.00
8. Hourly work to set screen, bail test, well development grouting @ 60.00 per hour	1200.00
9. Mob and demob of pump and equipment (lump sum)	500.00
10. Install and remove pump and discharge pipe (lump sum)	500.00
11. 24-hour pumping test @ 50.00 per hour	1200.00
12. Recovery @ 40.00 per hour (3 hours)	120.00
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sub-total	14,130.00
+ 10% contingencies	1,413.00
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TOTAL	<u><u>\$15,543.00</u></u>

5.2 Parcel 2:

Parcel 2 as shown in figure 1 is described as 40 acres in size with an irrigation requirement of 330 gpm or 8.25 gpm of water per acre. The land is located on the bench, northeast of Ootischenia at an elevation of between 1800 and 1850 feet or about 200 feet above the Castlegar Airfield. Nine wells on record located between the Castlegar Airfield and the valley side wall were examined. These wells are however located on the flats and may not be indicative of groundwater conditions up on the bench. It

should be mentioned however that these wells range in depth between 60 and 335 feet while yields reported range between 7 and 30 gpm. Records indicate bedrock was encountered in 5 of the wells at depths ranging between 65 and 246 feet. Silt or silty sand was encountered in all wells. Well construction may prove more encouraging within the boundaries of Parcel 2 where similar topography and geologic conditions to Parcel 1 may be evident. There is a lack of hydrogeologic information available for this area however, and test drilling would be necessary to determine the groundwater potential of the area. Similar well construction and testing cost estimates to those outlined for Parcel 1 could be anticipated. Test drilling should be sited as far away from the valley side wall as possible to reduce the boundary effects that may result.

5.3 Parcel 3:

Parcel 3 is described as 30 acres in size with an irrigation requirement of 265 gpm or 8.8 gpm of water per acre. This land slopes gently in a direction towards the Columbia river from an elevation of 1575 feet to 1450 feet. Groundwater Section records show four wells are located near the boundaries of Parcel 3. One well encountered silt at 208 feet which continued to a depth of 280 feet before drilling was terminated. In contrast, a few high-capacity wells are located east of Parcel 3 where terrace or delta deposits are deposited against the valley side wall. One of these wells was drilled to a depth of 229 feet for the Ootischenia Improvement District, was tested at 205 USgpm for a 24-hour period and utilized less than 3 feet of available drawdown. Another well located in the same general area was pumped at 488 USgpm for a 24-hour period. Although no boundary effects were detected during these tests this is a concern due to the presence of the bedrock side wall to the east and the relatively impervious silt formations to the west. The existence of these suspected boundaries within the zone of influence of the pumping well may become evident over a longer period of pumping. If further drilling is conducted in this area well spacing is critical in order to avoid or reduce interference between wells. It may be advantageous to construct an observation well close to the suspected boundary in order to detect a boundary effect earlier. Coarse gravels above till were encountered in the 229 foot well. These gravels appear to peter out into silt and sandy silt in a westerly direction towards the Columbia River.

In summary, favourable drilling conditions have been encountered directly east of the boundaries of Parcel 3 in delta or terrace deposits near the bedrock face of the valley wall. High capacity wells have been constructed within these deposits. Available information would indicate drilling conditions may be less favourable in a westerly direction towards and within the boundaries of Parcel 3 near the Columbia River.

Extensive silt and sandy silt deposits may be encountered in these areas.

Approximate costs involved following the same criteria as outlined for a well constructed within Parcel 1, however completed to an anticipated depth of 250 feet rather than 200 feet, and equipped with 10 feet of stainless steel screen, are estimated to be \$17,083.00.

5.4 Parcel 4:

Parcel 4 is described as 50 acres in size with an irrigation requirement of 370 gpm or 7.4 gpm of water per acre.

At present, no well record information is on file in the vicinity of Parcel 4. If silty conditions apparent in some wells located near the Columbia River and shallow depth to bedrock can be avoided and coarse water-bearing sand and gravel deposits can be located and developed then Parcel 4 may prove to have good groundwater potential. Aerial photographs indicate bedrock outcropping is extensive throughout this area. Test drilling is necessary to more fully understand the groundwater potential of this area. Aerial photographs show evidence of a large garbage dump directly north of Parcel 4. The migration of contaminated groundwater is particularly a concern where there may be clean coarse gravels in an area. The location of this dump site should be a major consideration when locating a test well.

5.5 Parcel 5:

Parcel 5 is described as 50 acres in size with an irrigation requirement of 410 gpm or 8.25 gpm of water per acre. One high capacity well near the boundaries of Parcel 5 is encouraging and indicates the area may have excellent potential for groundwater development. The well is located at the Brilliant Community Hall, was drilled in 1965 to a depth of 139 feet and is equipped with a 10-foot length of screen. This well was pumped at 350 USgpm for 8 hours. When pumping was terminated the well recovered almost immediately. The well record shows the aquifer is open below 140 feet, indicating the aquifer has even greater potential. Geologic conditions may be similar in this area to the area south, across the Kootenay River. Some high-capacity wells have been constructed near the Selkirk College in what is known as the Selkirk College aquifer. The similar setting of Parcel 5 at the junction of the Kootenay and Columbia Rivers with the peninsula around Selkirk College suggests it may be possible to encounter a high capacity aquifer within the boundaries of Parcel 5. Although test drilling in this area is necessary to more fully understand aquifer potential, the limited information available indicates that well depths in this area would be around 200 feet. Similar construction and testing costs to those outlined for Parcel 1 may apply here.

6. Water Quality:

At present, very limited water quality data is available for the Castlegar- Ootischenia areas. Only 6 field and lab analyses are presently available. These results indicate water quality around the Castlegar area is very hard (274 mg/L) and moderately mineralized (451 mg/L) while water quality to the south around Ootischenia and Kinnard is of better quality, softer (75-102 mg/L) with lower total mineralization (223 mg/L).

7. Summary:

As a prelude to the design and carrying out of a test-drilling program, a field survey conducted by a groundwater consultant should be carried out around the area of each Parcel of Crown Land. This survey would involve documenting up-to-date information on both older and recently constructed wells. The information is considered necessary as a preliminary step in establishing where the most suitable location may be for test drilling in an attempt to acquire the desired yield.

Geology throughout the study area is both varied and complex. Well records indicate that coarse sands and gravels appear to grade into silt and sandy silt in an easterly direction from the bedrock valley wall towards the Columbia River. Coarse water-bearing sands and gravels are apparent adjacent to the bedrock valley wall near Ootischenia and on the plateau near the Ootischenia Golf Course.

A review of information available has permitted certain observations to be made for each Parcel. These observations have been made, based on limited groundwater information and results obtained from the field survey and/or test drilling make these observations subject to possible considerable change. Each Parcel has been given a rating regarding the groundwater prospects to meet the desired yield. Ratings given are highly probable, good or insufficient data available.

Parcel 1 - insufficient data available - information from adjoining areas suggests that wells constructed near the boundaries of Parcel 1 might be successful.

Parcel 2 - insufficient data available - however similar geologic setting to Parcel 1 is encouraging.

Parcel 3 - good

Parcel 4 - insufficient data available

Parcel 5 - highly probable - one well located near the boundaries of Parcel 5 was very successful. A similar geologic setting to the Peninsula across the Kootenay River where the high capacity Selkirk College wells are constructed is very encouraging.

Cost estimates for well construction and testing are between \$15,000.00 and \$18,000.00 for 8-inch diameter test-production wells drilled to a depth of between 200 and 250 feet. Available information suggests that wells drilled to approximately this depth should be successful within or near the boundaries of Parcels 3 and 5. Insufficient data is available to estimate the anticipated well depths required for Parcels 1, 2 and 4.

Test drilling and pump testing should be undertaken under supervision of a consulting groundwater geologist/engineer.

A garbage dump is located near the boundaries of Parcel 4 and poses a potential contamination threat to groundwater. The location of this dump is a concern in the siting of test production wells near or within the boundaries of Parcel 4.

If a test-production well is constructed in an area it is recommended that during pumping any nearby wells be monitored for interference effects.

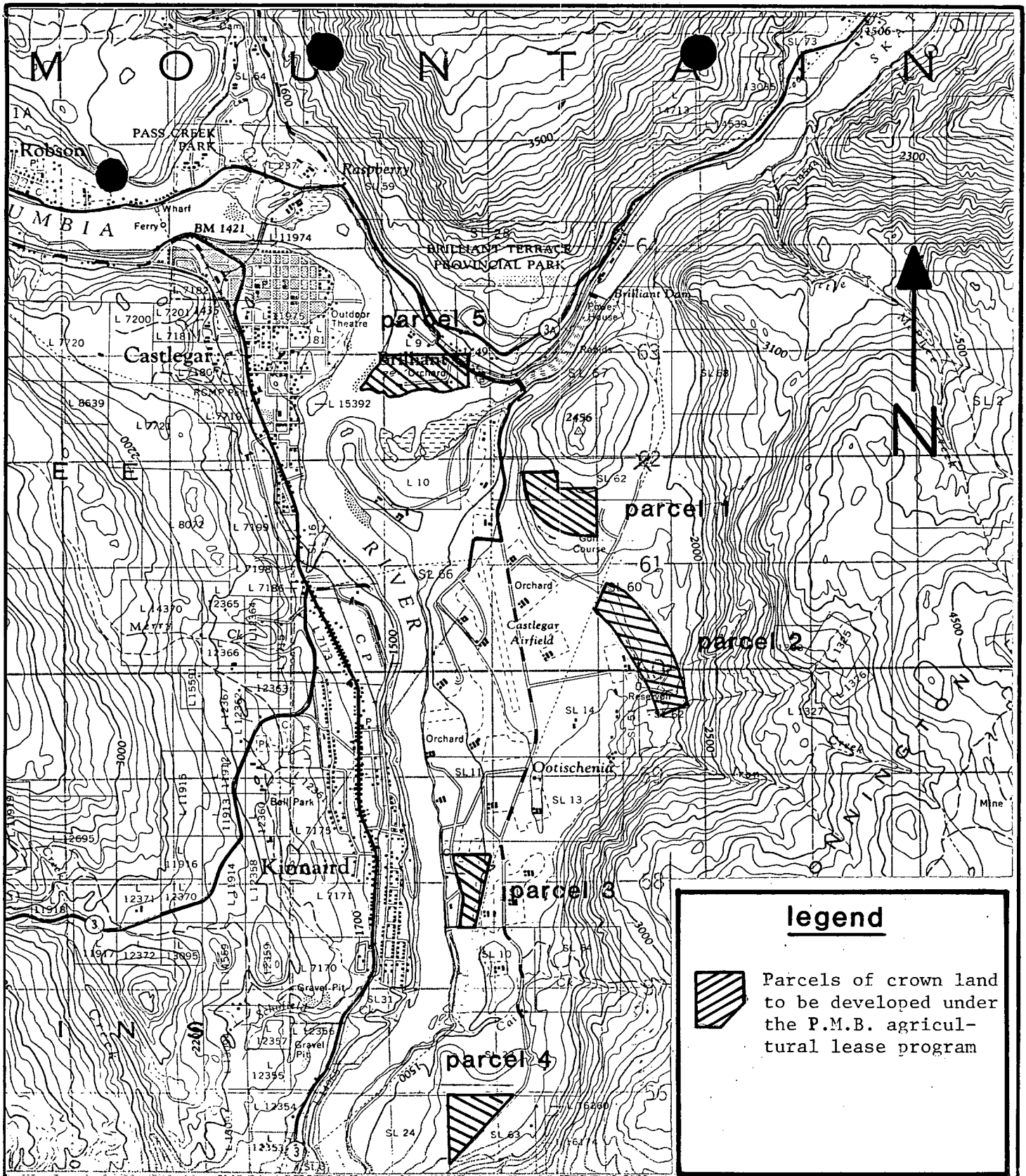
Cable-tool drilling is recommended for the collection of accurate soil samples for well screen design.

References:

Ministry of Environment, 1976 Soils and Landforms, 82 F/5 B.C.
Castlegar Kootenay District B.C. Nelson Map Area.

W.S. Hodge

W.S. Hodge
Senior Technician
Groundwater Section
Water Management Branch



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON
**Development of Agricultural
 Production on Crown Lands
 in Ootischnia**

SCALE: VERT. $1\frac{1}{4}'' = 1 \text{ mile}$
 HOR. $1\frac{1}{4}'' = 1 \text{ mile}$

DATE
September 1983

ENGINEER

FILE No. _____ DWG. No. **Figure 1**

WELL RECORD TABULATION
CASTLEGAR - OOTISHENIA AREAS

TABLE 1

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LOCATION			OWNER'S NAME	DEPTH		DISTANCE TO WATER	G.P.M.	WATER USE	WELL ENDS IN	DATE COMPL.	REMARKS
				DUG	DRILLED						
24-XII-Y4	#1		TROUSDALE		54	44	10	DOM.	SAND	SEPT 72	
24-XII-Y4	#2		IMPROVE DIST.		280				SILT		
24-XII-Y4	#3		GEORGE LEWIS		64	42	5	DOM.	SILTY SAND	FEB. 77	
24-XII-Y4	#4		IMPROVE DIST		248	197	200 ⁺	UTILITY	COARSE gravel	DEC 76	
24-XII-Y5	#1		GUIDO		80			-	MED SAND	APR 64	abandoned
24-XII-Y5	#2		GUIDO		63	38	3	DOM.	SAND FINE	MAY 64	
24-XII-Y5	#3		-		-						SPRING
24-XII-Y5	#4		CITY		93				SILT	JAN 76	DUMP SITE
24-XII-Y5	#5		CITY		327				BEDROCK	MAR 77	DETAILED LOG
24-XII-Y6	#1		NAGNER		70	30	10	DOM.	BEDROCK	OCT 78	
24-XII-Y6	#2		GATEN		70	20	7	DOM.	BEDROCK	SEPT 77	
24-XII-Y8	#1		VILLAGE OF KINNARD		340	202	163	DOM.	FINE SAND	1964-5	safe p.r. 210 USgpm
24-XII-Y8	#2		VILLAGE OF KINNARD		357.5	193	500	TOWN	MED. SAND	1964-5	DETAILED LOG
24-XII-Y8	#3		" " "		250	23	700	TOWN	MED. SAND	SEPT 70	CHEM. AVAILABLE
24-XII-Y8	#4		BORDEROFF		149	95	15	DOM.	SAND	OCT 76	
24-XII-Y9	#1		- OOTISHENIA		213	95		TEST HOLE	Bedrock	SEPT 64	abandoned
24-XII-Y9	#2		- OOTISHENIA		145	-	DRY	TEST HOLE	Bedrock	SEPT 64	abandoned
24-XII-Y9	#3		OOTISHENIA SCHOOL		233	166	10	SCHOOL	MED. SAND	1961	
24-XII-Y9	#4		S.W. SEMENOFF		240	194	50	DOM.	SAND	NOV 69	
24-XII-Y9	#5		SHERSTOBITOFF		248	130	7	DOM.	BEDROCK	FEB 73	

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TABLE 1

LOCATION	OWNER'S NAME	DEPTH		DISTANCE TO WATER	G.P.M.	WATER USE	WELL ENDS IN	DATE COMPL.	REMARKS
		DUG	DRILLED						
Z4-X11-Y10 #1	JOHN KANIGAN		60	47.5	25	DOM.	SAND & GRAVEL	APR 70	
Z4-X11-Y15 #1	WALTER KOFTINOFF		85	42.5	20	DEM.	SILTY SAND	68-69	
Z4-X11-Y16 #1	AIRPORT		335	235	30	DOM.	FINE SAND	1960	
Z4-X11-Y16 #2	STOCKNOFF		183	125	10	DOM.	FINE SAND	OCT. 1970	
Z4-X11-Y16 #3	IMPROVE DIST.		75	?	?	DISTRICT	BEDROCK	?	
Z4-X11-Y16 #4	Improve DIST		322	174	30	"	BEDROCK		
Z4-X11-Y17 #1	KONKIN		108	97	6	DEM.	SAND & GRAVEL	1961	abandoned
Z4-X11-Y17 #2	DEPT OF HWYS								TEST HOLES
Z4-X11-Y17 #3	VILLAGE OF KINNARD		390.	211	750	VILLAGE	MED SAND	1964-5	
Z4-X11-Y17 #4	KINNARD SCHOOL		190				FINE SAND		
Z4-X11-Y17 #5	FORESTRY TANNER STN.		200	DRY	-		SILTY SAND	AUG. 74	
Z4-X11-Y19 #1	VILLAGE		106	59.3	50	TEST HOLE	GRAVEL	APR 1960	ABANDONED
Z4-X11-Y20 #1	TRAILER COURT		188	126.3	300	DOM.	SAND & GRAVEL	ARR 1960	
Z4-X11-Y20 #2	FAMINOFF		51' 10"	32.25	800	DOM.	SAND & GRAVEL	NOV 1961	
Z4-X11-Y20 #3	WEST HOOTNEY COLLEGE		175	-	-	DOM.	SAND	AUG 1965	ABANDONED - UNSUCCESSFUL
Z4-X11-Y20 #4	WEST HOOTNEY COLLEGE		114	52	360	DOM.	SAND	AUG. 1965	
Z4-X11-Y20 #5	WEST HOOTNEY COLLEGE		172	40	1570	DOM.	COARSE GRAVEL	OCT. 1974	
Z4-X11-Y20 #6	WEST HOOTNEY COLLEGE		156	40.75	2204	DOM.	COARSE GRAVEL		
Z4-X11-Y20 #7	WEST HOOTNEY COLLEGE					OBS. WELL			OBS. WELL FOR FEED. WELL
Z4-X11-Y21 #1	OOTISHENIA		225	59	8	TEST WELL	GRAVEL & SAND		ABANDONED

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SCALE: VERT.....
HOR.....

DATE

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WELL RECORD TABULATION

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		DUG	DRILLED						
Z4-X11-Y21 #2	OOTISHENIA		145				COARSE SAND	OCT 1964	TEST HOLE
Z4-X11-Y22 #1	GOLF CLUB		161	100	180	DOM.	MED. SAND	NOV 1964	
Z4-X11-Y22 #2	GROUND WATER SECTION		122	81		OBS. WELL	SAND	SEPT 1966	OBS. WELL NR. 16-66
Z4-X11-Y22 #3	IMPROVE DIST.		183	100	210	DISTRICT	COARSE SAND	OCT 1964	TEST HOLE
Z4-X11-Y22 #4	OOTISHENIA		93.5	81	3/4	DOM.	bedrock	SEPT 1964	
Z4-X11-Y22 #5	GOLF COURSE		160	96.4	425	DOM.	bedrock	OCT 67	
Z4-X11-Y22 #6	GOLF COURSE		136		DRY	TEST	bedrock	SEPT 67	ABANDONED
Z4-X11-Y22 #7	GOLF COURSE		165	85	50	TEST	bedrock	MARCH 67	ABANDONED
Z4-X11-Y29 #1	VILLAGE		90	47.3	400	TEST	SAND	APR 1960	ABANDONED
Z4-X11-Y29 #2	VILLAGE		100	-	-		GRAVEL & SAND	AUG 1959	ABANDONED
Z4-X11-Y29 #3	NAZAROFF		139	74.5	300	DOM.	SAND	OCT 65	
Z4-X11-Y30 #1	CASTLEGAR		147.5	48.5	1100	TEST	SAND & GRAVEL	1960	
Z4-X11-Y30 #2	CASTLEGAR		102	41.25	375	TEST	SAND & GRAVEL	1959	
Z4-X11-Y30 #3	CASTLEGAR		126	65	1000	PROD. WELL	SAND & GRAVEL	1970	

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